ROHDE&SCHWARZ

Test and Measurement
Division

Autorun / Printer Control

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Contents

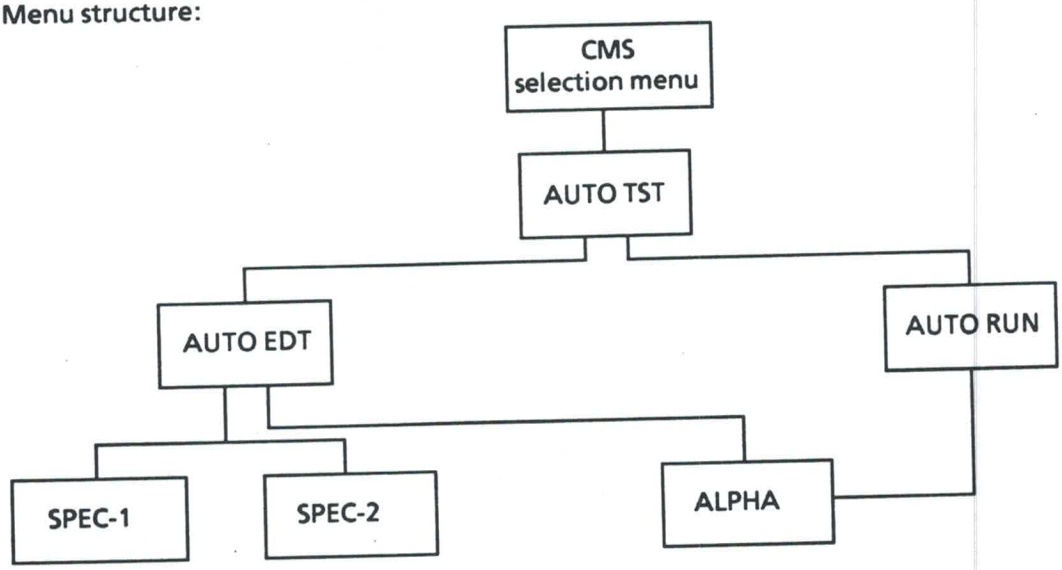
		Page
Autorun Control		5
1	**Generation of Programs on the CMS**	5
1.1	**Insertion of Additional Program Lines**	8
1.2	**Clearing and Shifting of Command Lines**	9
1.3	**Adding Comments in the Program**	11
1.4	**Delays and Stops in the Active Program Run**	12
1.5	**Repetitions of Program Sections**	14
1.6	**Conditional Statements in the Program**	17
1.6.1	Conditional Execution of Program Sections	18
1.7	**Printer Control during the Program Run**	21
1.7.1	Printing of Reports	22
1.7.2	Report Formats	23
2	**Execution of Programs**	24
2.1	**Parameters for Program Execution**	24
2.1.1	Report Header	25
2.1.2	Report Formats	25
2.1.3	Target Address of Report	25
2.1.4	STOP Conditions	25
2.1.5	Delays in the Program	25
2.1.6	Initialization of the Printer	26
2.1.7	Form Feed of the Printer	26
2.1.8	Clearing of the Printer Buffer (SPOOLER CLEAR)	26
2.2	**Program Suspensions**	26
3	**Management of Programs and Test Reports**	27
3.1	**Loading of Programs and Reports from the Memory Card**	27
3.2	**Linking of Programs**	27
3.3	**Storing of Programs and Reports**	27
3.4	**Display of Directory**	27
3.5	**Display and Printing of Programs**	28
3.6	**Clearing of Programs and Reports**	28
3.7	**Memory Card Protection**	28

Autorun Control

Note: ***The electronic components on the memory card are insensitive to discharge pulses, only when R&S cards with protective sheathing are used.***

The Autorun Control in the CMS Radiocommunication Service Monitor allows the user to store and execute program sequences entered via front panel controls and to generate test reports printed out on an external printer. Battery-backed 32-Kbyte memory cards (CMS-Z1) or 128-Kbyte memory cards (CMS-Z2) serve as program library and storage media for test reports.

Menu structure:

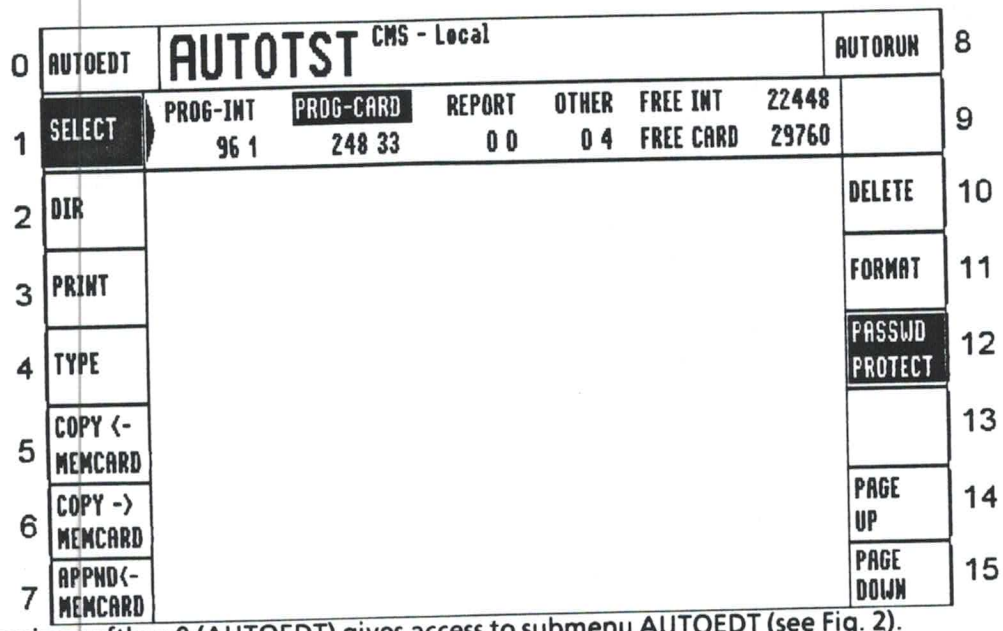


1 Generation of Programs on the CMS

Actuation of softkey 9 in the CMS selection menu calls the main menu AUTOTEST (see Fig. 1).

Fig. 1 Main menu AUTOTEST

This menu comprises all the softkeys required for storing, loading and display of programs.



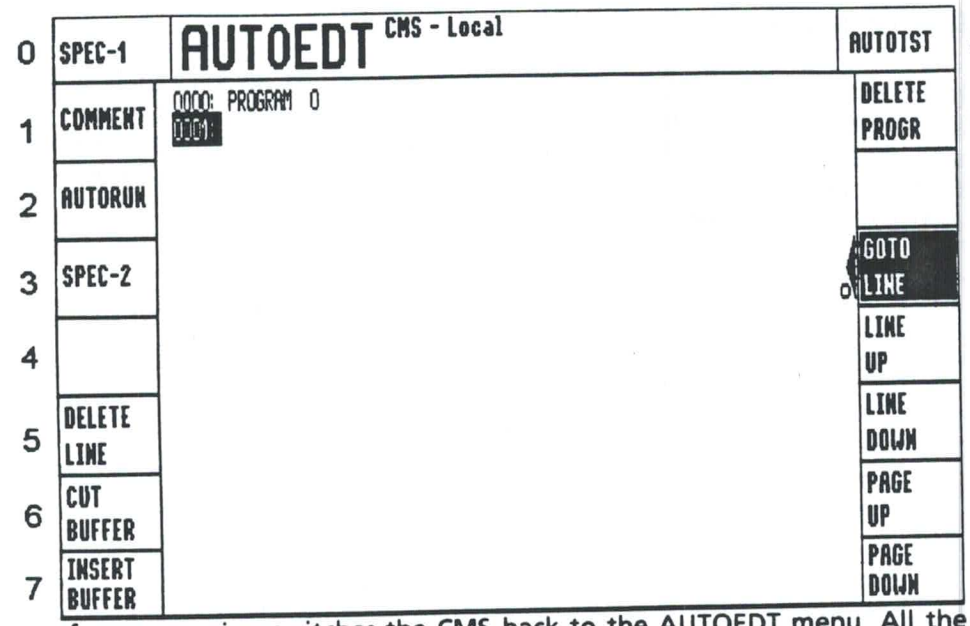
Pressing softkey 0 (AUTOEDT) gives access to submenu AUTOEDT (see Fig. 2).

Fig. 2 Submenu AUTOEDT

Programming is initated by pressing the START hardkey, and the CMS switches back to the selection menu (or the menu selected last in the LEARN mode). Any command entered then and stored via hardkey STORE corresponds to one program line for the started sequential program. The individual commands are commented in the first status line as IEC bus commands. Actuation of hardkey STOP permits the user to leave the LEARN mode, i.e. programming is stopped and the CMS returns to the AUTOEDT menu. The programmed commands are then listed in the display in the same sequence as entered. Each command line is preceded by a number.

Example: Following power-up the CMS is set to the selection menu

AUTOTST		→	Select Autorun Control
AUTOEDT		→	Select LEARN mode
START		→	Start programming
TX-TEST	STORE	→	Select transmitter test
AF1		→	Select AF generator 1
1 kHz	STORE	→	Frequency setting 1 kHz
SHIFT AF1		→	Select AF level generator 1
25 mV	STORE	→	Level setting 25 mV
DEMOD		→	Select demodulation
MENU ↓		→	Select submenu DEMOD
WEIGHT		→	Select peak weighting
WEIGHT	STORE	→	Select RMS weighting
MENU ↑		→	Leaving submenu DEMOD
COUNT	STORE	→	Select frequency count
POWER	STORE	→	Select power measurement
DEMOD	STORE	→	Select demodulation measurement
RX-TEST	STORE	→	Select the receiver test
STOP		→	Stop programming



Stop of programming switches the CMS back to the AUTOEDT menu. All the commands previously entered in the LEARN mode are listed in the display:

```
0000: PROGRAM 0
0001: DISPLAY:MENU          01,00
0002: FREQUENCY:AF:I1         1000.00 Hz
0003: LEVEL:AF:I1           +25000 uV
0004: DEMODULATION:WEIGHTING    RMS
0005: COUNT:RF
0006: POWER:RF
0007: DEMODULATION
0008:   DISPLAY:MENU                    02,00
0009:
```

Line 0 always identifies the number of the program. This line is automatically inserted. A maximum of about 1200 lines is possible. The cursor is positioned in the last empty line; respectively marked lines can be deleted or additional lines be inserted.

Maximally 14 lines are read out in the display per display page. Softkeys 14 PAGE UP and 15 PAGE DOWN are used for page turning. The softkeys 12 LINE UP and 13 LINE DOWN permit to shift the cursor by one line, respectively. Softkey 11 GOTO LINE moves the cursor to a defined position.

To delete the complete program sequence, the softkey 9 DELETE PROGR is pressed. Before deletion, the CMS prompts the user by the message "ARE YOU SURE?", which is acknowledged for program deletion by pressing hardkey ENTER or aborted using hardkey CLEAR.

1.1 Insertion of Additional Program Lines

The user wishes to activate the lowpass filter of the CMS in the program example of previous Section 1 before performing the measurements. To this end, the cursor is shifted to the command line that is to be preceded by the additional commands (line 5 in this example). Then the hardkey START is pressed to restart programming. The CMS is switched back to the menu which was active on completion of programming or on start-up of the program sequence.

GOTO LINE 5 ENTER		→	Select command line to be preceded by additional commands
START		→	Start programming
TX-TEST		→	Change to transmitter test
FILTER		→	Activate filter selection
MENU ↓		→	Select submenu FILTER 1
LP 3.4 kHz	STORE	→	Select lowpass filter
MENU ↑		→	Leave submenu
STOP		→	Stop programming

The last key actuation which stops programming resets the CMS to the AUTOEDT menu. The display then shows the following program sequence:

```
0000: PROGRAM 0
0001: DISPLAY:MENU          01,00
0002: FREQUENCY:AF:I1         1000.00 Hz
0003: LEVEL:AF:I1           +25000 uV
0004: DEMODULATION:WEIGHTING    RMS
0005: FILTER:TXTEST:LP        ON
0006: COUNT:RF
0007: POWER:RF
0008: DEMODULATION
0009: DISPLAY:MENU          02,00
0010:
```

Line 5 FILTER:TXTEST:LP ON is additionally included in the program sequence and the program has been renumbered. Lines can be inserted as long as the CMS is set to LEARN mode. The cursor is not shifted in this case but remains on the command line to which it is set.

1.2 Clearing and Shifting of Command Lines

To delete a line in the active program sequence, the cursor must be set to the respective line and softkey 5 DELETE LINE is pressed. The line numbers of the following lines are renumbered accordingly and the cursor remains in the same position, i.e. the next command line.

To clear several lines, the cursor is set to the beginning of the lines to be deleted and softkey 6 CUT BUFFER is pressed. Then the cursor is moved to the end of the lines to be deleted and softkey 6 CUT BUFFER is actuated again. The selected characters are then highlighted in inverse display. For moving the cursor the softkeys 11 to 15 and the spinwheel can be used. Maximally 42 lines starting from the start position of the cursor can be deleted at a time. If more lines are selected for deletion, the error message "cut buffer full" appears.

When softkey 6 CUT BUFFER is pressed the first time, CUT BUFFER is highlighted in inverse display to indicate that the delete function is active. Actuation of any other key except softkeys 11 to 15 disables the delete function again.

Pressing softkey 6 the second time resets the softkey labelling to normal display, but softkey 7 INSERT BUFFER is shown in inverse display. At the same time, the selected lines disappear from the program and the command sequence is renumbered.

However, the lines disappeared from the screen are not irrevocably lost but are temporarily stored in a buffer. Only by activating the delete function again, i.e. pressing softkey 6 CUT BUFFER again, these lines are cleared from the program for good.

Intermediate storage can also be used for shifting or copying of command lines. Any lines stored in the buffer can be inserted in one or several positions in the program sequence (except before line 0), which must be marked by cursor before.

In the example program from Section 1.1, the user wishes to copy the lines 1 to 4 into the sequence after line 9 and then delete them again:

GOTO LINE 1 ENTER	→	Mark beginning of lines to be copied
CUT BUFFER	→	Activate buffer
GOTO LINE 5 ENTER	→	Mark end of lines to be copied*
CUT BUFFER	→	Fill buffer and clear lines
INSERT BUFFER	→	Resinsert lines
GOTO LINE 10 ENTER	→	Mark line from where to insert the lines
INSERT BUFFER	→	Insert lines

**** Note: For copying n lines, n + 1 lines must be marked.***

The complete program thus reads as follows:

```
0000: PROGRAM 0
0001: DISPLAY:MENU          01,00
0002: FREQUENCY:AF:I1         1000.00 Hz
0003: LEVEL:AF:I1           + 25000 uV
0004: DEMODULATION:WEIGHTING    RMS
0005: FILTER:TXTEST:LP        ON
0006: COUNT:RF
0007: POWER:RF
0008: DEMODULATION
0009: DISPLAY:MENU          02,00
0010: DISPLAY:MENU          01,00
0011: FREQUENCY:AF:I1         1000.00 Hz
0012: LEVEL:AF:I1           + 25000 uV
0013:  DEMODULATION:WEIGHTING         RMS
0014:
```

The selected lines can be inserted in the program at other positions as often as required. The respective position where to add the lines is always marked by the cursor.

Lines 10 to 13 are to be deleted again:

GOTO LINE 10 ENTER	→	Mark beginning of lines to be deleted
CUT BUFFER	→	Activate buffer
GOTO LINE 14 ENTER	→	Mark end of lines to be deleted
CUT BUFFER	→	Fill memory

Lines 10 to 13 are thus removed again from the program and the program is reset to its original sequence.

1.3 Adding Comments in the Program

It may be useful in the course of a program run to supply additional information for the user in the second status line, for instance to switch on the radio transmitter of the mobile phone. Softkey 1 COMMENT in the AUTOEDT menu gives access to submenu ALPHA (see Fig. 3) for input of additional comments for the program.

Fig. 3 Submenu ALPHA

For input of characters first the softkey 4 CHAR CURSOR is pressed. The characters required for the comment are selected using the VAR spinwheel and acknowledged by pressing the ENTER key.To modify the entered text (i.e. delete and insert), the softkey 9 TEXT CURSOR is pressed and the TEXT CURSOR (light characters on a dark background) set to the required position using the VAR spinwheel. Then, the letters to the left and the right of the marked location can be deleted by pressing the softkey 7 and softkey 15, respectively. Actuation of CLEAR deletes the complete comment.
To insert a new text in the comment, again as described above the softkey 4 CHAR CURSOR is pressed and the required respective characters are input.

Using the STORE key, the contents of the entered comment line are stored in the program. Also several lines can be stored without leaving the ALPHA menu. Max. 34 characters per line can be entered.

Softkey MENU ↑ or softkey 8 only permit leaving the menu without storing the comment line in the program.

In the example program in Section 1.2, the user wishes to insert the comment "switch on transmitter" before the line 6:

GOTO LINE 6 ENTER	→	Mark the line to be preceded by a comment
COMMENT	→	Access to submenu ALPHA

Select the individual characters of "SWITCH ON TRANSMITTER" using the VAR spinwheel and press the hardkey ENTER after each character to acknowledge entry.

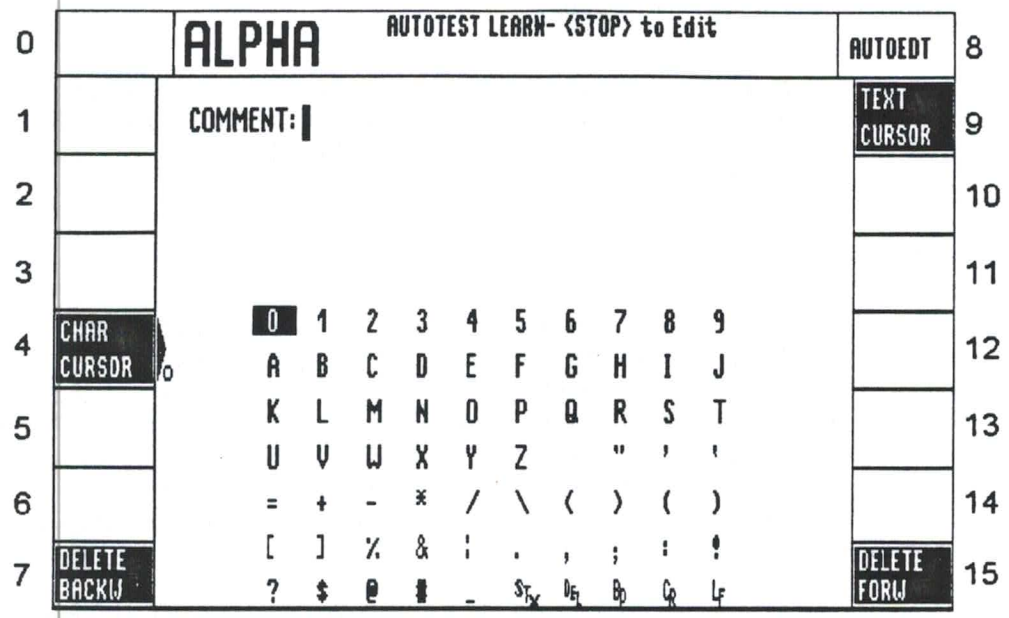
STORE	→	Store the line "SWITCH ON TRANSMITTER"
MENU ↑		→ Return to the AUTOEDT menu

The program reads as follows:

Line 6 reads out the comment "switch on transmitter". Comments are characterized by "--" characters and are always centered. These comments can also be added for better readability of the programs. However, during the program run they are also displayed in the second status line.

1.4 Delays and Stops in the Active Program Run

For certain measurements, e.g. measurements at mobile phones with compandors, delays must be provided in the program sequence. Also, defined stop pauses are required in the program flow to await user reactions on comments. In this case, the pause is terminated and the program continued again by the user by pressing the hardkey START.




```
0000: PROGRAM 0
0001: DISPLAY:MENU          01,00
0002: FREQUENCY:AF:I1         1000.00 Hz
0003: LEVEL:AF:I1           +25000 uV
0004: DEMODULATION:WEIGHTING     RMS
0005: FILTER:TXTEST:LP       ON
0006: ------switch on transmitter------
0007: NT:RF
0008: POWER:RF
0009: DEMODULATION
0010: DISPLAY:MENU          02,00
0011:
```

As the Autorun Control operates at high speed, in most cases the user is not always able to clearly follow the sequence. To avoid this, the special function also permits the user to insert defined delays between each individual command line.

The submenu SPEC-1 (see Fig. 4) is reached by pressing softkey 0 (SPEC-1) in the AUTOEDT menu.

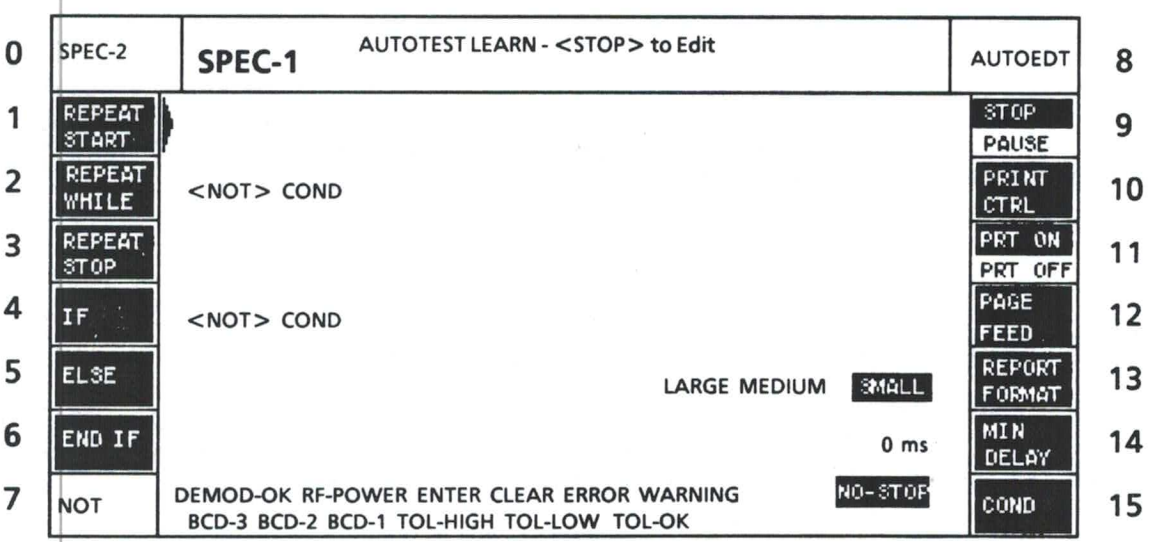


Fig. 4 Submenu SPEC-1

Softkey 9 STOP PAUSE is used to define delays and stops. STOP STORE is entered to set a stop in the program, which is then continued by pressing hardkey START. PAUSE and values between 1 and 10000 serve to effect delays in the program.

Softkey 14 MIN DELAY determines the delays between the execution of the individual commands. Delays of 0 ms (no waiting time) or from 10 ms to 10000 ms can be selected.

No entries are accepted by the CMS during these delays, i.e. the keyboard is disabled.
To return to the AUTOEDT menu, the softkey 8 AUTOEDT is pressed.

In the program example of Section 1.3, a stop is to be inserted after the comment in line 6. This is to allow the user to selectively continue the program run when the transmitter is switched on. Also, a delay of 100 m is to be defined before the DEMOD measurement in line 9. To allow the user to follow the program, a delay of 500 ms is set between the individual commands.

GOTO LINE 1 ENTER	→	Mark the line from where the delays apply
SPEC-1	→	Access to the SPEC-1 menu
MIN DELAY 500 ENTER STORE	→	Insert delay of 500 ms between the individual commands
AUTOEDT	→	Return to the AUTOEDT menu
GOTO LINE 8 ENTER	→	Mark the line to be preceded by a stop
SPEC-1	→	Access to the SPEC-1 menu
STOP STORE	→	Insert stop pause
AUTOEDT	→	Return to the AUTOEDT menu
GOTO LINE 11	→	Mark the line to be preceded by a delay
SPEC-1	→	Access to the SPEC-1 menu
PAUSE 100 ENTER STORE	→	Insert delay of 100 ms
AUTOEDT	→	Return to the AUTOEDT menu

The program example then reads as follows:

```
0000: PROGRAM 0
0001: SPECIAL:MINDELAY          500
0002: DISPLAY:MENU          01,00
0003: FREQUENCY:AF:I1          1OOO.00 Hz
0004: LEVEL:AF:I1          + 25000 uV
0005: DEMODULATION:WEIGHTING      RMS
0006: FILTER:TXTEST:LP          ON
0007: ------switch on transmitter-------
0008: SPECIAL:STOP              0
0009: COUNT:RF
0010: POWER:RF
0011: SPECIAL:PAUSE           100
0012: MODULATION
0013: DISPLAY:MENU          02,00
0014:
```

Each time the CMS returns to the AUTOEDT menu the command lines are renumbered. However, it is not necessary following each command entered in the SPEC-1 menu to return to the AUTOEDT menu. As long as commands are entered in the SPEC-1 menu they are inserted in the program sequence in the current cursor position.

1.5 Repetitions of Program Sections

It is often required to have certain program sections repeated in the sequence if the same measurement is to be carried out with different parameters (e.g. frequency response measurements).

Softkeys 1 to 3 in the SPEC-1 menu are available for this purpose (REPEAT START, REPEAT WHILE und REPEAT STOP).

Repetitions of program sections are generally initiated via REPEAT START X or REPEAT WHILE, X being the number of repetitions ranging from 1 to 10000. REPEAT WHILE initiates a repetition of program sections until a pre-defined condition is fulfilled. To terminate the repetition, always the softkey REPEAT STOP is pressed. If no REPEAT STOP is entered, the complete program is fully executed to the end.

Repetitions can be nested to a depth of five. The following is an example for nesting to a depth of two:

```
REPEAT START 100
    further commands
       REPEAT START 10
          further commands
       REPEAT STOP
    further commands
REPEAT STOP
```

The conditions to stop repetitions initiated with REPEAT WHILE can be defined in the SPEC-1 menu via the softkeys 7 NOT and 15 COND. Softkey 15 COND permits to select the condition, softkey 7 NOT can be used to negate the condition if the display of softkey 7 NOT is backlighted. For instance, REPEAT WHILE NOT WARNING means that the program section selected is repeated as long as no warning is given, while REPEAT WHILE WARNING means that the section is repeated as long as warnings are given.

The following conditions can be selected (all conditions are not negated):

DEMOD-OK	Valid value of demodulated signal
RF-POWER	Power available
ENTER	ENTER key was pressed with WAIT FOR KEY
CLEAR	CLEAR key was pressed with WAIT FOR KEY
ERROR	Error messages
WARNING	Warnings
NO-STOP	always fulfilled during program execution
BCD-3	Control line 3 of Control Interface CMS-B5 set to HIGH
BCD-2	Control line 2 of control interface CMS-B5 set to HIGH
BCD-1	Control line 1 of control interface CMS-B5 set to HIGH
BCD-0	Control line 0 of control interface CMS-B5 set to HIGH
TOL-HIGH	Tolerance of measurement value above the set value
TOL-LOW	Tolerance of measurement value below the set value
TOL-OK	Tolerance of measurement value in the set range
REPEAT:WHILE:NO-STOP	opens an endless loop
REPEAT:WHILE:NOT NO-STOP	this loop is executed exactly once

Note: ***If the conditions BCD-0 to BCD-3 are used, the lines must be defined as inputs before.***

With the conditions TOL-LOW, TOL-OK and TOL-HIGH, the contents of the loop are executed once in any case, with all other conditions the validity of the condition must be verified before the line REPEAT WHILE.... A loop is to be executed at least once!

In the following sequence, the program example of Section 1.4 is expanded such that by means of a pre-defined repetition the AF frequency response of the transmitter (in dB) is measured until no more RF power is applied to the CMS. To this end, first a repetition block REPEAT WHILE is inserted before line 12 with the condition RF-POWER and terminated again after line 12:

GOTO LINE 12 ENTER	→	Mark the line where to start the repetition block
SPEC-1	→	Access to SPEC-1 menu
COND	→	Actuate until the RF-POWER display is backlighted
NOT RF-POWER	→	Switch on negation to wait for RF power
REPEAT WHILE STORE	→	Insert repetition block
REPEAT STOP	→	Terminate repetition block
NOT	→	Switch off negation
REPEAT WHILE STORE	→	Insert repetition block
AUTOEDT	→	Return to AUTOEDT menu
GOTO LINE 16 ENTER	→	Mark the line before which to terminate the repetition block
SPEC-1	→	Access to SPEC-1 menu
REPEAT STOP STORE	→	Terminate repetition block

The program now reads as follows:

```
0000: PROGRAM 0
0001: DELAY                500
0002: DISPLAY:MENU         01,00
0003: FREQUENCY:AF:I1          1000.00 Hz
0004: LEVEL:AF:I1          + 25000 uV
0005: DEMODULATION:WEIGHTING    RMS
0006: FILTER:TXTEST:LP         ON
0007: ——switch on transmitter——
0008: STOP
0009: COUNT:RF
0010: POWER:RF
0011: STOP                 100
0012: SPECIAL:REPEAT WHILE NOT RF-POWER
0013: SPECIAL:REPEAT STOP
0014: SPECIAL:REPEAT WHILE RF-POWER
0015: DEMODULATION
0016: REPEAT STOP
0017:   DISPLAY:MENU                    02,00
0018:
```

With the repetition block inserted in program lines 12 to 14, the demodulated signal is then measured until no more RF power is applied to the CMS.

As a next step, the user wishes to measure the frequency response of the demodulated signal of 11 measurement values, starting from 500 Hz in steps of 250 Hz. The reference is 1 kHz.

GOTO LINE 15 ENTER	→	Mark the line where to insert
START	→	Start programming
TX-TEST		
AF1 1000 Hz STORE	→	Frequency of reference measurement
DEMOD STORE	→	Select DEMOD measurement
SHIFT REF ENTER STORE	→	Measured value set as reference
AF1 250 Hz STORE	→	Frequency of modulation generator set to 250 Hz
VAR 250 Hz STORE	→	Select 250 Hz-increment
DEMOD STORE	→	Select DEMOD measurement
STOP	→	Leave LEARN mode
GOTO LINE 19 ENTER	→	Mark the line to be preceded by the repetition block
SPEC-1	→	Access to SPEC-1 menu
REPEAT START 11 ENTER STORE	→	Insert repetition block with 11 repetitions
AUTOEDT	→	Return to AUTOEDT menu
GOTO LINE 22 ENTER	→	Mark the line where to end the repetition block
SPEC-1	→	Access to SPEC-1 menu
REPEAT STOP	→	End repetition block
AUTOEDT	→	Return to AUTOEDT menu

The program thus reads as follows:

```
0000: PROGRAM 0
0001: DELAY                  500
0002: DISPLAY:MENU           01,00
0003: FREQUENCY:AF:I1          1000.00 Hz
0004: LEVEL:AF:I1            + 25000 uV
0005: DEMODULATION:WEIGHTING     RMS
0006: FILTER:TXTEST:LP         ON
0007: ------switch on transmitter-------
0008: STOP
0009: COUNT:RF
0010: POWER:RF
0011: PAUSE                  100
0012: SPECIAL:REPEAT WHILE NOT RF-POWER
0013: SPECIAL:REPEAT STOP
0014: SPECIAL:REPEAT WHILE RF-POWER
0015: FREQUENCY:AF:I1          1000.00 Hz
0016: DEMODULATION
0017: DEMODULATION:REFERENCE
0018: FREQUENCY:AF:I1            250 Hz
0019: SPECIAL:REPEAT START 11
0020: FREQUENCY:AF:I1:VARIATION      250 Hz
0021: DEMODULATION
0022: SPECIAL:REPEAT STOP
0023: SPECIAL:REPEAT STOP
0024:   DISPLAY:MENU                      02,00
0025:
```

The repetition block for frequency response measurement starts from line 15. The start value of 500 Hz results from the AF generator setting plus one increment. The increment must be in the repetition block as the value is increased with each repetition.

1.6 Conditional Statements in the Program

Conditional statements with branching can be incorporated in the program using the function IF-ELSE-END IF. The softkeys 4 to 6 (IF, ELSE, END IF) in the SPEC-1 menu give access to this function.

As a rule, a conditional statement is initiated with the IF condition (with the same conditions valid as in Section 1.5) and terminated by END IF. The command ELSE can be set between these two commands, which is executed if the condition is not fulfilled.

```
IF RF-POWER
 Commands a
ELSE
 Commands b
ENDIF
```

In this example, the commands a are executed if RF power is applied and the commands b if no RF power is present. Nesting to a maximal depth of two is permissible.

Repetition blocks and conditional statements can be interleaved in the program. However, they cannot be freely nested at will:

Permissible examples:

```
    IF condition 1
       REPEAT START X
          further commands
    REPEAT STOP
 ELSE
    REPEAT WHILE NOT condition 2
          further commands
       REPEAT STOP
    END IF
```

```
    REPEAT START X
       IF condition
          further commands
       ELSE
          further commands
       END IF
    REPEAT STOP
```

Illegal examples are:

```
  REPEAT WHILE condition 1
     IF condition 2
          further commands
  REPEAT STOP
     ELSE
          further commands
     END IF
```

Repetition blocks and conditional statements must also be completed.

1.6.1 Conditional Execution of Program Sections

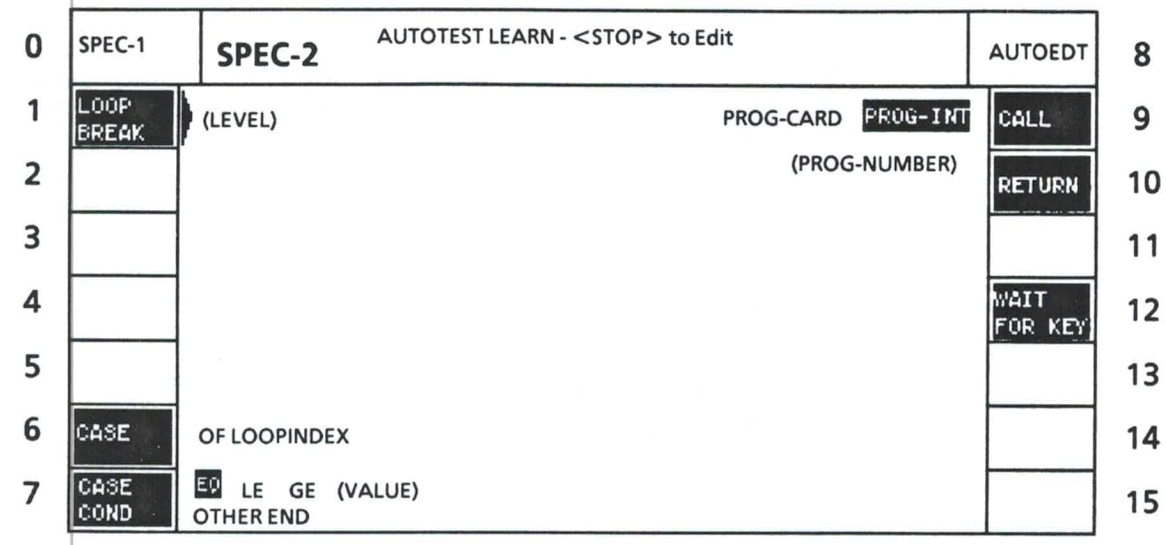


Fig. 5 Submenu SPEC-2

The menu SPEC-2 offers extended possibilities of program generation:

Conditional execution of program sections (depending on the loop counter):

In order to be able to perform different settings when a loop is executed repeatedly, softkey 6 and softkey 7 permit to use a case differentiation of the following type:

REPEAT:START or REPEAT:WHILE — Beginning of loop

The commands are always executed in this case.

CASE:OF:LOOP — Beginning of case differentiation
CASE:COND EQ 3

The commands are only executed in loop 3.

CASE:COND EQ 7

The commands are only executed in loop 7.

CASE:COND OTHER

The commands are executed in all runs except for loop 3 and 7.

CASE:COND END — End of case differentiation

The commands are always executed.

REPEAT:STOP — End of loop

After starting a case differentiation, an appropriate case specification is searched for in the following commands until the end of the case differentiation (CASE:COND:END or end of program), i.e. the command CASE:OF:LOOP (softkey 6) must always be followed by a CASE:COND command (softkey 7) in the next line.

If the condition of a CASE:COND line is fulfilled, the following commands are executed.

The subsequent CASE:COND command (independent of a condition) or the program end terminate the command execution.

Possible case specifications:

EQ	number	loop index = number
LE	number	loop index ≤ number
GE	number	loop index ≥ number
OTHER		any loop index
END		end of case differentiation

Waiting for user entry

If a program run is to depend on decisions of the user, softkey 12 (WAIT FOR KEY) can be used to determine that a user entry is waited for.

During the program run, the user is requested at this place to make an entry, which sets the conditions ENTER and CLEAR as follows:

User entry	Condition	
	ENTER	CLEAR
ENTER	true	false
CLEAR	false	true
Any other key	false	true

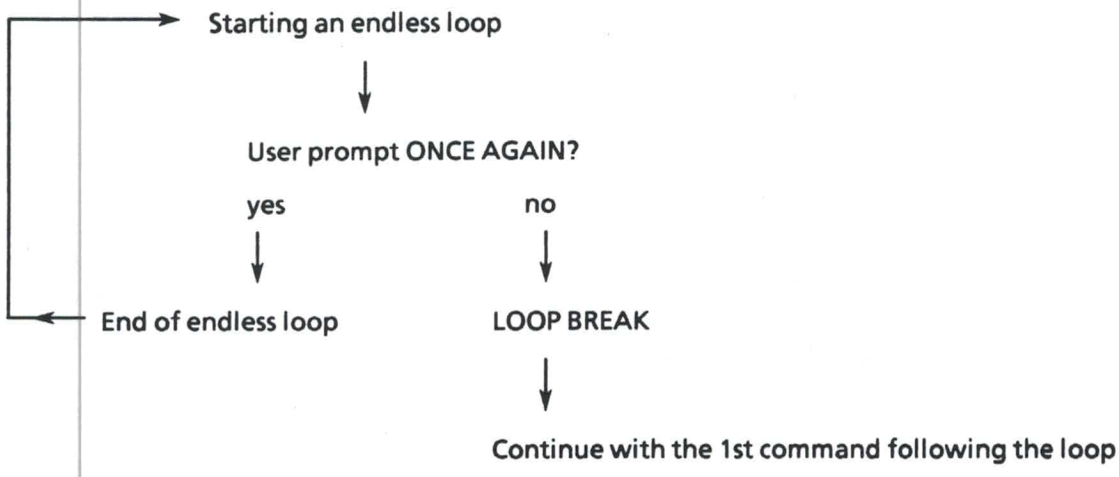
The conditions ENTER and CLEAR can be read out in conditional loops and in IF conditions.

Aborting a loop (softkey 1 : LOOP BREAK)

The LOOP BREAK command allows loop-execution (endless loops or a loop with a high repetition number) to be terminated prematurely when the desired result is obtained.

Normally, the current loop is concerned; however, several nested loops can also be terminated by indicating the appropriate number.

Example:



Calling up programs by other programs

Softkey 9 (CALL) can be used to insert a program call (internal or from memory card) into another program.

When syntax testing, a check is made to see whether the program to be called is available; otherwise, a warning is generated. The program generation itself, however, can be terminated by changing to the AUTOTST menu.

During the program run, the execution is continued with the first command of the program indicated. A return to the calling program is possible with a RETURN command or at the end of the called program.

Softkey 10 (RETURN) can be used to return to the calling program prematurely. During the program run, the execution is continued with the next command of the calling program after the call. If there is no calling program, the program execution is terminated as with a program end.

1.7 Printer Control during the Program Run

A printer connected to the CMS to give out test reports can be directly controlled from the program sequence. Softkeys 10 to 13 (PRINT CTRL, PRINT ON, PRINT OFF, PAGE FEED, REPORT FORMAT) in the SPEC-1 menu are used for this purpose.

With softkey 10 PRINT CTRL, control characters can be sent to the printer which are normally not included in the printouts but effect switchover of printer functions, e.g. switching on or off of the underline function.

These control characters can be entered only in the HEX code. Maximally 10 characters per command line are permissible.

The control characters are entered via the keypad (0 to 9 and A to F) and each entry is completed by pressing hardkey STORE.

The printer can be switched on or off during the program run using the softkey 11 (PRINT ON, PRINT OFF). Again, these commands are acknowledged by pressing hardkey STORE.

Softkey 12 is used to effect form feed.

The softkey function 13 REPORT FORMAT can be used to select the format of the printout (SMALL, MEDIUM or LARGE) during the program run (see Section 1.7.2).

Note: ***Softkey 5 REPORT TARGET has highest priority in the AUTORUN menu. If the target for the report is set to OFF, all the printer controls in the program are disabled.***

Example: The printer is to be initialized at the beginning of a sequential program (CMS in AUTOEDT menu (command sequence for this printer HEX: 1B 40), the protocol format be set to LARGE and the printer then be switched on. Following further commands, i.e. measurements, the report is to be generated:

SPEC-1	→	Access to the SPEC-1 menu
PRINT CTRL 1 B 4 0 STORE	→	HEX code for initialization
PAUSE 1000 STORE	→	Insert delay before new commands can be sent to the printer
REPORT FORMAT	→	Press softkey until LARGE display is backlighted
STORE	→	Store function
PRINT ON STORE	→	Switch on printer
AUTOEDT	→	Return to AUTOEDT menu

The following command lines are displayed:

0006 previous command
0007 PRINT CTRL 1B 40
0008 PAUSE 1000
0009 REPORT FORMAT LARGE
0010 PRINT ON
0011 further commands

If the function PRINTER or MEMCARD is selected in the AUTORUN menu using softkey 5 REPORT TARGET, a report header information is generated at each program start and the subsequent program lines are printed out until PRINT OFF is set.

1.7.1 Printing of Reports

All the parameters measured during the program run can be given out to a printer in form of reports or be stored on a memory card. Test reports are printed out in the following form:

```
REPORT: 26   PROGRAM: 03   20-APR-89 09:24   USER: XXXXXX
DEVICE under TEST IDENTIFICATION:.....

NO    COMMAND      PARAMETER      RESULT     TOL

0001 ------------------TRANSMITTER TEST----------------------
0002 LEVEL:RF        0.1 mV
0003 DEMODULATION                   2.75 kHz    OK
0004 DEMODULATION                   4.45        FAULT
0005 SINAD           20 dB          20.1 dB
---> RF LEVEL                  0.5 uV
0006 LEVEL:RF        ::1MV

9999 TOTAL TOLERANCE                            FAULT
```

Explanations:

NO:	Line number of active program
COMMAND:	IEC bus format of command
PARAMETER:	Preset parameter settings
RESULT:	Measurement results as specified in the display. In the case of two measurement results (SINAD search routine), the second value is indicated in a subsequent line (marked by →).
TOL:	Tolerance evaluations are listed in the report only for those commands which are immediately followed by +TOL and/or -TOL. OK means no violation of the tolerance range, FAULT means that the tolerance limit is exceeded.
::	In the case of setting values, which are stated only in the course of the active program sequence, the entered value is documented after :: .
Report header:	(see Section 2.1.1).

If the program data in the report include tolerance evaluations, the individual tolerance evaluations are automatically summed up at the end of the report, i.e. the section TOTAL TOLERANCE lists if no (OK) or at least one tolerance violation (FAULT) has occurred during the program run.

1.7.2 Report Formats

The format of the report can be defined by the user before starting the program sequence or from the active program using REPORT FORMAT LARGE, REPORT FORMAT MEDIUM or REPORT FORMAT SMALL. If the program sequence is already started, the user can no longer manually modify the format from the active program. It is neither possible to modify the format of already executed reports.

Three report formats are available:

REPORT FORMAT LARGE: Complete logout of program data, i.e. all commands, comments and measurements are documented.

REPORT FORMAT MEDIUM: Commands pertaining to the autorun control (e.g. changing of menus) and all settings are suppressed. However, setting values which are stated only in the course of the program run are included in the report.

REPORT FORMAT SMALL: Only measurement data are reported.

2 Execution of Programs

A program generated in the AUTOEDT menu can be started from the AUTORUN menu. To access the AUTORUN menu, the softkey 3 AUTORUN is pressed in the AUTOEDT menu.

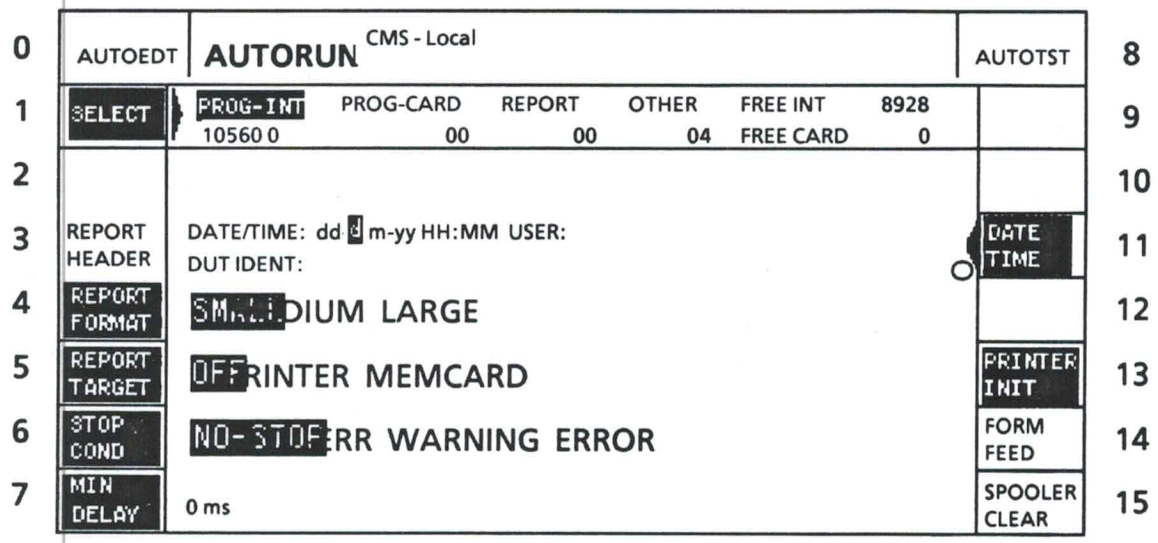


Fig. 6 Submenu AUTORUN

This menu permits to set or modify the parameters required for the program execution. The program execution is started via hardkey START. This can be done in any menu. The currently selected program is started.

Once the program sequence is started, the CMS is in AUTOTEST RUN mode. The first status line reads out the message AUTOTEST RUN - HOLD by <STOP>.

In this mode, the CMS executes all the commands stored in the active program in the sequence as entered.

2.1 Parameters for Program Execution

It is possible before starting the program run to set some parameters which are not yet determined in the actual program setup (cf. Sections 2.1.1 to 2.1.8). Other functions such as COPY additionally require the desired program/report number to be entered directly above the number field.

Information on the selected programs and reports is read out in the two lines between softkeys 1 and 9.

In the CMS the following data types in short-form are available in these two lines:

PROG-INT: CMS-internal programs

PROG-CARD: programs on memory card

REPORT: reports on memory card

OTHER: stored instrument states (= PANEL) and other data types on memory card

The left-hand number below each data type indicates the memory occupied by the data type (in characters), the right-hand number specifies the number of the currently selected program/report.

To the right of the abbreviations

FREE INT: internal program memory,
FREE CARD: memory card,

the size of the available (free) memory is indicated.

2.1.1 Report Header

Each report contains a report header at the beginning, which specifies the current date, the user and a DUT identification. On actuation of softkey 3 REPORT HEADER, the menu REPORT (similar to the ALPHA-Menü) is automatically called up and the user can enter the respective data as described in Section 1.3. To leave the REPORT menu again, the hardkey MENU ↑ is pressed.

In addition, also not the following:
A text can be entered in the fields USER or DUT IDENT or an already existing text be modified by pressing the softkey 9 TEXT CURSOR, if required several times. The field DATE/TIME is selected by pressing softkey 1 DATE/TIME.
In the field DATE/TIME, each numeric value of the date section can be directly set (i.e. incremented or decremented) using the VAR spinwheel. The individual numeric values are selected by pressing the softkey 1 DATE/TIME several times. The softkeys 7, 15 and ENTER have no functions in this case, CLEAR initializes the field.

2.1.2 Report Formats

Softkey 4 REPORT FORMAT is used to select one of the report formats, LARGE, MEDIUM or SMALL (cf. Section 1.7.2). If a format has been selected during program generation, the pre-set format is modified in the program irrespective of the setting of softkey 4 from the position where such a command has been inserted in the active program.

2.1.3 Target Address of Report

Softkey 5 REPORT TARGET selects the target address of the test report, i.e. PRINTER or memory card MEMCARD, or no report (OFF).

In the OFF setting, any printer control commands entered in the program are disabled (cf. Section 1.7).

2.1.4 STOP Conditions

Softkey 6 STOP COND permits to select one of the following conditions: NO STOP, stop in the case of violations of the tolerance range (TOL ERR), stop with warnings (WARNING) or stop of the program with error messages (ERROR).

Irrespective of the setting of softkey 6, any stops entered in the program as commands are executed (cf. Section 1.4).

2.1.5 Delays in the Program

Softkey 7 MIN DELAY has the same function as softkey 14 in the SPEC-1 menu (cf. section 1.4).

The delay set is valid until it is overwritten by a MIN DELAY command stored in the program.

2.1.6 Initialization of the Printer

Softkey 13 PRINTER INIT is used to enter the command sequence for initialization of the connected printer. The characters are entered in the HEX code via the keypad (0 to 9 and A to F). The initialization itself is started using hardkey ENTER.

2.1.7 Form Feed of the Printer

Softkey 14 FORM FEED is used to effect a form feed of the printer, which sets the print head to the next page to the beginning of the first line.

This function is above all useful to coordinate the line counter of the CMS with the connected printer.

2.1.8 Clearing of the Printer Buffer (SPOOLER CLEAR)

All the characters for printout are stored in a buffer (SPOOLER). During printing, these characters are read from the buffer in the sequence as stored. This offers the advantage that no delays are required for printing and that printing is carried out in background mode, i.e. the CMS is immediately ready for user operation again.

To abort printing, the buffer must be cleared using softkey 15 SPOOLER CLEAR.

2.2 Program Suspensions

The active program can be stopped by pressing hardkey STOP, as a result of programmed stops or by one of the stop conditions STOP COND. The first status line displays the message AUTO HOLD - <START><STOP><RETURN>.

The display then shows the menu which was valid before the active program was started, or the menu called up by programming. The CMS is ready for entries of settings, which, however, are not transferred to the program.

To leave the HOLD mode and restart the program, the hardkey START is pressed. The program is continued exactly where it was interrupted.

When hardkey STOP is pressed again, the CMS leaves the AUTOTEST mode and is switched to manual operation in the currently displayed menu.

When hardkey RETURN is pressed in the HOLD mode, the CMS accesses the AUTORUN menu and the report number is incremented by one. This means that the report number must not always be entered before program start. The program can again be executed using hardkey START.

If the user accesses the submenu AUTOEDT from the AUTORUN menu via the AUTOTST menu, the first 14 lines of the program are not displayed as is normally the case but the cursor marks the first command in the program sequence that was not yet executed. If the program has been completely executed, the cursor marks the first free line of the program. However, in the case of error it is easier for the user to verify the cause of error if the program is not completely executed.

3 Management of Programs and Test Reports

All the functions required for the management of program and test reports (loading, saving, printing and display) are accessible from the AUTOTST menu (see Fig. 1). Maximally 100 programs can be stored in the CMS, additional programs must be loaded via memory cards where they are stored.

3.1 Loading of Programs and Reports from the Memory Card

Softkey 1 SELECT in the AUTOTST menu allows to select if a program or a report is to be loaded. The program or report is selected by entering the respective program number. Loading is effected by pressing softkey 5 COPY <-MEMCARD.

It is possible to load several programs from the memory card into the CMS.

3.2 Linking of Programs

Several individual programs can be linked to one program. First one program is loaded and the program to be appended selected using softkey 1. Both programs are linked together by means of the softkey function 7 (APPND <-MEMCARD).

3.3 Storing of Programs and Reports

Programs generated in the CMS can be stored on the memory card using softkey 6 COPY -> MEMCARD. For this purpose, first a program number must be entered via softkey 1. If a program with the same number is already stored on the memory card, the message "DELETE EXISTING REPORT (PROGRAMM)?" is given out. Pressing the ENTER key overwrites the already existing program, CLEAR is used for aborting.

3.4 Display of Directory

The programs available in the CMS as well as the programs and test reports stored on the memory card can be displayed via softkey 2 DIR. Via softkey 1 SELECT, the user first has to select again if programs in the CMS or on the memory card are to be displayed.

The display reads out the number and the first line of the programs. Therefore, when generating a program always a comment should be inserted in the first program line to identify the program.

With reports, always the report number and the DUT identification are specified (cf. Section 2.1.1).

If more programs or test reports are available than can be displayed, the softkeys 14 PAGE UP and 15 PAGE DOWN are provided to call up the other programs or reports.

3.5 Display and Printing of Programs

If a program is selected by softkey 1, softkey 4 TYPE can be pressed to have its contents displayed. Paging through the contents is possible by means of softkeys 14 PAGE UP and 15 PAGE DOWN.

Using softkey 3 PRINT, the selected program or report can be printed out on a printer connected to the CMS.

3.6 Clearing of Programs and Reports

Programs and reports can be cleared from the memory card and the CMS using softkey 10 DELETE. First the program or report to be deleted is selected via softkey 1 PROGR REPORT and softkey 9 CMS MEMCARD. Before the program or report is deleted, the user is prompted by "ARE YOU SURE ?". ENTER acknowledges clearing, CLEAR is pressed for aborting.

The entire contents saved on the memory card or all the programs in the CMS can be cleared by means of softkey 11 FORMAT. Again, softkey 9 is used for selecting. The user is prompted again by "ARE YOU SURE ?", which is acknowledged by ENTER or aborted by CLEAR.

3.7 Memory Card Protection

With softkey 12 PASSWD PROTECT (see page 5) the memory card can be write protected. This protection is for the functions FORMAT, DELETE and COPY→MEMCARD.

By pressing this softkey the user gets the message "Please, enter password." The password is a number between 1 to 60 000. Confirmation is done by pressing ENTER. For verification a second confirmation is to be done "To rerify, please reenter password."

The background of softkey 12 indicates the protection status:
black = Memory Card protected
white = Memory Card unprotected

To unprotect a memory card it is only necessary to key in the password.