ROHDE&SCHWARZ

Test and Measurement
Division

Operating Manual

SIGNAL GENERATOR

SME

1038.6002.02/03/06

Printed in the Federal
Republic of Germany

Certified Quality System

ISO 9001

DQS REG. NO 1954-04

Qualitätszertifikat

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist nach ISO 9001 zertifiziert.

Certificate of quality

Dear Customer,

You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards.
The Rohde & Schwarz quality management system is certified according to ISO 9001.

Certificat de qualité

Cher client,

Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité.
Le système de gestion qualité de Rohde & Schwarz a été homologué conformément à la norme ISO 9001.

ROHDE & SCHWARZ

095.1000 Bl 0-0796

Safety Instructions

This unit has been designed and tested according to the standards outlined overleaf and has left the manufacturer's premises in a state fully complying with the safety standards.

In order to maintain this state and to ensure safe operation, observe the following instructions, symbols and precautions.

1) When the unit is to be permanently cabled, first connect protective ground conductor before making any other connections.

2) Built-in units should only be operated when properly fitted into the system.

3) For permanently cabled units without built-in fuses, automatic switches or similar protective facilities, the AC supply line shall be fitted with fuses rated to the units.

4) Before switching on the unit ensure that the operating voltage set at the unit matches the line voltage.

   If a different operating voltage is to be set, use a fuse with appropriate rating.

5) Units of protection class I with disconnectible AC supply cable and plug may only be operated from a power socket with protective ground contact.

   The protective ground connection should not be made ineffective by an extension cable.

   Any breaking of the protective ground conductor within or outside of the unit or loosening of the protective ground connection may cause the unit to become electrically hazardous.

   The protective ground conductor shall not be interrupted intentionally.

6) Before opening the unit, isolate it from the AC supply.

   Adjustment and replacement of parts as well as maintenance and repair should be carried out only by specialists approved by R & S.

   Observe safety regulations and rules for the prevention of accidents.

   Use only original parts for replacing parts relevant to safety (e.g. power on/off switches, power transformers or fuses).

7) Also observe the additional safety instructions specified in this manual.

Explanation of Symbols Used

 - Read operating manual, observe the safety symbols used

 - Caution, shock hazard

 - Protective ground connection

 - Unit ground

 - Equipotentiality

 - Ground

1 Preparation for Use

1.1 Putting into Operation

Before putting the SME into operation, please make sure that

- the covers of the casing are put on and screwed,
- the ventilation openings are free,
- no signal voltage levels exceeding the permissible limits are applied at the inputs,,
- the outputs of the instrument are not overloaded or connected incorrectly.

If these points are not observed, the instrument might be damaged.

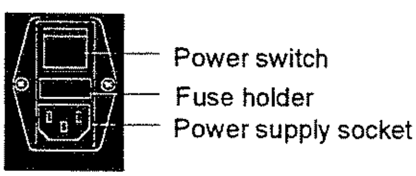
1.1.1 Supply Voltage

The SME can be operated at a.c. systems from 90 to 132 V and 180 to 265 V at system frequencies from 47 to 440 Hz. The power supply socket is situated at the rear of the instrument. The instrument automatically sets itself to the voltage applied within the permissible voltage ranges. It is not necessary to set the instrument to a certain supply voltage.

1.1.2 Power Fuses

The SME is protected against short circuits by means of two fuses according to nameplate of the power supply. The fuses are situated in the draw-out fuse holder which is inserted between power supply socket and power switch (see below).

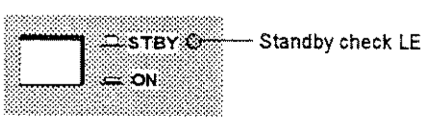
1.1.3 Switching On/Off the Instrument



Power switch at the rear of the instrument

Switch on/off: ➢ Press power switch at the top/bottom
When the instrument is switched off, the marking "O" is visible at the top of the power switch.

The power switch can remain switched on permanently. Switching off is only necessary when the instrument is to be completely disconnected from the mains.



On/off switch at the front of the instrument

Switch on: ➢ Press switch.
The instrument is ready for operation.

Switch off: ➢ Release switch.
The instrument assumes the STANDBY mode.

1.1.4 Initial Status

Upon switching on, the instrument either automatically assumes the status which was set when it was switched off (parameter POWER-ON STATE PREVIOUS SETTING in LEVEL-LEVEL menu) or the RF output is disconnected (POWER-ON STATE RF OFF).
If the instrument need not to be operated from the initial status any further, a defined default status should be established by pressing the [PRESET] key prior to further settings.

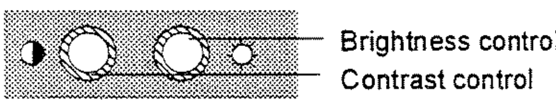
STANDBY Mode

In the STANDBY mode the optional reference oscillator (option SM-B1) remains switched on, which increases frequency accuracy.

Frequency accuracy after switching on when the oven-controlled reference oscillator is fitted (option SM-B1)

When switching on from the STANDBY mode, the specified frequency accuracy is reached immediately. If the power switch was switched off, the reference oscillator needs some minutes of warm-up time to reach its nominal frequency. During this period of time, the output frequency does not yet reach its final value either. In the status line in the header field of the display the message "OVEN COLD" is displayed for this time.

1.1.5 Setting Contrast and Brightness of the Display



Contrast and brightness of the display can be set by means of the contrast and brightness controls situated below the display.

1.1.6 RAM With Battery Back-Up

The SME has a static read-write memory (CMOS-RAM) with battery back-up, in which 50 different complete settings of the instrument can be stored (cf. Chapter 2, section "Storing and Calling of Instrument Settings"). In addition, all data and/or lists the user enters himself, such as for list mode, memory sequence, user correction of the level and data sequences with digital modulation, are stored in the RAM. Further, all data of the calibrations running within the instrument in the SME are stored in the RAM (cf. Chapter 2, section "Calibration").

A lithium battery with a service life of approx. 5 years serves to supply the RAM with power. When the battery is discharged, the data stored will be lost. Exchanging the battery is described in Chapter 4.

1.1.7 Preset Setting

A defined setting status is achieved by pressing the [PRESET] key.

Preset Status:

RF frequency	100 MHz
RF level	-30 dBm
Reference frequency	internal, adjustment off
Offsets	0
Modulations	switched off
Transient-free level setting	switched off, level attenuator mode: AUTO
Internal level control	level ALC: ON
User correction	level UCOR: OFF
PLL bandwidth	auto
LF output	switched off
Sweep	switched off
List mode	switched off
Memory sequence	switched off
Suppression of indications	system security: unaltered
Protection of calibration data	protection lock: unaltered
Settings stored	unaltered
Data, lists etc. stored	unaltered
IEC-bus address	unaltered
Beeper	unaltered

All parameters and circuit states, even those of operating modes which are not activated, are preset by means of Preset.

The presettings going beyond the above list can be seen from the menu representations as of Section 2.4 which each indicate the Preset setting status.

1.2 Functional Test

On switching on the instrument and permanently during operation, the SME carries out a self test. The ROM contents as well as the battery of the non-volatile RAM are checked on switching on the instrument and the RAM contents with every calling the memory. The most important instrument functions are automatically monitored during operation.

If an error is detected, the message "ERROR" is displayed in the status line. For further identification of the error, press the [ERROR] key. Thereupon a description of the error/s is displayed (cf. Chapter 2, section "Error Messages"). Return to the menu exited by pressing the [RETURN] key.

If required, the self tests can be induced purposefully. See Chapter 4, section "Functional Test".
Further, internal test points can be polled by the user and the results be read out and displayed. See Chapter 2, section "Voltage Indication of Test Points".

1.3 Fitting the Options

Due to its variety of options, the SME offers the possibility of providing the instrument with the equipment exactly corresponding to the application. Newly fitted options are automatically recognized and the relevant parameters added in the menu.

After every change of the instrument configuration, the CMOS RAM has to be cleared as the storage data shift:

➢ Switch off the instrument

➢ Switch the instrument on again with the [RESET] key pressed

The internal calibration routines VCO SUM, LEV PRESET and PULSE GEN now have to be called up again to restore the cleared calibration values.
These routines are accessible via menu UTILITIES-CALIB (see also Chapter 2, section "calibration").
The calibration routines have to be carried out in the following order:

1. Summing loop (VCO SUM)
2. LEV PRESET
3. PULSE GEN (if installed)

1.3.1 Opening the Casing

Caution:
Prior to opening the SME unplug the power connector.

Remove paneling

➢ Remove four screws in the two tilt feet at the rear of the instrument.

➢ Remove the upper paneling towards the top and rear.

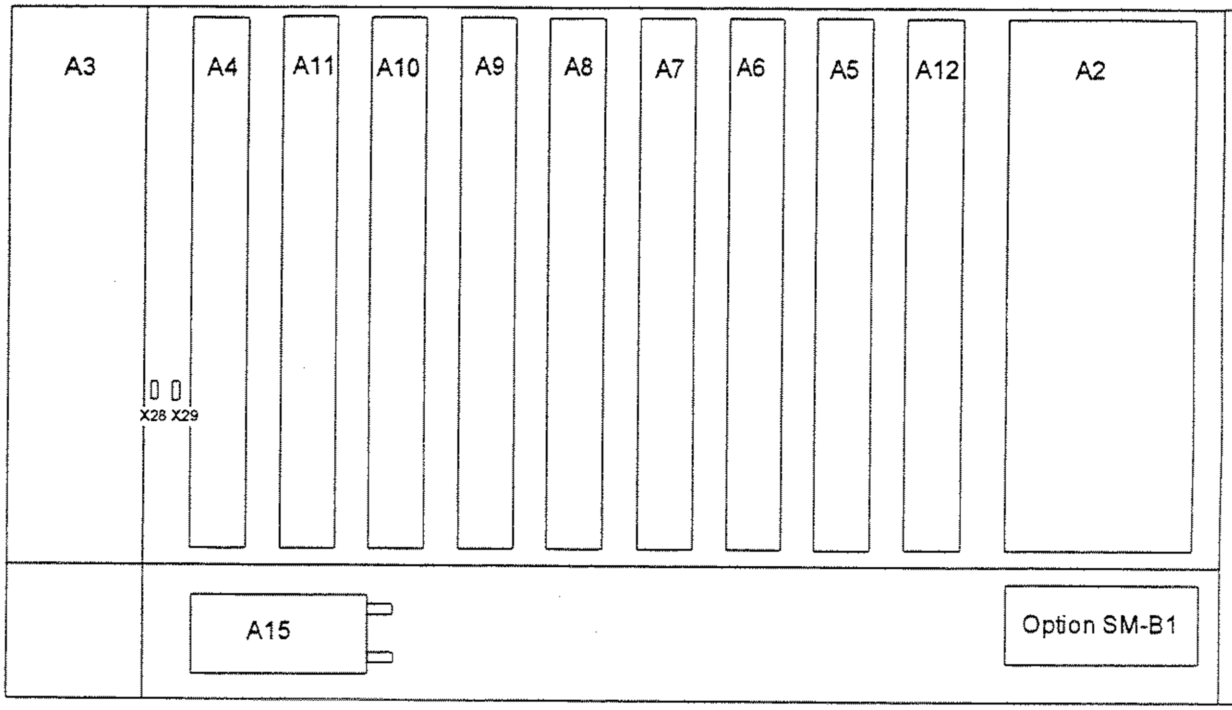
➢ Turn the instrument.

➢ Remove the lower paneling towards the top and rear.

Open ventilation ducts

When an option is fitted at a slot which has not been used up to now, the appropriate ventilation duct of the plexiglas plate at the left in the casing frame must be opened. The openings are pre-punched so that the respective part is easy to break out.

1.3.2 Overview of the Slots



A2 = power supply
A3 = front unit
A4 = option
A5 = option
A6 = option
A7 = reference/step synthesis
A8 = digital synthesis
A9 = summing loop
A10 = output section, 1.5 GHz
A11 = output section 3 GHz/6 GHz
A11 = option
A15 = attenuator

Fig. 1-1 SME, View from the top

1.3.3 Option SM-B1 - Reference Oscillator OCXO

Fitting the option

- Fasten the option at the back end of the lateral opening by means of the screw threads provided there.
- If slots A5 and A6 are both occupied, one of these modules must be removed temporarily.
- Feed ribbon cable W710 through the rear square cut-out to the motherboard, insert into connector X22 and snap in the locking.
- Feed coaxial cable W710 from socket X711 of the option through the second cut-out along the rear transverse panel to connector X74 at the A7 module, reference/step synthesis, via the motherboard and insert there. Fasten the cable at the transverse panel using the cable ties attached.

Set tuning voltage and calibrate OCXO

The crystal oscillator was factory-tuned to nominal frequency and the appropriate tuning voltage indicated on the cover of the module. The calibration value now has to be calculated from this value and transferred to the memory of the signal generator.

Calculate calibration value

The tuning voltage is generated by a 12b-bit-D/A converter which is scaled such that a tuning voltage of 12 volts is generated with calibration value (CALIBRATION DATA) 4000.
The calibration value is thus calculated from the tuning voltage (V_{tun}) as follows

$$\text{CALIBRATION DATA} = V_{tun} \times 4000 \ / \ 12$$

For checking purposes, the voltage at pin 16 of plug X22 on the motherboard can be remeasured and corrected if necessary. A check by means of frequency measurement may only be made after a warm-up of 2 hours and against a calibrated reference.

Store calibration value

- Call menu UTILITIES-CALIB-REF OSC.
- Enter the calculated calibration voltage with CALIBRATION DATA by means of the rotary knob or keypad.
- Select STORE CALIBRATION DATA
- Terminate entry using the [SELECT] key
  The new calibration value is stored in the EPROM.

Note: *The flash EPROM does not permit the deletion of individual data. Thus new memory space is occupied for each calibration. If there is no memory space available any more, the EPROM must be cleared by an authorized service shop and be written into anew. Thus a calibration should only be made if necessary*

1.3.4 Option SM-B2 - LF Generator

Fitting as 1st generator

As 1st generator, the LF generator is fitted at one of the rear slots A5, A6 or A12.

- Withdraw jumper X29 at the front top of the motherboard.
- Plug jumper X3 at position 2-3 (on the right) on the option (to the right of multipoint connector X50).

Fitting as 2nd generator

If there already is a generator at one of the slots A5, A6 or A12, the LF generator is mounted at slot A4.

- Withdraw jumper X28 on the motherboard.
- Plug jumper X3 at position 1-2 on the option.

1.3.5 Options SM-B3, SM-B8 and SM-B9 - Pulse Modulator 1.5, 3 and 6 GHz

When fitting this option, the RF characteristics of the instrument change to such an extent that the output level has to be calibrated. This requires calibrated test instruments , a control processor and service kit SM-Z2. For this reason, fitting should be carried out at an authorized R&S service shop. Fitting is described in the service manual (stock number 1039.1856.24).

1.3.6 Option SM-B4 - Pulse Generator

The pulse generator is fitted within module A4, pulse modulator.

Fitting the option

- ➢ Open module A4.
- ➢ Fasten the pulse generator board by means of 4 screws.
- ➢ Plug in connectors W10 and W11.
- ➢ Screw on cover again.
- ➢ Establish the following RF connections at the pulse generator:

Cable	From	To	Signal
W43	A4-X43	Rear panel	VIDEO
W44	A4-X44	Rear panel	SYNC

- ➢ Cable 50-MHz reference, cf. Section 1.3.12

Calibrating pulse generator

- ➢ Call menu UTILITIES/ CALIB /PULSE GEN
- ➢ Select action CALIBRATE ↗ and activate using the [SELECT] key
- ➢ The start and end of the calibration are displayed. Calibration only takes a few seconds.

Note: *The calibration data are stored in the RAM, thus the calibration can be repeated as often as required.*

1.3.7 Option SM-B5 - FM/PM Modulator

The FM/PM modulator is fitted at slot A6.

Fitting the option

- ➢ Withdraw cable W89 from X99 of the summing loop and use again.
- ➢ Establish the following connections:

Cable	From	To	Signal
W89	A8-X89	A6-X67	FDSYN
W65	A6-X65	A7-X71	REF100
W67	A6-X69	A9-X99	FDFM

Adjustment

Option SM-B5 loads the internal modulation generators so that their output voltage decreases by approx. 1%. This causes a modulation error which can be corrected by the adaptation of the corresponding adjustments. This requires service kit SM-Z2 (stock no.: 1039.3520.02).

Standard generator

- Press key [PRESET].
- Set LFGEN1 in menu MODULATION / AM / AM SOURCE INT.
- Set the voltage at pin A6 of the plug of the module to 1 V (crest voltage) using R298 (AF LEVEL) .

Option SM-B2, LF generator

- Press the [PRESET] key.
- Set LFGEN2 in menu MODULATION / AM / AM SOURCE INT.
- Set the voltage at pin A7 of the plug of the module to 1 V (crest voltage) using R55 (1Vp DDS ADJ).

Option SM-B6, Multifunction generator

- Press the [PRESET] key.
- Set LFGEN2 in menu MODULATION / AM / AM SOURCE INT.
- Set the voltage at pin A7 of the plug of the module to 1 V (crest voltage) using R380 (DAC1 AMPL ADJ).
- Press the [PRESET] key.
- Set the following in menu MODULATION / VOR :
  - MODE NORM
  - VAR DEPTH 0%
  - SUBCARRIER DEPTH 0%
  - COM/ ID STATE ON
  - COM/ ID DEPTH 100%
- Set the voltage at pin A7 of the plug of the module to 1 V (crest voltage) using R465 (DAC2 AMPL ADJ).

1.3.8 Option SM-B6 - Multifunction Generator

The multifunction generator is fitted at one of rear slots A5, A6 or A12.

- ➢ Undo the board locking on both sides of the motherboard.
- ➢ Plug the PCB on one of the slots.
- ➢ Lock modules again
- ➢ Remove jumper X29 at the front top of the motherboard
- ➢ Cable 50-MHz reference, cf. Section 1.3.12

1.3.9 Option SME-B11 - DM-Coder

The data coder is fitted into module A8, digital synthesis.

- ➢ Open module A8.
- ➢ Fasten the DM coder board by means of 4 screws.

  Caution: *The four insulating washers supplied have to be placed between the spacers on module A8 and PCB of the option.*
- ➢ Plug in connector W1, W2 and W3.
- ➢ Screw on cover again.

After fitting the module, the amplitude content and the delay for the DQPSK modulation must be calibrated following the calibrations mentioned in Section 1.3.

Amplitude content

- ➢ Allow the SME to warm up.
- ➢ Set 836 MHz in the FREQUENCY menu.
- ➢ Select PRBS in the DIGITAL MOD / DQPSK / SOURCE menu.
- ➢ Select TRIM ON in menu UTILITIES / CALIB / DQPSK AMPLITUDE.
- ➢ Select the following in menu UTILITIES / DIAG / TPOINT

  - TEST POINT 704

  - STATE ON

  The diagnostic point of the ALC control voltage can be switched on.
- ➢ Adjust the voltage at this test point to 0 ±4 mV using potentiometer R297 on module A7, digital synthesis. Adjustment element R297 (LEVEL) can be accessed from the bottom of the instrument without dismantling the module.

Delay compensation

- Allow the SME to warm up.
- Connect the spectrum analyzer (see Section 5, item 2) to the RF output of the SME.
- SME settings
  - Menu FREQUENCY 836 MHz
  - Menu LEVEL 0 dBm
  - Menu DIGITAL MOD / DQPSK data source PRBS .
- Settings at the spectrum analyzer:
  - Center frequency 836 MHz
  - Span 300 kHz
  - Resolution bandwidth 3 kHz
  - Video bandwidth 100 Hz.
- Check spectrum
  The spectrum should observe the following tolerance limits (the reference level is at the center frequency)

Offset frequency	**Level**
0 kHz	0 dB (reference level)
30 to 50 kHz	< -40 dB
> 50 kHz	< -50 dB

- Select DELAY in menu UTILITIES / CALIB / DQPSK.
- Adjust the delay such that the spectrum has symmetric spurious sidebands which are as low as possible and observes the tolerance limits.

  Note: *The delay data are stored in the RAM, thus the calibration can be repeated as often as required.*

If the value for the delay thus found is different from the DEFAULT SETTING stored with R&S, the new value can also be transferred to the EPROM (see note in Section 1.3.3, however)

- Select OVERWRITE DEFAULT SETTING in menu UTILITIES / CALIB / DQPSK.

1.3.10 Option SME-B12 - DM Memory Extension

The memory extension is mounted on one of rear slots A5, A6 or A12.

- ➢ Undo the board locking on both sides of the motherboard.
- ➢ Plug the PCB on one of the slots A5, A6, or A12.
- ➢ Fix the board locking.

1.3.11 Option SME-B19 - Rear Panel Connections for RF and LF

The SME can be retrofitted to include rear panel connections for RF and LF for mounting it into a 19" rack using option SME-B19. The mounting instructions are attached to the option.

1.3.12 Options SME-B41 - FLEX Protocol - and SME-B42 - POCSAG

Options SME-B41 and SME-B42 are software options. They can be enabled by a keyword. The keyword is printed on a label which is part of the equipment supplied and has to be stuck to the rear of SME.
A prerequisite for installing the options is that option SME-B11 (DM Coder, hardware: VAR ≥ 4, REV ≥ 1) and SME-B12 (Memory Extension, hardware: VAR ≥ 2, REV ≥ 2) as well as a firmware version ≥ 1.95 are part of SME.

Enabling option

- ➢ Call up menu UTILITIES-INSTALL and then press key [SELECT].
- ➢ Select option (FLEX) or (POCSAG) to be installed and then press key [SELECT].
- ➢ Select option (FLEX) or (POCSAG) to be installed in line OPTION TO INSTALL and then press key [SELECT].
- ➢ Enter the 6-digit keyword into the entry field INSTALLATION KEY and then press [ENTER]
- ➢ Switch off unit and then switch on again.

After installation, the new option can be checked in the module list in menu UTILITIES-DIAG-CONFIG

1.3.13 Cabling of the 50-MHz Reference (REF50)

Instrument without options

Cable	From	To
W72	A7-X72	A8-X81

Instrument with option multifunction generator

Cable	From	To
W172	A7-X72	A5--X53
W72	A5-X51	A8-X81

Instrument with option pulse generator

Cable	From	To
W41	A7-X72	A4-X41
W72	A4-X42	A8-X81

Instrument with options multifunction generator and pulse generator

Cable	From	To
W172	A7-X72	A5-X53
W41	A5-X51	A4-X41
W72	A4-X42	A8-X81

1.4 Mounting into a 19" Rack

Caution: *Ensure free air inlet at the perforation of the side walls and air outlet at the rear of the instrument in rack mounting.*

The SME can be mounted into a 19" rack by means of rack adapter ZZA-94 (stock no. 396.4905.00). The mounting instructions are attached to the adapter.

2 Operation

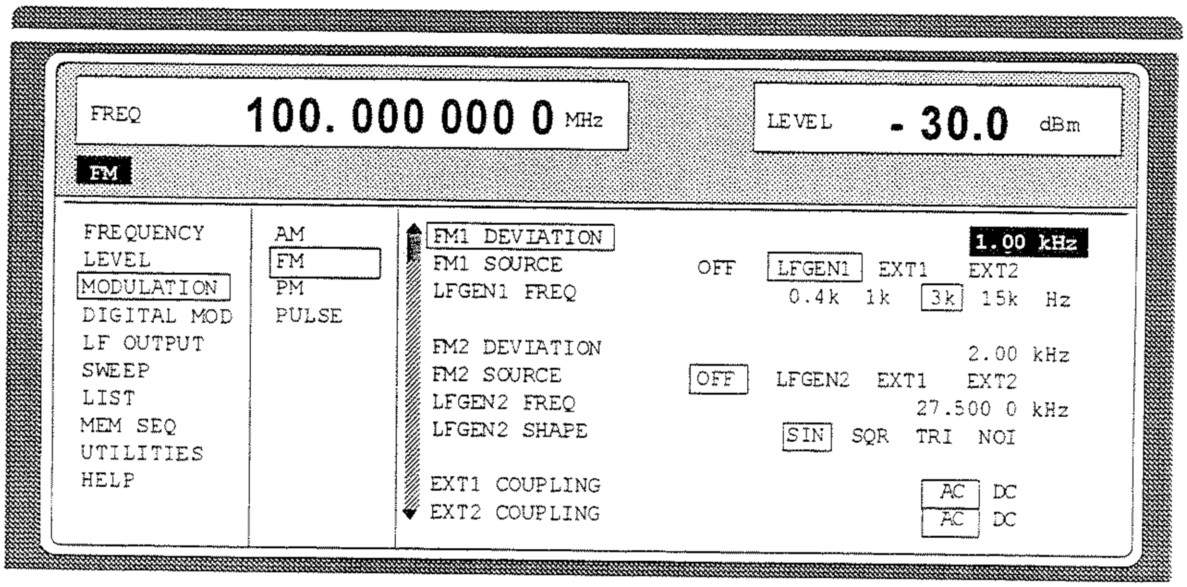
2.1 Explanation of Front and Rear Panel

2.1.1 Elements of the Front Panel

2.1.1.1 Display

(cf. Fig. 2-1, A Front panel view, display)

1



The display shows in the

header field:
- the current frequency and level settings.
- status messages.
- error messages.

menu field:
- the main menu and the submenus selected with the current settings.

Parameters can be selected and changed in the menus indicated.

see as well Section 2.2.1, Display

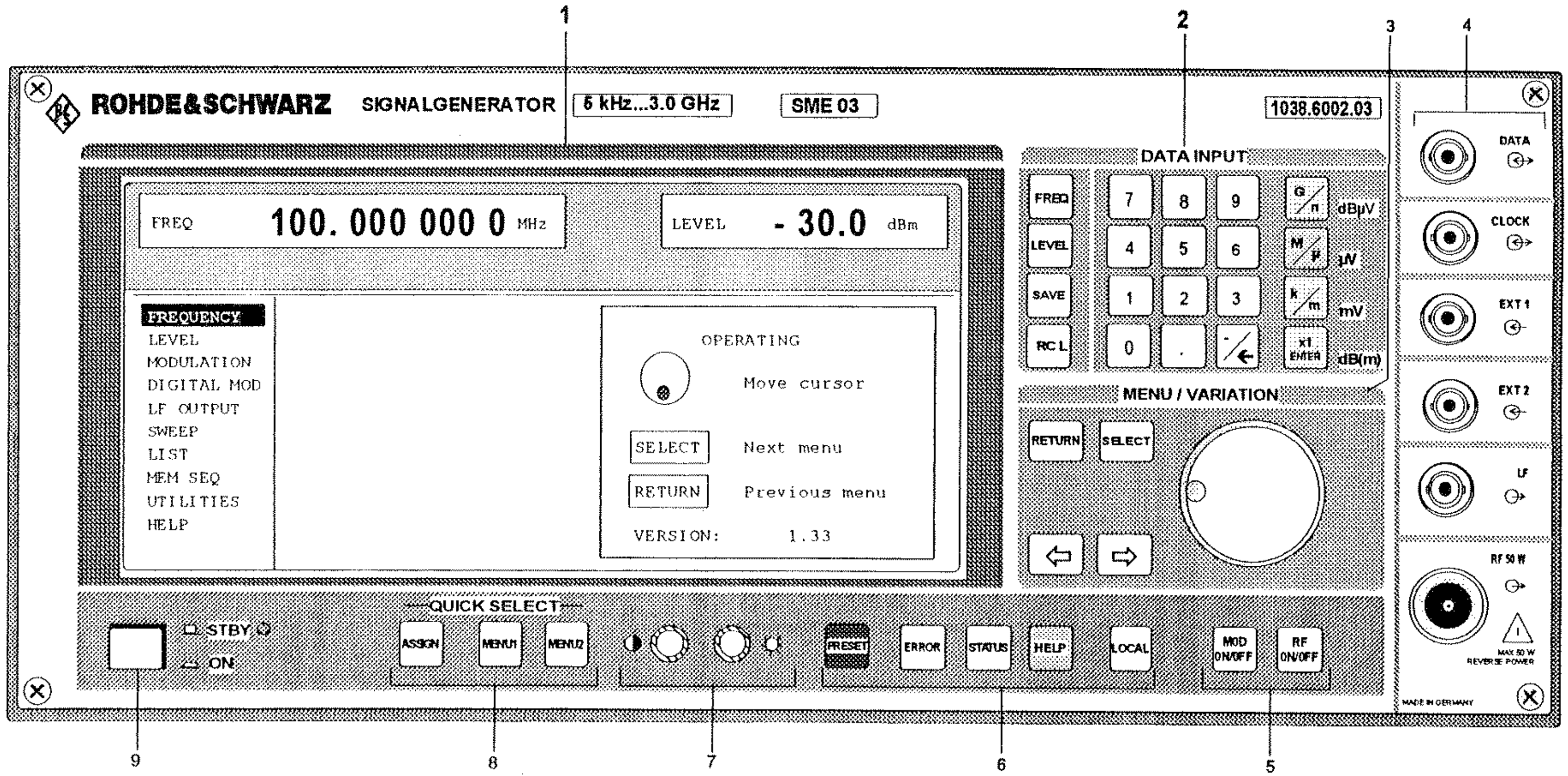


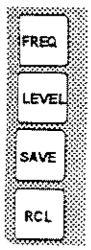
Fig. 2-1,a Front panel view, display

2.1.1.2 Controls

(cf. Fig. 2-1, B front panel view, controls)

2 DATA INPUT

Parameter field



Parameters RF frequency and RF level can be entered directly by means of the parameter keys, alternatively to menu operation. Further, complete instrument settings can be stored and called.

FREQ Opens the setting of the RF frequency via value input or variation by means of a rotary knob. The current menu is maintained. Return to the menu by means of the [RETURN] key. (Setting of the RF frequency also in the FREQUENCY menu).

LEVEL Opens the setting of the RF level via value input or variation by means of a rotary knob. The current menu is maintained. Return to the menu by means of the [RETURN] key. (Setting of the RF level also in the LEVEL menu).

SAVE Opens the storing of the current instrument setting. Memory selection is effected by entering a number (1 to 50) and is finished by means of the [ENTER] key.

RCL Opens the calling of an instrument setting stored. Memory selection is effected by entering a number (1 to 50) and is finished by means of the [ENTER] key.

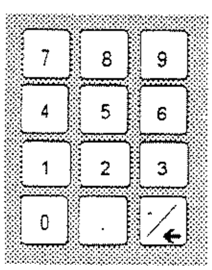
see as well
Section 2.2.2.5,
Use of [FREQ] and [LEVEL] Keys

Section 2.4,
RF Frequency

Section 2.5,
RF Level

Section 2.2.5,
Storing and Calling of Instrument Settings

Numeric input field



Numeric values, decimal point and minus sign can be entered by means of the digital keys.,

0...9 Enters the digit.

• Enters the decimal point

-/← Enters the minus sign.
Deletes the last input (digit, sign or decimal point) - key [BACKSPACE].

see as well
Section 2.2.2,
Basic Operating Steps

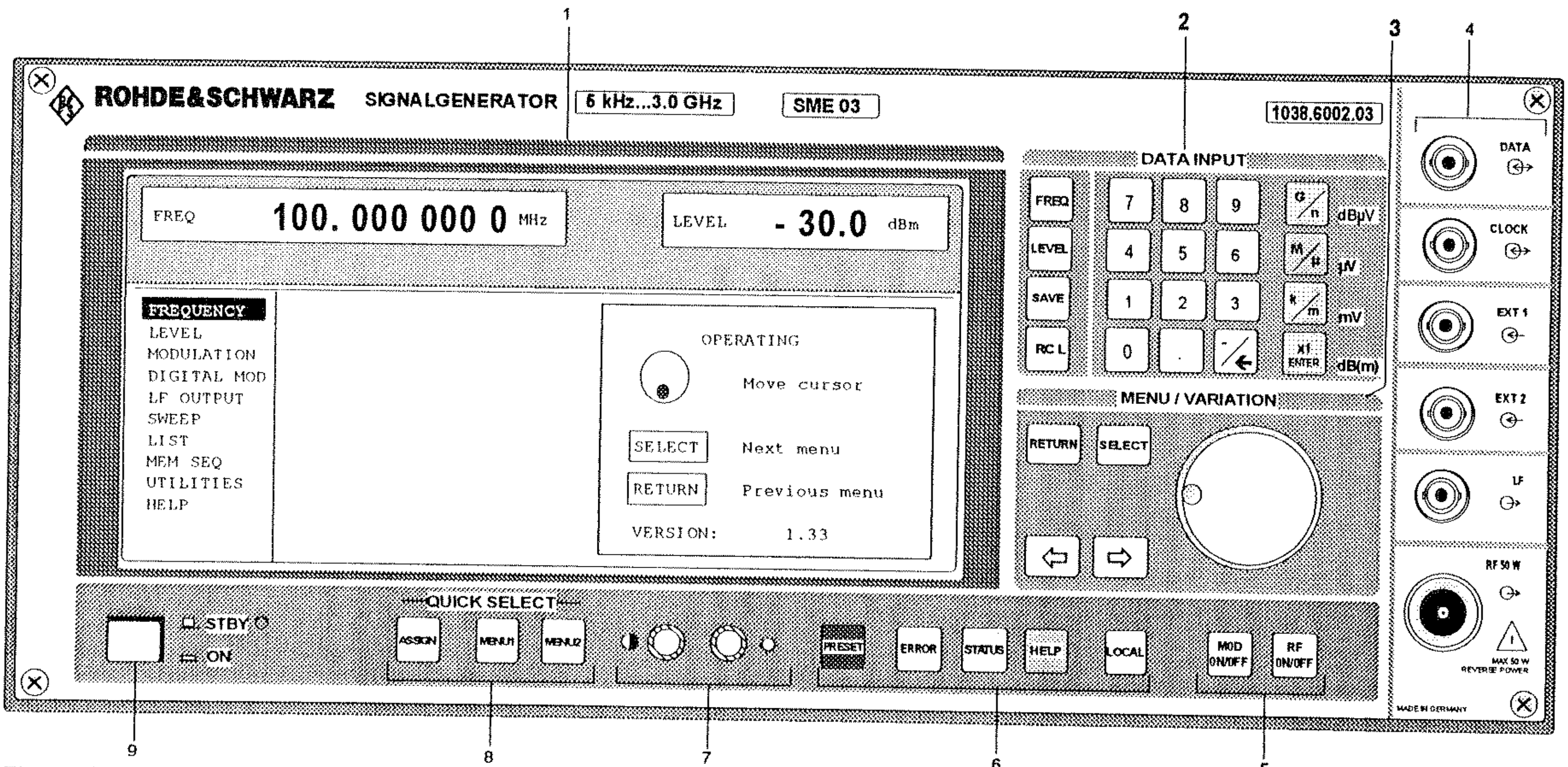
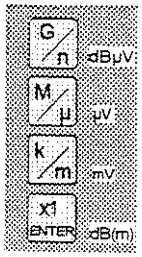


Fig. 2-1,b Front panel view, controls

2 DATA INPUT

Unit keys with enter function



The unit keys terminate the input of values and specify the multiplication factor for the respective basic unit. The basic units are displayed next to the input field while numbers are entered. In the case of level settings, the unit keys specify the unit.

G/n	dBµV	Selects giga/nano, with RF level dBµV, with LF level dBu.
M/µ	µV	Selects mega/micro, with level V.
k/m	MV	Selects kilo/milli, with level mV.
1x Enter	dB(m)	Terminates entries in the basic unit and value inputs without unit.
		Selects with level dBm
		Selects with level offset and level step width dB.

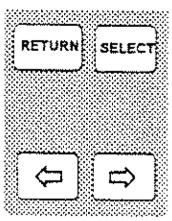
In order to change to another level unit, simply press the unit key desired. Parameter LEVEL must be activated, e.g. by pressing the [LEVEL] key.

see as well
Section 2.2.2,
Basic Operating
Steps

Section 2.2.2.7,
Change Unit of Level

3 MENU/VARIATION

Menu keys



The menu keys access the menus and settings within the menus.

RETURN	Returns the menu cursor to the next higher menu level.
SELECT	Acknowledges the choice marked by the menu cursor
⇐	Moves the digit cursor to the left by one position in the marked value indication. Moves the menu cursor to the left by one position in a 1-out-of-n selection.
⇒	Moves the digit cursor to the right by one position in the marked value indication. Moves the menu cursor to the right by one position in a 1-out-of-n selection.

see as well
Section 2.2.2,
Basic Operating Steps

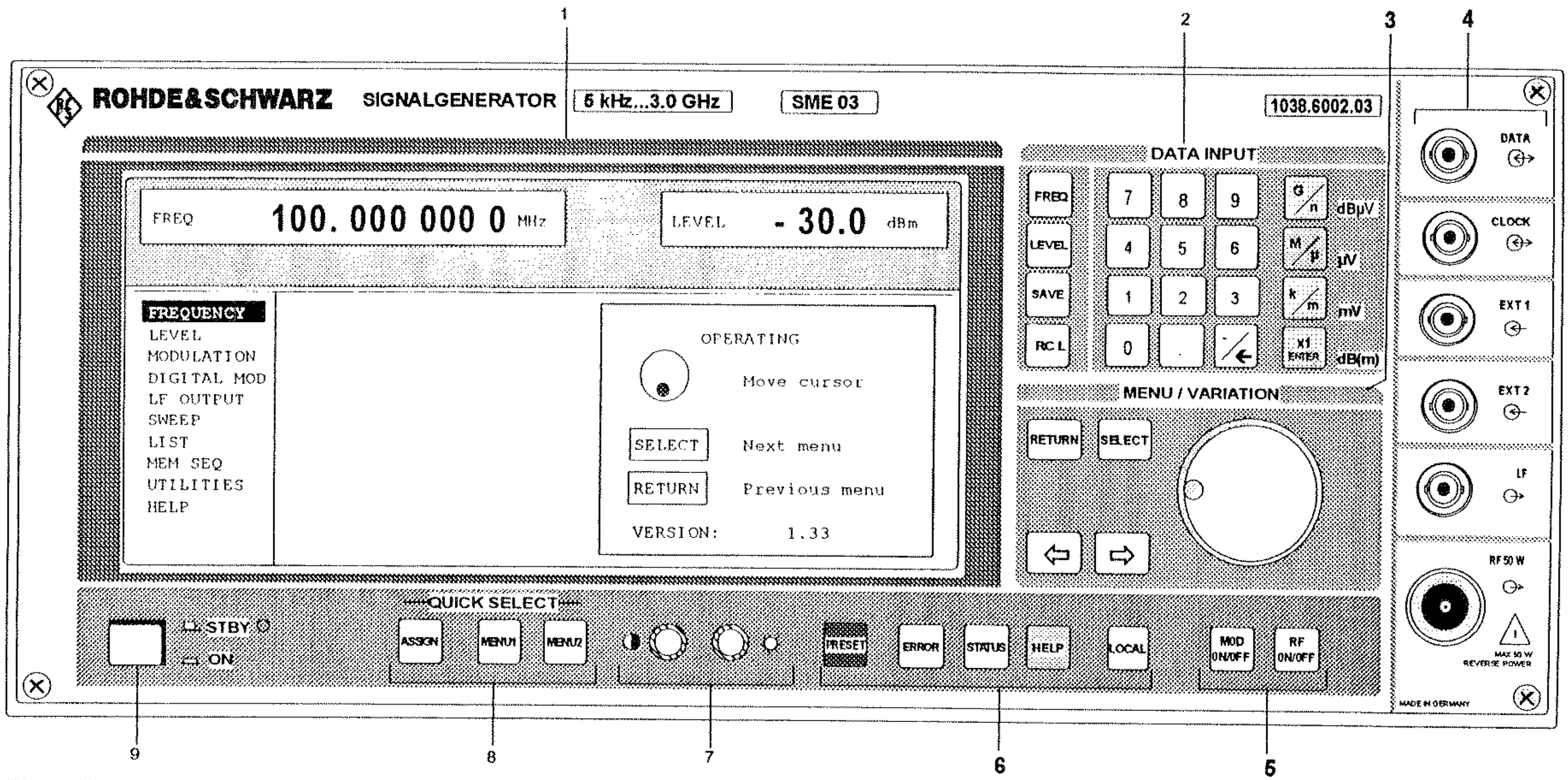
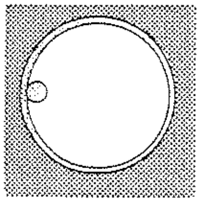


Fig. 2-1,b Front panel view, controls

3 MENU/VARIATION

Rotary knob



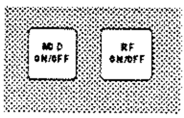
The rotary knob moves the menu cursor over the positions of a menu level to choose from or varies the value of a parameter. The variation is either effected in steps of one or in a step width that can be specified at will.

See as well
Section 2.2.2, Basic Operating Steps
Section 2.2.3, Sample Setting for First Users

4

See Section 2.1.1.3, page 2.11, Inputs/Outputs.

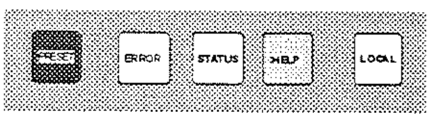
5



RF ON/OFF	Switches on/off the RF signal.
MOD ON/OFF	Switches on/off the modulation selected in the UTILITIES MOD KEY menu.

See as well
Section 2.2.2.6, Use of [RF ON/OFF] and [MOD ON/OFF] Keys

6



PRESET	Establishes a defined instrument status.
ERROR*	Indicates error and caution messages.
STATUS*	Indicates the instrument status.
HELP*	Indicates context-sensitive auxiliary text.
LOCAL	Switches the instrument from the REMOTE mode (remote control) to the LOCAL mode (manual control).

* Exit the menus using the [RETURN] key.

See as well
Section 1.1.7, Preset Setting
Section 2.12, Help System
Section 2.13, Status
Section 2.14, Error Messages
Section 3, Remote Control

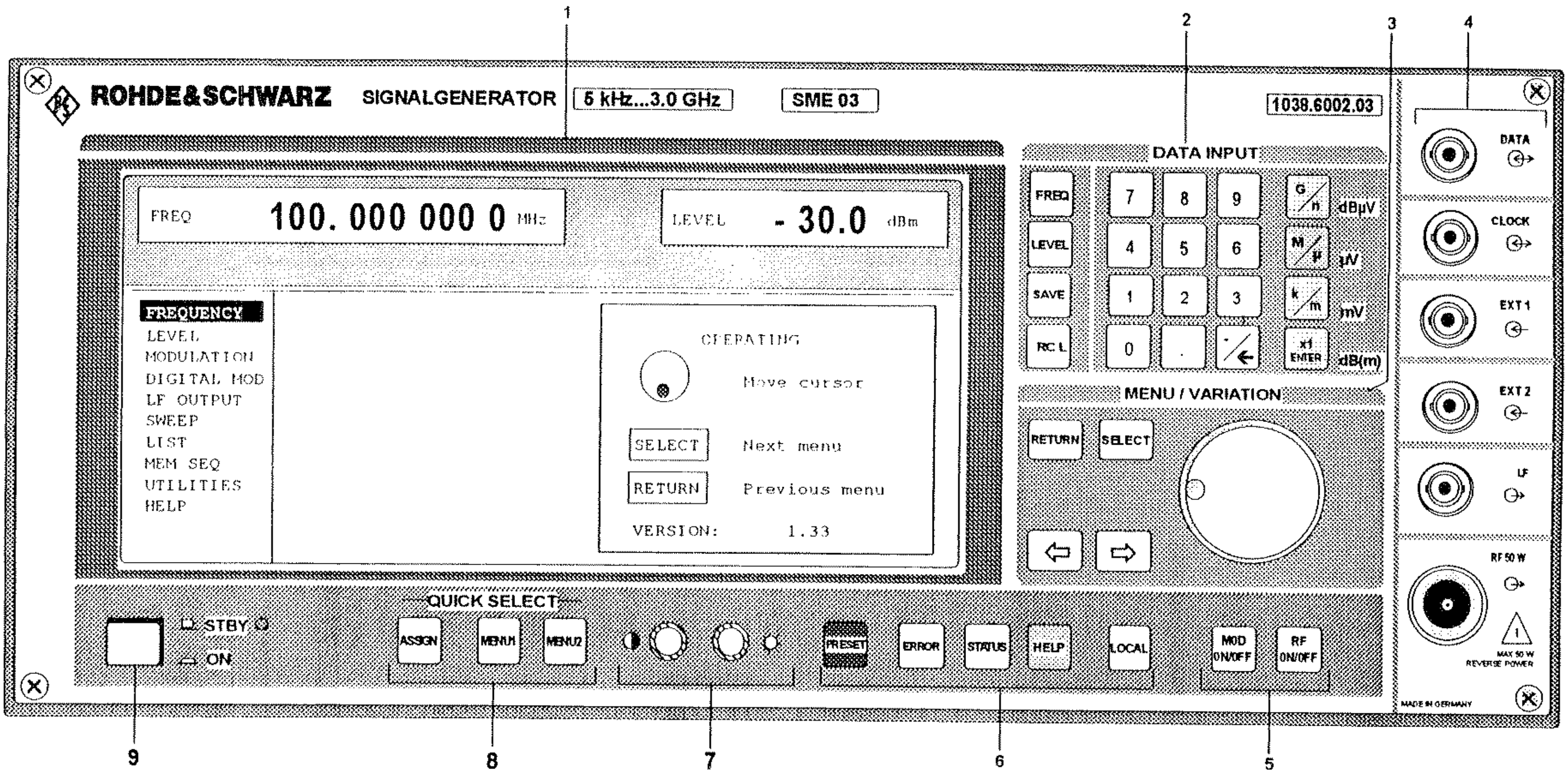
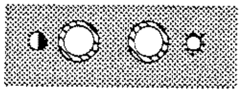


Fig. 2-1,b Front panel view, controls

7

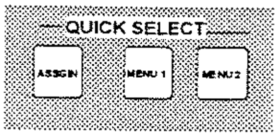


Brightness and contrast of the display can be set using the rotary knobs.

◑	Contrast
☼	Brightness

See as well
Section 1.1.5,
Setting of Contrast and Brightness of the Display

8 QUICK SELECT

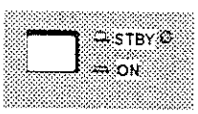


The menu-quick-selection keys permit fast access to two menus selected.

ASSIGN	Stores the current menu as menu1 when the MENU1 key is pressed afterwards or as menu2 when the MENU2 key is pressed afterwards.
MENU1	Activates menu1 stored.
MENU2	Activates menu2 stored.

See as well
Section 2.2.2, Basic Operating Steps

9 Switching On/Off



The On/Off switch switches the instrument from the standby mode to the ready-for-operation status. Prerequisite: The power switch at the rear of the instrument must be switched on.

STBY	LED is illuminated in the standby mode.

see as well

Section 1.1.3,
Switching On/Off the Instrument

Section 2.1.2,
Elements of the Rear Panel, Power Switch

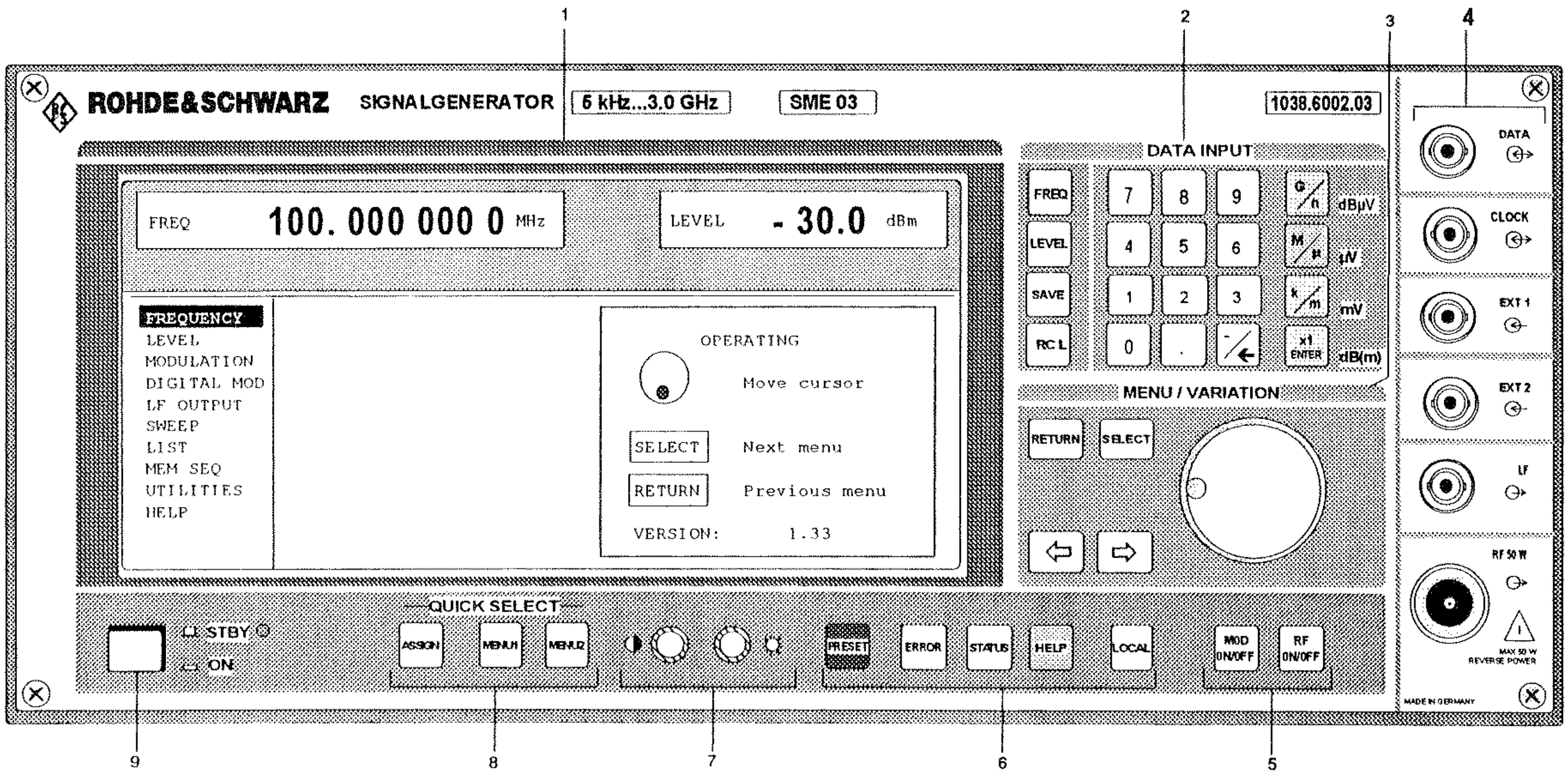
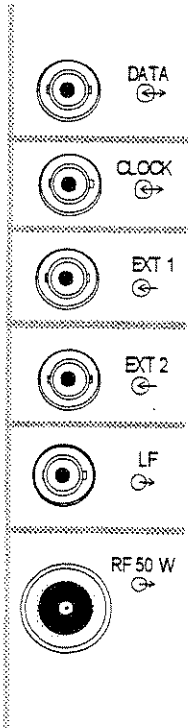


Fig. 2-1,c Front panel view, inputs/outputs

2.1.1.3 Inputs/Outputs

(Cf. Fig. 2-1, C Front panel view, Inputs/Outputs)

4



DATA	Input external data signal for digital modulation. Input resistance 1 kΩ, TTL-level. Output* data signal with operating mode internal. Level: TTL	See as well Section 2.6.3, Digital Modulation
CLOCK	Input* external clock-pulse signal for digital modulation. Input resistance 1 kΩ, TTL-level. Output* clock-pulse signal with operating mode internal. Level:TTL	Section 2.6.3,. Digital Modulation
EXT1	Input external modulation signal, alternatively for AM or FM (PM). Input resistance >100 kΩ. Nominal voltage: U_S = 1 V Max. permissible overvoltage: ± 15 V	
EXT2	Input external modulation signal for FM (PM). Input resistance >100 kΩ. Nominal voltage: U_S = 1 V max. permissible overvoltage: ± 15 V	
LF	Output** LF signal of the internal LF-generators LF Gen 1 and LF Gen 2. Source resistance < 10 Ω.	Section 2.7, LF outputs
RF	Output RF signal. Source resistance 50 Ω	Section 2.2.2.6, Use of [ON/OFF] and [MOD ON/OFF] Key

* When fitted with option DM-Coder, SME-B11
** Options: SM-B2, SM-B6

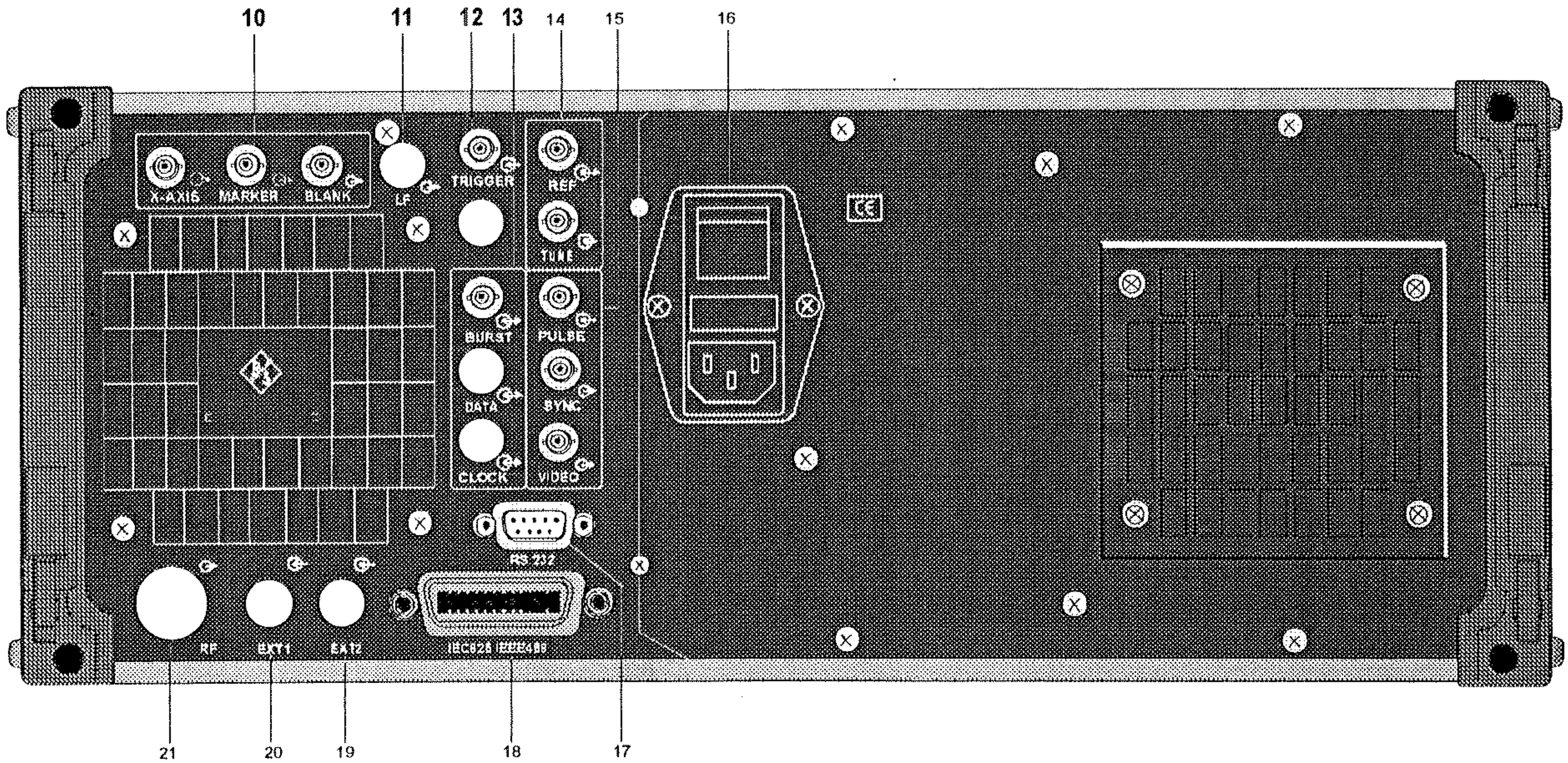


Fig. 2-2 Rear panel view

2.1.2 Elements of the Rear Panel

(Cf. Fig. 2-2, Rear panel view)

10

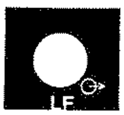
Outputs for control and triggering in the sweep and list operating modes.

X-AXIS	Level: 0 to 10 V.
MARKER	Level: TTL
BLANK	Level: TTL

See as well Section 2.8, Sweep

Section 2.9, LIST Mode

11



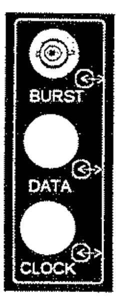
LF	Cut-out, provided to relocate the LF output at the front to the rear of the instrument.

12

TRIGGER	Input to trigger sweep, memory sequence, LIST mode and DM memory extension. Level: TTL

See as well respective section as to menus and Section 2.11.14, Input/Output Settings (AUX I/O)

13



BURST	Signal input/output for digital modulation. Signal output for synchronization with data signal generated internally. Level TTL. Signal input in the external operating mode to control level bursts. Level TTL.
DATA	Cut-out, provided to relocate the data input/output at the front to the rear of the instrument.
CLOCK	Cut-out, provided to relocate the clock input/output at the front to the rear of the instrument.

See as well Section 2.6.3, Digital Modulation

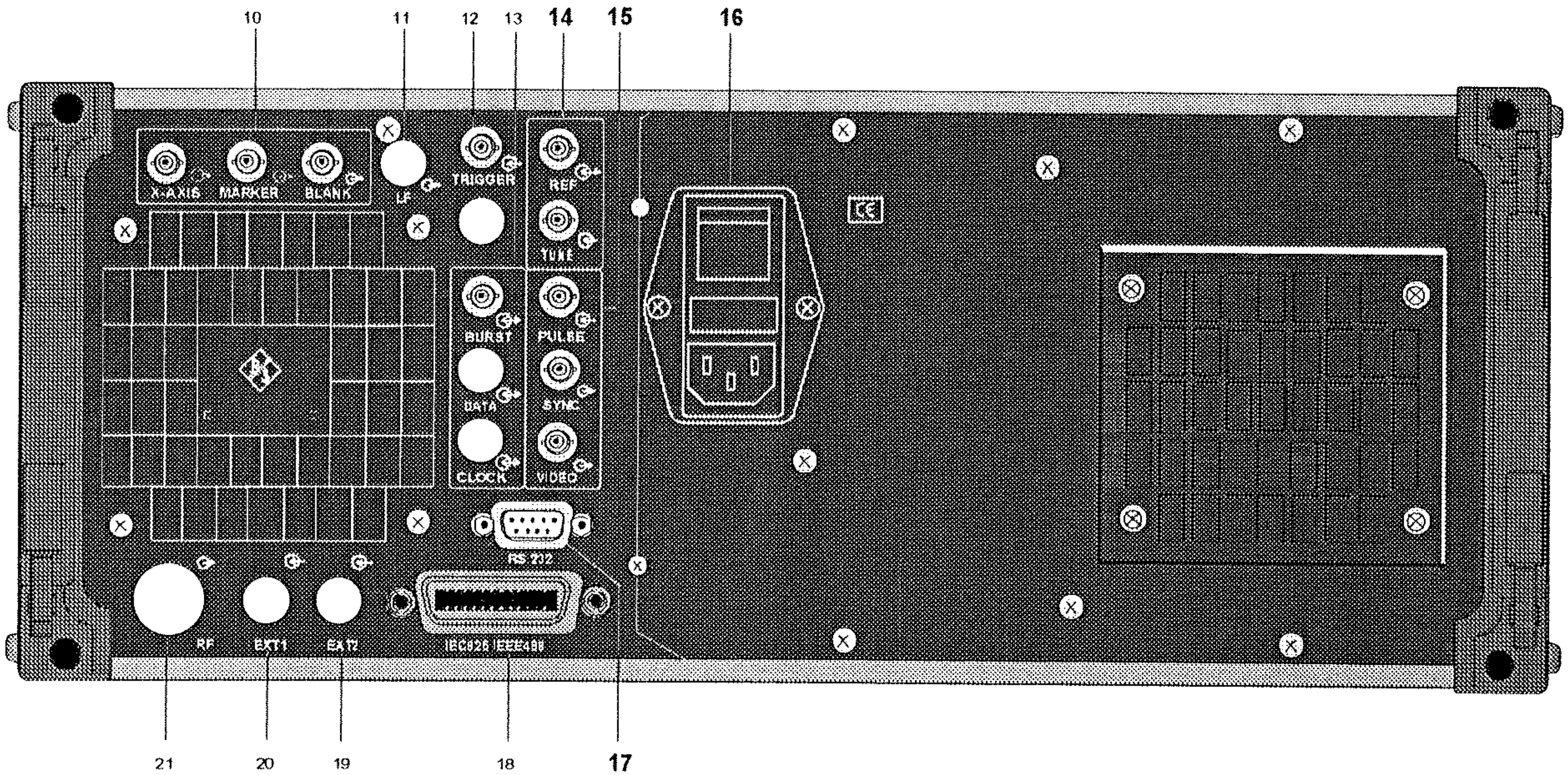
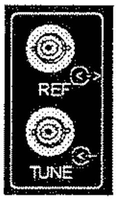


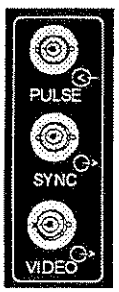
Fig. 2-2 Rear panel view

14



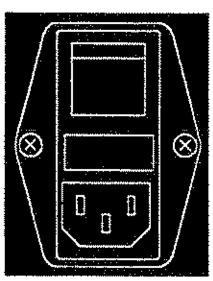
REF	Output of the internal 10-MHz reference signalwith reference internal. Source resistance 50 Ω. Input for external reference frequency with reference external. Adjustable to external reference frequencies from 1 MHz to 16 MHz in 1-MHz steps. Input resistance 200 Ω.	See as well Section 2.11.5, Reference Frequency Int/Ext
TUNE	Tuning input for the internal reference frequency. Voltage range ±10 V, pulling range $\pm 1 \cdot 10^{-6}$.	

15



PULSE	Input to trigger the pulse generator or to directly control the pulse modulation. Level: TTL. Input resistance 50 Ω/10kΩ, selectable Max. permissible overvoltage: ±15 V	See as well Section 2.6.2.5, Pulse Modulation
SYNC	Output SYNC signal with pulse modulation. Level: TTL	
VIDEO	Output video signal with pulse modulation. The signal is synchronous with the RF pulse. Level: TTL	

16



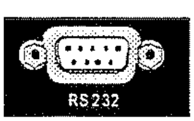
Power switch
On when pressed at the top

Fuse holder
F1 and F2

Power supply connection

See as well
Section 1.1.1, Supply Voltage
Section 1.1.2, Power Fuses
Section 1.1.3, Switching On/Off the Instrument

17



RS-232	RS-232 interface used for software update, the loading of calibration data, and remote control. The pin assignment corresponds to the pin assignment of a PC.	See as well Chapter 3, Remote Control

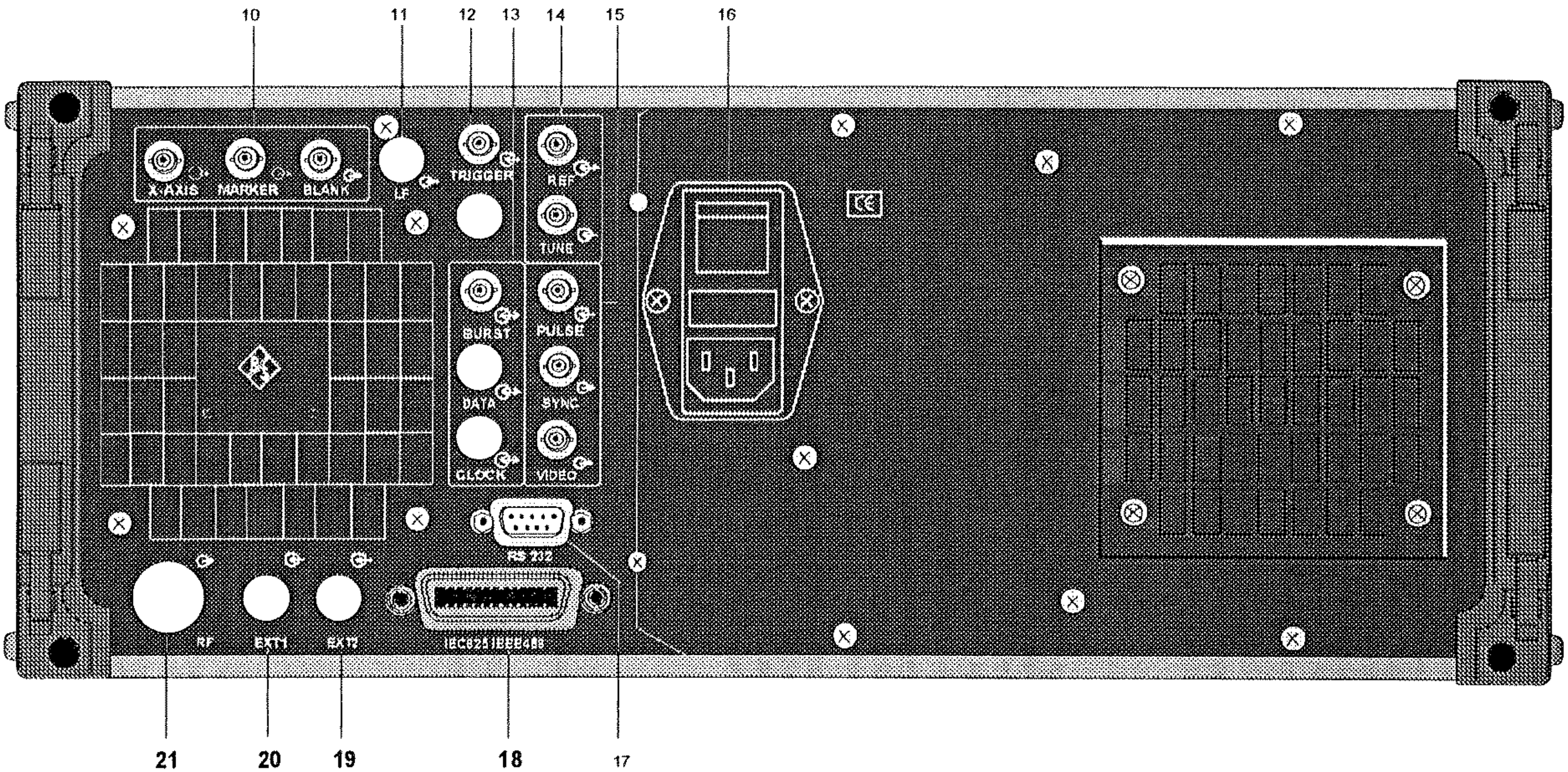


Fig. 2-2 Rear panel view

18

IEC 625	IEC-Bus (IEEE 488)	See as well Chapter 3, Remote Control
IEEE 488	Remote-control interface	

19

EXT2 — Cut-out, provided to relocate the EXT2 input at the front to the rear of the instrument.

20

EXT1 — Cut-out, provided to relocate the EXT1 input at the front to the rear of the instrument.

21

RF — Cut-out, provided to relocate the RF output at the front to the rear of the instrument.

2.2 Operating Concept

2.2.1 Display

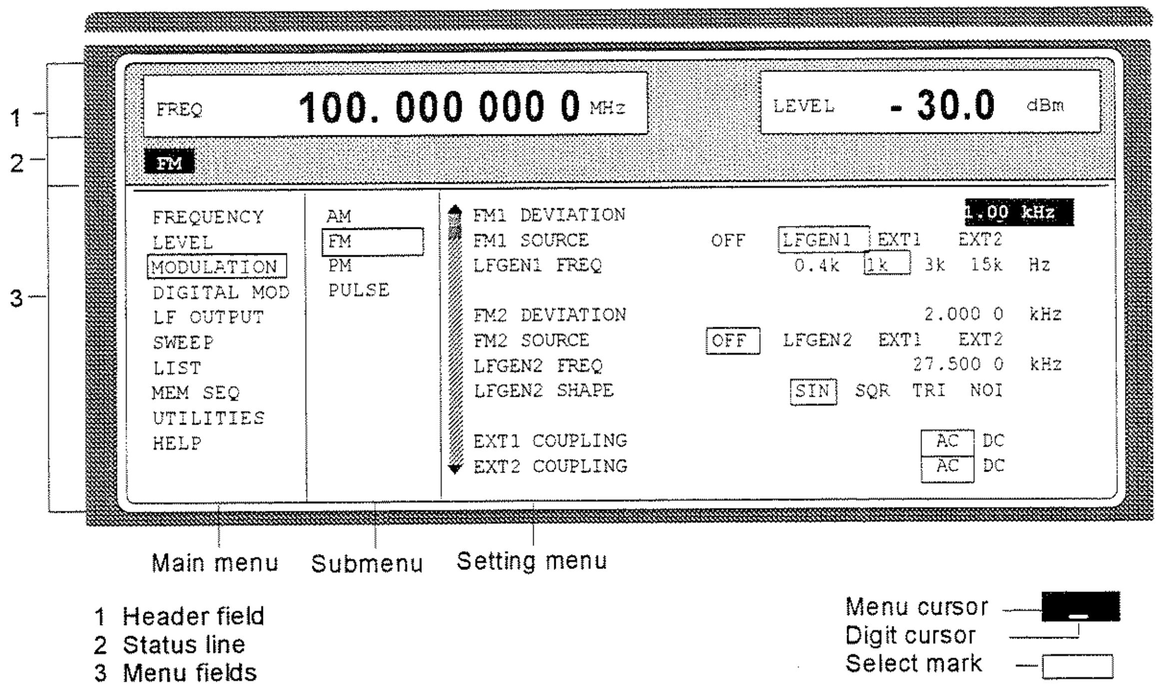


Fig. 2-3 Design of the display

Header field (1)The header field of the display indicates frequency and level of the RF output signal. In the RF-sweep operating mode, the start and stop frequencies are displayed in two lines one above the other. The start and stop levels are indicated in the LEVEL-sweep operating mode correspondingly.

Status line (2) The status line below describes operating mode and operating state of the instrument. Error messages and notes for caution are also displayed in the status line.

Menu fields (3)The indication fields below the header field are reserved for the menu representations. The image contents of these fields change as a function of the menu selected. The field at the left-hand display margin is occupied with the main menu, the topmost level of the menu structure. The main menu is always faded in.

Each further field adjacent at the right contains submenus.
The field ending with the right-hand display margin shows the setting menu. In this menu all setting values and setting states connected with the menu selected are indicated. When accessing submenus, the higher-order menus remain in the display. The current menu path is evident through the select marks.

Menu cursor — The menu cursor shows the user at which position in the menu he is. The position of the menu cursor is evident from the inverse notation of the term (white characters on a black background)

Digit cursor — As an underscore, the digit cursor marks the position which can be varied by means of the rotary knob in a value indication.

Select mark — The frame around a term marks current menus or valid settings in the setting menu.

2.2.2 Basic Operating Steps

The operating principle is explained in this section. For better understanding, please read sections "Display" (Section 2.2.1) and "Sample Setting for First Users" (Section 2.2.3) in addition.

To operate the instrument, menus are called in the display. All setting possibilities and the current setting status are evident from the menus. All settings can be made by accessing the menus.

RF frequency and RF level can also be set without menu operation using keys [FREQ] and [LEVEL]. RF signal and modulation can also be switched on/off without menu operation using keys [RF ON/OFF] and/or [MOD ON/OFF].

2.2.2.1 Calling the Menus

Accessing the menus is effected using rotary knob [VARIATION], [SELECT] key and [RETURN] key.

Rotary knob Rotary knob [VARIATION] moves the menu cursor over the positions of a menu level to be selected.

If a scrollbar is visible at the left-hand margin of a menu, the menu is larger than the screen window. If the menu cursor is moved to the margin of the screen window, the covered lines become visible.

[SELECT] key The [SELECT acknowledges the selection marked by means of the menu cursor.

[RETURN] key The [RETURN] key

- returns the menu cursor to the next higher menu level.

  The menu cursor is shifted to the left into the preceding column of the menu structure.
- resets the menu cursor from frequency or level value indication in the header field into the menu field to the menu called last.
- closes the display pages called using keys [STATUS], [HELP] and [ERROR] again.

Settings are accessed in the setting menus ending with the right-hand display margin.

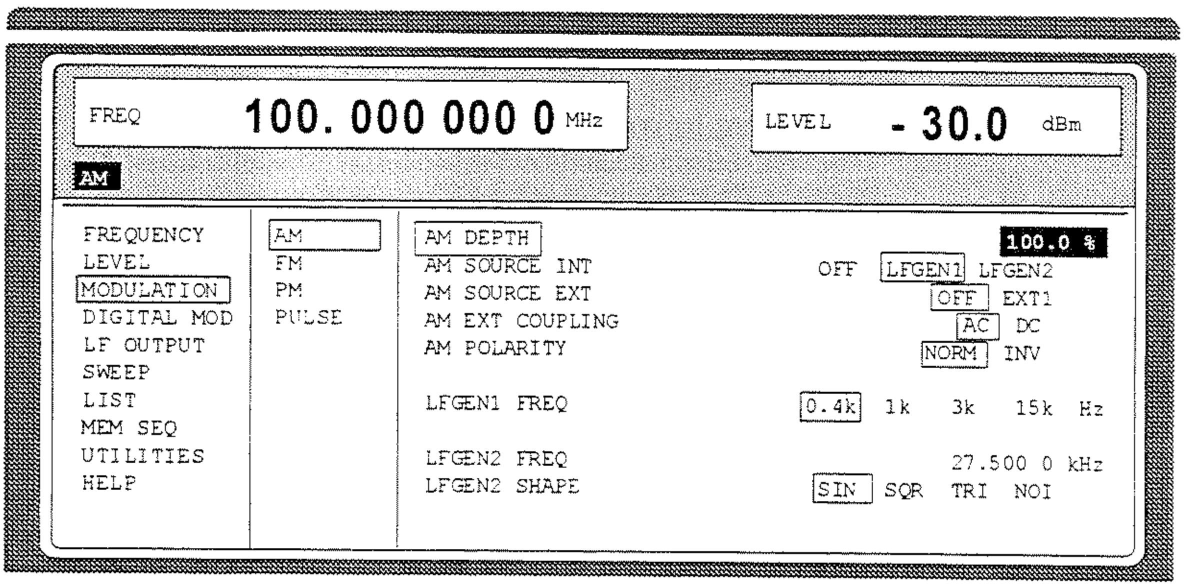


Fig. 2-4 MODULATION-AM menu

2.2.2.2 Selection and Change of Parameters

Select parameter

- ➢ Set the menu cursor to the name of the parameter desired using the rotary knob, e.g. to AM DEPTH in the AM menu, Fig. 2.4..

Change setting value

- ➢ Select parameters.
- ➢ Press the [SELECT] key.
- ➢ The menu cursor changes from the parameter selected in the left-hand column of the setting menu to the setting value on the right, e.g. from AM DEPTH to 100%, Fig. 2-4.

via value inputs

- ➢ Press the first digit of the new value or minus sign.
  The old value is deleted, the entry is indicated in the marked field.
- ➢ Enter further digits.
- ➢ Terminate the input using a unit key or, in the case of inputs in the base unit or in the case of inputs without unit, using the [1x/Enter] key.
- ➢ Press the [RETURN] key.
  The menu cursor wraps back to the appropriate parameter.

using rotary knob

- ➢ Set the underscore to the position of the setting value to be varied using keys [⇨] [⇦].
- ➢ Turn the rotary knob.
  The position underscored is varied in steps of 1.

  Note: *RF frequency and RF level can also be varied in a step width which can be defined arbitrarily using the rotary knob. In the respective setting menu (FREQUENCY or LEVEL) the step width is entered as KNOB STEP USER and the KNOB STEP set from DECIMAL to USER. To point to the fact that the step width has been converted to the value programmed, the underscore as a symbol of the digit cursor disappears in the respective value indication.*

1-out-of-n selection

- ➢ Select parameters.
- ➢ Press the [SELECT] key.
  The menu cursor changes from the parameter selected in the left-hand column of the setting menu to the current selection on the right, e.g. from LFGEN1 FREQ to 0.4 kHz, Fig. 2-4.
- ➢ Set the menu cursor to the position desired within the 1-out-of-n selection using the rotary knob or cursor keys [⇐] [⇒].
- ➢ Press the [SELECT] key.
  The setting is made.
  The selection mark which has marked the setting valid up to now wraps to the new position.
- ➢ Press the [RETURN] key.
  The menu cursor wraps back to the respective parameter

Quick selection of a parameter

The quick selection of a parameter reduces the number of operating steps if several parameters are set successively. The menu cursor can directly be set further from line to line in the column of the setting values.

➢ Press the [SELECT] key.

The menu cursor wraps from the setting value of a parameter to the setting value of the parameter in the next line.

The following is true:

- The wrap from a 1-out-of-n selection line into the next line is effected when menu cursor and selection mark are superimposed.
- Actions which can be carried out are skipped.
- If necessary, scrolling is triggered at window limits.
- A wraparound is effected at the end of the menu.
- The column of the setting values can be exited at each position by pressing the [RETURN] key.

2.2.2.3 Triggering Action

Lines in the setting menu which are marked with the "➔" symbol at the end of the line qualify an action which can be carried out. Instruction SEARCH ONCE ➔ in the LEVEL-ALC menu, e.g., switches on level control for level calibration for a short period of time.

Trigger action

➢ Set the menu cursor to the respective instruction.

➢ Press the [SELECT] key.

The action is triggered.

While the action is carried out, the instruction remains framed by the selection mark.

2.2.2.4 Quick Selection of Menu (QUICK SELECT)

The keys of the QUICK SELECT control field are used to call selected menus quickly by one keystroke.

Store menus

➢ Establish the desired operating status of the current menu.

➢ Press the [ASSIGN] key.

➢ Press key [MENU1] or [MENU2].

The current menu is stored as menu1 or menu2. That is to say, 2 menus can be stored in total.

Call menus

➢ Press key [MENU1] or [MENU2].

Menu1 or menu2 stored is displayed. Exactly the operating status which was current at the point of time of storing is reconstructed.

2.2.2.5 Use of [FREQ] and [LEVEL] Keys

RF frequency and RF level can be set without menu operation as well using direct keys [FREQ] and [LEVEL].

Key [FREQ]/ [LEVEL]

➢ Press the [FREQ] or [LEVEL] key.

The frequency and/or the level indication in the header field of the display is marked.

The current menu at the display is maintained.

➢ Alter the value via a value input or the rotary knob.

➢ Press the [RETURN] key.

The menu cursor wraps to the position marked last in the menu.

2.2.2.6 Use of [RF ON / OFF] and [MOD ON / OFF] Keys

RF signal and modulation can be switched on/off without menu operation as well using direct keys [RF ON / OFF] and/or [MOD ON / OFF] (see Section 2.6.1.3, [MOD ON/OFF] key as well).

Key [RF ON / OFF] / [MOD ON / OFF]

➢ Press the [RF ON / OFF] and/or [MOD ON / OFF] key.

The RF output signal and/or the modulation is switched on/off.

2.2.2.7 Changing Unit of Level

For the level, the unit of the value set can be changed without a new value input.

Change level unit

➢ Activate LEVEL parameter.

- Press the [LEVEL] key or
- set the menu cursor in the LEVEL menu to the setting value of the AMPLITUDE parameter.

➢ Press the unit key with the desired level unit.

The level is indicated in the desired unit.

2.2.2.8 Correction of Input

Digital entries can be corrected by one of the unit/Enter keys before terminating the input.

Key [-/←] The backspace key deletes the value entered digit by digit. When the last digit is deleted, the previous value is displayed.

Key [RETURN] Pressing the [RETURN] key deletes the entire entry and results in the previous value being indicated again.

For a subsequent new input in the setting menu, the menu cursor is to be set to the setting value again using the [SELECT] key.

For a subsequent new input via the [FREQ] or [LEVEL] keys, the respective key has to be pressed again.

Key [FREQ]/ [LEVEL] In the case of a frequency or level input by means of the [FREQ] or [LEVEL] keys, pressing the [FREQ] and/or [LEVEL] key again deletes the entire input.

2.2.3 Sample Setting for First Users

First users most quickly become familiar with the operation of the instrument if they execute the pattern setting of this section.

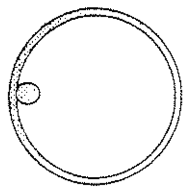
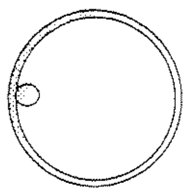
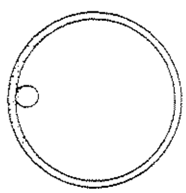
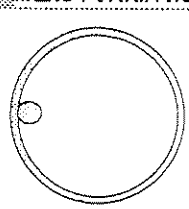
First frequency and level of the RF output signal are set via keys [FREQ] and [LEVEL] in the DATA INPUT field:

- Frequency 250 MHz
- Level 10 dBm

Operating steps	Explanations
PRESET	Reset the instrument to the defined state.
DATA INPUT FREQ 2 5 0 M/μ dBμV	Set the frequency to 250 MHz. The menu cursor marks the permanent frequency indication.
DATA INPUT LEVEL 1 0 x1 ENTER	Set the level to 10 dBm. The menu cursor marks the permanent level indication.
RETURN	Reset the menu cursor to the menu field.

The output signal is to be amplitude-modulated next.

- AM modulation depth 15.5 %
- AM signal 3-kHz sine

Operating steps	Explanations
MENU / VARIATION  MODULATION SELECT MENU / VARIATION	Select MODULATION menu. ➢ Set menu cursor to MODULATION using the rotary knob and subsequently press [SELECT] key. The submenu is displayed
MENU / VARIATION  AM SELECT MENU / VARIATION	Select AM submenu The AM setting menu is displayed.
MENU / VARIATION  AM DEPTH SELECT MENU / VARIATION	Select AM DEPTH parameter. The menu cursor marks the setting value.
DATA INPUT 1 5 . 0 x1 ENTER	Enter modulation depth 15.5 % and acknowledge.
RETURN	Reset menu cursor to AM DEPTH.
MENU / VARIATION  AM SOURCE INT SELECT MENU / VARIATION	Select AM SOURCE INT. The menu cursor marks the current 1-out-of-n selection.

Operating steps	Explanations
MENU / VARIATION — LFGEN1 — MENU / VARIATION SELECT	Select LF generator 1 as modulation source. The selection mark marks LFGEN1. AM is faded in the status line as a hint that AM is switched on.
RETURN	Reset menu cursor to AM SOURCE INT.
MENU / VARIATION — LFGEN1 FREQ — MENU / VARIATION SELECT	Select parameter LFGEN1 FREQ. The menu cursor marks the current frequency selection.
MENU / VARIATION — . 3k . — MENU / VARIATION SELECT	Set the frequency of LF generator 1 to 3 kHz. The selection mark marks 3 kHz. The indications on the display are represented in Fig. 2-5.

The AM modulation setting is completed.

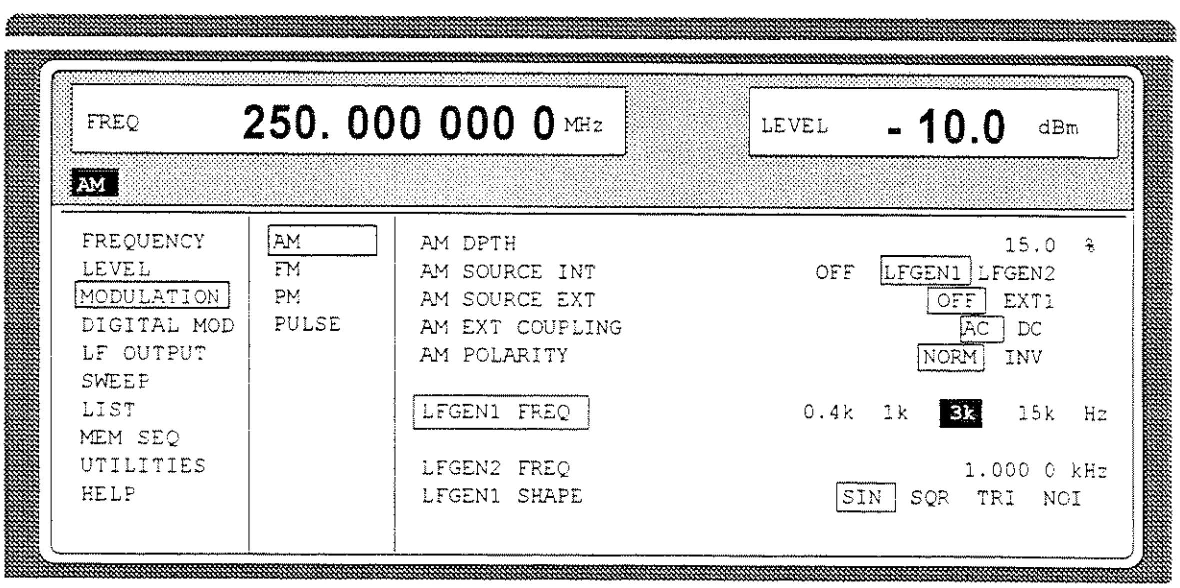
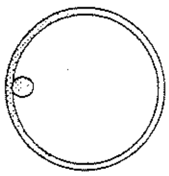
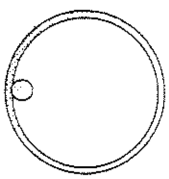
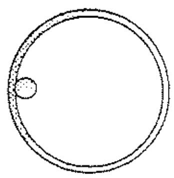


Fig. 2-5 Display after AM setting

Subsequently to the above setting, 420 MHz as new RF frequency and 12.5 kHz as the step width for the RF frequency variation are set in the following. Parameter quick select is used, which reduces the number of operating steps.

Operating steps	Explanations
RETURN RETURN RETURN	Reset the menu cursor to the main menu in 3 steps.
MENU / VARIATION  FREQUENCY MENU / VARIATION SELECT	Select FREQUENCY menu. The frequency setting menu is displayed.
MENU / VARIATION  FREQUENCY MENU / VARIATION SELECT	Select FREQUENCY parameter. The menu cursor marks the setting value.
DATA INPUT 4 2 0 M/μ	Enter frequency 420 MHz and acknowledge.
SELECT SELECT	Set menu cursor to the setting value of parameter KNOB STEP USER.
DATA INPUT 1 2 . 5 k/m	Enter step width 12.5 kHz.
SELECT	Set menu cursor to the current KNOB STEP selection.

Operating steps			Explanations
MENU / VARIATION 	. USER .	MENU / VARIATION SELECT	Select USER (user-defined step width). The selection mark marks USER. This results in step width 12.5 kHz being used in the case of variation using the rotary knob.

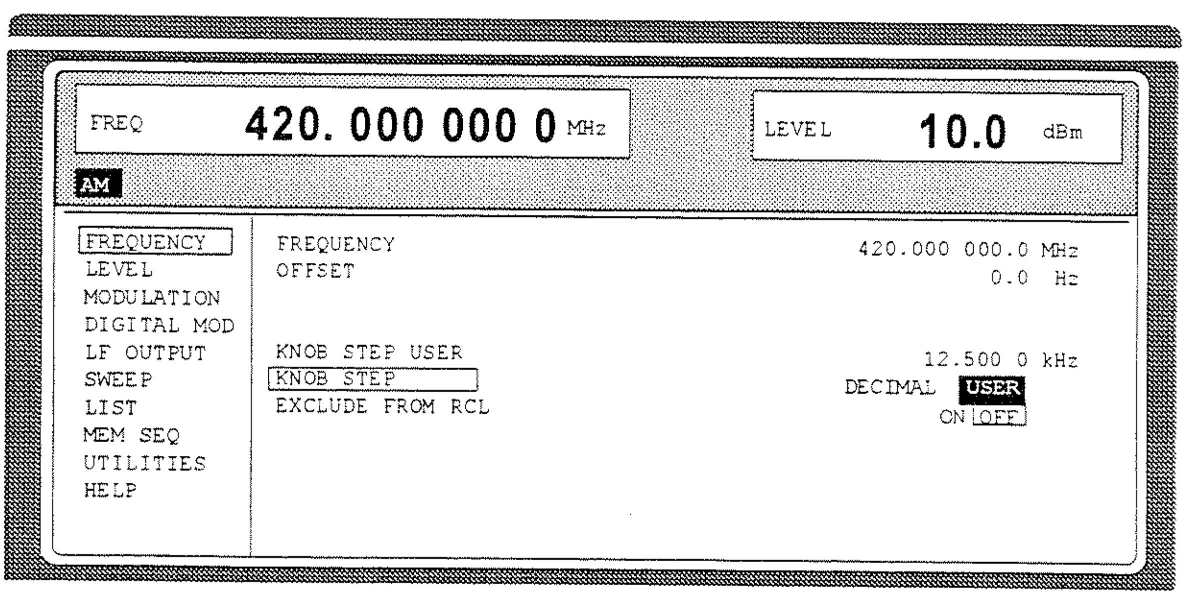


Fig. 2-6 Display after pattern setting

2.2.4 List Editor

The SME offers the possibility to generate lists. Lists are used for setting sequences (LIST mode or memory sequence), as data source for digital modulations or for level correction which can be defined by the user (UCOR). They consist of elements which are defined by an index and at least one parameter per index. Each list is marked by a separate name and can be selected via this name. The lists are accessed in the menus assigned in each case, e.g. to the settings sequences of frequency and level value pairs in the LIST menu. However, the lists are always generated and processed in the same way and the procedures are hence explained in detail by the example of the memory sequence mode (menu MEM SEQ) in this section. A pattern setting at the end of this section allows the user to become familiar with the operation of the list editor.

Setting menus providing list processing are structured in two pages:

The first page, called OPERATION page in the following contains the general configuration parameters for processing a list. Further, the general list functions such as selecting and deleting the list as well as calling an editing mode are provided. The second page, the EDIT page, is automatically displayed when calling an edit function and serves to enter and modify the parameters of the list.

The OPERATION page has a similar arrangement with all list editors. As an example, the OPERATION page of the MEM SEQ menu is shown:

Menu selection: MEM SEQ

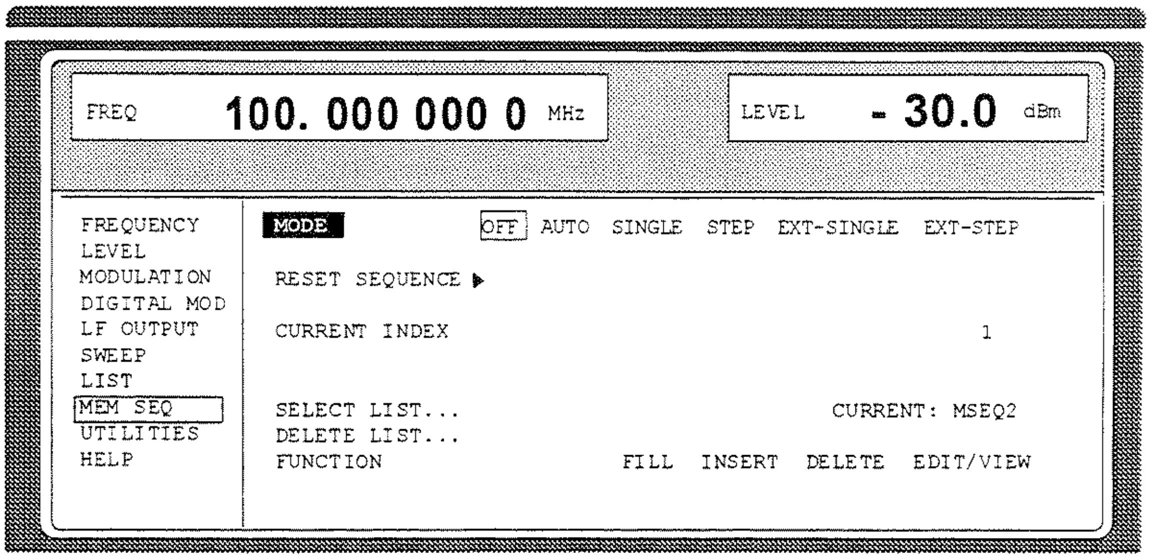


Fig. 2-7 OPERATION page of the MEM SEQ menu

The settings for MODE, CURRENT INDEX, etc. are irrelevant for the general description of the list editors and are described in greater detail in Section 2.10, MEMORY SEQUENCE mode.

The last three menu lines of the OPERATION page always exist and are reserved for selecting and deleting lists as well as for calling the edit functions (and hence the EDIT page)

SELECT LIST Opens a selection window in which a list can be selected from the existing lists or a new, empty list can be generated. In this line the active list is always displayed.

DELETE LIST Opens a selection window in which the list to be deleted can be selected..

FUNCTION Selection of the edit function for processing the lists. The EDIT page is automatically called through the selection (cf. Section 2.2.4.3).

FILL	Filling a list with elements.
INSERT	Insertion of elements into a list.
DELETE	Deletion of elements of a list.

2.2.4.1 Select and Generate - SELECT LIST

SELECT LIST opens a selection window in which either an existing list can be selected or a new, empty list can be generated (cf. Fig. 2-8). By pressing the [RETURN] key, the selection window is closed without changing the setting.

Select list

➢ Mark the list desired using the rotary knob.

➢ Press [SELECT] key.

The selected list is included in the instrument setting. The selection window is closed. The selected list is displayed under CURRENT.

Generate list

➢ Mark CREATE NEW LIST ↗ using rotary knob.

➢ Press [SELECT] key.

A new empty list is automatically generated which can be filled using functions FILL or EDIT. The selection window is closed. The new list is displayed under CURRENT.

No modification of the setting

➢ Press [RETURN] key.

Selection: SELECT LIST

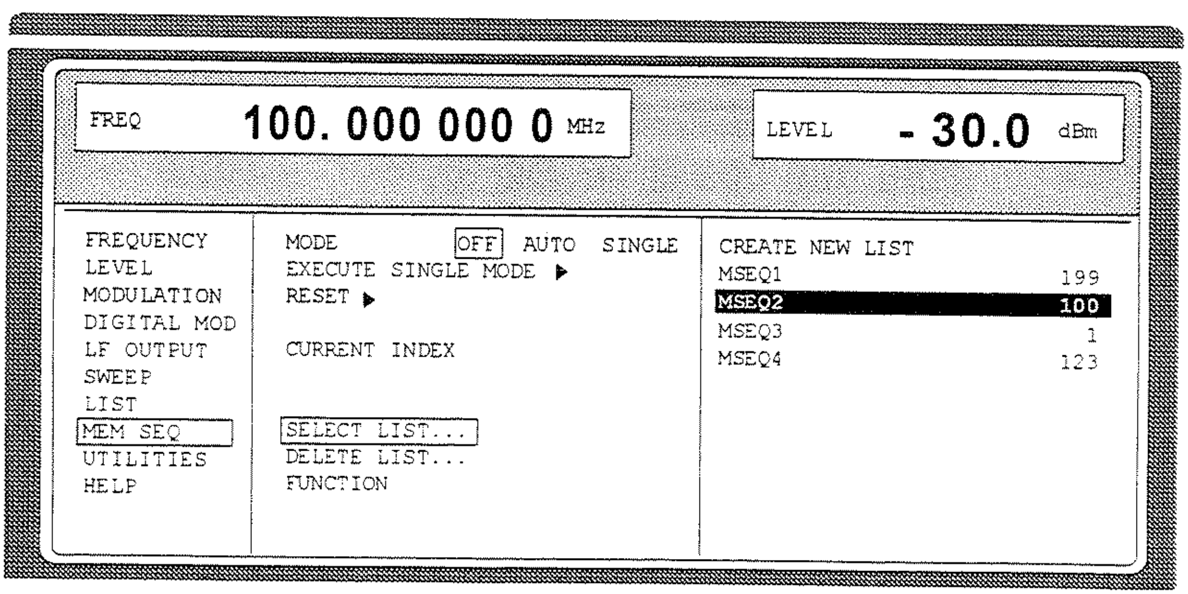


Fig. 2-8 SELECT-LIST-selection window

CREATE NEW LIST ➔ Generating a new list. The name of the list cannot be selected freely in the case of manual control. A definite list name is automatically generated in the following form:

MSEQ<n>, with <n> ∈ {0..9}, e.g. MSEQ1 (with Memory Sequence)

This applies correspondingly to the other operating modes. In the case of LIST mode, LIST1 would be generated for example. If a list is created via IEC bus, an arbitrary list name can be given (cf. Section 3). Unrestricted access is also possible by means of the selection window.

MSEQ2 100 The list currently set is marked in the selection window by means of the selection mark, here SEQ2. In addition to the list name, the length of the list is given, here 100 elements.

2.2.4.2 Deletion of Lists - DELETE LIST

DELETE LIST opens a selection window in which the list to be deleted can be selected.. The lists are represented together with their name and their length (cf. Fig. 2-9). By pressing the [RETURN] key the selection window is exited without deleting a list.

Delete list

- ➢ Mark desired list using the rotary knob.
- ➢ Press [SELECT] key.

  The prompt "enter [SELECT to delete list/sequence?" is displayed
- ➢Press [SELECT] key.

  The list is deleted. If the prompt is acknowledged with the [RETURN] key, however, the list is not deleted. The selection window is automatically closed due to the acknowledgment of the prompt.

Selection: DELETE LIST

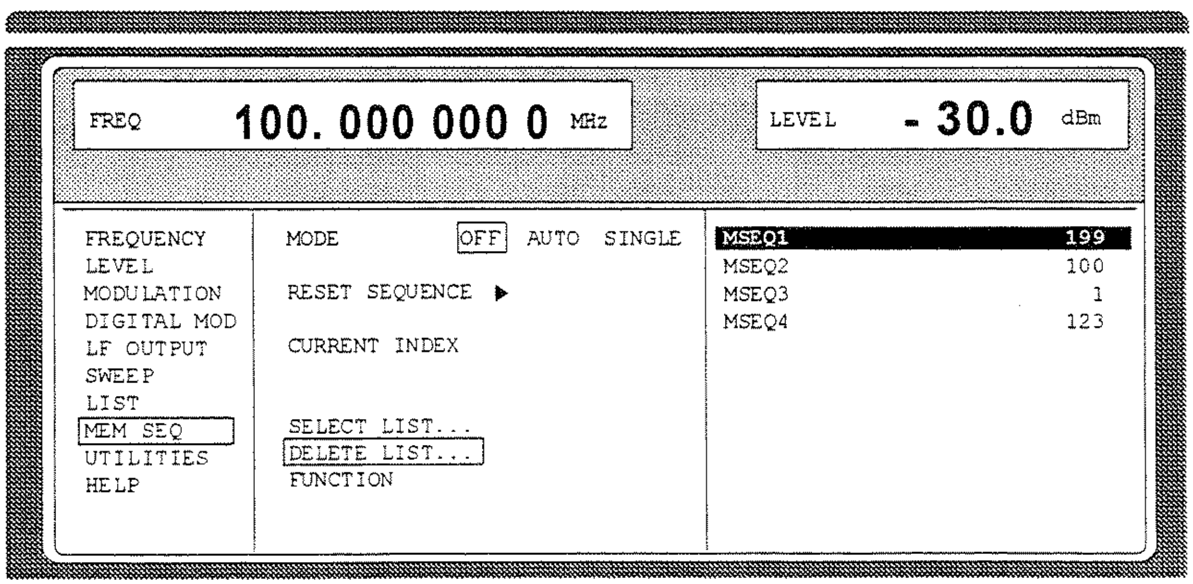


Fig. 2-9 DELETE-LIST selection window

2.2.4.3 Edition of Lists

Due to the selection of an edit mode on the OPERATION page the EDIT page is automatically activated. When the EDIT/VIEW function is selected, the largest possible section of the list is displayed (cf. Fig. 2-10). In the case of block functions FILL, INSERT and DELETE, an input window is additionally displayed (cf. Fig. 2-11 to 2-13).

Functions SELECT LIST and FUNCTION are available on the EDIT page as on the OPERATION page.

Return to the OPERATION page is effected by pressing the [SELECT] key twice.

Single-value function EDIT/VIEW

By selecting the EDIT/VIEW function, the entire list can be viewed or modifications of single values be carried out.

If the cursor marks a value in the INDEX column of the list, the EDIT mode is exited by pressing the [RETURN] key. The menu cursor then marks FUNCTION again.

There is no separate function for storing the list. This means that every modification of the list is transferred to the internal data set and has an effect on exiting the EDIT/VIEW function.

Selection: FUNCTION EDIT/VIEW

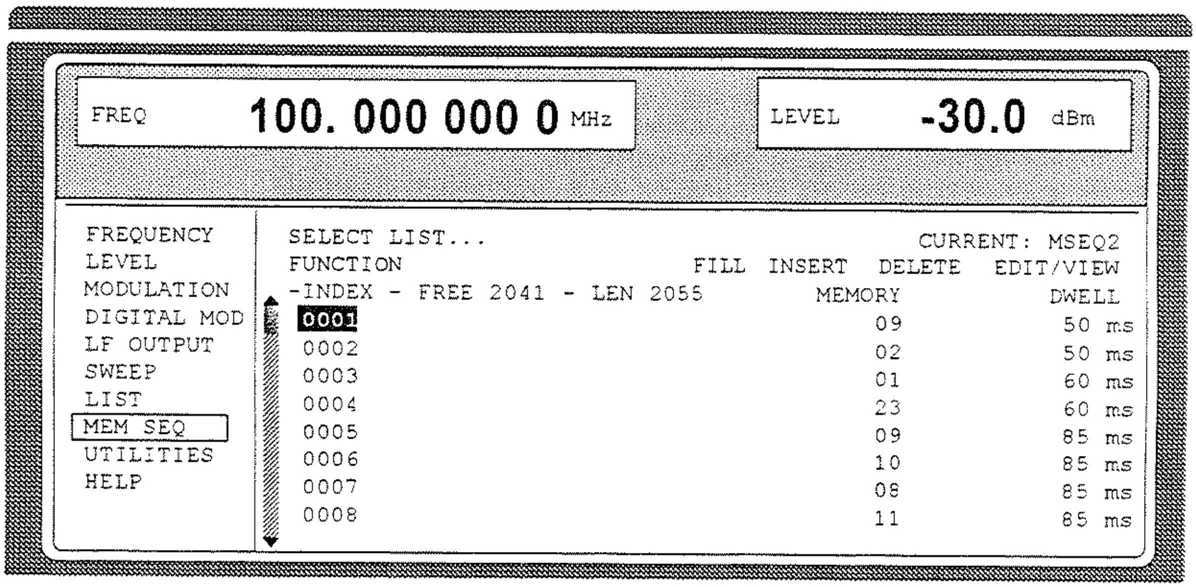


Fig. 2-10 Edit function EDIT/VIEW

INDEX Position in the list

FREE Space available. FREE 2041 means that space for 2041 parameter elements is available in the list memory in total.

LEN Occupied space. LEN 2055 means that the current list occupies 2055 elements in the list memory.

MEMORY DWELL Identification of the column below. The number of parameter columns is different for the various list editors. The list editor for digital modulation data possess three parameter columns (DATA, BURST and LEVEL ATTENUATION).

Select parameters

- ➢ Mark the index associated to the parameter using the rotary knob or directly enter the value of the index via the numeric keys.
- ➢ Press [SELECT] key.
  Parameter MEMORY is marked. If the second parameter DWELL is to be marked, press the [SELECT] key again.

Modify parameters

- ➢ Vary the value of the parameter selected using the rotary knob or enter the value directly using numeric keys.

  Note: *The binary coder data of the digital modulations which cannot be varied are an exception. Further, all numeric keys except for "0" and "1" are ineffective in these cases.*

- ➢ Press the [ENTER] key or unit keys.
  The value is included in the data set. The menu cursor marks the value of the next column. In the last column, the menu cursor then marks the next line of column MEMORY.
- ➢ Press the [RETURN] key.
  The menu cursor wraps back to the INDEX column. The EDIT mode is exited by repeatedly pressing the [RETURN] key (cf. Section 2.2.4.4).

Block function FILL

Using function FILL, a parameter, e.g. MEMORY, is overwritten with constant or linearly increasing/decreasing values within a defined range. The input window is exited by pressing the [RETURN] key without a modification being carried out.
If the filler range exceeds the end of the list, the list is automatically extended.

The list entry, in the example for MEMORY, with index [AT +n] is calculated as follows from the information AT, RANGE, starting value (MEMORY) and WITH INCREMENT:

$$\text{MEMORY[AT+n]} = \text{starting value (MEMORY)} + n \cdot \text{increment} \quad | \quad (0 \le n \le \text{RANGE1})$$

Selection: FUNCTION-FILL

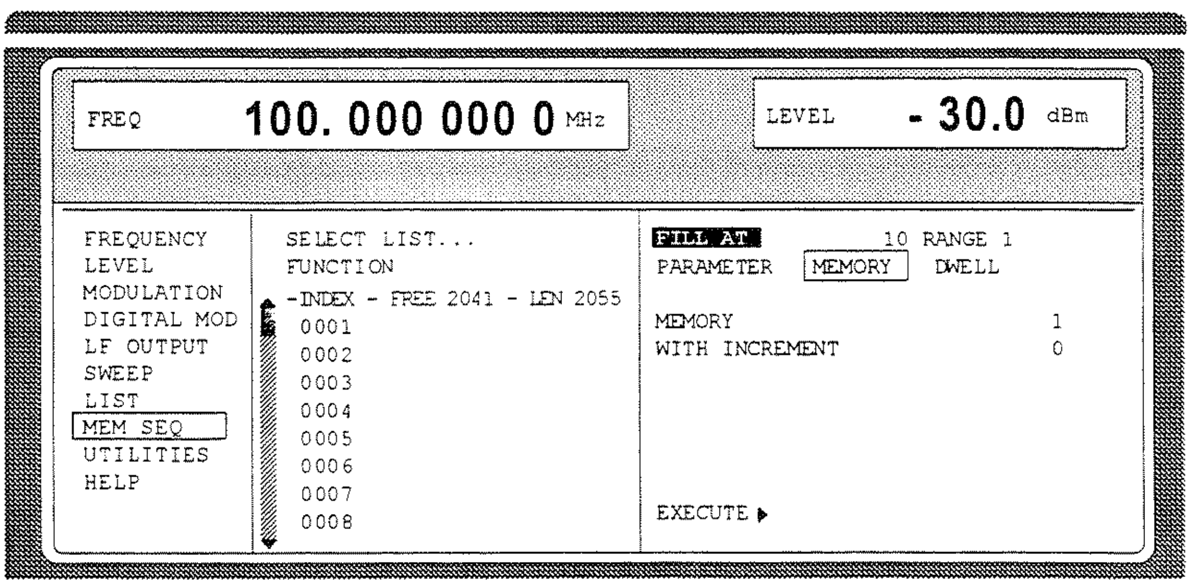


Fig. 2-11 Block function FILL: Input window

FILL AT

Setting the filling range.

AT Lower limit (index)

RANGE Number of the elements to be inserted

PARAMETER

Selection on which of the parameters the filling function is to have an effect. This menu option is eliminated if the list only includes elements with one parameter.

MEMORY or DWELL

Input of the starting value for the parameter selected. This option is only displayed if a selection has been made under PARAMETER MEMORY or DWELL.

WITH INCREMENT

Input of the increment between two successive values. If 0 is entered as increment, a filling procedure with constant values is achieved. This option is only displayed if a selection has been made under PARAMETER MEMORY or DWELL.

Note: *In the case of some types of lists, e.g. digital modulation data, indicating an increment is eliminated since there are binary data. In these cases line WITH INCREMENT is eliminated.*

EXECUTE ➔

Starts the filling sequence. After the function has been executed, the input window is automatically exited. The current index points to the first element after the processed range.

Filling a list

After selection of function FILL, the menu cursor marks FILL AT.

- ➢ Press the [SELECT] key.
  The menu cursor marks the value at AT.
- ➢ Vary index value using the rotary knob or enter using the numeric keys and the [ENTER] key.
- ➢ Press the [SELECT] key.
  The menu cursor marks the value at RANGE.
- ➢ Vary value using the rotary knob or enter using the numeric keys and the [ENTER] key.
- ➢ Press the [SELECT] key.
  The menu cursor marks MEMORY or DWELL in input line PARAMETER.
- ➢ Select MEMORY using the rotary knob (if not yet marked) and press the [SELECT] key.
  The menu cursor marks the value in input line MEMORY.
- ➢ Vary starting value for column MEMORY using the rotary knob or enter using the numeric keys and the [ENTER] key.
- ➢ Press the [SELECT] key
  The menu cursor marks the value in input line WITH INCREMENT.
- ➢ Vary the value of the increment desired using the rotary knob or enter using the numeric keys and the [ENTER] key.
- ➢ Press the [RETURN] key.
- ➢ Mark the action EXECUTE ➔
- ➢ Press the [SELECT] key.
  The filling sequence is initiated. After the function has been carried out, the input window is automatically exited. The menu cursor marks FUNCTION. The EDIT page shows the end of the range that has been filled right now.

Block function INSERT

Function INSERT inserts the desired number of elements with constant or linearly increasing/de-creasing values before the element with the given starting index. All elements which had been stored from the starting index are shifted to the end of the range to be inserted.

Input is effected analogously to filling a list.

By pressing the [RETURN] key the input window is exited without a modification being effected. The menu cursor then marks FUNCTION.

The list entry, in the example for MEMORY, with index [AT +n] is calculated as follows from the information AT, RANGE, starting value (MEMORY) and WITH INCREMENT:

MEMORY[AT+n] = starting value (MEMORY) + n · Increment | ($0 \leq n \leq$RANGE-1)

Selection: FUNCTION INSERT

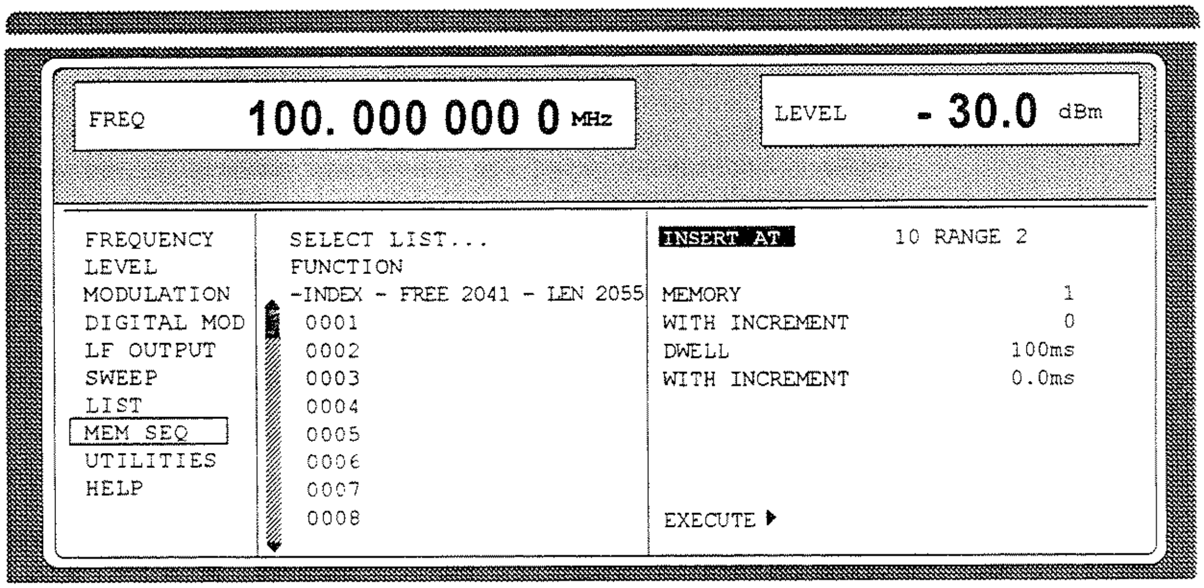


Fig. 2-12 Edit function INSERT: Input window

INSERT AT Input of the starting index and the number of the elements to be inserted.

- AT Starting index before which the insert operation is to be effective.
- RANGE Number of the elements to be inserted

MEMORY Input of the starting value for MEMORY.

DWELL Input of the starting value for DWELL.

WITH INCREMENT Input of the increment between two successive values for MEMORY or DWELL. If 0 is indicated as increment, constant values are achieved to be inserted RANGE times.

Note: *In the case of some types of lists, e.g. digital modulation data, indicating an increment is eliminated since there are binary data. In these cases all lines WITH INCREMENT are eliminated.*

EXECUTE → Starts the inserting sequence. After the function has been executed, the input window is automatically exited. The menu cursor marks FUNCTION. The EDIT page shows the beginning of the range that has moved forward.

Block function DELETE

Function DELETE deletes the elements of the range indicated. This does not leave a gap in the list but the remaining elements move forward. If the given range exceeds the end of the list, deletion until the end of the list is effected.

Input is analog to filling a list.

By pressing the [RETURN] key, the input window is exited without a modification being carried out. The menu cursor then marks FUNCTION.

Selection: Function DELETE

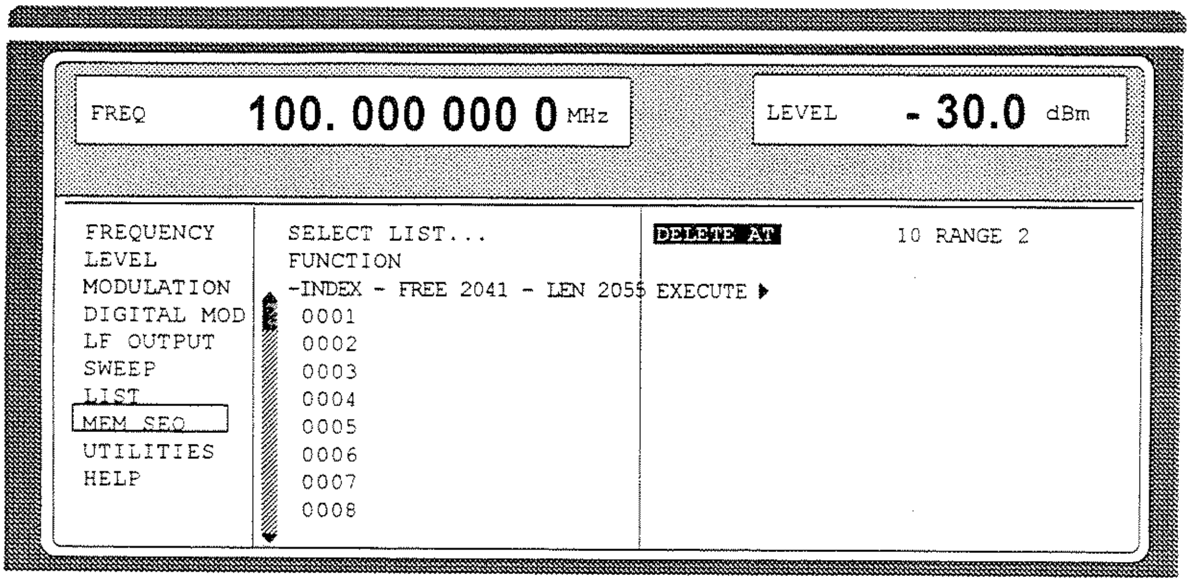


Fig. 2-13 Edit function DELETE: Input window

DELETE AT Input of the block of the list to be deleted

AT	Lower limit (INDEX)
RANGE	Number of elements to be deleted.

EXECUTE → Starts the deletion. After the function has been executed, the input window is automatically exited. The menu cursor marks FUNCTION. The EDIT page shows the beginning of the range that has moved forward.

2.2.4.4 Pattern Setting to Operate the List Editor

The user can become familiar with the operation of the list editor by means of the following pattern setting in the MEM SEQ menu. List MSEQ2 shall be changed using the single-value function EDIT/VIEW:

- Memory location number of the first element 20
- Dwell time of the first element 15s
- Memory location number of the second element 1.

When the setting has been terminated, return to the OPERATION page of the MEM SEQ menu.

At the beginning of the operation sequence, menu MEM SEQ is called. List MSEQ2 is active. The menu cursor marks a parameter of the setting menu on the OPERATION page (c.f. Fig. 2-14).

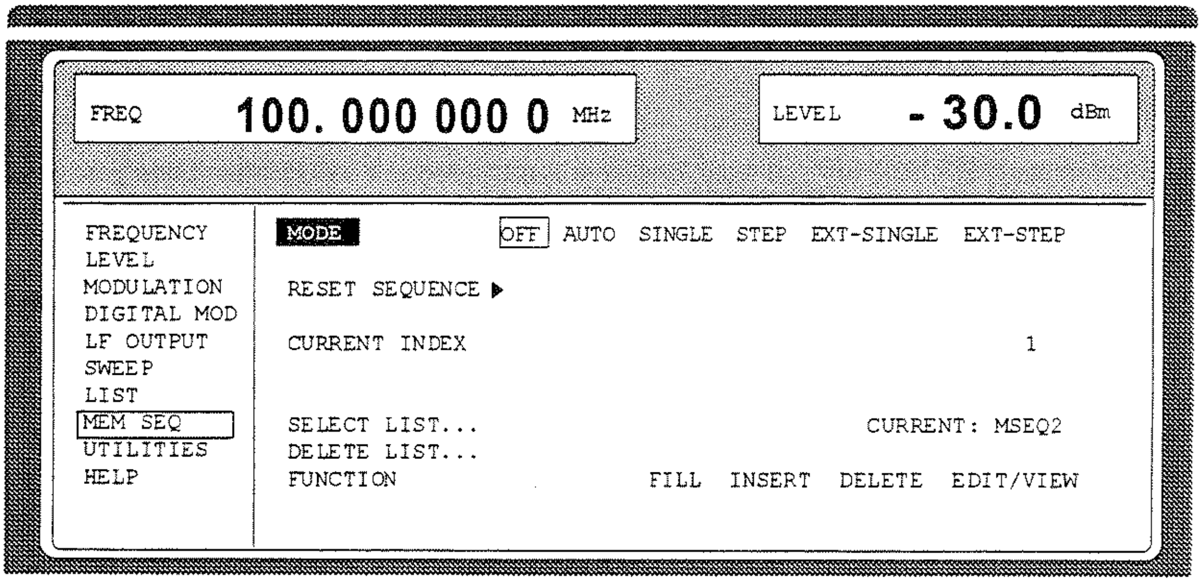
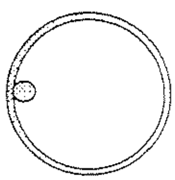
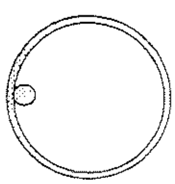


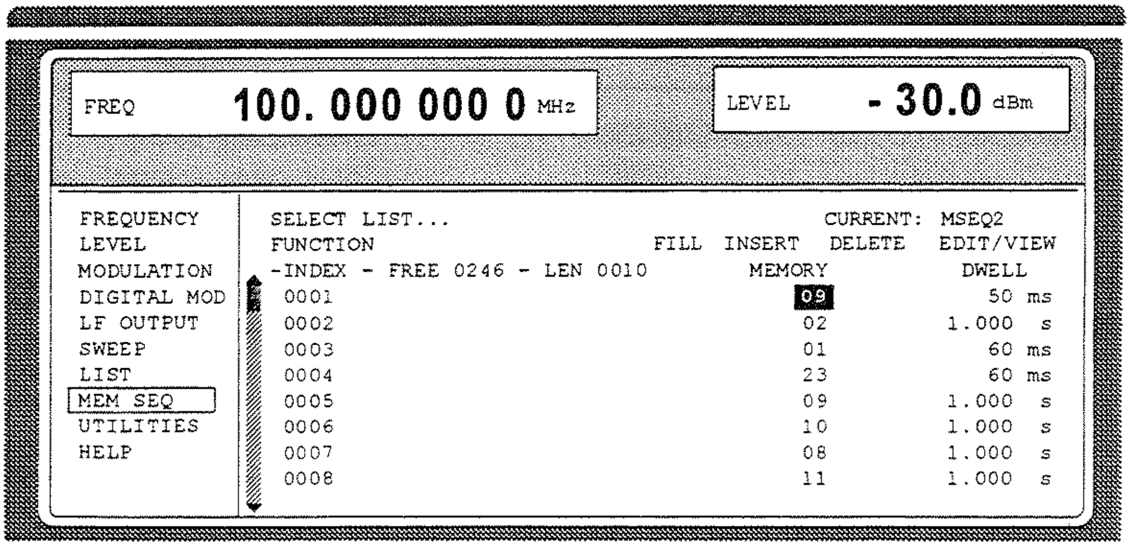
Fig. 2-14 Starting point of the pattern setting

Operating steps	Explanations
MENU / VARIATION  FUNCTION MENU / VARIATION SELECT	Select the FUNCTION menu item.
MENU / VARIATION  . EDIT/VIEW . MENU / VARIATION SELECT	Select single-value function EDIT/VIEW. The EDIT page of the MEM SEQ menu is called. The menu cursor marks the index of the first element of list SEQ2.
SELECT	Set the menu cursor to the memory location number value of the first element (c.f. Fig. 2-15,A).

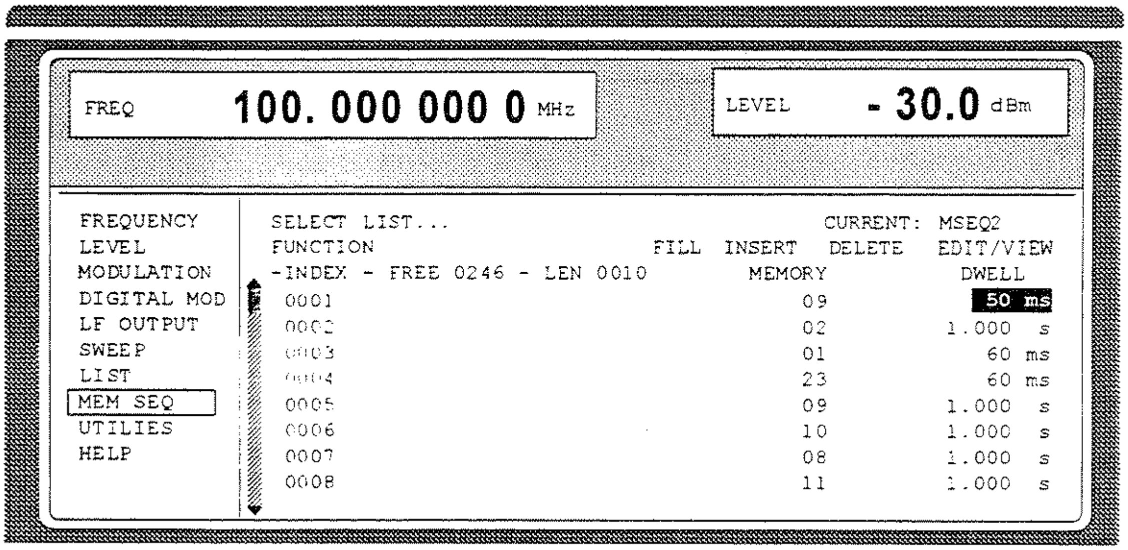
Operating steps	Explanations
DATA INPUT [2] [0] [1x ENTER]	Enter MEMORY 20. The menu cursor automatically wraps to the DWELL value of the first element (Fig. 2-15,B).
DATA INPUT [1] [5] [1x ENTER]	Enter DWELL 15 s. The menu cursor automatically wraps to the MEMORY value of the second element.
DATA INPUT [1] [1x ENTER]	Enter MEMORY 1. The menu cursor automatically wraps to the DWELL value of the second element.
[RETURN]	Reset the menu cursor to the index.
[RETURN]	Reset the menu cursor to the FUNCTION menu item of the EDIT page of menu MEM SEQ (c.f. Fig. 2-15,C).
[RETURN]	Reset the menu cursor to the FUNCTION menu item of the OPERATION page of menu MEM SEQ.

Note: *With the return to the OPERATION page the operation of the list editor is finished. In the list mode (menu LIST), function LEARN ↗ must be activated subsequently to ensure that the settings are transferred to the hardware.*

A



B



C

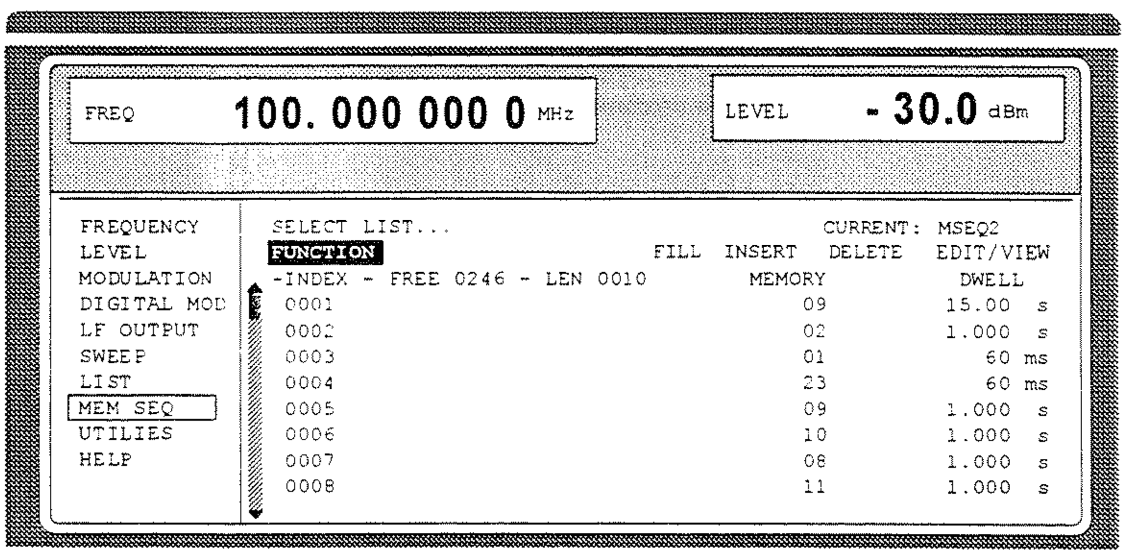


Fig. 2-15, a to c Pattern setting - Edition of a list

2.2.5 Save/Recall - Storing/Calling of Instrument Settings

50 complete instrument settings can be stored in memory locations 1 to 50.

Operating steps	Explanations
DATA INPUT: SAVE 1 2 1x ENTER	Store current instrument setting in memory location 12.
DATA INPUT: RCL 1 2 1x ENTER	Call instrument setting of memory location 12.

The digital display during a save or recall entry is faded in a window.

Memory location 0 has a special function. Here the instrument setting which was current prior to the last memory recall and prior to a preset setting is automatically stored. This permits the resetting of instrument settings which have inadvertently been deleted using Recall 0.

If an instrument setting is stored in which a sweep was switched on, the sweep is started using the recall.

The parameter EXCLUDE FROM RCL in the FREQUENCY and LEVEL-LEVEL menus determines whether the saved RF frequency and RF level are loaded when an instrument setting is loaded, or whether the current settings are maintained.

Store IEC-bus command: "*SAV 12"

Call IEC-bus command: "*RCL 12"

Notes: – *The contents of lists, as they are used for the LIST mode or for user correction (UCOR), is not saved in the SAVE memory. It is stored under the respective list name and can be called. If instrument settings are called which go back to list data such as level setting using UCOR, the current list contents is used. If this has been altered, it is not identical to the list contents at the point of storing any more.*

– *Memory Sequence is dealt with in Section 2.10.*

2.3 Menu Summary

- FREQUENCY
- LEVEL
  - LEVEL
  - ALC
  - UCOR
  - EMF
- MODULATION
  - AM
  - FM (Option SM-B5)
  - PM (Option SM-B5)
  - PULSE (Option SM-B3/B8/B9)
  - STEREO (Option SM-B5/B6)
  - VOR (Option SM-B6)
  - ILS-GS (Option SM-B6)
  - ILS-LOC (Option SM-B6)
  - MKR-BCN (Option SM-B6)
- DIGITAL MOD
  - GMSK (Option SME-B11)
  - GSFK (Option SME-B11)
  - QPSK (Option SME-B11)
  - GSK (Option SME-B11)
  - 4FSK (Option SME-B11)
  - FFSK (Option SME-B11)
  - ERMES (Option SME-B11 and SME-B12)
  - FLEX (Option SME-B11, SME-B12 and SME-B41)
  - POCSAG (Option SME-B11, SME-B12 and SME-B42)
- LF OUTPUT
- SWEEP
  - FREQ
  - LEVEL
  - LFGEN (Option SM-B2/SM-B6)
- LIST
- MEM SEQ
- UTILITIES
  - SYSTEM
    - GPIB
    - RS232
    - SECURITY
    - LANGUAGE
  - REF OSC
  - PHASE
  - PROTECT
  - CALIB
    - VCO SUM
    - LEV PRESET
    - PULSE GEN (Option SM-B4)
    - REF OSC
    - QPSK (Option SME-B11)
    - LEVEL
  - DIAG
    - CONFIG
    - TPOINT
    - PARAM
  - TEST
  - MOD KEY
  - AUX I/O
  - BEEPER
- HELP

2.4 RF Frequency

The frequency of the RF output signal can be set directly using the [FREQ] key (cf. Section 2.2.2.5) or by accessing menu FREQUENCY.
In the header field of the display, the frequency of the RF output signal is indicated under FREQ.
In the case of frequency settings opened by means of the [FREQ] key, the value entered directly is the frequency of the RF output signal.
The input value of frequency settings effected in the FREQUENCY menu considers the offset in calculation (cf. Section 2.4.1). This offers the possibility of entering the desired output frequency of possibly series-connected instruments such as mixers in the menu.

Note: *Further settings:*

Frequency sweep	*Menu SWEEP*
LF frequency	*Menu MODULATION*
	Menu LF-OUTPUT
int./ext. reference frequency	*Menu UTILITIES-REF OSC*
Phase of the output signal	*Menu UTILITIES-PHASE*

Menu selection: FREQUENCY

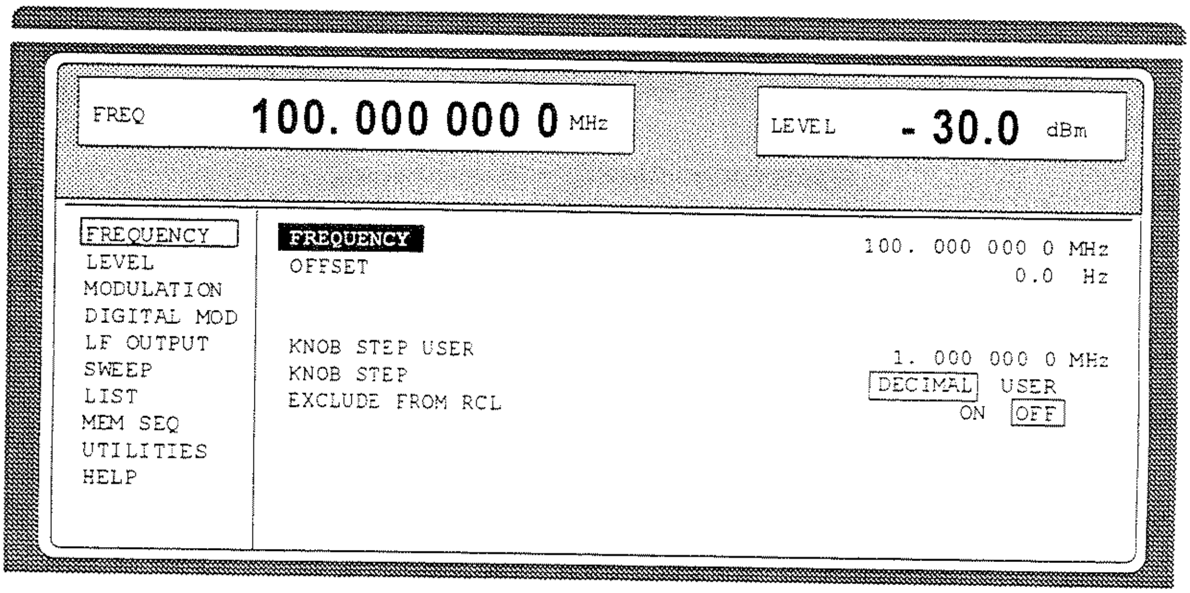


Fig. 2-16 Menu FREQUENCY (preset setting)

FREQUENCY Input value of the RF frequency considering the OFFSET input value. The frequency of the RF output signal is determined by input values FREQUENCY and OFFSET (cf. Section 2.4.1 Frequency Offset).

IEC-bus short command `:FREQ 100E6`

OFFSET Input value of the frequency offset, e.g., of a series-connected mixer (cf. Section 2.4.1, Frequency Offset).

IEC-bus short command `:FREQ:OFFS 0`

KNOB STEP USER Input value of the step width for frequency variation using the rotary knob. The RF frequency is varied in the step width entered if KNOB STEP is set to USER.

IEC-bus short command `:FREQ:STEP 1MHz`

KNOB STEP	DECIMAL:	Variation step width corresponding to the position of the digit cursor.
	USER:	"User Defined", variation step width as entered under KNOB STEP USER .
EXCLUDE FROM RCL	OFF	The saved frequency is loaded when instrument settings are loaded with the [RECALL] key or with a memory sequence. IEC-bus short command `:FREQ:RCL INCL`
	ON	The RF frequency is not loaded when instrument settings are loaded, the current settings are maintained. IEC-bus short command `:FREQ:RCL EXCL`

2.4.1 Frequency Offset

The SME offers the possibility of entering an offset (OFFSET) of possibly series-connected instruments in the FREQUENCY menu. The indication/input value under FREQUENCY considers this input and represents the frequency value of the RF signal at the output of these instruments (cf. Fig. 2-17).

Input values FREQUENCY and OFFSET have the following connection with the frequency of the RF output signal:

FREQUENCY - OFFSET = RF output signal.

An offset input does not cause a variation of the RF output signal, but only a variation of indication value FREQUENCY in the FREQUENCY menu.

The RF output frequency of the SME is indicated in the header field of the display. It can be entered directly, i.e. without considering the offset using the [FREQ] key.

The offset setting also remains effective with the frequency sweep.

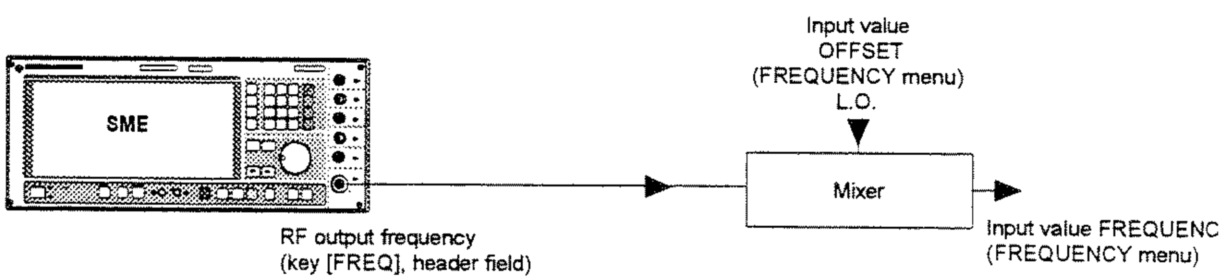


Fig. 2-17 Example of a circuit with frequency offset

2.5 RF Level

The RF output level can be set directly using the [LEVEL] key (cf. Section 2.2.2.5) or by accessing the LEVEL menu.

In the header field of the display, the set RF output level is indicated under LEVEL.

The input value of level settings opened using the [LEVEL] key directly corresponds to the RF output level.

The input value of the level settings effected in the LEVEL-LEVEL menu mathematically considers the offset of an attenuation/amplification element which is possibly series-connected (cf. Section 2.5.1). This offers the possibility of entering the desired level at the output of series-connected instruments, the SME then alters the RF output level correspondingly. The offset can also be entered in the LEVEL-LEVEL menu.

dBm, dBµV, mV and µV can be used as level units. The 4 unit keys are directly labeled with these units. In order to change to another level unit, simply press the desired unit key.

Notes:
- *The message UNLEVELED is displayed in the status line if the level set in the overrange is not reached.*
- *Further settings: Level sweep menu SWEEP*

Menu selection: LEVEL - LEVEL

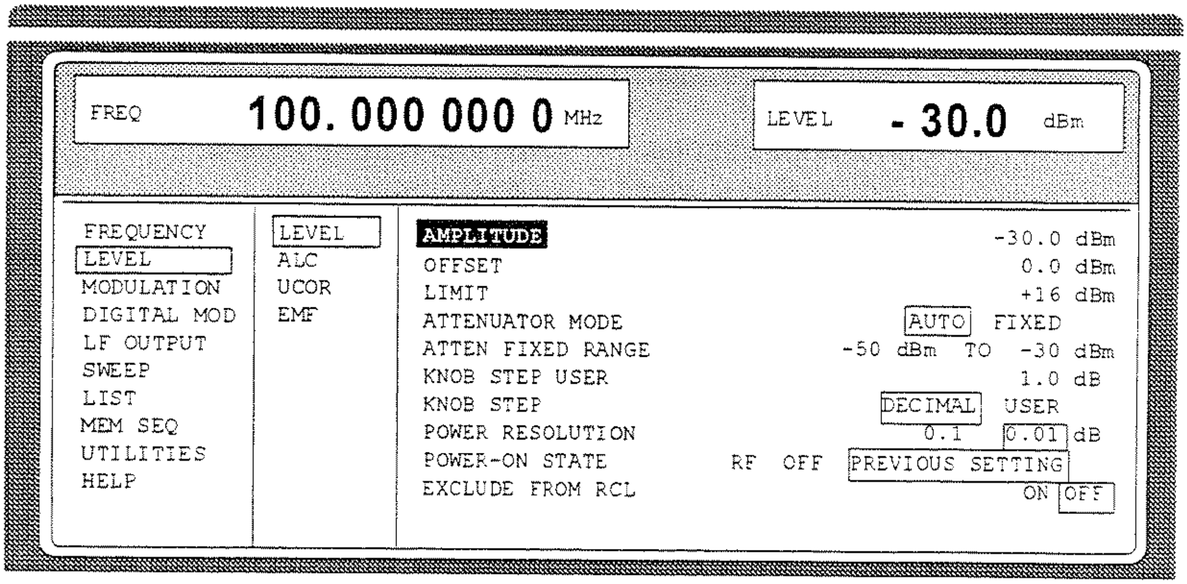


Fig. 2-18 Menu LEVEL (preset setting) POWER RESOLUTION is set to 0.01 dB

AMPLITUDE Input value of the RF level considering the OFFSET input value. The level of the RF output signal is determined by input values AMPLITUDE and OFFSET (cf. Section 2.5.2, Level Offset).

IEC-bus short command `:POW 30`

OFFSET Input value of the level offset of the RF output level compared to the input value of the RF level indicated in the LEVEL menu. Input in dB (cf. Section 2.5.1, Level Offset).

IEC-bus short command `:POW:OFFS 0`

LIMIT	Input value of level limitation. This value indicates the upper limit of the level at the RF output connector. If a level above this limit is attempted to be set, a warning is displayed in the status line. IEC-bus short command `:POW:LIM 16 dBm`	
ATTENUATOR MODE	AUTO	Normal operation. The attenuator switching mechanically switches in steps of 5 dB, the switching points being fixed. IEC-bus short command `:OUTP:AMOD AUTO`
	FIXED	Level settings are effected without switching the attenuator (cf. Section 2.5.2, Interrupt-free Level Setting). IEC-bus short command `:OUTP:AMOD FIX`
ATTEN FIXED RANGE	Indication of the level range in which the level is set without interruption in the "ATTENUATOR MODE FIXED" operating mode.	
KNOB STEP USER	Input value of the step width for level variation using the rotary knob. The RF level is varied in the step width entered if KNOB STEP is set to USER. IEC-bus short command `:POW:STEP 1`	
KNOB STEP	DECIMAL	Variation step width according to the position of the digit cursor.
	USER	User Defined, variation step width as entered under KNOB STEP USER.
POWER RESOLUTION	Selection of resolution of LEVEL display. For level range -99.9 dBm to +16 dBm the resolution for the level display can be set to 0.1 dB or 0.01 dB.	
POWER-ON STATE	Selection of the state the RF output is to assume after power-on of the unit	
	RF OFF	Output is switched off
	PREVIOUS SETTING	Same state as before switch-off
	IEC-bus short command	`:OUTP:PON ON`
EXCLUDE FROM RCL	OFF	The saved RF level is loaded when instrument settings are loaded with the [RECALL] key or with a memory sequence. IEC-bus short command `:POW:RCL INCL`
	ON	The RF level is not loaded when instrument settings are loaded, the current settings are maintained. IEC-bus short command `:POW:RCL EXCL`

2.5.1 Level Offset

The SME offers the possibility of entering the offset (OFFSET) of a possibly series-connected attenuator/amplification element in the LEVEL-LEVEL menu. The indication/input value under AMPLITUDE considers this input (see below) and represents the level value of the signal at the output of the series-connected instrument (cf. Fig. 2-19).
Input values LEVEL and OFFSET in the LEVEL menu have the following connection with the RF output level:

LEVEL OFFSET = output level

An offset input does not effect an alteration of the RF output level, but only an alteration of the LEVEL indication value in the LEVEL menu. The offset is to be entered in dB.

The RF output level of the SME is indicated in the header field of the display. It can be entered directly, i.e. without considering an offset, using the [LEVEL] key.

The offset setting also remains effective in the ATTENUATOR MODE FIXED operating mode and with level sweep.

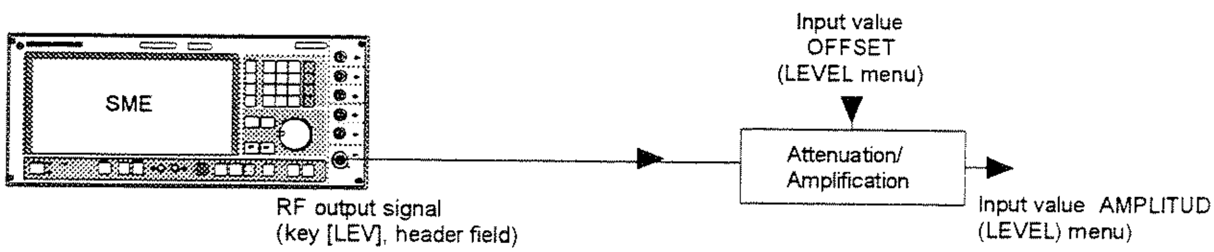


Fig. 2-19 Example of a circuit with level offset

2.5.2 Interrupt-free Level Setting

In the ATTENUATOR MODE FIXED operating mode, level settings are carried out without interruption. An electronic attenuation setting is used instead of the interrupting attenuator.

If the normal variation range of 23 dB is violated, the level under/overrange warning is displayed. In these ranges, level accuracy and spectral purity are no longer guaranteed.

2.5.3 Switching On/Off Internal Level Control

Menu LEVEL-ALC offers access to settings for level control.

Level control can be deactivated and various bandwidths of the level control can be switched on.

Switching off level control (ALC STATE OFF) switches over the internal level control into a sample-and-hold operation. In this operating mode, level control is automatically switched on for a short period of time after every level and frequency setting, and then the level control is held at the value achieved. Switching off the level control is used with multi-transmitter measurements to achieve a larger intermodulation ratio.

Bandwidth setting influences the AM noise of the output signal. The bandwidth of the level control has the same effect as a filter of the same bandwidth.

Menu selection: LEVEL - ALC

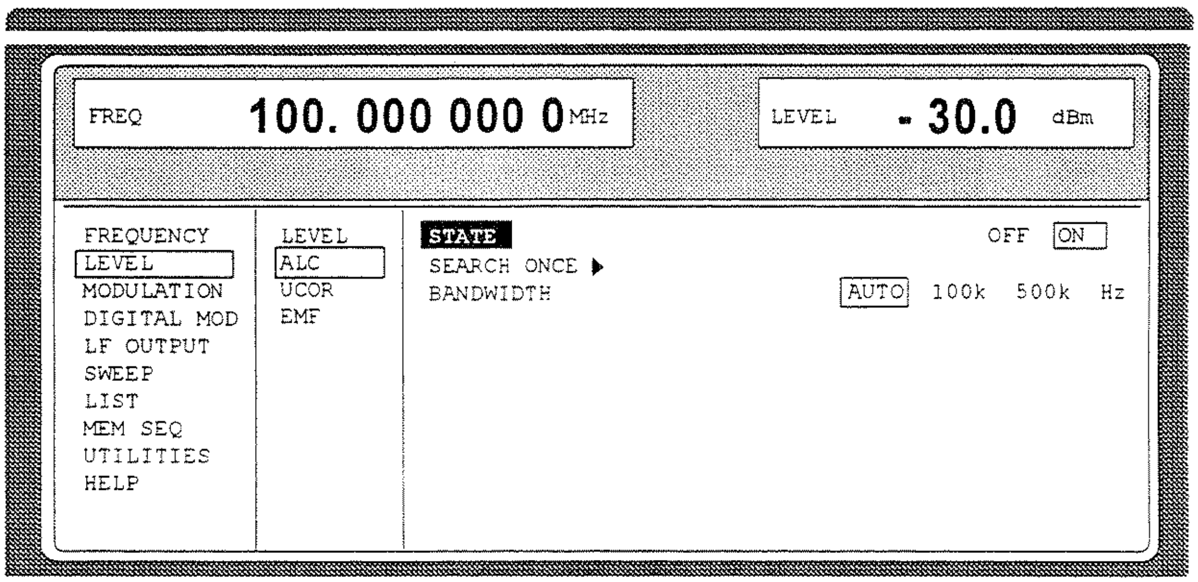


Fig. 2-20 Menu LEVEL - ALC (preset setting)

STATE

ON Normal state. Internal level control is permanently switched on.
IEC-bus short command `:POW:ALC ON`

OFF Internal level control is deactivated. In this state no AM and no digital modulation with AM content is possible.
IEC-bus short command `:POW:ALC OFF`

SEARCH ONCE → Manual short-time switching on of the level control for level calibration in the ALC STATE OFF operating mode.
IEC-bus short command `:POW:ALC ON;ALC OFF`

2.5.4 Internal Level Control - Bandwidth Selection

BANDWIDTH Selection of the bandwidth of the level control.

AUTO The bandwidth is automatically adapted to the operating conditions.
IEC-bus short command `:POW:ALC:BAND:AUTO ON`

100 kHz Bandwidth narrow. This setting improves AM noise with carrier offset >100 kHz. However, the AM bandwidth is restricted..
IEC-bus short command `:POW:ALC:BAND 100kHz;BAND:AUTO OFF`

500 kHz Full bandwidth
IEC-bus short command `:POW:ALC:BAND 500kHz;BAND:AUTO OFF`

2.5.5 User Correction (UCOR)

Function "User Correction" can be used to create and activate lists in which arbitrary RF frequencies are assigned level correction values.

Up to 10 lists with a total of 160 correction values can be compiled. For frequencies which are not included in the list the level correction is determined by means of interpolation of the nearest correction values.

When user correction is switched on, the LEVEL indication is completed by the indication UCOR (User Correction) in the header field of the display. The RF output level is the sum of both values.

LEVEL + UCOR = output level

If the offset setting is used at the same time, the LEVEL indication value is the difference of the input values AMPLITUDE and OFFSET of the menu LEVEL.

AMPLITUDE OFFSET = LEVEL

The user correction is effective in all operating modes if switched on.

Menu selection: LEVEL - UCOR

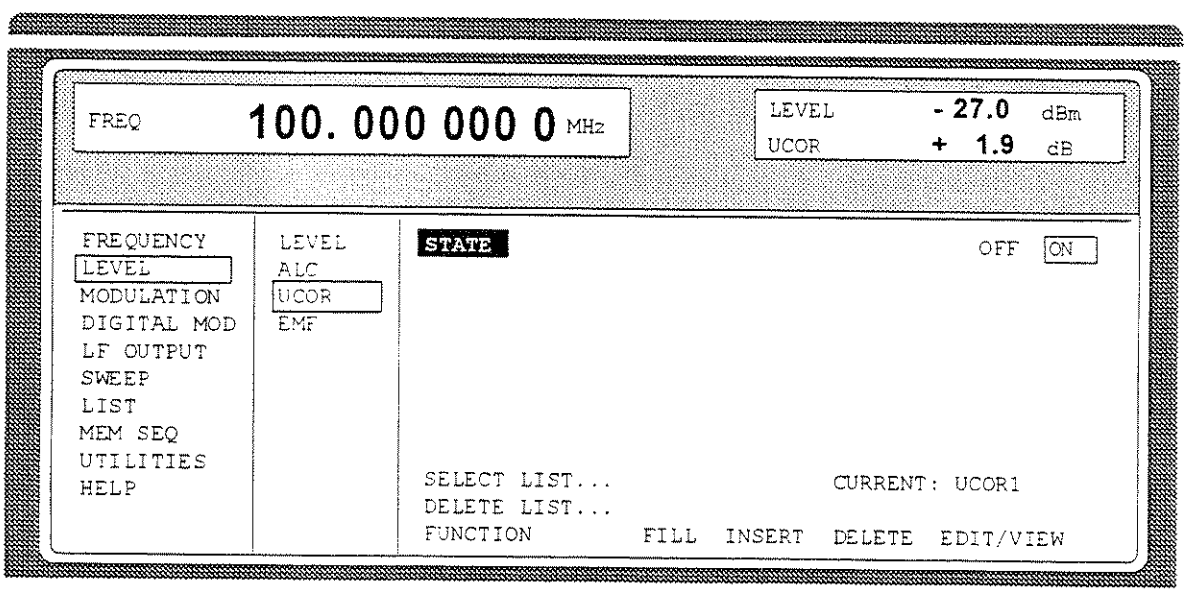


Fig. 2-21 Menu LEVEL - UCOR - OPERATION side

STATE Switching on/off user correction.
IEC-bus short command `:CORR ON`

SELECT LIST... Selection of a list or generation of a new list(cf. Section 2.2.4, List Editor)
IEC-bus short command `:CORR:CSET "UCOR1"`

DELETE LIST... Deletion of a list (cf. Section 2.2.4, List Editor)
IEC-bus short command `:CORR:CSET:DEL "UCOR2"`

FUNCTION Selection of the editing mode to process the selected list
IEC-bus short commands `:CORR:CSET:DATA:FREQ 100 MHz, 102 MHz,...`
`:CORR:CSET:DATA:POW 1dB, 0.8dB,...`

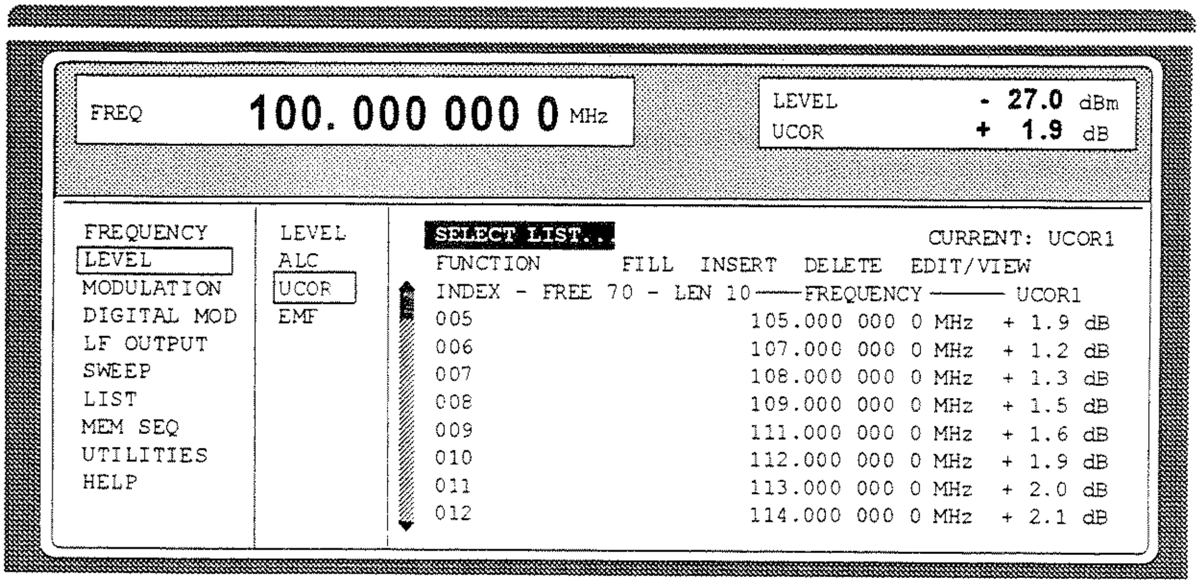


Fig. 2-22 Menu UCOR - LEVEL-EDIT side

2.5.6 EMF

The signal level can also be set and indicated as the voltage of EMF (open-circuit voltage).

EMF is displayed in the header field of the display after the unit of the level indication.

Menu selection: LEVEL - EMF

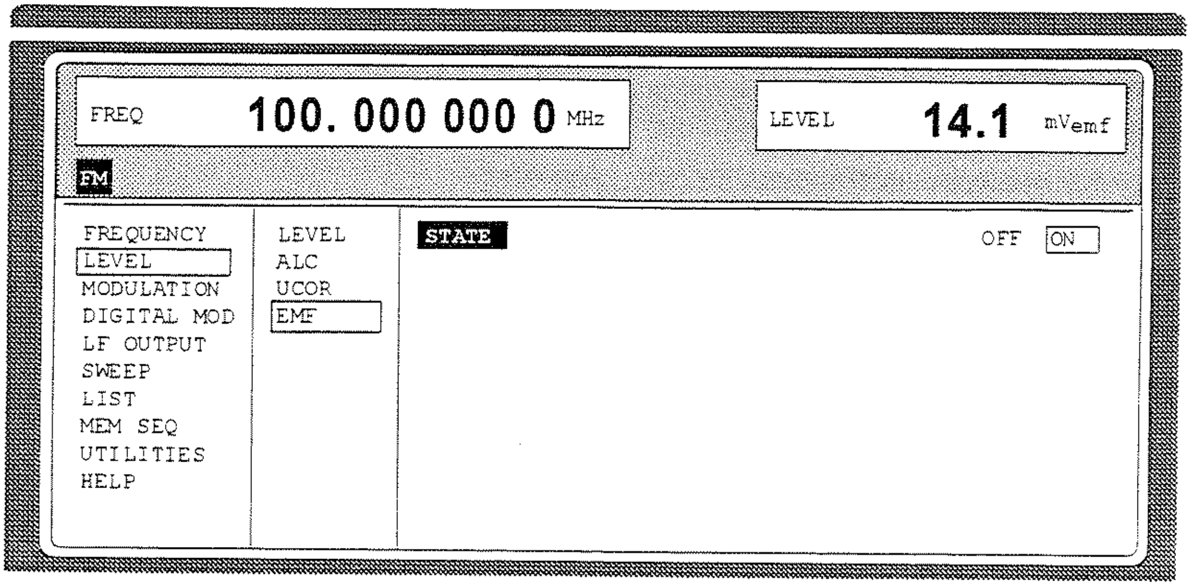


Fig. 2-23 Menu LEVEL-EMF

STATE	ON	Voltage value of the level is the voltage of EMF.
	OFF	Voltage value of the level is voltage at 50 Ω (preset setting).

2.5.7 [RF ON / OFF]-Key

The RF output signal is switched on and off again using the [RF ON / OFF] key. This does not influence the current menu. When the output signal is switched off, the message "RF OFF" is displayed in the LEVEL indication of the header field. If RF OFF is displayed, the 50-Ω source resistance is maintained.

IEC-bus short command `:OUTP OFF`

2.5.8 Reset Overload Protection (only SME02 and SME03)

SME02 and SME03 are protected against overload by an external signal which is fed into the RF output. If an external signal is too high, the overload protection responds. This state is indicated by means of the message "RF OFF" in the LEVEL indication in the header field and the message "OVERLOAD" in the status line.

➢ Reset the overload protection by pressing the [RF ON / OFF] key.

IEC-bus short command `:OUTP:PROT:CLE`

SMT06 is not protected against overvoltage, the IEC/IEEE-bus command being ignored.

2.6 Modulation

The SME offers the following modulations:

- Amplitude modulation (AM)
- Frequency modulation (FM) *
- Phase modulation (PM) *
- Pulse modulation (PULSE) *
- FM-stereo modulation (STEREO) **
- VOR/ILS modulation (VOR, ILS-GS, ILS-LOC, MKR BCN) *

  and the digital modulations:
- GMSK, GFSK, QPSK, FSK, FFSK, 4FSK and *
- Radiocommunication services ERMES, FLEX and POCSAG. *

Internal or external modulation sources can be used for all modulations.

2.6.1 Modulation Sources

Internal Modulation Sources

Internal modulation generators LF GEN1 and LF GEN2 are available for AM, FM and PM depending on the equipment. For a more detailed description, cf. Section 2.6.2.1, LF Generator.

For internal pulse modulation, the instrument can be equipped with a pulse generator (option SM-B4). For a more detailed description, cf. Section 2.6.2.5.1, Pulse Generator.

A PRBS generator with selectable sequence lengths and a data generator are available for the digital modulations (cf. Section 2.6.3, Digital Modulation).

External Modulation Sources

The appropriate input sockets to the different modulations in the case of external supply can be taken from table 2-1. DM (digital modulation) stands for GMSK, GFSK, QPSK, FSK, FFSK and 4FSK. External AM, FM and PM can be AC or DC-coupled.

Table 2-1 Input sockets for the different types of modulation

Modulation	Inputs					
	EXT1	EXT2	PULSE	DATA	CLOCK	BURST
AM	X					
FM1	X	X				
FM2	X	X				
PM1	X	X				
PM2	X	X				
PULSE			X			
DM				X	X	X

* Only with option

The external modulation signal must show a voltage of V_s = 1 V (V_{eff} = 0.707 V) in order to maintain the modulation depth or deviation indicated. Deviations of more than ±3 % are signaled in the status line by means of the following messages (cf. table 2-2).

Table 2-2 Status messages in the case of a deviation from the rated value at the external modulation input

Message	Deviation
EXT1-HIGH	Voltage at EXT1 too high
EXT1-LOW	Voltage at EXT1 too low
EXT2-HIGH	Voltage at EXT2 too high
EXT2-LOW	Voltage at EXT2 too low
EXT-HI/HI	Voltage at EXT1 and EXT2 too high
EXT-LO/LO	Voltage at EXT1 and EXT2 too low
EXT-HI/LO	Voltage at EXT1 too high and EXT2 too low
EXT-LO/HI	Voltage at EXT1 too low and EXT2 too high

2.6.1.1 Simultaneous Modulation

Basically, every combination of AM, FM, pulse modulation and a digital modulation (GMSK, GFSK, QPSK, FSK, FFSK or 4FSK) is possible. Instead of FM, phase modulation (PM) can be switched on as well. There are only restrictions for modulations of the same kind and for the multiple use of the 2nd LF generator (cf. table 2-3).

Two-tone AM is possible by simultaneously switching on the external and internal source.

Two-tone FM or two-tone PM is possible by simultaneously switching on FM1 and FM2 or PM1 and PM2. For FM1 and FM2 (PM1 and PM2) separate deviations can be set and separate sources switched on.

Note: *With two-tone modulation please observe that the set deviation or modulation depth is valid for one signal and the sum deviation or sum modulation depth is determined by adding both signals. This results in overmodulation if the maximal value for deviation or modulation depth is exceeded.*

2.6.1.2 Alternate Switching Off of Modulations

Due to the multiple use of some functional modules in the instrument some modulations cannot be set at the same time (cf. table 2-3). In the case of manual control, incompatible modulations deactivate one another, a short-time warning is displayed in the status line.

Note: *The IEC-bus control according to SCPI forbids the mutual influence of types of modulation on one another. In the case of remote control, an error message is outputted when the attempt is made to switch on incompatible types of modulation (cf. annex B).*

Table 2-3 Modulations which cannot be operated simultaneously

	AM INT1	AM INT2	AM EXT1	FM INT1	FM1 EXT1,2	FM2 INT2	FM2 EXT1,2	PM1 INT1	PM1 EXT1,2	PM2 INT2	PM2 EXT1,2	Stereo	VOR	ILS	MCR BCN
AM INT1													X	X	X
AM INT2												X	X	X	X
AM EXT1													☒	☒	X
FM1 INT1					☐			X	X	X	X				
FM1 EXT1,2				☐				X	X	X	X				
FM2 INT2							☐	X	X	X	X	X	X	X	X
FM2 EXT1,2						☐		X	X	X	X	X			
PM1 INT1				X	X	X	X		☐			X			
PM1 EXT1,2				X	X	X	X	☐				X			
PM2 INT2				X	X	X	X				☐	X	X	X	X
PM2 EXT1,2				X	X	X	X			☐		X			
Stereo		X				X	X	X	X	X	X		X	X	X
VOR	X	X	☒			X				X		X		X	X
ILS	X	X	☒			X				X		X	X		X
MKR-BCN	X	X	X			X				X		X	X	X	

X Mutual switching off in the case of manual control
☒ in the VOR-(ILS..) menu AM EXT can be added as an own parameter
☐ Switching off by means of 1-out-of-n selection

2.6.1.3 [MOD ON/OFF] Key

The modulations can directly be switched on/off using the key or by accessing the MODULATION menu. When switching on using the [MOD ON/OFF] key, the modulation sources which are set in the modulation menus are used.

The [MOD ON/OFF] key can either be effective for all modulations or for a selected modulation. The selection for which modulation the [MOD ON/OFF] key is effective is made in the UTILITIES-MOD KEY menu (cf. Section " Assigning Modulation to [MOD ON/OFF] Key").

When selecting a certain type of modulation, each pressing the [MOD ON/OFF] key switches on or off the modulation selected.

In the case of selection "all modulations", the [MOD ON/OFF] key has the following effect:

- At least one modulation is active:
  Pressing the [MOD ON/OFF] key switches off all active modulations. Which modulations were active is stored.
- No modulation is active:
  Pressing the [MOD ON/OFF] key switches on the modulations which were last switched off using the [MOD ON/OFF] key.

2.6.2 Analog Modulation

2.6.2.1 LF-Generator

The SME is equipped with a fixed-frequency generator as internal modulation source as a standard. The generator supplies sinusoidal signals of the frequencies of 0.4, 1, 3 and 15 kHz.
In addition to the standard equipment, the SME can be equipped with the following optional LF modulation sources:

- LF-generator, option SM-B2
- Multifunction generator, option SM-B6

It is possible to fit two optional modulation sources unless option SM-B3, pulse modulator, is fitted. If two options are fitted, the access to the internal standard generator is eliminated. The different possibilities of modulation generator fitting are visible from table 2-4:

Table 2-4 Modulation generators as component parts

LF-Generator 1	LF-Generator 2
Standard generator	---
Standard generator	Option SM-B2, LF-generator
Standard generator	Option SM-B6, multifunction generator
Option SM-B2, LF-generator	Option SM-B2, LF-generator
Option SM-B2, LF-generator	Option SM-B6, multifunction generator

The selection of the waveform and frequency of the internal modulation signals can be made in one of the modulation menus (AM, FM, PM) as well as in the LF-output menu.

Notes:

- *In conformance to the possibilities of the modulation generator options fitted, there are differences in the modulation menus for AM, FM and PM.*
- *The following modulations cannot be set simultaneously and deactivate one another: LFGEN SHAPE NOI and LF sweep.*

2.6.2.2 Amplitude Modulation

Menu MODULATION-AM offers access to settings for amplitude modulation.

Notes:

- *In the level range from 7 to 13 dBm, the specified AM data are only guaranteed for a linearly decreasing modulation depth with a rising level. When a modulation depth is set that is too high, "WARNING" is displayed in the status line or the message "WARN - 221 Settings conflict; AM forces level into overrange" is displayed after pressing the ERROR key.*
- *Modulations AM, VOR, ILS and MKR BCN deactivate one another. AM SOURCE INT = LFGEN2 and STEREO deactivate one another as well.*

Menu selection: MODULATION- AM

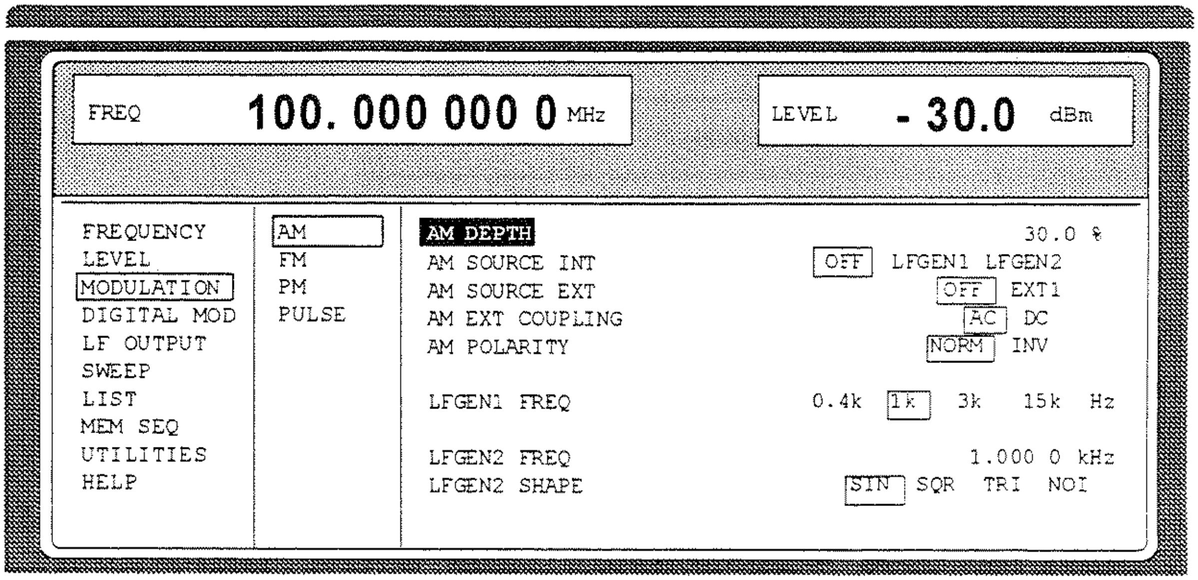


Fig. 2-24 Menu MODULATION-AM (preset setting), fitted with option SM-B2, LF-generator (LFGEN2)

AM DEPTH Input value of the modulation depth..

IEC-bus short command `:AM 30PCT`

AM SOURCE INT Selection of the internal source.

IEC-bus short command `:AM:SOUR INT1; STAT ON`

AM SOURCE EXT Selection of the external source.

IEC-bus short command `:AM:SOUR EXT; STAT ON`

AM EXT COUPLING Selection of the kind of coupling AC or DC with external supply (input EXT1).

IEC-bus short command `:AM:EXT:COUP AC`

AM POLARITY
Selection of the polarity of amplitude modulation.

NORM	A positive modulation voltage generates a higher output level.
INV	The AM polarity is inverted.

IEC-bus short command `:AM:POL NORM`

LFGEN1 FREQ
Selection of the frequency of the 1st LF generator.
IEC-bus short command `:AM:INT1:FREQ 1kHz`

LFGEN2 FREQ
Input value of the frequency of the 2nd LF generator.
IEC-bus short command `:AM:INT2:FREQ 1kHz`

LFGEN2 SHAPE
Selection of the waveform of the 2nd LF generator.
IEC-bus short command `:SOUR2:FUNC SIN`

2.6.2.3 Frequency Modulation

Menu MODULATION-FM offers access to settings for frequency modulation.

Note: *The following modulations cannot be set simultaneously and deactivate one another: FM and PM; FM2 and STEREO; FM2 SOURCE = LFGEN2 and VOR, ILS, MKR BCN*

Menu selection: MODULATION-FM

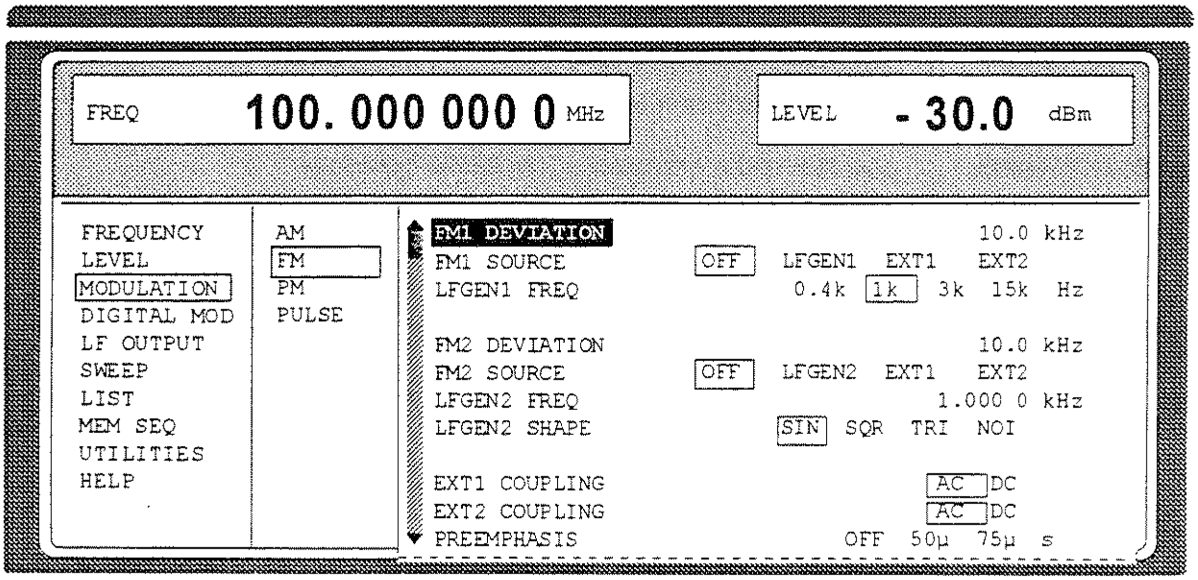


Fig. 2-25 Menu MODULATION-FM (preset setting), fitted with option SM-B2, LF-generator (LFGEN2) and Option SM-B5, FM/PM-modulator

FM1 DEVIATION Input value of the deviation for FM1.
IEC-bus short command `:FM1 10kHz`

FM1 SOURCE Switching on and off FM1 and selection of the modulation source.
IEC-bus short command `:FM1:SOUR INT; STAT ON`

LFGEN1 FREQ Selection of the frequency of the 1st LF generator.
EC-bus short command `:FM1:INT:FREQ 1kHz`

FM2 DEVIATION Input value of the deviation for FM2.
EC-bus short command `:FM2 10kHz`

FM2 SOURCE Switching on and off FM2 and selection of the modulation source.
EC-bus short command `:FM2:STAT OFF`

LFGEN2 FREQ Input value of the LFGEN2 frequency.
EC-bus short command `:FM2:INT:FREQ 1kHz`

LFGEN2 SHAPE Selection of the waveform of the 2nd LF generator.
EC-bus short command `:SOUR2:FUNC SIN`

EXT1 COUPLING Selection of the type of coupling AC or DC for the external input EXT1.
IEC-bus short command `:FM1:EXT1:COUP AC`

EXT2 COUPLING Selection of the type of coupling AC or DC for the external input EXT2.
IEC-bus short command `:FM1:EXT2:COUP AC`

PREEMPHASIS Selection of the preemphasis
IEC-bus short command `:FM1:PRE 50us`

2.6.2.3.1 FM Deviation Limits

The maximal deviation depends on the RF frequency set (cf. Fig. 2-26). It is possible to enter a deviation that is too high for a certain RF frequency or to vary the RF frequency to a range in which the deviation can no longer be set. In this case the maximally possible deviation is set and an error message is displayed.

In the RF range 93.75 MHz to 130 MHz a different synthesis range is selected depending on the deviation set. If the deviation is smaller than 62,5 kHz, the synthesizer is in the division range with optimal spectral purity. If the deviation set is larger than 62,5 kHz, the extended heterodyne band is automatically selected.

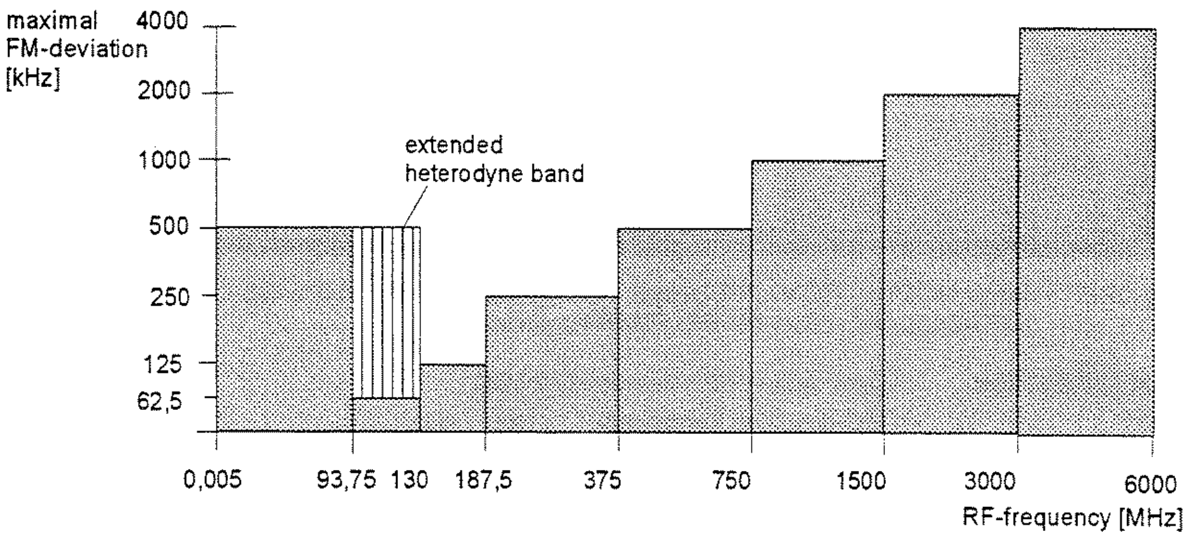


Fig. 2-26 Dependency of the FM maximal deviation on the RF frequency set

2.6.2.3.2 Preemphasis

Preemphasis results in a preemphasis of the modulation signal with time constants 50 µs or 75 µs. The higher frequencies of the modulation signal are preemphasized.

When preemphasis is switched on, only 1/4 of the maximal deviation is permissible. The highest permissible modulation frequency is 15 kHz. Exceeding the permissible modulation frequency can lead to overmodulation.

2.6.2.4 Phase Modulation

Menu MODULATION-PM offers access to settings for phase modulation.

Note: *The following modulations cannot be set simultaneously and deactivate one another:*
PM and FM
PM and STEREO
PM2 SOURCE = LFGEN2 and VOR, ILS, MKR BCN

Menu selection: MODULATION - PM

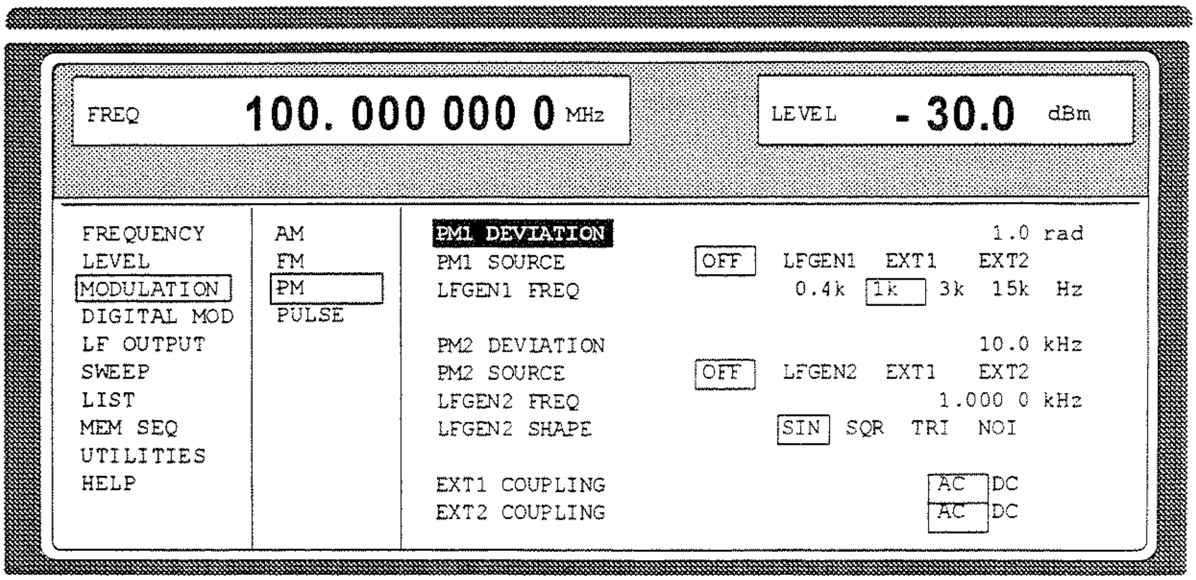


Fig. 2-27 Menu MODULATION - PM (preset setting) fitted with option SM-B2, LF-generator (LFGEN2), and option SM-B5, FM/PM-modulator

PM1 DEVIATION Input value of the deviation for PM1.
IEC-bus short command `:PM1 1RAD`

PM1 SOURCE Switching on and off PM1 and selection of the modulation source.
IEC-bus short command `:PM1:SOUR:INT; STAT ON`

LFGEN1 FREQ Selection of the frequency of the 1st LF generator.
IEC-bus short command `:PM1:INT:FREQ 1kHz`

PM2 DEVIATION Input value of the deviation for PM2.
IEC-bus short command `:PM2 1RAD`

PM2 SOURCE Switching on and off PM2 and selection of the modulation source.
IEC-bus short command `:PM2:SOUR INT; STAT ON`

LFGEN2 FREQ Input value of the LFGEN2 frequency.
IEC-bus short command `:PM2:INT:FREQ 1kHz`

LFGEN2 SHAPE Selection of the waveform of the 2nd LF generator.
IEC-bus short command `:SOUR2:FUNC SIN`

EXT1 COUPLING Selection of the type of coupling AC or DC with external supply for PM1 (input EXT1).

IEC-bus short command `:PM:EXT1:COUP AC`

EXT2 COUPLING Selection of the type of coupling AC or DC with external supply for PM2 (input EXT2).

IEC-bus short command `:PM:EXT2:COUP AC`

2.6.2.4.1 PM Deviation Limits

The maximal deviation depends on the RF frequency set (cf. Fig. 2-28). It is possible to enter a deviation that is too high for a certain RF frequency or to vary the RF frequency to a range in which the deviation can no longer be set. In this case the maximally possible deviation is set and an error message displayed.

In the RF range 93.75 MHz to 130 MHz a different synthesis range is selected depending on the deviation set. If the deviation is smaller than 0,625 rad, the synthesizer is in the division range with optimal spectral purity. If the deviation set is larger than 0,625 rad, the extended heterodyne band is automatically selected.

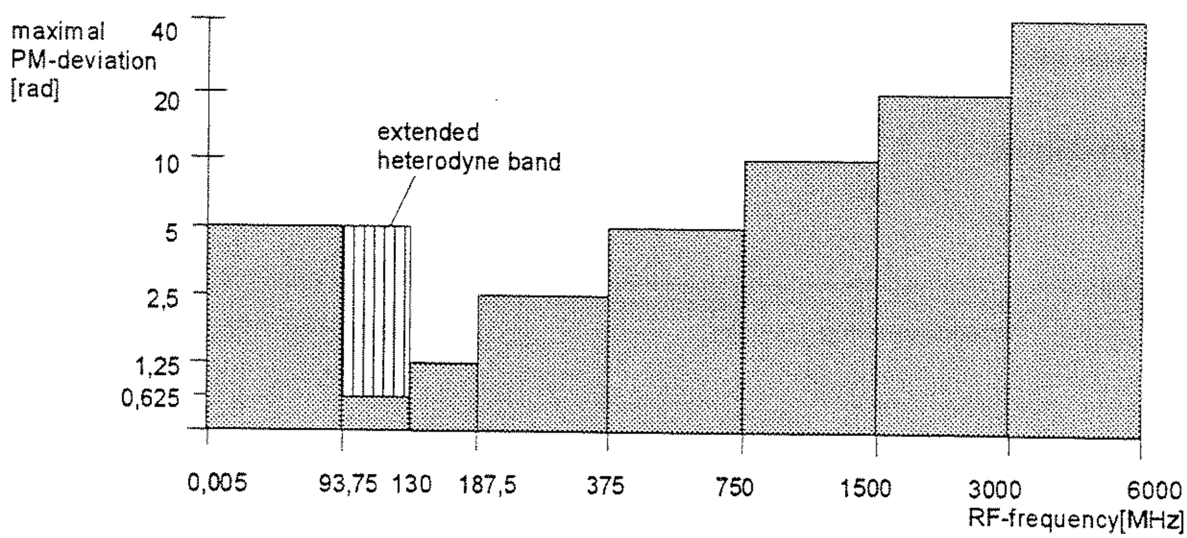


Fig. 2-28 Dependency of the PM maximal deviation on the RF frequency set

2.6.2.5 Pulse Modulation

The pulse modulator can be controlled by an external source as well as by the internal pulse generator. In the case of external control, the external source directly feeds the pulse modulator. The envelope of the RF is identical to the control signal. In the case of control by the internal pulse generator, the pulse form of the pulse generator determines the envelope of the RF. Pulse delay, pulse width and period can be set.

The polarity of the pulse modulation is selectable. With POLARITY = NORM, the RF level is on with HIGH level at modulation input PULSE. The input resistance is selectable between 50 Ω and 10 kΩ.

2.6.2.5.1 Pulse Generator

As an internal modulation source, the pulse generator (option SM-B4) offers the possibility to set single and double pulses with variable pulse delay, pulse width and period. The pulse generator can be triggered internally or by means of an external signal at the PULSE input. The internal triggering is derived from the reference frequency and hence very stable. In trigger mode EXT, the positive or the negative edge can be used to trigger the pulse generator.

The pulse generator can also be operated as an independent function without the pulse modulator being controlled if the pulse modulation source SOURCE is switched to OFF or EXT. The pulse can be tapped at the VIDEO output.

The inputs and outputs to the pulse generator are at the rear of the instrument.

Signal examples:

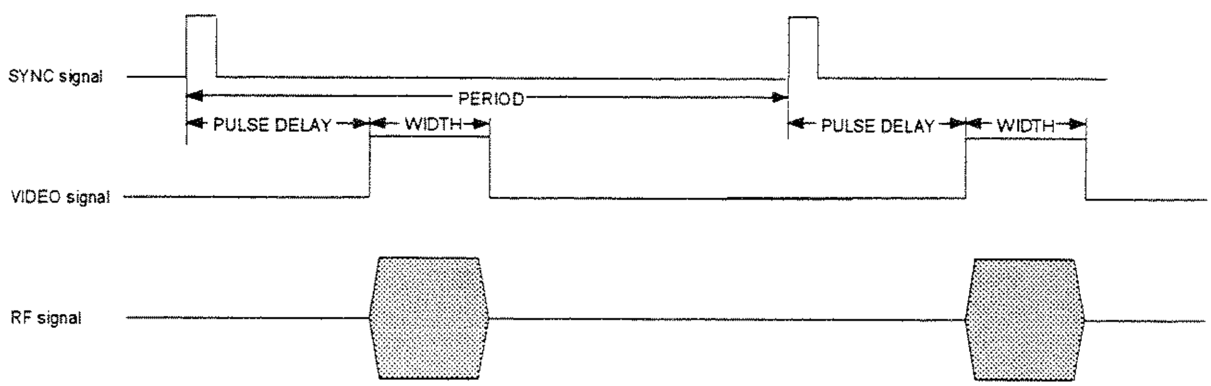


Fig. 2-29 Signal example 1: single pulse, TRIGGER MODE = AUTO

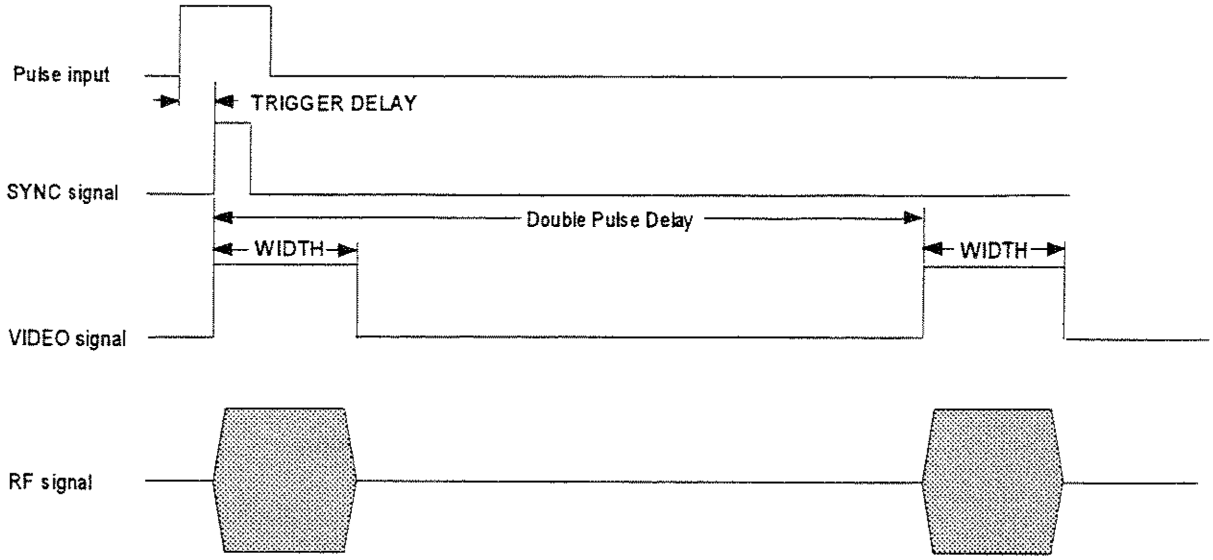


Fig. 2-30 Signal example 2: double pulse, TRIGGER MODE = EXT, SLOPE = POS

Note: *The minimum period length depends on parameters WIDTH and PULSE DELAY. To avoid a settings conflict the following has to be true:*
PERIOD ≥ 1,1 × (WIDTH + PULSE DELAY) + 30 ns

For double pulse the following has to be true:
DOUBLE PULSE DELAY ≥ WIDTH + 40 ns

Menu MODULATION-PULSE offers access to settings for pulse modulation and to the pulse generator. If only option SM-B3, pulse modulator, is fitted, only the first 3 lines are displayed in the setting menu.

Menu selection: MODULATION - PULSE

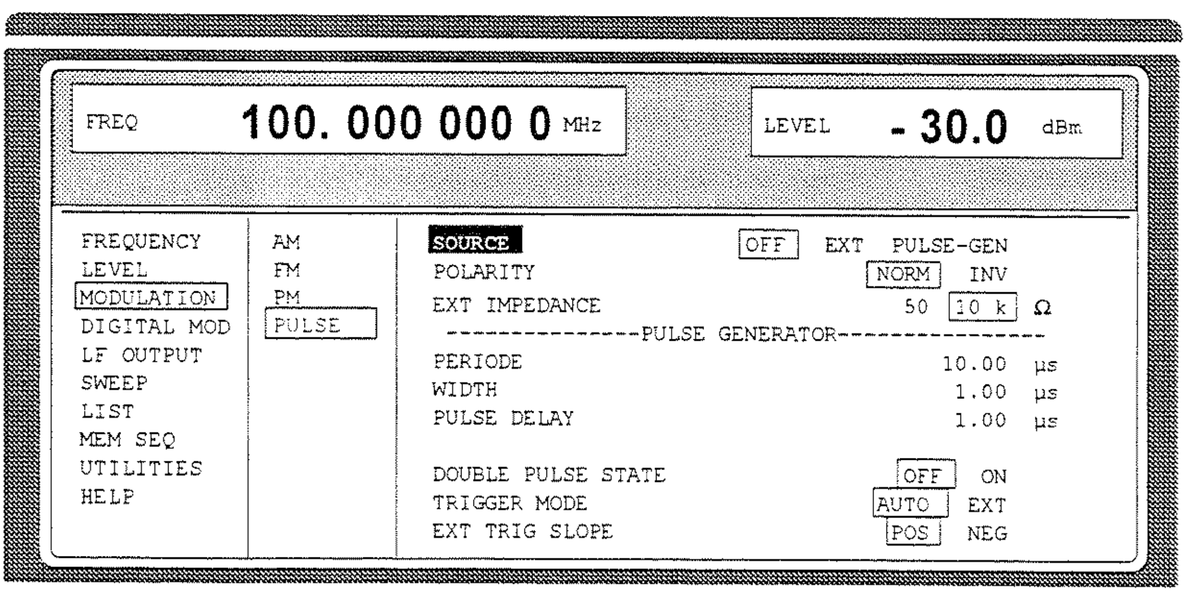


Fig. 2-31 Menu MODULATION-PULSE (preset setting), fitted with option SM-B3, pulse modulator, and option SM-B4, pulse generator.

SOURCE
Selection of the modulation source.
IEC-bus short command `:PULM:SOUR INT; STAT ON`

POLARITY
Selection of the polarity of the modulation
NORM The RF signal is on during high level.
INV The RF signal is suppressed during high level.
IEC-bus short command `:PULM:POL NORM`

EXT IMPEDANCE
Selection of the input resistance 50 Ω or 10 kΩ.
IEC-bus short command `:PULM:EXT:IMP 50`

PERIOD
Input value of the period.
IEC-bus short command `:PULS:PER 10us`

WIDTH
Input value of the pulse width.
IEC-bus short command `:PULS:WIDT 1us`

PULSE DELAY
Input value of the single-pulse delay. Is only displayed if DOUBLE PULSE STATE is set to be OFF.
IEC-bus short command `:PULS:DEL 1us`

DOUBLE PULSE DELAY
Input value of the double-pulse delay.
IEC-bus short command `:PULS:DOUB:DEL 1us`

DOUBLE PULSE STATE
Switching on/off the double pulses.
ON Double pulse is switched on
OFF Single pulse
IEC-bus short command `:PULS:DOUB ON`

TRIGGER MODE
Selection of the trigger mode.
AUTO Period as entered under PERIOD.
EXT Period is determined by the external signal at the PULSE input.
IEC-bus short command `:TRIG:PULS:SOUR AUTO`

EXT TRIG SLOPE
Selection of the active edge of the external trigger signal.
POS Pulse generator triggers on positive edge of the external signal.
NEG Pulse generator triggers on negative edge of the external signal..
IEC-bus short command `:TRIG:PULS:SLOP POS`

2.6.2.6 Stereo Modulation

By means of option SM-B6, multifunction generator, and option SM-B5, FM/PM modulator, stereo multiplex signals conforming to standards can be generated according to the pilot-tone method.

Note: *The following modulations cannot be set simultaneously and deactivate one another:*
STEREO and FM
STEREO and PM
STEREO and AM if SOURCE AM = LFGEN2

Menu selection: MODULATION - STEREO

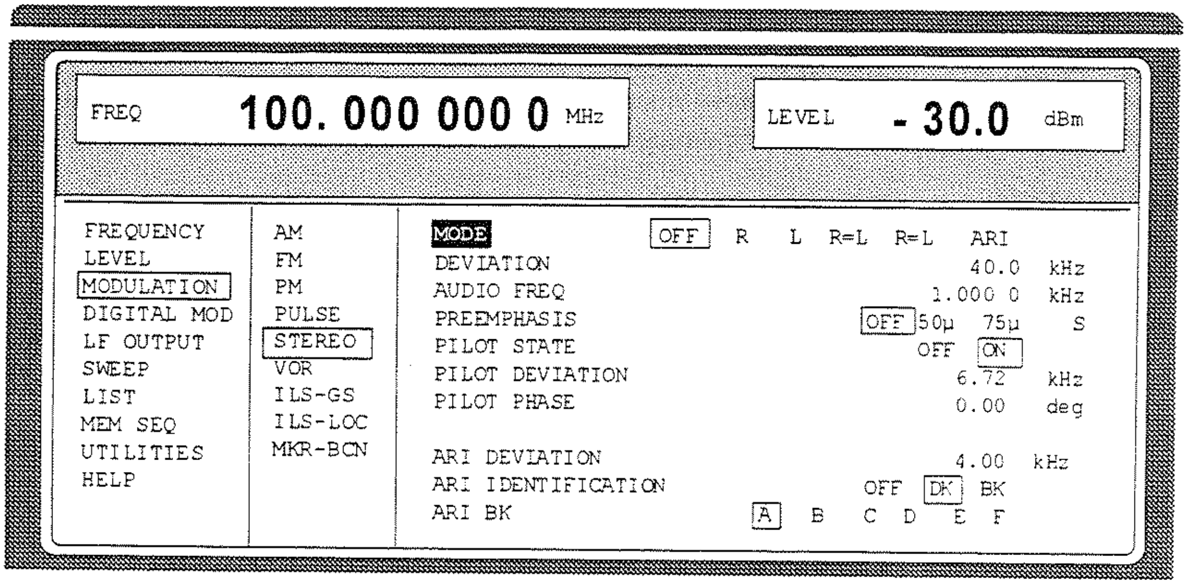


Fig. 2-32 Menu MODULATION-STEREO (preset setting), fitted with option SM-B6, multifunction generator, and option SM-B5, FM/PM modulator

MODE

Selection of the operating mode.

OFF	The stereo signal is switched off.
R	Audio signal only in the right-hand channel.
L	Audio signal only in the left-hand channel.
R=L	Audio signals of same frequency and phase in both channels.
R=L	Audio signals of same frequency but opposite phase in both channels.
ARI	Generation of 19-kHz pilot tone and ARI traffic channel signals.

IEC-bus short command `:STER:STAT ON; SIGN AUD; AUD:MODE LEFT`

DEVIATION

Input value of the frequency deviation of the STEREO-MPX signal without considering the pilot-tone content.

IEC-bus short command `:STER 40kHz`

AUDIO FREQ

Input value of the frequency of the audio signal.

IEC-bus short command `:STER:AUD 1kHz`

PREEMPHASIS	Selection of the preemphasis of the audio signal. 50 uS Preemphasis 50 µs 75 uS Preemphasis 75 µs OFF Preemphasis switched off IEC-bus short command `:STER:AUD:PRE OFF`
PILOT STATE	Switching on/off the pilot tone. IEC-bus short command `:STER:PIL:STAT OFF`
PILOT DEVIATION	Input value of the frequency deviation of the pilot tone. IEC-bus short command `:STER:PIL 6720`
PILOT PHASE	Input value of the phase of the pilot tone. The zero point of the suppressed 38-kHz subcarrier of the STEREO multiplex signal serves as phase reference. IEC-bus short command `:STER:PIL:PHAS 0`
ARI DEVIATION	Input value of the deviation content of the unmodulated 57-kHz-ARI subcarrier in the ARI operating mode. IEC-bus short command `:STER:ARI 4kHz`
ARI IDENTIFICATION	Selection between ARI broadcasting code (DK) and traffic area code (BK). OFF The area code and the broadcasting code are switched off. DK The broadcasting code is activated. The AM modulation depth of the broadcasting code (125 Hz) on the ARI subcarrier is m=0.3. BK The area code is activated. The AM modulation depth of the area code chosen under ARI BK is m=0.6. IEC-bus short command `:STER:SIGN ARI; ARI:TYPE DK`
ARI BK	Selection of the standard traffic area codes. A Traffic area code A, 23,7500 Hz B Traffic area code B, 28,2738 Hz C Traffic area code C, 34,9265 Hz D Traffic area code D, 39,5833 Hz E Traffic area code E, 45,6731 Hz F Traffic area code F, 53,9773 Hz IEC-bus short command `:STER:SIGN ARI; ARI:TYPE BK; ARI:BK A`

2.6.2.7 VOR- / ILS-Test Signals

By means of option SM-B6, multifunction generator, test signals for avionics systems

- VOR (VHF Omnidirectional Range) ,
- ILS (Instrument Landing System) and
- MKR-BCN (Marker Beacon) can be generated.

2.6.2.7.1 VOR Modulation

Notes:

- *The following modulations cannot be set simultaneously and deactivate one another:*
  VOR and AM
  VOR and PM if SOURCE PM = LFGEN2
  VOR and FM if SOURCE FM = LFGEN2
- *In the AM, FM, PM and LF-output menu the message "VOR" is displayed under LFGEN2 if the VOR modulation is activated.*

Menu selection: MODULATION-VOR

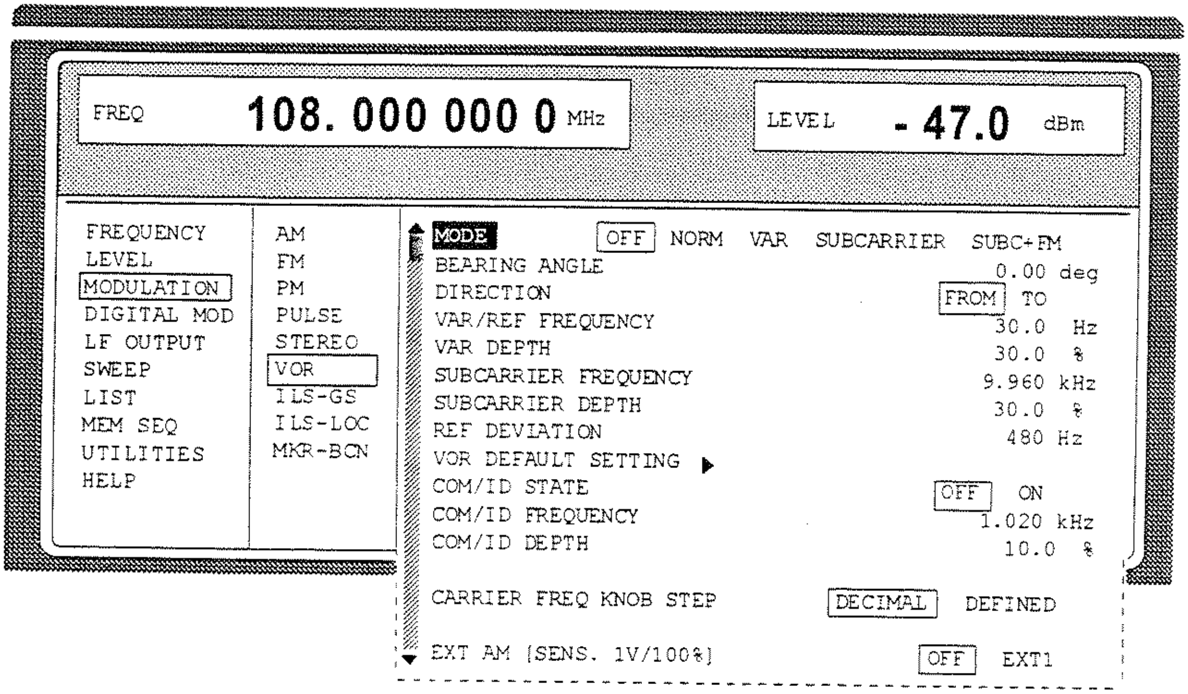


Fig. 2-33 Menu MODULATION-VOR (preset setting), fitted with option SM-B6, multifunction generator

MODE Selection of the VOR operating mode.

OFF	VOR modulation is switched off. In menus AM, FM, PM and LF-OUTPUT, the original setting is displayed under LFGEN2, the message "VOR" is eliminated.
NORM	VOR modulation is activated.
VAR	Amplitude modulation of the output signal with the 30-Hz signal content of the VOR signal. The modulation depth of the 30-Hz signal corresponds to the value set under VAR DEPTH.
SUBCARRIER	Amplitude modulation of the output signal with the unmodulated 9960-Hz FM carrier of the VOR signal. The modulation depth corresponds to the value set under SUBCARRIER DEPTH.
SUBC+FM	Amplitude modulation of the output signal with the frequency-modulated 9960-Hz FM carrier of the VOR signal. The frequency deviation corresponds to the value set under REF DEVIATION, the modulation depth to the value set under SUBCARRIER DEPTH.

IEC-bus short command `:VOR:STAT ON; MODE NORM`

BEARING ANGLE	Input value of the phase angle between the 30-Hz VAR signal and the 30-Hz reference signal. IEC-bus short command `:VOR 0deg`
DIRECTION	Selection of the reference position of the phase information. FROM: Selection of the beacon as a reference position. The angle set under BEARING ANGLE corresponds to the angle between the true north and the connection line between beacon and airplane. TO: Selection of the airplane position as a reference position. The angle set under BEARING ANGLE corresponds to the angle between the true north and the connection line between airplane and beacon. IEC-bus short command `:VOR:DIR FROM`
VAR/REF FREQUENCY	Input value of the frequency of the VAR and the REF signal. IEC-bus short command `:VOR:VAR:FREQ 30`
VAR DEPTH	Input value of the AM modulation depth of the 30-Hz VAR signal. IEC-bus short command `:VOR:VAR 30PCT`
SUBCARRIER FREQUENCY	Input value of the frequency of the FM carrier. IEC-bus short command `:VOR:SUBC 9960`
SUBCARRIER DEPTH	Input value of the AM modulation depth of the FM carrier. IEC-bus short command `:VOR:SUBC:DEPT 30PCT`
REF DEVIATION	Input value of the frequency deviation of the REF signal on the FM carrier. IEC-bus short command `:VOR:REF 480`
VOR DEFAULT SETTING	Call the VOR default setting. The default setting corresponds to the setting represented in Fig. 2-33 except for the MODE setting (=NORM). The selection of the CARRIER FREQ KNOB STEP parameters is not changed by calling this function. IEC-bus short command `:VOR:PRES`
COM/ID STATE	Switching on/off an additional communication/identification signal (COM/ID signal). IEC-bus short command `:VOR:COM ON`
COM/ID FREQUENCY	Input value of the frequency of the COM/ID signals. IEC-bus short command `:VOR:COM:FREQ 1020`
COM/ID DEPTH	Input value of the AM modulation depth of the COM/ID signals. IEC-bus short command `:VOR:COM:DEPT 10PCT`

CARRIER FREQ KNOB STEP

Selection of the variation of the carrier frequency via the rotary knob.

DECIMAL Decimal variation according to the current cursor position.

DEFINED Variation in predefined steps according to the standardized VOR transmitting frequencies (see table, values in MHz):

Note: *If DEFINED is selected, the current RF frequency is automatically switched over to the next VOR transmitting frequency according to the table when switching on modulation VOR.*

108.00	109.40	110.80	112.10	112.80	113.50	114.20	114.90	115.60	116.30	117.05	117.75
108.05	109.45	110.85	112.15	112.85	113.55	114.25	114.95	115.65	116.35	117.10	117.80
108.20	109.60	111.00	112.20	112.90	113.60	114.30	115.00	115.70	116.40	117.15	117.85
108.25	109.65	111.05	112.25	112.95	113.65	114.35	115.05	115.75	116.45	117.20	117.90
108.40	109.80	111.20	112.30	113.00	113.70	114.40	115.10	115.80	116.50	117.25	117.95
108.45	109.85	111.25	112.35	113.05	113.75	114.45	115.15	115.85	116.55	117.30	
108.60	110.00	111.40	112.40	113.10	113.80	114.50	115.20	115.90	116.60	117.35	
108.65	110.05	111.45	112.45	113.15	113.85	114.55	115.25	115.95	116.65	117.40	
108.80	110.20	111.60	112.50	113.20	113.90	114.60	115.30	116.00	116.75	117.45	
108.85	110.25	111.65	112.55	113.25	113.95	114.65	115.35	116.05	116.80	117.50	
108.00	110.40	111.80	112.60	113.30	114.00	114.70	115.40	116.10	116.85	117.55	
109.05	110.45	111.85	112.65	113.35	114.05	114.75	115.45	116.15	116.90	117.60	
109.20	110.60	112.00	112.70	113.40	114.10	114.80	115.50	116.20	116.95	117.65	
109.25	110.65	112.05	112.75	113.45	114.15	114.85	115.55	116.25	117.00	117.70	

EXT AM [SENS. 1V/100%]

Switching on/off an external modulation signal via socket EXT1.

OFF External AM input EXT1 switched off.

ON External AM input EXT1 activated.
The sensitivity is 10 mV per percent modulation depth.

IEC-bus short command `:VOR:SOUR INT2,EXT`

Note: *As automatic level monitoring of the external modulation signal is switched off in this operating mode, there can be an overmodulation as a function of the level of the external signal without a corresponding caution message being generated.*
In order to avoid an overmodulation, the peak value of the external signal is to be delimited corresponding to the sum of the modulation depths of the remaining VOR signal components.

2.6.2.7.2 ILS-Glide Slope Modulation (ILS-GS)

Notes:

- *The following modulations cannot be set simultaneously and deactivate one another: ILS-GS and AM, ILS-GS and PM if SOURCE PM = LFGEN2 ILS-GS and FM if SOURCE FM = LFGEN2*
- *In the AM, FM, PM and LF-output menu the message "ILS-GS" is displayed under LFGEN2 if the ILS-GS modulation is activated.*
- *With setting CARRIER FREQ KNOB STEP= DEFINED, a change to modulation ILS-LOC automatically causes the RF frequency to be adapted to the localizer value which is coupled to the glide-slope setting.*

Menu selection: MODULATION-ILS-GS

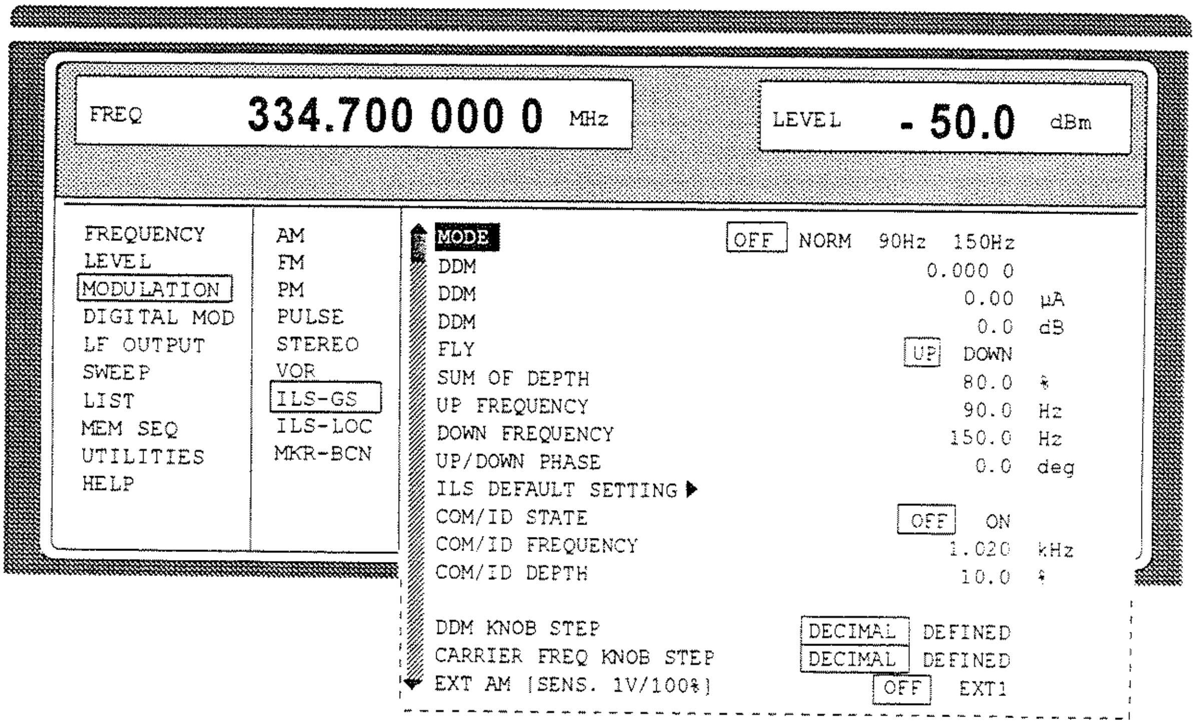


Fig. 2-34 Menu MODULATION-ILS-GS (preset setting), fitted with option SM-B6, multifunction generator

MODE

Selection of the ILS-GS operating mode.

OFF ILS-GS modulation is switched off. In menus AM, FM, PM and LF-OUTPUT, the original setting is displayed under LFGEN2, the message "ILS-GS" is eliminated.

NORM ILS-GS modulation is activated.

90 Hz Amplitude modulation of the output signal with the 90-Hz signal content of the ILS-GS signal. The modulation depth of the 90-Hz signal results from the settings of parameters SUM OF DEPTH (SOD) and DDM according to:

AM(90 Hz) = 0,5 × (SOD + DDM × 100%)

150 Hz Amplitude modulation of the output signal with the 150-Hz signal content of the ILS-GS signal. The modulation depth of the 150-Hz signal results from the settings of parameters SUM OF DEPTH (SOD) and DDM acc. to:

AM (150 Hz) = 0,5 × (SOD DDM × 100%)

IEC-bus short command `:ILS:STAT ON; TYPE GS; MODE NORM`

DDM

Difference in Depth of Modulation. Input value of the difference in depth of modulation between the 90-Hz and the 150-Hz tone of the ILS-GS modulation signal. The DDM value is calculated to formula (parameter UP/DOWN = DOWN):

DDM = [AM(90 Hz) - AM(150 Hz)] /100%

A variation of the DDM value automatically leads to a variation of the value of the instrument current and the DDM value in dB.

IEC-bus short command `:ILS:DDM 0`

DDM

Input value of the current of the ILS indicating instrument corresponding to the DDM value. A variation of the value of the instrument current automatically leads to a variation of the DDM value and the DDM value in dB. The value of the instrument current is calculated according to:

DDM μ A = DDM × 857,1 μ A

IEC-bus short command `:ILS:DDM:CURR 0`

DDM

Input of the DDM value in dB. A variation of the value automatically leads to a variation of the DDM value and the value of the instrument current. The dB value is calculated according to:

DDM dB = 20 × LOG [(SOD+DDM×100%) / (SOD-DDM×100%)]

IEC-bus short command `:ILS:DDM:LOG 0`

FLY

Selection between ILS-GS operating modes UP and DOWN. A change of the setting automatically changes the sign of the DDM value.

UP In operating mode UP, the 150-Hz modulation signal is predominant, the DDM value is positive.

DOWN In operating mode DOWN, the 90-Hz modulation signal is predominant, the DDM value is negative.

IEC-bus short command `:ILS:DDM:DIR UP`

SUM OF DEPTH

Input value of the arithmetic sum of the modulation depths of the 90-Hz and 150-Hz ILS-GS signal contents. The RMS modulation depth of the sum signal depends on the phase setting of both modulation tones.

IEC-bus short command `:ILS:SOD 80PCT`

UP FREQ

Input value of the modulation frequency of the antenna lobe arranged at the top.
IEC-bus short command `:ILS:ULOB 90`

DOWN FREQ

Input value of the modulation freq. of the antenna lobe arranged at the bottom.

IEC-bus short command `:ILS:LLOB 150`

Note: *A variation of one of the two modulation frequencies causes an automatic adaptation of the other modulation frequency in such a way that a frequency-response ratio of 3:5 or 5:3 is maintained.*

UP/DOWN PHASE

Input value of the phase between the modulation signals of the upper and lower antenna lobe. The zero point of the 150-Hz signal serves as a reference. The input is effected in degrees of the 150-Hz signal.

IEC-bus short command `:ILS:PHAS 0deg`

ILS DEFAULT SETTING

Call the ILS-GS default setting. The default setting corresponds to the setting represented in Fig. 2-34 except for the MODE setting (=NORM). The selection of the CARRIER FREQ KNOB STEP parameter is not changed by calling this function.

IEC-bus short command `:ILS:PRES`

COM/ID STATE

Switching on/off an additional communication/identification signal (COM/ID-Signal).

IEC-bus short command `:ILS:COM ON`

COM/ID FREQUENCY

Switching on/off an additional communication/identification signal (COM/ID-Signal).

IEC-bus short command `:ILS:COM:FREQ 1020`

COM/ID DEPTH

Input value of the AM modulation depth of the COM/ID signal.

IEC-bus short command `:ILS:COM:DEPT 10PCT`

DDM KNOB STEP

Input value of the AM modulation depth of the COM/ID signal.

DECIMAL Decimal variation according to the current cursor position.

DEFINED Variation between the predefined DDM values:

-0,4000
-0,1750 (Glide Sector)
-0,0910, 0,0450
0,0000 (Glide Path)
+0,0450, +0,0910
+0,1750 (Glide Sector)
+0,4000

CARRIER FREQ KNOB STEP

Variation between the predefined DDM values:

DECIMAL Decimal variation according to the current cursor position..

DEFINED Variation in predefined steps according to the standardized GLIDE-SLOPE transmitting frequencies (see table).

Note: *If DEFINED is selected, the current RF frequency is automatically switched over to the next GLIDE-SLOPE transmitting frequency acc. to the table when switching on the modulation.*

LOC/GS (MHz)	LOC/GS (MHz)	LOC/GS (MHz)	LOC/GS (MHz)	LOC/GS (MHz)	LOC/GS (MHz)	LOC/GS (MHz)
108.10 / 334.70	108.70 / 330.50	109.30 / 332.00	109.90 / 333.80	110.50 / 329.60	111.10 / 331.70	111.70 / 333.50
108.15 / 334.55	108.75 /330.35	109.35 / 331.85	109.95 / 333.65	110.55 / 329.45	111.15 / 331.55	111.75 / 333.35
108.30 / 334.10	108.90 / 329.30	109.50 / 332.60	110.10 / 334.40	110.70 / 330.20	111.30 / 332.30	111.90 / 331.10
108.35 / 333.95	108.95 / 329.15	109.55 / 332.45	110.15 / 334.25	110.75 / 330.05	111.35 / 332.15	111.95 / 330.95
108.50 / 329.90	109.10 331.40	109.70 / 333.20	110.30 / 335.00	110.90 / 330.80	111.50 / 332.90	
108.55 / 329.75	109.15 / 331.25	109.75 / 333.05	110.35 / 334.85	110.95 / 330.65	111.55 / 332.75	

EXT AM [SENS. 1V/100%]

Switching on/off an external modulation signal via socket EXT1.

OFF External AM input EXT1 switched off.

ON External AM input EXT1 activated.
The sensitivity is 10 mV per percent of modulation depth.

IEC-bus short command `:ILS:SOUR INT2, EXT`

Note: *As the automatic level monitoring of the external modulation signal is switched off in this operating mode, there can be an overmodulation as a function of the level of the external signal without a corresponding caution message being generated.*
In order to avoid an overmodulation, the peak value of the external signal is to be delimited corresponding to the sum of the modulation depths of the remaining ILS signal components.

2.6.2.7.3 ILS-Localizer Modulation (ILS-LOC)

Notes:

- *The following modulations cannot be set simultaneously and deactivate one another:*
  ILS-LOC and AM
  ILS-LOC and PM if SOURCE PM = LFGEN2
  ILS-LOC and FM if SOURCE FM = LFGEN2
- *In the AM, FM, PM and LF-output menu the note "ILS-LOC" is displayed under LFGEN2 if the ILS-LOC modulation is activated.*
- *With setting CARRIER FREQ KNOB STEP= DEFINED, a change to modulation ILS-GS automatically causes the RF frequency to be adapted to the glide-slope value which is coupled to the localizer setting.*

Menu selection: MODULATION ILS - LOC

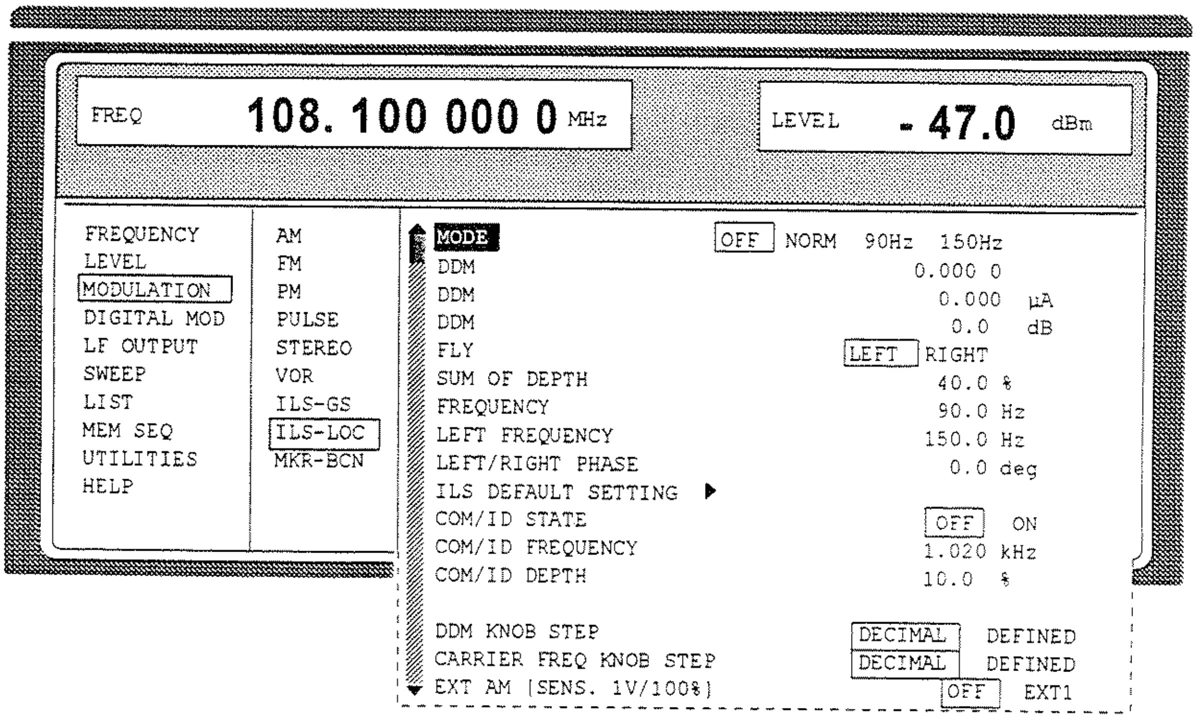


Fig. 2-35 Menu MODULATION-ILS-LOC (preset setting), fitted with option SM-B6, multifunction generator

MODE

Selection of the ILS-LOC operating mode.

OFF ILS-LOC modulation is switched off. In menus AM, FM, PM and LF-OUTPUT the original setting is displayed under LFGEN2, the note "ILS-LOC" is eliminated.

NORM ILS-LOC modulation is activated.

90 Hz Amplitude modulation of the output signal with the 90-Hz signal content of the ILS-LOC signal. The modulation depth of the 90-Hz signal is calculated from the settings of parameters SUM OF DEPTH (SOD) and DDM according to:
AM (90 Hz) = 0,5 × (SOD + DDM × 100%)

150 Hz Amplitude modulation of the output signal with the 150-Hz signal content of the ILS-LOC signal. The modulation depth of the 150-Hz signal results from the settings of parameters SUM OF DEPTH (SOD) and DDM according to:
AM (150 Hz) = 0,5 × (SOD DDM × 100%)

IEC-bus short command `:ILS:STAT ON; TYPE LOC; LOC:MODE NORM`

DDM

Difference in Depth of Modulation.
Input value of the difference in depth of modulation between the 90-Hz and the 150-Hz tone of the ILS-LOC modulation signal. The DDM value is calculated according to the following formula (parameter LEFT/RIGHT = RIGHT):

DDM = [AM(90 Hz) AM (150 Hz)] / 100%

If LEFT of parameter LEFT/RIGHT is selected, negative DDM values result with otherwise same setting. A variation of the DDM value automatically leads to a variation of the DDM value in dB and the value of the instrument current.

IEC-bus short command `:ILS:LOC:DDM 0`

DDM

Input value of the current of the ILS indicating instrument corresponding to the DDM value.
A variation of the value of the instrument current automatically leads to a variation of the DDM value and the DDM value in dB. The value of the instrument current is calculated according to:

DDM µ A = DDM × 857,1 µ A

IEC-bus short command `:ILS:LOC:DDM:CURR 0`

DDM

Input of the DDM value in dB.
A variation of the DDM value in dB automatically leads to a variation of the value of the instrument current and of the DDM value. The dB value is calculated according to:

DDM dB = 20 × LOG [(SOD+DDM×100%) / (SODDDM×100%)]

IEC-bus short command `:LOC:DDM:LOG 0`

FLY

Selection between ILS-LOC operating modes LEFT and RIGHT. A change of the setting automatically changes the sign of the DDM value.

LEFT In the LEFT operating mode, the content of the 150-Hz modulation signal is predominant. The DDM value is negative.

RIGHT In the RIGHT operating mode, the content of the 90-Hz modulation signal is predominant. The DDM value is positive..

IEC-bus short command `:ILS:LOC:DDM:DIR LEFT`

SUM OF DEPTH

Input value of the arithmetic sum of the modulation depths of 90-Hz and 150-Hz ILS-LOC signal contents. The RMS modulation depth depends on the phase setting of both modulation tones.

IEC-bus short command `:ILS:LOC:SOD 40PCT`

LEFT FREQUENCY

Input value of the modulation frequency of the antenna lobe arranged at the left viewed from the plane.

IEC-bus short command `:ILS:LOC:LLOB 90`

RIGHT FREQUENCY

Input value of the modulation frequency of the antenna lobe arranged at the right viewed from the plane.

IEC-bus short command `:ILS:LOC:RLOB 150`

Note: *A variation of one of the two modulation frequencies causes an automatic adaptation of the other modulation frequency in such a way that a frequency-response ratio of 3:5 or 5:3 is maintained.*

LEFT/RIGHT PHASE

Input value of the phase between the modulation signals of the left-hand and right-hand antenna lobe. The zero point of the 150-Hz signal serves as a reference.
The input is effected in degrees of the 150-Hz signal.

IEC-bus short command `:ILS:LOC:PHAS 0deg`

ILS DEFAULT SETTING

Calling the ILS-LOC default setting.
The default setting corresponds to the setting represented in Fig. 2-35 except for the MODE setting (=NORM). The selection of the CARRIER FREQ KNOB STEP parameter is not changed by calling this function.

IEC-bus short command `:ILS:LOC:PRES`

COM/ID STATE

Switching on/off an additional communication/identification signal (COM/ID signal).

IEC-bus short command `:ILS:LOC:COM ON`

COM/ID FREQUENCY

Switching on/off an additional communication/identification signal (COM/ID signal).

IEC-bus short command `:ILS:LOC:COM:FREQ 1020`

COM/ID DEPTH

Input value of the AM modulation depth of the COM/ID signal.

IEC-bus short command `:ILS:LOC:COM:DEPT 10PCT`

DDM KNOB STEP

Selection of the variation of the DDM value via the rotary knob.

DECIMAL Decimal variation according to the current cursor position.

DEFINED Variation between the predefined DDM values:
-0,2000,
-0.1550 (Course Sector)
-0,0930, -0,0460
0,0000 (Course Line)
+0,0460, +0,0930
+0,1550 (Course Sector)
+0,2000

CARRIER FREQ KNOB STEP

Selection of the variation of the carrier frequency via the rotary knob. The selection is effective on both ILS modulations.

DECIMAL Decimal variation according to the current cursor position.

DEFINED Decimal variation according to the current cursor position.

Note: *If DEFINED is selected, the current RF frequency is automatically switched over to the next LOCALIZER transmitter frequency according to the table when switching on the modulation.*

EXT AM [SENS. 1 V/100%]

Switching on/off an external modulation signal via socket EXT1.

OFF External AM input EXT1 switched off.

ON External AM input EXT1 activated.
The sensitivity is 10 mV per percent modulation depth.

IEC-bus short command `:ILS:SOUR INT2, EXT`

Note: *As automatic level monitoring of the external modulation signal is switched off in this operating mode, there can be an overmodulation as a function of the level of the external signal without a corresponding caution message being generated.*
In order to avoid an overmodulation, the peak value of the external signal is to be delimited corresponding to the sum of the modulation depths of the remaining ILS signal components.

2.6.2.7.4 Marker Beacon

Notes:

- *The following modulations cannot be set simultaneously and deactivate one another: MKR-BCN and AM, MKR-BCN and PM if SOURCE PM = LFGEN2 MKR-BCN and FM if SOURCE FM = LFGEN2*
- *In the AM, FM, PM and LF-output menu the note "MKR-BCN" is displayed under LFGEN2 if the MKR-BNC modulation is activated.*

Menu selection: MODULATION-MKR-BCN

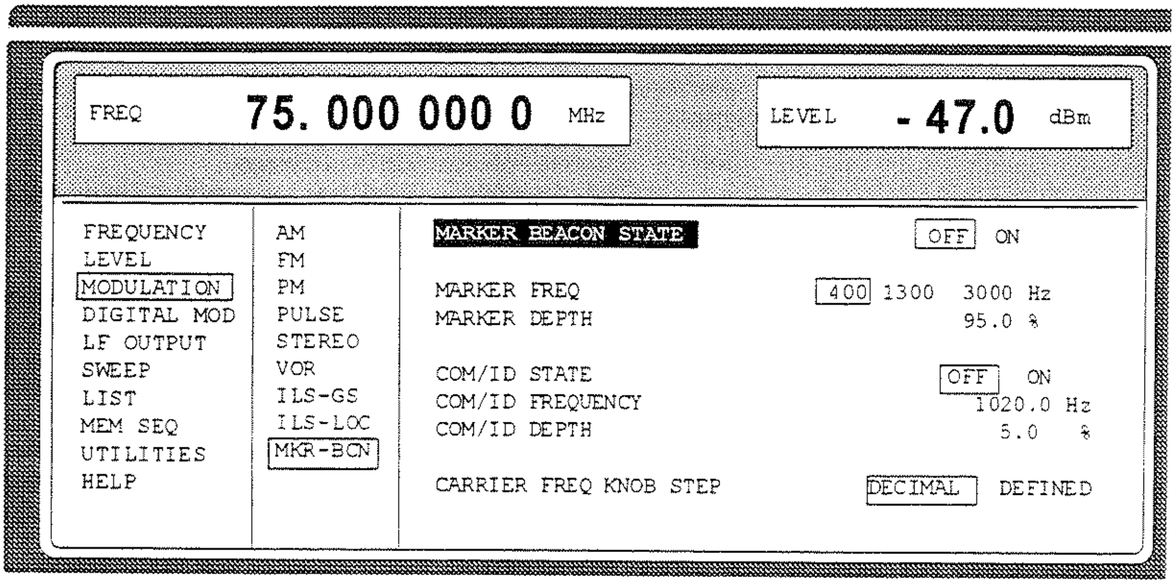


Fig. 2-36 Menu MODULATION-MKR-BCN (preset settings), fitted with option SM-B6, multifunction generator.

MARKER BEACON STATE Switching on and off the marker-beacon signal.

IEC-bus short command `:MBE:STAT ON`

MARKER FREQ Switching on and off the marker-beacon signal.

IEC-bus short command `:MBE:FREQ 400`

MARKER DEPTH Input value of the modulation depth of the marker-beacon signals.

IEC-bus short command `:MBE:DEPT 95PCT`

COM/ID STATE Switching on and off an additional communication/identification signal (COM/ID signal).

IEC-bus short command `:MBE:COM ON`

COM/ID FREQUENCY Input value of the frequency of the COM/ID signal.

IEC-bus short command `:MBE:COM:FREQ 1020`

COM/ID DEPTH Input value of the AM modulation depth of the COM/ID signal.

IEC-bus short command `:MBE:COM:DEPT 5PCT`

CARRIER FREQ KNOB STEP

Selection of the variation of the carrier frequency via the rotary knob.

DECIMAL Decimal variation according to the current cursor position.

DEFINED Variation in predefined steps according to the standardized marker beacon transmitter frequencies (s. table, val. in MHz).

Note: *If DEFINED is selected, the current RF frequency is automatically switched over to the next marker beacon transmitter frequency when switching on the modulation.*

74.600	75.675	74.750	74.825	74.900	74.975	75.050	75.125	75.200	75.275	75.350
74.625	74.700	74.775	74.850	74.925	75.000	75.075	75.150	75.225	75.300	75.375
74.650	74.725	74.800	74.875	74.950	75.025	75.100	75.175	75.250	75.325	75.400

2.6.3 Digital Modulation

The SME offers the following digital modulations (option SME-B11, DM coder):

• **GMSK** for	GSM/PCN	(Global System for Mobile Communications/ Personal Communication System)
	CDPD	(Cellular Digital Packet Data)
	MC9	(French Communication network)
	MOBITEX	(Mobile data system)
	DSRR	(Digital Short Range Radio)
	MD24 to MD192	(Standards according to ETS specifications)
• **GFSK** for	DECT	(Digital European Cordless Telephony)
	CT2	(Cordless Telephony)
	CT3	(Cordless Telephony)
• **QPSK** for	NADC	(North American Digital Cellular)
	PDC	(Pacific Digital Cellular)
	TFTS	(Terrestrial Flight Telephone System)
	APCO25	(Association of Public Safety Communications Officers, Project 25)
	TETRA	(Trans European Trunked Radio)
	MSAT	(Mobile Satellite)
	INMARSAT-M	(International Maritime Satellite)
• **FSK** for	POCSAG	(Post Office Code Standardization Advisory Group)
	CITYRUF	(German pager system)
	FLEX	(Flexible High Speed Paging System)
• **4FSK** for	ERMES	(European Radio Message System)
	APCO25	(Association of Public Safety Communications Officers, Project 25)
	FLEX	(Flexible High Speed Paging System)
	MODACOM	(Mobile Data Communication)
• **FFSK** for	POCSAG	(Post Office Code Standardization Advisory Group)

Internal or external data sources can be used. A PRBS generator with selectable sequence lengths and a data generator (RAM) are available as an internal data source. Option SME-B12, memory extension, increases the memory depth to 8 MBit.

Option SME-B12, memory extension, can be used to set radiocommunication service ERMES directly, cf. Section "Radiocommunication Service ERMES".

Option SME-B41, FLEX, together with option SME-B12, memory extension, can be used to generate call signals complying to the FLEX standard.

Option SME-B42, POCSAG, together with option SME-B12, memory extension, can be used to generate call signals complying to the POCSAG standard.

2.6.3.1 Data Generator

The data generator contains a memory for the data (DATA), for level switchover (LEV ATT) and for the BURST output (BURST) each. The data generator can be programmed via the IEC bus or manually using the list editor (cf. Fig. 2-37). The maximal memory capacity is 8192 bits. The data generator can also be programmed for shorter sequences. The data of all three memories are combined in a list. Up to 10 different lists can be stored in the instrument.
Option SME-B12, DM memory extension, increases the memory depth to 8 MBit (cf. Section 2.6.3.3, DM memory extension, option SME-B12).

The DATA memory contains the modulation data bits.

The LEV-ATT memory contains the bits to control the level reduction. A logic "0" means the level indicated in the header field. A logic "1" means a level reduction by the value indicated in the menu under LEVEL ATTENUATION. For a constant carrier, either the bits of the LEV-ATT list or the parameter LEVEL ATTENUATION must be set to 0.

The BURST memory contains the bits to control the BURST output. A logic "1" means level HIGH. A logic "0" means level LOW.

What is to be observed is that the modulation generation is subject to a delay that must not be neglected. In order to keep the level reduction or the BURST signal synchronous with the modulation, these memories are to be programmed offset by the delay. The delays of the different modulations are listed in table 2-5, radio network data (cf. Fig. 2-38, signal example with respect to DM delay as well).

Sockets DATA, CLOCK and BURST are switched to be an output if the data generator is switched on, and the bit sequences can be tapped there. The BURST output can be used to control the pulse modulator or to trigger the LIST mode, if there is an external cable connection from the PULSE input or TRIGGER input at the rear of the unit.

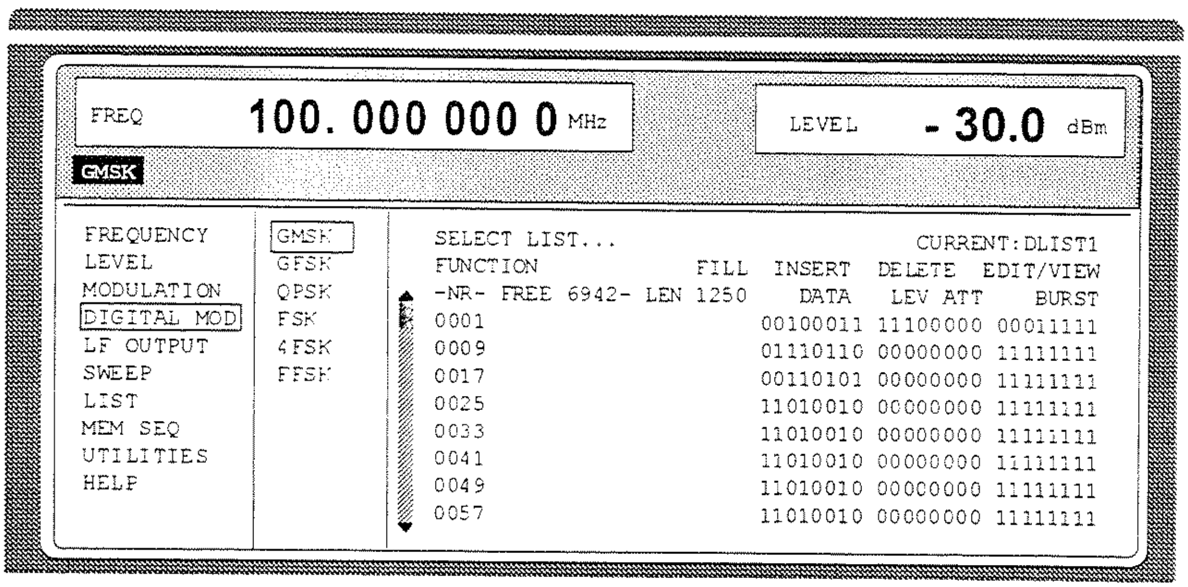


Fig. 2-37 Menu DIGITAL MOD-GMSK, edit page

IEC-bus short commands for programming the data generator::

```
:DM:DATA:SEL "DLIST1"
:DM:DATA:DATA 0,0,1,0,0,0,1,1,0,1,1,1,0,1,1,0
:DM:DATA:ATT 1,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0
:DM:DATA:BURS 0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,1
```

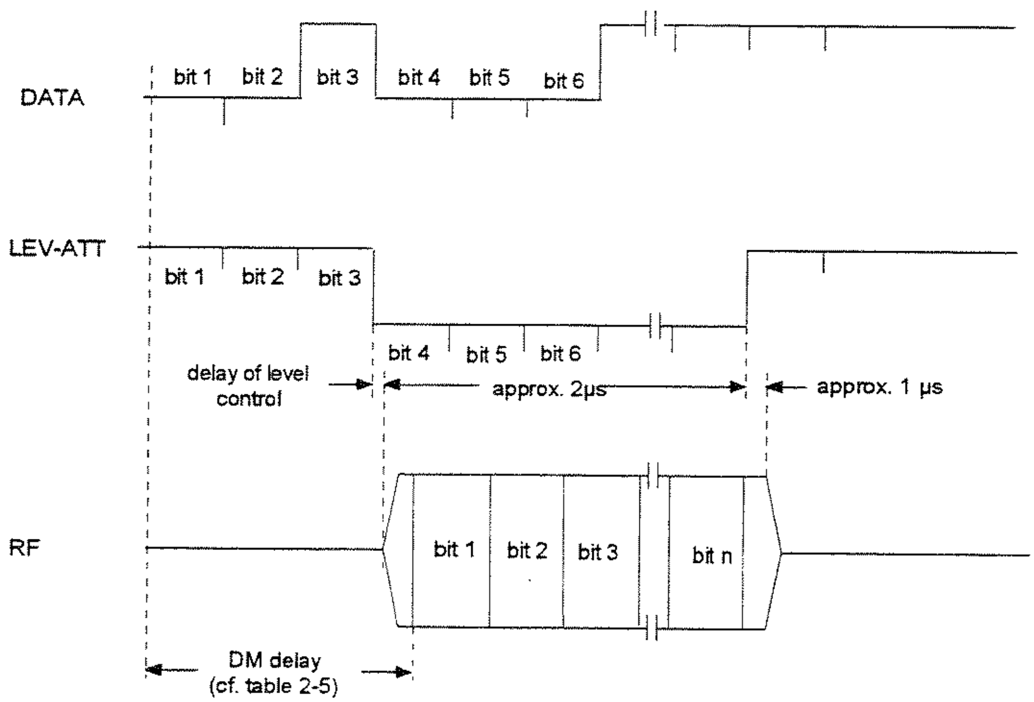


Fig. 2-38 Signal example with respect to DM delay and delays of level control

2.6.3.2 PRBS Generator

The PRBS generator (Pseudo Random Binary Sequence) supplies pseudo random bit sequences with sequence lengths of

2^9-1 = 511	(9 bit),
2^{15}-1 = 32767	(15 bit),
2^{20}-1 = 1048575	(20 bit),
2^{21}-1 = 2097151	(21 bit) or
2^{23}-1 = 8388607	(23 bit)

If the PRBS generator is switched on, the PRBS bit sequence replaces the data bit sequence of the data generator. The programming of the level reduction and the BURST output remains valid even if the PRBS generator is switched on. For a constant carrier, either the bits of the LEV-ATT list or parameter LEVEL ATTENUATION must hence be set to 0.

Sockets DATA, CLOCK and BURST are switched to be an output if the PRBS generator is switched on, and the bit sequences can be tapped there.

2.6.3.3 DM Memory Extension, Option SME-B12

Option SME-B12, memory extension, increases the memory depth of the data generator. The memory depth depends on the selection of the memory space allocation (MEM MODE, cf. submenu CONFIG XMEM...). If the entire memory area is allocated to the DATA memory (MEM MODE 8M*1), the memory depth is increased to 8 MBit. If the memory area is divided up into the three memories DATA, LEV-ATT and BURST (MEM MODE 1M*3), however, the memory depth is decreased to 1 MBit.

In the DM menus, the memory extension can be activated in submenu SELECT LIST... by selecting list "XMEM".

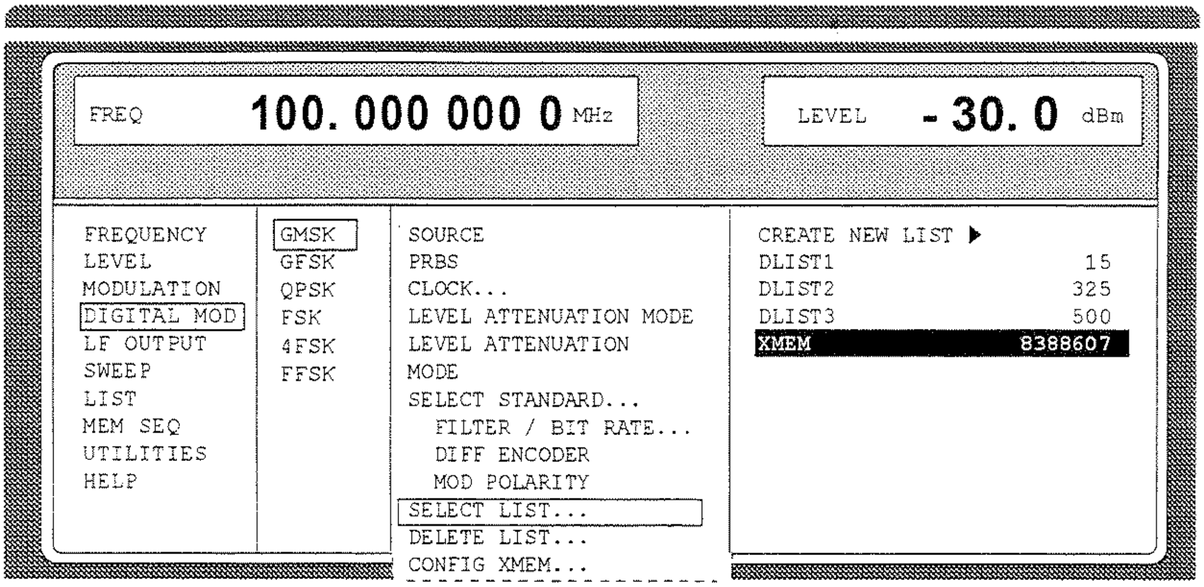


Fig. 2-39 Selection of the memory extension in submenu SELECT LIST...

Compared to all other lists, list "XMEM" is special for the following reasons:

- It cannot be processed using the list editor. The data are either loaded externally via the DATA socket (RECORD DATA→) or entered via the IEC bus or the RS-232 interface.
- List "XMEM" cannot be deleted. The previous data of a certain memory area are overwritten when new data are read into this memory area.
- List "XMEM" can be divided up into several sublists (memory areas). The memory areas are defined by the start address and the length of the data sequence. Their contents is permanently stored.

For modulation types QPSK and 4FSK it should be noted that a symbol is coded with two bits, the X bit and the Y bit. If data lists for these modulations are to be stored in the memory extension, three operating modes can be selected, each storing the X and Y bits in the "XMEM" list in a different way. Switchover between the different modes is not possible without a change of the XMEM data:

1.	CLOCK MODE BIT MEM MODE 8M*1	In this mode, X and Y bits are stored serially in the "XMEM" list and are transmitted via the DATA line. The X bit can be found at the start address.
2.	CLOCK MODE BIT MEM MODE 1M*3	In this mode, the X and Y bits are also stored serially in the "XMEM" list and are transmitted via the DATA line. The X bit can be found at the start address. The LEV-ATT (level reduction) and the BURST channel can be used.
3.	CLOCK MODE SYMB MEM MODE 1M*3	(DM Coder VAR.4/REV.1 or higher) In this mode, X and Y bits are stored in parallel in the "XMEM" list and are transmitted in parallel via the DATA or BURST line. The LEV-ATT channel can be used for level reduction.

During the serial operating modes 1 and 2 (bit clock) the DM coder and the memory extension are synchronized with regard to the X and Y bit, if one of the settings (e.g. BITRATE or LENGTH) is changed. As this synchronization is effected via the trigger input of the memory extension (EXT TRIG), it is not possible to externally trigger the memory extension. The external trigger mode has to be switched off (EXT TRIGGER = OFF). If EXT TRIGGER is ON an error message is displayed.

In the parallel operating mode 3 (symbol clock) the synchronization is not required and the memory extension can be externally started via connector TRIGGER (EXT TRIGGER = ON is allowed).

By selecting list "XMEM", list editor line FUNCTION is replaced by submenu CONFIG XMEM...which contains the parameters of the memory extension.

Menu selection DIGITAL MOD - „DM“ - CONFIG XMEM...

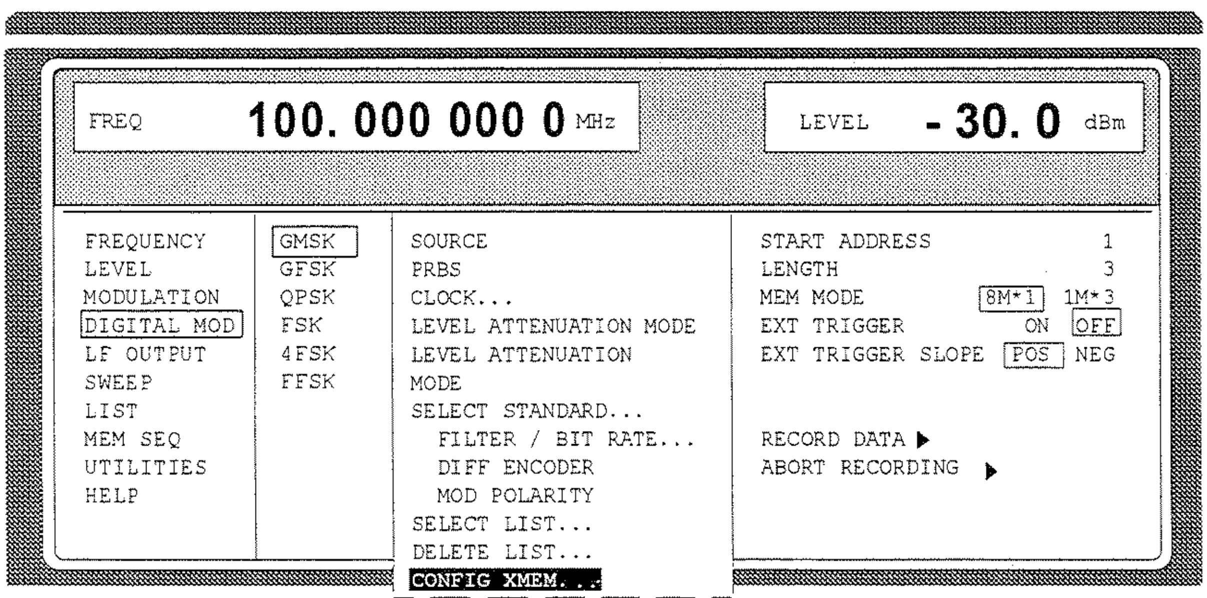


Fig. 2-40 Submenu DIGITAL MOD-GMSK-CONFIG XMEM...

START ADDRESS

Input value of the start address

Input range in mode 8M*1: 1 to 8388478

Input range in mode 1M*3: 1 to 1048558.

IEC-bus short command `:DM:DATA:XMEM:STAR 1`

LENGTH

LENGTH Input value of the sequence length.

For a start address = 1 the following applies:

Input range in mode 8M*1: 3 to 8388480

Input range in mode 1M*3: 3 to 1048560.

On increasing the start address, the maximum sequence length is reduced correspondingly. If the maximum value is exceeded, an error message is displayed.

IEC-bus short command `:DM:DATA:XMEM:LENG 3`

MEM MODE

MEM MODE Selection of the allocation of the memory area.

8M*1 The 8-MBit memory area can only be used for data.

1M*3 The memory area is divided up into DATA, LEV ATT and BURST. The memory depth is 1 MBit.

IEC-bus short command `:DM:DATA:XMEM:MODE DATA`

EXT TRIGGER

Switching on/off the external trigger facility.

ON The run of the list is triggered by the external trigger signal. Each trigger signal starts a new run beginning with the start address.

OFF The external trigger mode is switched off.

IEC-bus short command `:DM:DATA:XMEM:TRIG ON`

EXT TRIGGER SLOPE

Selection of the active edge of the external trigger signal.

POS The sequence starts with the positive edge of the trigger signal.

NEG The sequence starts with the negative edge of the trigger signal

IEC-bus short command `:DM:DATA:XMEM:TRIG:SLOP POS`

RECORD DATA →

Starts the recording of data from an external source via the DATA input (cf. Section "Recording a Data Sequence from an External Source (External Loading)"). Recording can be effected by means of both an external or internal clock. The clock can be selected in the CLOCK submenu (cf. Section "QPSK modulation").

During the time of recording, the note "RECORDING" is displayed on the right side of the line. When recording has been finished, the note "DONE" is displayed for a short time.

Note: *Recording is only possible if SOURCE EXT is activated.*

IEC-bus short command `:DM:DATA:XMEM:REC`

ABORT RECORDING →

Aborts a running recording. The note "ABORTED" is displayed at the right margin of the line for a short time. The data recorded up to the point of time of the abortion remain in the memory.

IEC-bus short command `:ABORt:XMEM`

2.6.3.3.1 Recording a Data Sequence from an External Source (External Loading)

Call DM menu

- Mark one of the digital modulations using the menu cursor and press key [SELECT].

Select external

- Mark parameter SOURCE using the menu cursor and press key [SELECT].
- Mark selection EXT using the menu cursor and press key [SELECT].

Set the bit rate

- Mark submenu SELECT STANDARD... using the menu cursor and press key [SELECT].
- Mark one of the standards using the menu cursor and press key [SELECT].

or

- Mark parameter BITRATE using the menu cursor and press key [SELECT].
- Enter the bit rate using rotary knob or numeric key and press key [1 x ENTER].

Memory extension

- Mark submenu SELECT LIST... using the menu cursor and press key [SELECT].
- Mark list XMEM using the menu cursor and press key [SELECT].

Define memory area and memory

Note: *In recording, the memory area is overwritten from the start area and memory address to the stop address (START ADDRESS + LENGTH –1)*
Up to 7 bits below the start address and up to 15 bits above the stop address (START ADDRESS + LENGTH –1) are additionally overwritten with a random value. The additional bits must be considered if a new recording is to be effected between recordings already stored.

- Mark submenu CONFIG XMEM... using the menu cursor and press key [SELECT].
- Mark parameter START ADDRESS using the menu cursor and press key [SELECT].
- Enter the start address using rotary knob or numeric keys and press key [1 x ENTER].
- Enter the start address using rotary knob or numeric keys and press key [1 x ENTER].
- Mark parameter LENGTH using the menu cursor and press key [SELECT].
- Enter the sequence length using rotary knob or numeric keys and press key [1 x ENTER].
- Mark parameter MODE using the menu cursor and press key [SELECT].
- Mark selection 8M*1 using the menu cursor and press key [SELECT].

Select external clock

➢ Mark submenu CLOCK... using the menu cursor and press key [SELECT].

➢ Mark parameter CLOCK SOURCE using the menu cursor and press key [SELECT].

➢ Mark selection COUPLED using the menu cursor and press key [SELECT].

Connect external

➢ Connect the data source to input socket DATA of the SME.

➢ Connect the clock source to input socket CLOCK of the SME.

Recording

➢ Mark action RECORD DATA ➔ to be executed using the menu cursor and press key [SELECT].

If parameter CLOCK EDGE is set on POS, the data with the positive clock edge is read in.

The data sequence recorded can be activated as an internal source by switching over parameter SOURCE from EXT to DATA in the DM menu after the recording.

The above example describes the recording of a DATA sequence in the 8M*1 mode (MEM MODE 8M*1). For recording in the 1M*3 mode the same settings can be used except for selection 1M*3 for MEM MODE. It should be noted that the setting range for the start address and the sequence length is reduced. No bits will be overwritten below the start address and one bit overwritten above the stop address.

In the 1M*3 mode, the LEV-ATT channel can be used for level reduction. During recording, this signal then has to be fed into the BURST connector and is stored on the LEV-ATT and BURST channel (same contents on the two channels).

2.6.3.4 External Data Sources

Inputs DATA, CLOCK and BURST are available for the digital modulation with external data signals. The polarity of the modulation and the active clock edge can be selected in the menu. In the case of 4FSK and QPSK modulation, the CLOCK input can be switched over between bit clock and symbol clock. The BURST input controls the level reduction indicated in the menu under LEVEL ATTENUATION in the case of external modulation. What is to be considered is that the delays of modulation processing and level control are different. The delays of the different modulations are listed in table 2-5, radio network data. The delays of the level control are 2 μs in switch-on and approx. 1 μs in switch-off (cf. Fig. 2-38 as well).

Table 2-5 Radio network data

Network	Modulation	Filter	Bit rate	Delay (INT)	Delay (EXT)
GSM / PCN	GMSK	Gauss 0.3	270.833 kb/s	3.8 bit	2.8 bit
CDPD	GMSK	Gauss 0.5	19.2 kb/s	3.8 bit	2.8 bit
MC9	GMSK	Gauss 0.25	8 kb/s	3.8 bit	2.8 bit
DSRR	GMSK	Gauss 0.5	4 / 16 kb/s	3.8 bit	2.8 bit
MD24...MD192	GMSK	Gauss 0.3 / 0.5	2.4. to 19.2 kb/s	3.8 bit	2.8 bit
MOBITEX	GMSK	Gauss 0.3	8 kb/s	3.8 bit	2.8 bit
DECT	GFSK	Gauss 0.5	1152 kb/s	4.4 bit	3.4 bit
CT2	GFSK	Gauss 0.5	72 kb/s	4.4 bit	3.4 bit
CT3	GFSK	Gauss 0.5	640 kb/s	4.4 bit	3.4 bit
NADC	π/4 DQPSK	√cos 0.35	48.6 kb/s	12 bit	12 bit
PDC	π/4 DQPSK	√cos 0.5	42 kb/s	12 bit	12 bit
TFTS	π/4 DQPSK	√cos 0.4	44.2 kb/s	12 bit	12 bit
APCO25	π/4 DQPSK	cos 0.2	9.6 kb/s	12 bit	12 bit
TETRA	π/4 DQPSK	√cos 0.35	36 kb/s	12 bit	12 bit
MSAT	QPSK	√cos 0.6	6.75 kb/s	12 bit	12 bit
INMARSAT-M	OQPSK	√cos 0.6	8 kb/s	12 bit	12 bit
ERMES	4FSK	Bessel 3.9 kHz	6.25 kb/s	3.3 bit	3.3 bit
APCO25	4FSK	cos 0.2	9.6 kb/s	9.5 bit	9.5 bit
FLEX	4FSK	Bessel 3.9 kHz	3.2 / 6.4 kb/s	3.3 bit	3.3 bit
MODACOM	4FSK	√cos 0.2	9.6 kb/s	9.5 bit	9.5 bit
CITYRUF	FSK	Gauss 2.73	512/1200/2400 b/s	3.6 bit	2.6 bit
POCSAG	FSK	Gauss 2.73	512/1200/2400 b/s	3.6 bit	2.6 bit
FLEX	FSK	Bessel 3.9 kHz	1.6/3.2 kb/s	1.5 bit	0.5 bit
POCSAG	FFSK	AF 1200/1800	1200 b/s	2.0 bit	1.0 bit

2.6.3.5 GMSK Modulation

Menu DIGITAL MOD-GMSK offers access to settings for GMSK modulation.

Menu selection: DIGITAL MOD - GMSK

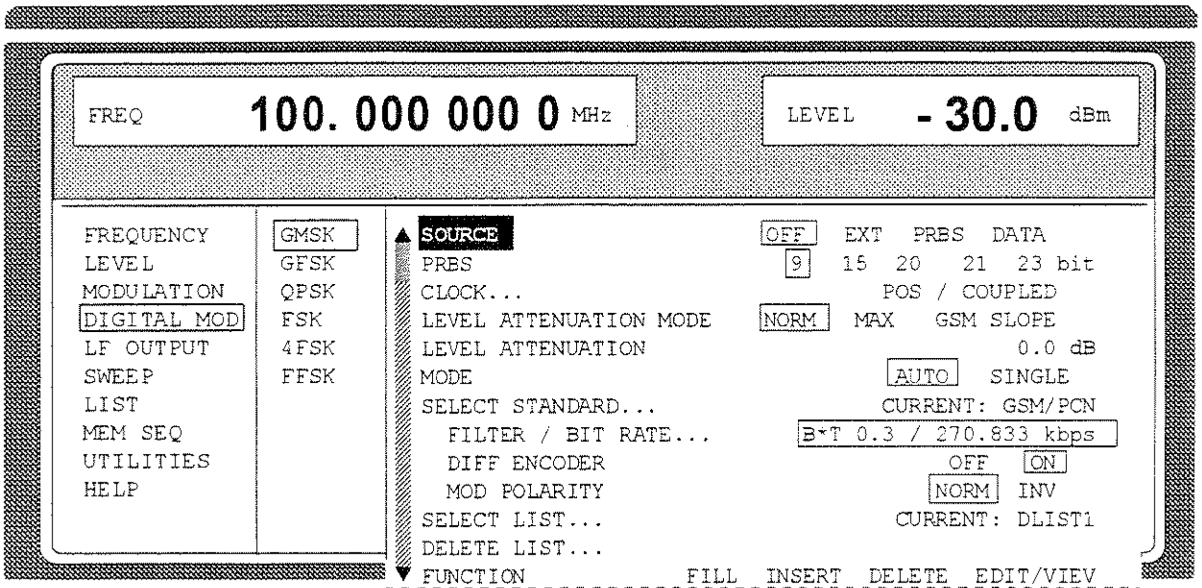


Fig. 2-41 Menu DIGITAL-MOD-GMSK (preset setting), fitted with option SME-B11, DM coder

SOURCE

Selection of the modulation source for GMSK.

OFF	GMSK is switched off
EXT	GMSK with external data signals
PRBS	GMSK with pseudo random binary sequence
DATA	GMSK with internally stored data sequence

IEC-bus short command `:DM:TYPE:GMSK; SOUR EXT; STAT ON`

PRBS

Selection of the Pseudo Random Binary Sequence.

IEC-bus short command `:DM:PRBS 9`

CLOCK...

Opens a window to set the clock parameters. The current settings are displayed (cf. Section "QPSK modulation").

LEVEL ATTENUATION MODE

Selection of the operating mode for level reduction

NORM	The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.
MAX	The level reduction is set to a maximum attenuation of >80dB.
GSM SLOPE	The rise and fall time of the level reduction correspond to GSM power ramping

IEC-bus short command `:DM:DATA:ALEV:MODE NORM`

LEVEL ATTENUATION

Input value of the level reduction. The level reduction is internally controlled by the LEV-ATT bits in the data list or externally via connector BURST. A logic "1" in the data list causes a level reduction.

IEC-bus short command `:DM:DATA:ALEV 0dB`

MODE

Selection of the operating mode for the DATA generator.

AUTO The data are always repeated.

SINGLE The data are sent once as soon as the run has been started using EXECUTE SINGLE MODE↗

IEC-bus short command `:TRIG:DM:SOUR AUTO`

SELECT STANDARD...

Opens a window to select one of the standard GMSK modulations (see Table 2-5). By selecting a standard, the parameters indented below the line SELECT STANDARD are set according to standard. If the setting of a parameter is different from the standard, SELECT STANDARD... CURRENT:USER is displayed.

IEC-bus short command `:DM:GMSK:STAN GSM`

BITRATE /FILTER ...

Selection of filtering BxT and bitrate. The following is to choose from:

bitrate = 2.4 kb/s / B×T=0.3; 0.5
bitrate=2.5 kb/s / B×T=0.5
bitrate = 3.0 kb/s / B×T=0.5
bitrate = 3.6 kb/s / B×T=0.3 ;0.5
bitrate = 4.0 kb/s / B×T=0.3 ; 0.5
bitrate = 4.8 kb/s / B×T=0.3 ; 0.5
bitrate = 5.0 kb/s / B×T=0.5
bitrate = 6.0 kb/s / B×T=0.5
bitrate = 7.2 kb/s / B×T=0.3 ;0.5
bitrate = 8 kb/s / B×T=0.25 ; 0.3 ;0.5
bitrate = 9.6 kb/s / B×T=0.3 ; 0.5
bitrate = 10 kb/s / B×T=0.5
bitrate = 12.0 kb/s / B×T=0.5
bitrate = 14.4 kb/s / B×T=0.3 ; 0.5
bitrate = 16.0 kb/s / B×T=0.3 ; 0.5
bitrate=19.2 kb/s / B×T=0.3 ; 0.5
bitrate = 20.0 kb/s / B×T=0.5
bitrate = 24.0 kb/s / B×T=0.5
bitrate = 28.8 kb/s / B×T=0.3 ; 0.5
bitrate = 32.0 kb/s / B×T=0.3 ; 0.5
bitrate = 38.4 kb/s / B×T=0.3 ; 0.5
bitrate = 40.0 kb/s / B×T=0.5
bitrate = 48.0 kb/s / B×T=0.5
bitrate = 64.0 kb/s / B×T=0.3 ; 0.5
bitrate = 76.8 kb/s / B×T=0.3 ; 0.5
bitrate = 80.0 kb/s / B×T=0.5
bitrate = 270.833 kb/s / B×T=0.2 ; 0.3 ; 0.5
bitrate = 512 kb/s / B×T=0.5
bitrate = 1000 kb/s B×T=0.4

The current selection is displayed.

IEC-bus short commands `:DM:GMSK:FILT 0.3; BRAT 8kb/s`

DIFF ENCODER

Switching on/off the GSM difference coding.

IEC-bus short command `:DM:GMSK:DCOD ON`

MOD POLARITY

Selection of the polarity of the modulation excursion.

NORM Polarity of the modulation as specified according to GSM.

INV Polarity of the modulation is inverted.

IEC-bus short command `:DM:GMSK:POL NORM`

SELECT LIST...

Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

DELETE LIST...

Deletion of a list (cf. Section 2.2.4, List Editor).

FUNCTION

Selection of the editor function for processing the lists (cf. Section 2.2.4, List Editor).

2.6.3.6 GFSK Modulation

Menu DIGITAL MOD - GFSK offers access to settings for GFSK modulation.

Menu selection: DIGITAL MOD - GFSK

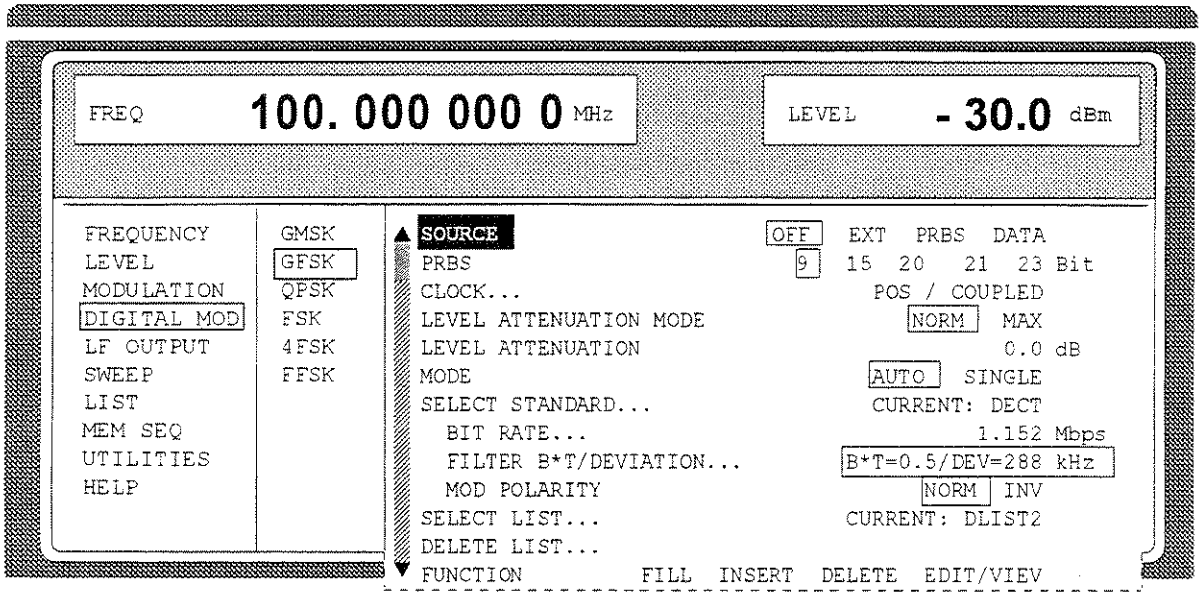


Fig. 2-42 Menu DIGITAL MOD-GFSK (preset setting), fitted with option SME-B11, DM coder

SOURCE

Selection of the modulation source for GFSK.

IEC-bus short command `:DM:TYPE GFSK; SOUR EXT; STAT ON`

PRBS

Selection of the Pseudo Random Binary Sequence.

IEC-bus short command `:DM:PRBS 9`

CLOCK ...

Opens a window to set the clock parameters. The current settings are displayed (cf. Section "QPSK modulation").

LEVEL ATTENUATION MODE

Selection of the operating mode for level reduction

NORM The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.

MAX The level reduction is set to a maximum attenuation of >80dB.

IEC-bus short command `:DM:DATA:ALEV:MODE NORM`

LEVEL ATTENUATION

Input value of the level reduction. The level reduction is internally controlled by the LEV ATT bits in the data list or externally via connector BURST. A logic "1" in the data list causes a level reduction.

IEC-bus short command `:DM:DATA:ALEV 0dB`

MODE

Selection of the operating mode for the DATA generator.

AUTO	The data are always repeated.
SINGLE	The data are sent once as soon as the run has been started using EXECUTE SINGLE MODE↗

IEC-bus short command `:TRIG:DM:SOUR AUTO`

SELECT STANDARD...

Opens a window to select one of the standard GFSK modulations (see Table 2-5). By selecting a standard, the parameters indented below the line SELECT STANDARD are set according to standard. If the setting of a parameter is different from the standard, SELECT STANDARD... CURRENT:USER is displayed.

IEC-bus short command `:DM:GFSK:STAN DECT`

BIT RATE

Input value of the bit rate for the selected standard.
The specified ranges are 10...585 kb/s and 640 ...1170 kb/s.
With settings B×T=0.5 / DEV=14.0 kHz and DEV=25.2 kHz the specified range is 0.05 to 90 kb/s.

IEC-bus short command `:DM:GFSK:BRAT 1152 kb/s`

FILTER / DEVIATION

Opens a window to select different settings with filtering BxT and with the deviation. The following is to choose from:

B×T=0.5 / DEV=14.0 kHz	B×T=0.7 / DEV= 14.4 kHz
B×T=0.5 / DEV=18.0 kHz	B×T=0.5 / DEV= 20.0 kHz
B×T=0.4 / DEV= 25.2 kHz	B×T=0.5 / DEV=25.2 kHz
B×T=0.5 / DEV=160 kHz	B×T=0.5 / DEV=180 kHz
B×T=0.5 / DEV=202 kHz	B×T=0.5 / DEV=259 kHz
B×T=0.4 / DEV=288 kHz	B×T=0.5 / DEV=288 kHz
B×T=0.6 / DEV=288 kHz	B×T=0.5 / DEV=317 kHz
B×T=0.5 / DEV=403 kHz	

The values currently set are displayed.

Note: *In the RF range from 130 to 187 MHz, deviations >200 kHz are not possible.*

IEC-bus short command `:DM:GFSK:FILT 0.5; DEV 288kHz`

MOD POLARITY

Selection of the polarity of the frequency modulation.

NORM	Logic "1" generates a positive deviation.
INV	Logic "1" generates a negative deviation.

IEC-bus short command `:DM:GFSK:POL NORM`

SELECT LIST...

Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

DELETE LIST...

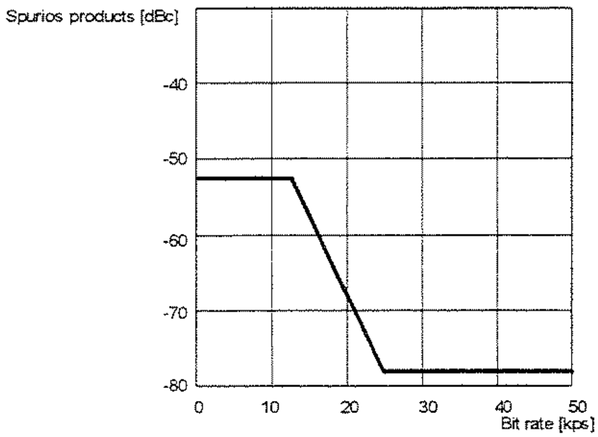
Deletion of a list (cf. Section 2.2.4, List Editor).

FUNCTION

Selection of the editor function to process the selected list (cf. Section 2.2.4, List Editor).

2.6.3.7 QPSK Modulation

Menu DIGITAL MOD - QPSK offers access to settings for QPSK modulation setting range of the bit rate is 1.00 to 24.3 kbps and 27.0 to 48.6 kbps. In range 1.00 to 24.3 kbps the nonharmonic suppression is reduced by aliasing products. The spurious products occur at the frequency spacing = 15 × bit rate. The spurious level is shown in the diagram.



Menu selection DIGITAL MOD - QPSK

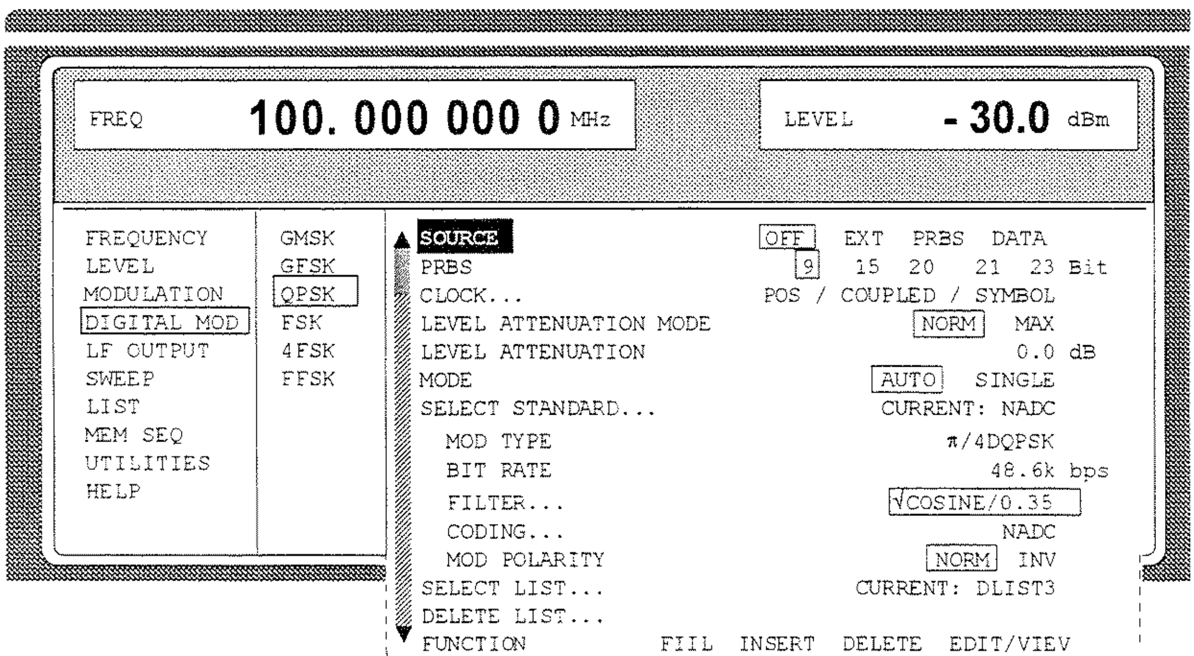


Fig. 2-43 Menu DIGITAL MOD - QPSK (preset setting), fitted with option SME-B11, DM coder

SOURCE Selection of the modulation source for QPSK.
IEC-bus short command `:DM:TYPE QPSK; SOUR EXT; STAT ON`

PRBS Selection of the Pseudo Random Binary Sequence.
IEC-bus short command `:DM:PRBS 9`

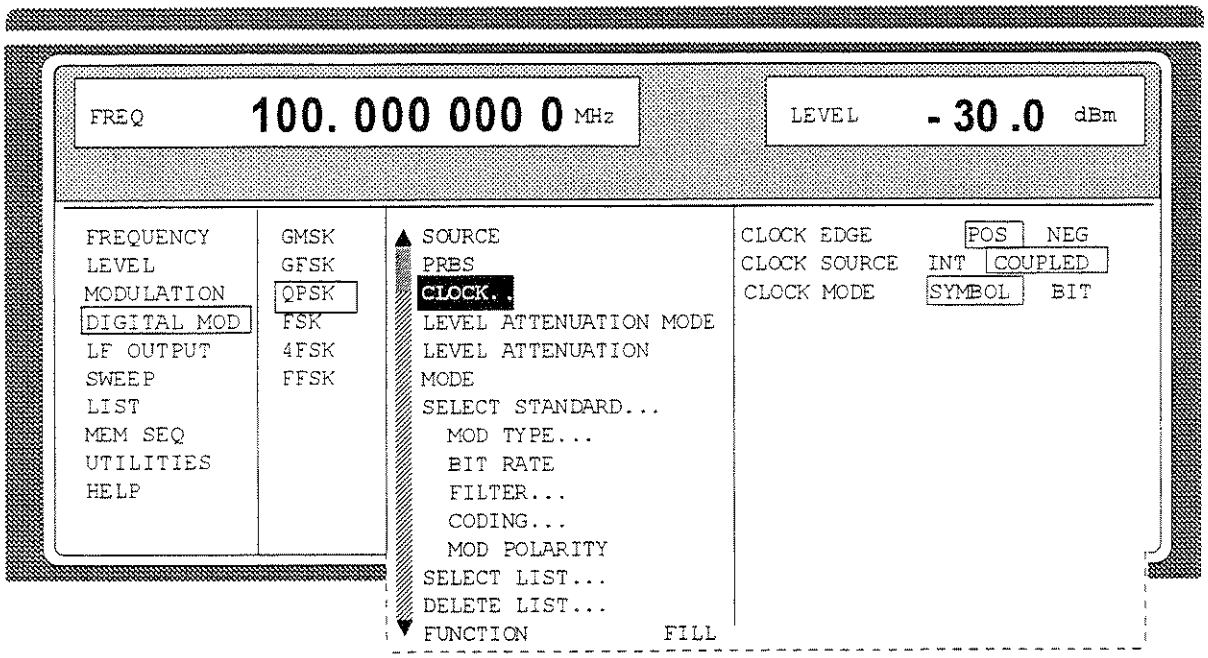


Fig. 2-44 Submenu DIGITAL-MOD-QPSK-CLOCK...(preset setting)

CLOCK...

Opens a window to set the clock parameters. The current settings are displayed.

CLOCK EDGE Selection of the active clock edge

- POS — The positive clock edge is active.
- NEG — The negative clock edge is active.

IEC-bus short command `:DM:CLOC:POL NORM`

CLOCK SOURCE Selection of the clock source

- INT — The internal clock generator is also used with an external data source. The CLOCK socket is switched to form an output
- COUPLED — The CLOCK input/output is switched in accordance with the DATA input/output.

IEC-bus short command `:DM:CLOC:SOUR COUP`

CLOCK MODE Selection of the clock pulse for the CLOCK input/output.

- SYMBOL — The CLOCK input/output is set to symbol clock pulse.
- BIT — The CLOCK input/output is set to bit clock pulse.

IEC-bus short command `:DM:CLOC:MODE SYMB`

LEVEL ATTENUATION MODE

Selection of the operating mode for level reduction

- NORM — The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.
- MAX — The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.

IEC-bus short command `:DM:DATA:ALEV:MODE NORM`

LEVEL ATTENUATION

Input value of the level reduction. The level reduction is internally controlled by the LEV ATT bits in the data list or externally via connector BURST. A logic "1" in the data list causes a level reduction.

IEC-bus short command `:DM:DATA:ALEV 0dB`

MODE

Selection of the operating mode for the DATA generator.

AUTO The data are always repeated.

SINGLE The data are sent once as soon as the run has been started using EXECUTE SINGLE MODE↗

IEC-bus short command `:TRIG:DM:SOUR AUTO`

SELECT STANDARD...

Opens a window to select one of the standard QPSK modulations (see Table 2-5). By selecting a standard, the parameters indented below the line SELECT STANDARD are set according to standard. If the setting of a parameter is different from the standard, SELECT STANDARD... CURRENT:USER is displayed.

IEC-bus short command `:DM:QPSK:STAN NADC`

MOD TYPE...

Opens a window to select modulation type. The following is to choose of:

QPSK, OQPSK, π/4QPSK, π/4DQPSK

IEC-bus short command `:DM:QPSK:TYPE QPSK`

BITRATE

Input value of the bit rate. The specified ranges are 1 to 24.3 kbps and 27 to 48.6 kbps. In the range 1 to 24.3 kbps, the nonharmonic suppression is reduced (cf. diagram).

IEC-bus short command `:DM:QPSK:BRAT 48.6kb/s`

FILTER..

Opens a window to select filtering (roll-off factor).
The following is to choose from:

OFF	cos / 0,2	
	cos /0,35,	√cos /0,35,
	cos /0,4,	√cos /0,4,
	cos /0,5,	√cos /0,5,
	cos/0,6	√cos /0,6.

Note: *For modulation type OQPSK only √cos/0.6 can be set.*

IEC-bus short command `:DM:QPSK:FILT SCOS,0.35`

CODING...

Selection of difference coding. The following is to choose from:
NADC, PDC, TETRA, APCO, TFTS, MSAT and INMARSAT

IEC-bus short command `:DM:QPSK:COD NADC`

MOD POLARITY

Selection of the polarity of the modulation excursion.

NORM Polarity of the modulation is specified according to standards.

INV Polarity of the modulation is inverted.

IEC-bus short command `:DM:QPSK:POL NORM`

SELECT LIST...

Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

DELETE LIST...

Deletion of a list (cf. Section 2.2.4, List Editor).

FUNCTION

Selection of the editor function to process the selected list (cf. Section 2.2.4, List Editor).

2.6.3.8 FSK Modulation

Menu DIGITAL MOD - FSK offers access to settings for FSK modulation. FSK modulation is possible with or without a filter. The filter can be switched off and allows free setting of the deviation. The maximum setting depends on the carrier frequency.

Carrier frequency	Maximum deviation
< 130 MHz	100 kHz
130 to 187.5 MHz	25 kHz
187.5 to 375 MHz	50 kHz
375 to 750 MHz	100 kHz
750 to 1500 MHz	200 kHz
1500 to 3000 MHz	400 kHz
3000 to 6000 MHz	800 kHz

If option SME-B11 is not installed, FSK modulation is only possible with an external source and without a filter. The menu indicates the lines SOURCE, DEVIATION and MOD POLARITY.

Menu selection DIGITAL MOD - FSK

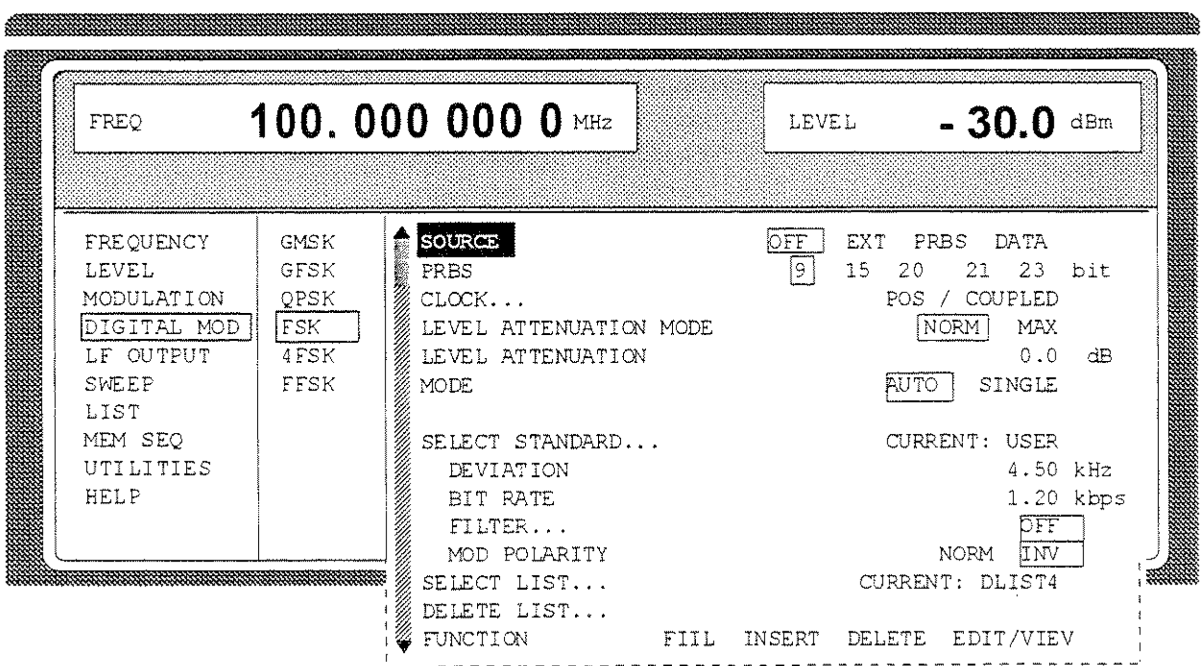


Fig. 2-45 Menu DIGITAL MOD - FSK (preset setting), fitted with option DM coder SME-B11

SOURCE Selection of the modulation source for FSK.
IEC-bus short command `:DM:TYPE FSK; SOUR EXT; STAT ON`

PRBS Selection of the Pseudo Random Binary Sequence.
IEC-bus short command `:DM:PRBS 9`

CLOCK ...

Opens a window to set the clock parameters. The current settings are displayed (cf. Section "QPSK modulation").

LEVEL ATTENUATION MODE

Selection of the operating mode for level reduction

NORM	The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.
MAX	The level reduction is set to a maximum attenuation of >80dB.

IEC-bus short command `:DM:DATA:ALEV:MODE NORM`

LEVEL ATTENUATION

Input value of the level reduction. The level reduction is internally controlled by the LEV ATT bits in the data list or externally via connector BURST. A logic "1" in the data list causes a level reduction.

IEC-bus short command `:DM:DATA:ALEV 0dB`

MODE

Selection of the operating mode for the DATA generator.

AUTO	The data are always repeated.
SINGLE	The data are sent once as soon as the run has been started using EXECUTE SINGLE MODEÔ

IEC-bus short command `:TRIG:DM:SOUR AUTO`

EXECUTE SINGLE MODE

Starts a single servicing of the data. This action to be executed is only displayed and is only effective if MODE is set to SINGLE.

IEC-bus short commands `:TRIG:DM:SOUR SING; :TRIG:DM`

SELECT STANDARD...

Opens a window to select one of the standard FSK modulations (see Table 2-5). By selecting a standard, the parameters indented below the line SELECT STANDARD are set according to standard. If the setting of a parameter is different from the standard, SELECT STANDARD... CURRENT:USER is displayed.

IEC-bus short command `:DM:FSK:STAN POCS1200`

DEVIATION

Input value of the deviation for FSK. If the FILTER is switched off, the deviation can be set in the range from 0 to 400 kHz. In this case, the maximum deviation depends on the carrier frequency and is limited to 20% of the analog FM deviation.

IEC-bus short command `:DM:FSK:DEV 4.5kHz`

BIT RATE

Input value of the bit rate for FSK. Setting range:

FILTER OFF: 0.05 to 1900 kbps

FILTER switched on: 0.05 to. 90 kbps; resolution: 3-digit

IEC-bus short command `:DM:FSK:BRAT 1200b/s`

FILTER... Opens a window to select the filters. The following filters can be selected:

OFF

BESSEL B×T=1.22	(corresponds to a bandwidth of 3.9 kHz at 3.2 kbps)
BESSEL B×T=2.44	(corresponds to a bandwidth of 3.9 kHz at 1.6 kbps)
GAUSS B×T=2.73	(corresponds to a rise time 250 µs at 512 bps)

Due to digital filtering, a change of the bit rate influences the cut-off frequency of the filter. That is why B×T (bandwidth×symbol duration) is indicated instead of the cut-off frequency which is specified according to the standard. The cut-off frequency of the filter is calculated as follows:
Cut-off frequency = B×T value × symbol rate

IEC-bus short command `:DM:FSK:FILT BESS, 1.22`

MOD POLARITY Selection of the polarity of the frequency modulation.

NORM Logic "1" generates a positive deviation.

INV Logic "1" generates a negative deviation.

IEC-bus short command `:DM:FSK:POL NORM`

SELECT LIST... Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

DELETE LIST... Deletion of a list (cf. Section 2.2.4, List Editor).

FUNCTION Deletion of a list (cf. Section 2.2.4, List Editor).

2.6.3.9 4FSK Modulation

Menu DIGITAL MOD - 4FSK offers access to settings for 4FSK modulation. The maximum setting depends on the carrier frequency:

Carrier frequency	Maximum deviation
< 130 MHz	100 kHz
130 to 187.5 MHz	25 kHz
187.5 to 375 MHz	50 kHz
375 to 750 MHz	100 kHz
750 to 1500 MHz	200 kHz
1500 to 3000 MHz	400 kHz
3000 to 6000 MHz	800 kHz

Menu selection DIGITAL MOD - 4FSK

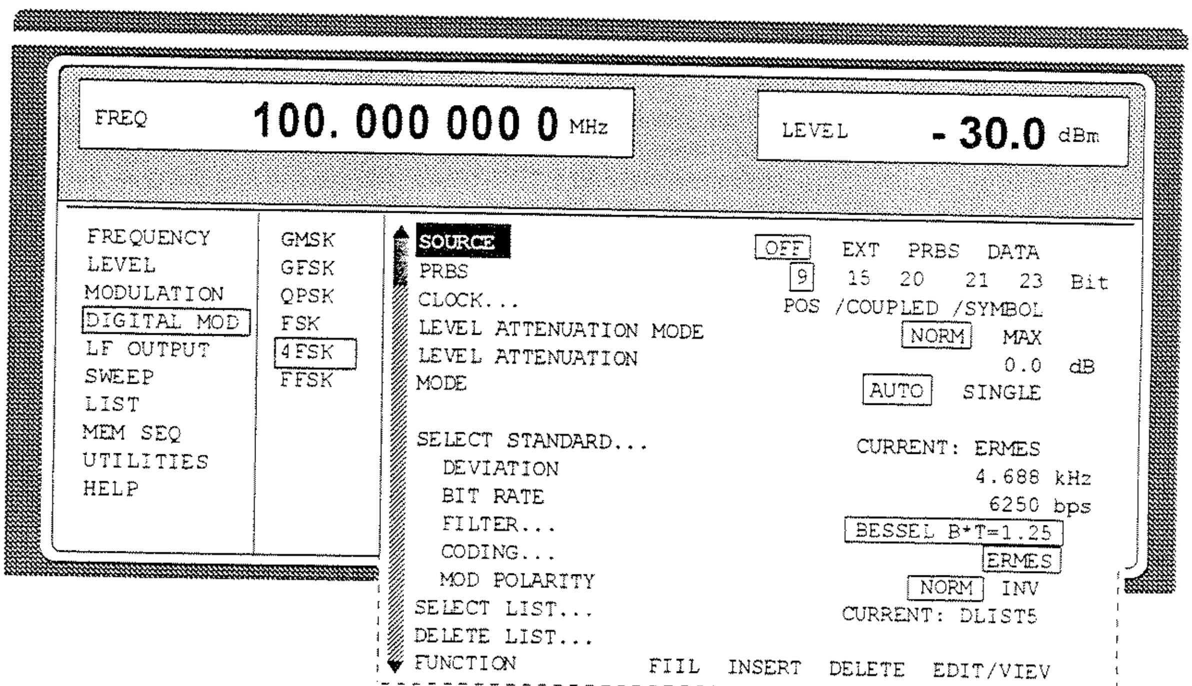


Fig. 2-46 Menu DIGITAL MOD - 4FSK (preset setting), fitted with option SM-B11, DM coder

SOURCE

Selection of the modulation source for 4FSK.

IEC-bus short command `:DM:TYPE FSK4; SOUR EXT; STAT ON`

PRBS

Selection of the Pseudo Random Binary Sequence..

IEC-bus short command `:DM:PRBS 9`

CLOCK ...

Opens a window to set the clock parameters. The current settings are displayed (cf. Section "QPSK modulation")

LEVEL ATTENUATION MODE

Selection of the operating mode for level reduction

NORM The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.

MAX The level reduction is set to a maximum attenuation of >80dB.

IEC-bus short command `:DM:DATA:ALEV:MODE NORM`

LEVEL ATTENUATION

Input value of the level reduction. The level reduction is internally controlled by the LEV ATT bits in the data list or externally via connector BURST. A logic "1" in the data list causes a level reduction.

IEC-bus short command `:DM:DATA:ALEV 0dB`

MODE

Selection of the operating mode for the DATA generator.

AUTO The data are always repeated.

SINGLE The data are sent once as soon as the run has been started using EXECUTE SINGLE MODE ↗.

IEC-bus short command `:TRIG:DM:SOUR AUTO`

EXECUTE SINGLE MODE →

Starts a single servicing of the data. These action to be executed is only displayed and is only effective if MODE is set to SINGLE.

IEC-bus short commands `:TRIG:DM:SOUR SING; :TRIG:DM`

SELECT STANDARD...

Opens a window to select one of the standard 4FSK modulations (see Table 2-5). By selecting a standard, the parameters indented below the line SELECT STANDARD are set according to standard. If the setting of a parameter is different from the standard, SELECT STANDARD... CURRENT:USER is displayed.

IEC-bus short command `:DM:FSK4:STAN ERM`

DEVIATION

Input value of the deviation for 4FSK. The maximum setting depends on the carrier frequency and is limited to 20% of the analog FM deviation.

IEC-bus short command `:DM:FSK4:DEV 4.6875 kHz`

BIT RATE

Input value of the bit rate for 4FSK.

Setting range: 1 to 24.3 kbps and 27 to 48.6 kbps.

IEC-bus short command `:DM:FSK4:BRAT 6250b/s`

FILTER ...

Opens a window to select the filters for 4FSK. The following filters can be selected::

BESSEL B×T=1.22 cos, 0.2

BESSEL B×T= 1.25 √cos, 0.2

BESSEL B×T= 2.44

Due to digital filtering, a change of the bit rate influences the cut-off frequency of the filter. That is why B×T (bandwidth×symbol duration) is indicated instead of the cut-off frequency which is specified according to the standard. The cut-off frequency of the filter is calculated as follows:

Cut-off frequency = B×T-value × symbol rate

IEC-bus short command `:DM:FSK4:FILT BESS, 1.25`

CODING...

Opens a window to select the coding following is to choose from:
APCO25, ERMES, FLEX and MODACOM

IEC-bus short command `:DM:FSK4:COD APCO`

MOD POLARITY

Selection of the polarity of the frequency modulation.

NORM Logic "1" generates a positive deviation.

INV Selection of the polarity of the frequency modulation.

IEC-bus short command `:DM:FSK4:POL NORM`

SELECT LIST...

Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

DELETE LIST...

Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

FUNCTION

Selection of the editor function to process the list selected (cf. Section 2.2.4, List Editor).

2.6.3.10 FFSK Modulation

Menu DIGITAL MOD - FFSK offers access to settings for FFSK modulation.

Menu selection: DIGITAL MOD - FFSK

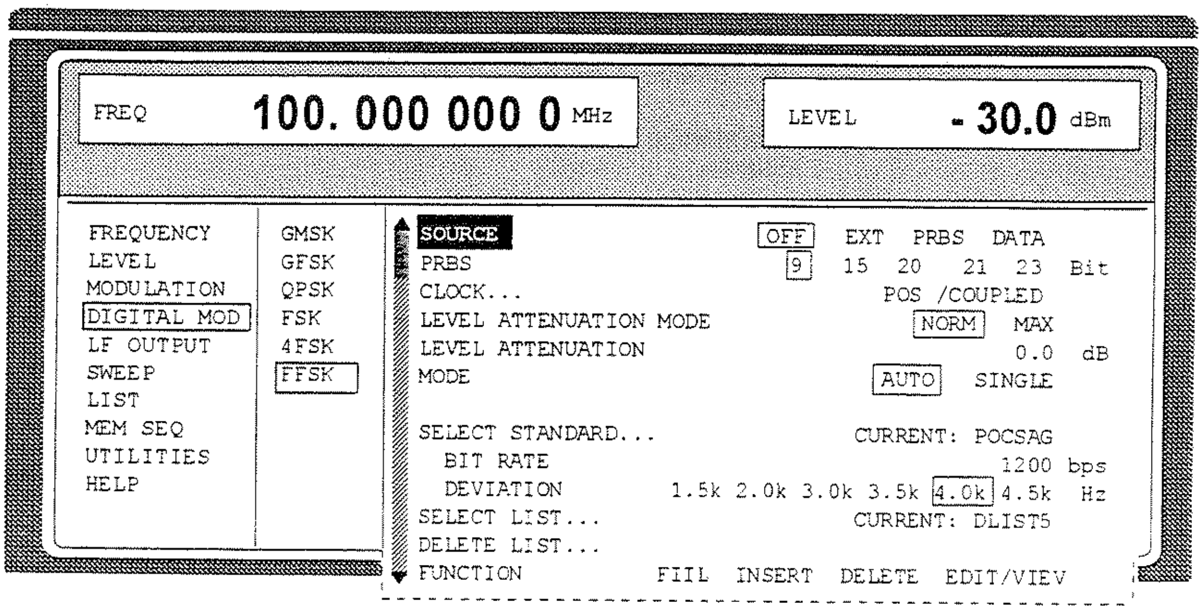


Fig. 2-47 Menu DIGITAL MOD - FFSK (preset setting), fitted with option SME-B11, DM-coder

SOURCE Selection of the modulation source FFSK.

IEC-bus short command `:DM:TYPE FFSK; SOUR EXT; STAT ON`

PRBS Selection of the Pseudo Random Binary Sequence.

IEC-bus short command `:DM:PRBS 9`

CLOCK ... Opens a window to set the clock parameters. The current settings are displayed (cf. Section "QPSK modulation").

LEVEL ATTENUATION MODE Selection of the operating mode for level reduction

NORM The level reduction corresponds to the value entered in LEVEL ATTENUATION. The linear range extends to an attenuation of approx. 30 dB.

MAX The level reduction is set to a maximum attenuation of >80dB.

IEC-bus short command `:DM:DATA:ALEV:MODE NORM`

LEVEL ATTENUATION Input value of the level reduction. The level reduction is internally controlled by the LEV ATT bits in the data list or externally via connector BURST. A logic "1" in the data list causes a level reduction.

IEC-bus short command `:DM:DATA:ALEV 0dB`

MODE	Selection of the operating mode for the DATA generator. AUTO The data are always repeated. SINGLE The data are sent once as soon as the run has been started using EXECUTE SINGLE MODE ↗ IEC-bus short command `:TRIG:DM:SOUR AUTO`
EXECUTE SINGLE MODE ➔	Starts a single servicing of the data. This action to be executed is only indicated and is only effective if MODE is set to SINGLE. IEC-bus short commands `:TRIG:DM:SOUR SING; :TRIG:DM`
SELECT STANDARD...	Opens a window to select the standard FFSK modulation (see Table 2-5). By selecting a standard, the parameters indented below the line SELECT STANDARD are set according to standard. If the setting of a parameter is different from the standard, SELECT STANDARD... CURRENT:USER is displayed. IEC-bus short command `:DM:FFSK:STAN POCS`
BIT RATE	Input value of the bit rate for the internal modulation signals. Setting range: 0.05 to 90 kbps.. IEC-bus short command `:DM:FFSK:BRAT 1200 b/s`
DEVIATION	Selection of the deviation for FFSK. The following is to choose from: 1.5 kHz, 2 kHz, 3 kHz, 3.5 kHz, 4 kHz and 4.5 kHz IEC-bus short command `:DM:FFSK:DEV 4kHz`
SELECT LIST...	Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).
DELETE LIST...	Deletion of a list (cf. Section 2.2.4, List Editor).
FUNCTION	Selection of the editor function to process the list selected (cf. Section 2.2.4, List Editor).

2.6.3.11 Radiocommunication Service ERMES

ERMES is a radiocommunication method permitting Europe-wide paging. If fitted with options SME-B11, DM coder, and SME-B12, memory extension, the SME generates ERMES call signals conforming to standard. All parameters and the message to be transmitted can be freely selected.

Note: *Switching on ERMES automatically switches off all other DM modulations.*

Menu selection: DIGITAL MOD - ERMES

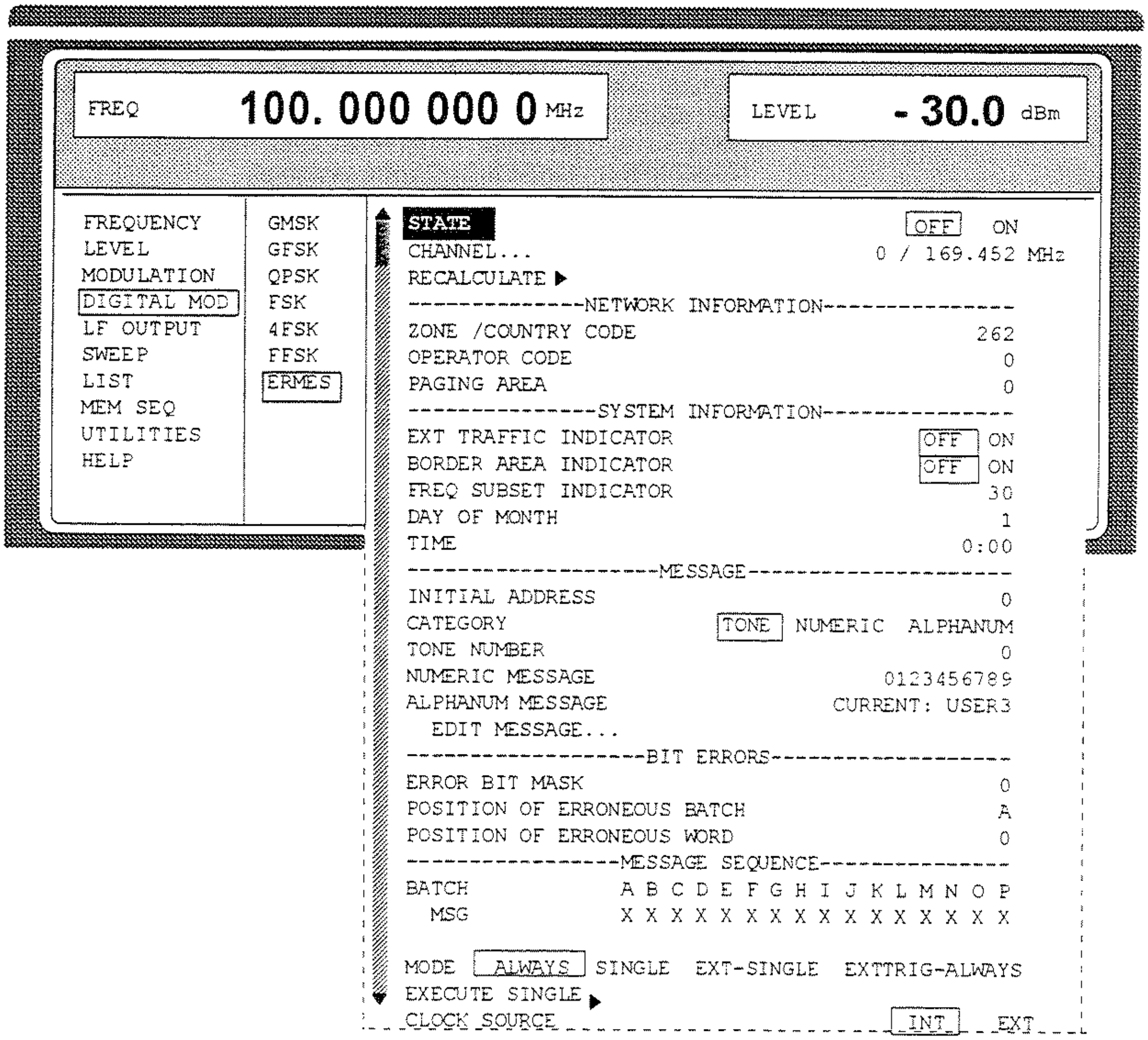


Fig. 2-48 Menu DIGITAL MOD - ERMES (preset setting), fitted with option SME-B11, DM coder and option SM-B12, memory extension

STATE

ON — Switching on ERMES. The RF frequency is set to the value determined by the selection of CHANNEL. The status line indicates the word ERMES, the batch, the number of subsequence, and the type of data sent. "MSG" indicates message data, "- - -" indicates fill data.

With every change from STATE OFF to STATE ON, the data for the memory extension are recalculated and written into list "XMEM". Every change of one of the ERMES parameters, except for MESSAGE SEQUENCE MODE, requires the data to be recalculated. During STATE ON, every change of the parameters thus generates a warning "ERMES settings and output signal mismatch". The data can be recalculated either by switching over to STATE OFF / STATE ON or by triggering action RECALCULATE ↗.

OFF — Switching off ERMES

IEC-bus short command `:ERM:STAT ON`

CHANNEL...

Opens a window to select the RF channel used. 16 channels with the appropriate frequencies can be selected:

Channel 0:	169,425 MHz	Channel 8:	169,625 MHz
Channel 1:	169,450 MHz	Channel 9:	169,650 MHz
Channel 2:	169,475 MHz	Channel 10:	169,675 MHz
Channel 3:	169,500 MHz	Channel 11:	169,700 MHz
Channel 4:	169,525 MHz	Channel 12:	169,725 MHz
Channel 5:	169,550 MHz	Channel 13:	169,750 MHz
Channel 6:	169,575 MHz	Channel 14:	169,775 MHz
Channel 7:	169,600 MHz	Channel 15:	169,800 MHz

The selection of the channel also influences the structure of the ERMES data. Thus the channel cannot be changed by readjusting the frequency in the FREQUENCY menu or via the [FREQ] key.

Readjusting the RF output frequency by means of the [FREQ] key or in the FREQUENCY menu is possible, however, message "ERMES channel / Frequency mismatch" is displayed.

IEC-bus short command `:ERM:CHAN 1`

RECALCULATE →

Triggers a recalculation of the data for the "XMEM" list. This action must be triggered after every change of the parameters, except for MESSAGE SEQUENCE MODE.

IEC-bus short command `:ERM:STAT OFF; STAT ON`

—NETWORK INFORMATION—

The parameters of the network information set the data denoting the network the SME simulates in greater detail. These data are included in every message (cf. ERMES standard).

ZONE / COUNTRY CODE

Input value of the zone and country code. Germany has the value 262.

IEC-bus short command `:ERM:NINF:ZCO 262`

OPERATOR CODE

Input value of the code of the network operator.

IEC-bus short command `:ERM:NINF:OPER 7`

PAGING AREA

Input value of the paging area.

IEC-bus short command `:ERM:NINF:PA 4`

— SYSTEM INFORMATION —

The parameters of the system information set the data of the transmitting system. These data are included in every message (cf. ERMES standard).

EXT TRAFFIC INDICATOR

Input value of the External Traffic Indicator Bit.

IEC-bus short command `:ERM:SI:ETI ON`

BORDER AREA INDICATOR

Input value of the Border Area Indicator Bit.

IEC-bus short command `:ERM:SI:BAI ON`

FREQ SUBSET INDICATOR

Input value of the Frequency Subset Indicator. One-channel networks have an FSI of 30 according to ERMES standard.

IEC-bus short command `:ERM:SI:FSI 30`

DAY OF MONTH

Input value of the date (day of month).

IEC-bus short command `:ERM:SI:DOM 24`

TIME

Input value of the time.

IEC-bus short command `:ERM:SI:TIME 12,59`

— MESSAGE —

The parameters of this section set the destination address and determine the message data.

INITIAL ADDRESS

Input value of the address of the pager. Every receiver has an own, nonrecurring address.

IEC-bus short command `:ERM:MESS:IA 0`

CATEGORY

Selection of the message category.

TONE Tone-only message

NUMERIC Numeric message

ALPHANUM Alphanumeric message

IEC-bus short command `:ERM:MESS:CAT TONE`

TONE NUMBER

Input value of the tone transmitted with message category TONE. 16 tones (8 normal, 8 urgent) are available.

IEC-bus short command `:ERM:MESS:TONE 1`

NUMERIC MESSAGE

Input of the character string for a numeric message. The SME maximally provides 16 digits. In addition to the 10 digits "0" to "9", the signs forward slash "/", upper-case letter "U", hyphen "-", period ".", percent "%" and blank can be used.

IEC-bus short command `:ERM:MESS:NUM "12% 12-17"`

ALPHANUM MESSAGE

Opens a window to select an alphanumeric message and to create a new one. The following is available:

FOX "The quick brown fox jumps over the lazy dog"
ALPHA "ABCD..." (complete ERMES character string)
LONG Message completely filling a batch
USER1 to 3 Three messages which can freely be edited by means of command EDIT MESSAGE..

IEC-bus short command `:ERM:MESS:ALPH "FOX"`

EDIT MESSAGE

Opens a window to edit one of the alphanumeric messages USER1 to USER3. The message to be processed must be selected using ALPHANUM MESSAGE.

IEC-bus short command `:ERM:MESS:ALPH:DATA "Test"`

— BIT ERRORS —

The SME offers the possibility of providing a 30-bit word of the message transmitted with bit errors for test purposes. The parameters of this section determine the faulty bits and their position.

ERROR BIT MASK

Input of the faulty bits into a 30-bit field. The decimal number transmitted (0 to 1073741823) is converted into a 30-bit binary number internally and thus determines the 30 bits. These bits are XORed with the word of the message to be corrupted and thus determine which bits of this word are transmitted correctly or wrongly.

IEC-bus short command `:ERM:ERR:MASK 0`

POSITION OF ERRONEOUS BATCH

Input value of the batch in which the faulty word is to be.

IEC-bus short command `:ERM:ERR:BATC A`

POSITION OF ERRONEOUS WORD

Input value of the faulty word. 0 to 153 are valid values (0 to 189 for a long batch)

IEC-bus short command `:ERM:ERR:WORD 1`

— MESSAGE SEQUENCE —

The SME always sends complete cycles from five subsequences. Two types of subsequence are generated. In the message subsequence, fill data and message data are mixed, the fill subsequence only contains fill data. The message subsequences of a cycle only differ in the subsequence number contained, they cannot be configured differently. I.e., the settings under BATCH are valid for all message subsequences of a cycle.
The fill subsequences cannot be configured, the subsequences of a cycle also only differ in the subsequence number contained.
The parameters of this section determine how the message subsequence is structured and when which subsequence is sent.

BATCH

For each of batches A to P of the message subsequence, a determination is possible whether it contains message data (an X under the letter) or fill data (a blank under the letter). Operation is analog to the variation of a number with the rotary knob, however, the characters are restricted to 2 there.

IEC-bus short command `:ERM:SEQ:DBAT A, B, G,H`

MODE

Selection of the message and fill subsequence.

ALWAYS The message subsequence is output continuously.

IEC-bus short command `:TRIG:DM:SOUR AUTO`

SINGLE The filler subsequence is output. With the trigger pulse, switchover to message subsequence is effected for 12 seconds.

IEC-bus short command `:TRIG:DM:SOUR SING`
`:ERM:TACT MESS`

EXT The filler subsequence is output. With the trigger pulse from the external trigger female connector, switchover to message subsequence is effected for 12 seconds.

IEC-bus short command `:TRIG:DM:SOUR EXT`
`:ERM:TACT MESS`

EXTTRIG-ALWAYS

The units waits for a signal edge at the trigger connector. After recognition of this edge, the unit behaves as described under setting ALWAYS.

IEC-bus short command `:TRIG:DM:SOUR EXT`
`:ERM:TACT STAR`

EXECUTE SINGLE ➔

Starts the output of a message subsequence (length: 12 seconds). Afterwards, fill subsequences are sent again. This action to be executed is only displayed and is only effective if MODE SINGLE is selected.

IEC-bus short command `*TRG`

CLOCK SOURCE

Selection of the clock source. This setting is also valid for FLEX and POCSAG but not for the other digital modulations.

INT The clock required for signal generation is generated internally and can be tapped at the CLOCK connector.

EXT The signal applied to the CLOCK connector is used as the clock signal.

Note: *For all bit rates, i.e. for 1600 bps and 3200 bps, a symbol clock rate of 3200 Hz is always used. This applies to both the output (CLOCK SOURCE INT) and the input (CLOCK SOURCE EXT) of the clock.*

IEC-bus short command `:DM:COMP:CLOC:SOUR INT`

2.6.3.12 Radiocommunication Service FLEX

Like ERMES, FLEX is a radiocommunication service that makes for convenient paging. When equipped with the SME-B41 (FLEX), SME-B11 (DM coder) and SME B12 (DM memory extension) options, the SME generates call signals complying to the FLEX or FLEX-TD standard. All essential parameters and the message to be transmitted are freely selectable.

Notes: - *When FLEX is switched on, all other DM modulations are automatically switched off.*
- *The RF frequency is not determined by the FLEX standard, it has to be set to the desired value by means of key [FREQ].*

Menu selection: DIGITAL MOD - FLEX

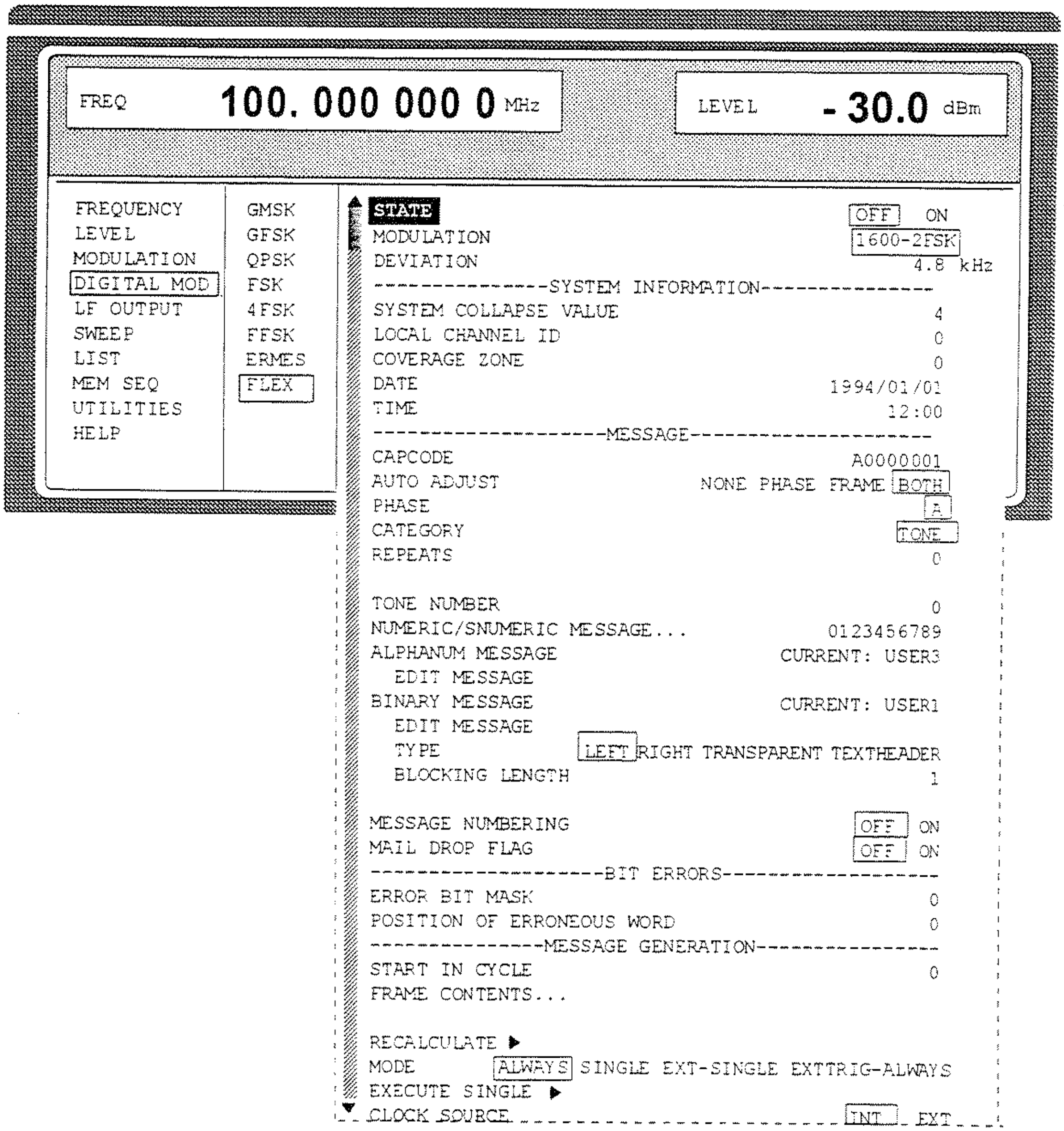


Fig. 2-49 Menu DIGITAL MOD - FLEX (preset settings), fitted with option SME-B41, Flex, option SME-B11, DM coder, and option SM-B12, memory extension

STATE

ON Switches on FLEX. The RF frequency has to be set to the desired value by means of key [FREQ]. The status line displays the cycle and frame number and the type of output data as well as the word FLEX. "MSG" stands for useful data, "FILL" for filler data, "OTH" for a bit pattern simulated data of another network, and "ASYN" for an "Emergency Resynchronization Frame" (see FLEX standard).

A switchover from STATE OFF to STATE ON results in a recalculation of the memory extension data and their entry into the list "XMEM". Changing FLEX parameters except for MESSAGE GENERATION MODE and FRAME CONTENTS... requires a recalculation of data. With radiocommunication service FLEX activated (STATE ON), every parameter change generates a warning "FLEX setting and output signal mismatch". The recalculation of data can either be effected by switchover from STATE OFF / STATE ON or by triggering RECALCULATE ↗.

OFF Switches off FLEX.

IEC-Bus short command `:FLEX:STAT OFF`

MODULATION

Selection of used bit rate and modulation. Four modulations are available:
1600bps/2FSK 3200bps/2FSK 3200bps/4FSK 6400bps/4FSK

IEC-bus short command `:FLEX:MOD 1600,FSK2`

DEVIATION

Input value of frequency deviation of modulation.
The deviation specifies the spacing from the carrier to the two further placed symbols in 4FSK. The FLEX standard specifies 4800 Hz for this value which may be varied for testing.

IEC-bus short command `:FLEX:DEV 4.8kHz`

— SYSTEM INFORMATION —

The system information parameters are used for setting the data of the sending system. These data are sent to the pager (see FLEX standard). COVERAGE ZONE, DATE and TIME are transmitted once per hour to the pager in cycle 0, frame 0.

SYSTEM COLLAPSE VALUE

Input value of number of bits (0 to 7) which the pager uses to compare its home frame number with the received frame number. The value 7 signifies that the pager only accepts messages in one of the 128 frames (provided its pager collapse value is not below 7). With the value 0 the pager receives messages in any frame.

IEC-bus short command `:FLEX:SI:COLL 4`

LOCAL CHANNEL ID

Entry of local channel according to the network operator specifications.

IEC-bus short command `:FLEX:SI:LCH 0`

COVERAGE ZONE

Entry of the current coverage zone.

IEC-bus short command `:FLEX:SI:CZON 0`

DATE

Input value of date.

IEC-bus short command `:FLEX:SI:DATE 1994,12,01`

TIME

Input value of date.

IEC-bus short command `:FLEX:SI:TIME 12,00`

— MESSAGE —

The parameters of this section are used for setting the destination address as well as the useful data of the message.

CAPCODE

Input value of the CAPCODE of the pager to be called as printed on the receiver. CAPCODE is defined in FLEX standard. The CAPCODE contains the addresses of the receiver as well as frame and phase information.

IEC-bus short command `:FLEX:MESS:CAPC "A0000001"`

AUTO ADJUST

Selection of which settings are influenced by a change of CAPCODE:

NONE No influence

PHASE The phase is adjusted to the value contained in CAPCODE. This is performed whenever the setting for CAPCODE is changed.

FRAME FRAME CONTENT is set so that in all the frames evaluated by the receiver (and only in those) FLEX data are also transmitted. All the other frames only contain filler data.

BOTH PHASE as well as FRAME CONTENT are adjusted.

IEC-bus short command: `:FLEX:PHAS:AUTO ON`
`:FLEX:FCON:AUTO ON`

PHASE

Selection of which phase (A to D) the message is to be transmitted. Since each frame lasts 1.875 sec independent of the modulation and more data can be transmitted at bit rates higher than 1600 bps, several independent channels ("phases") are bit-multiplexed. With 1600 bps, the message is transmitted for every setting in phase A. With 3200 bps, the message is transmitted in phase A if A and B are set, and transmitted in phase C if C and D are set. With 6400 bps, the message is transmitted in all the four phases depending on the relevant setting. Each pager is set to one phase. The phase can be calculated from the CAPCODE of a pager as shown below:
Phase = (Integer(CAPCODE/4)) modulo 4, with 0=A, 1=B, etc.

IEC-bus short command `:FLEX:PHAS A`

CATEGORY...

Selection of message category.

TONE	only-tone message
NUMERIC	numeric message, with ≤3 figures = short message
SNUMERIC	special numeric message
ALPHANUM	alphanumeric message
SECURE	secured alphanumeric message
BINARY	binary message

IEC-bus short command `:FLEX:MESS:CAT TONE`

REPEATS

Entry of the number of calls following the first call according to FLEX-TD.
For the value 0 (no repeat), normal flex frames are transmitted, whereas subframes according to flex-TD are used with other values. The repeat calls are transmitted at the frame interval defined by the SYSTEM COLLAPSE VALUE. A frame may contain a new message and repetitions of previous messages. The contents of the individual subframes is indicated in the status line. The following assignment applies:

or _	Subframe without useful data with one or three block information words (corresponds to ' ' in FRAME CONTENTS)
x or X	Subframe including useful data with one or three block information words (corresponds to 'X' in FRAME CONTENTS)
O or A	OTHER- or RESYNC-Frame (as in FRAME CONTENTS)

Notes:

- *Since the SME transmits the messages always completely in a (sub-)frame, the maximum length of the SME-generated message decreases with increasing values.*
- *The SME generates a complete cycle which is repeated continuously. Repetitions which are contained in the subsequent cycle are already transmitted in the current cycle, i.e., they might be transmitted prior to transmitting the original.*
- *With REPEATS = 3, the last subframe can not contain three block information words; principally, it contains only one block information word.*

IEC-bus short command: `FLEX:MESS:REP 0...3`

TONE NUMBER

Input value of the tone which is transmitted during category TONE. 8 tones are available.
IEC-bus short command `:FLEX:MESS:TONE 0`

NUMERIC/SNUMERIC MESSAGE...

Opens a window to enter the character string for a numeric or special numeric message. SME provides a maximum of 41 characters. In addition to the 10 figures "0" to "9" other characters such as square brackets right and left "[", "]", upper case letter "U", hyphen "-" and blank space " " can be used.

IEC-bus short command `:FLEX:MESS:NUM "12-17"`

ALPHANUM/SECURE MESSAGE...

Opens a window to select or create an alphanumeric or secured alphanumeric message. There is one common character set for the two types of messages. The following selection can be made:

FOX	"The quick brown fox jumps over the lazy dog"
ALPHA	"ABCD..." (complete FLEX character set)
USER1...4	Four messages that can be freely edited by command EDIT MESSAGE.

IEC-bus short command `:FLEX:MESS:ALPH "FOX"`

EDIT MESSAGE...

Opens a window to edit one of the alphanumeric messages USER1 to USER4. The message to be processed has to selected with ALPHANUM/SECURE MESSAGE.

IEC-bus short command `:FLEX:MESS:ALPH:DATA "Test"`

BINARY MESSAGE...

Opens a window to select a binary message.

IEC-bus short command `:FLEX:MESS:BIN:SEL "USER1"`

EDIT MESSAGE...

Opens a window to edit one of the binary messages. The message to be processed has to be selected wit BINARY MESSAGE. Values 0 and 1 are available. Each value represents 1 bit. The maximum length of the message is 460 bit.

IEC-bus short command `:FLEX:MESS:BIN:DATA "1101"`

TYPE

Selection of type of binary message.

LEFT	Display from left to right.
RIGHT	Display from right to left.
TRANSPARENT	Data are not interpreted.
TEXTHEADER	Transparent data with text header.

IEC-bus short command `:FLEX:MESS:BIN:TYPE LEFT`

BLOCKING LENGTH

Entry of number of bits to be interpreted as a unit (character). Permissible values are 1 to 16.

IEC-bus short command `:FLEX:MESS:BIN:BLEN 1`

MESSAGE NUMBERING

Selection of whether or not the transmitted message is to be assigned a message number.
Every message transmitted can be assigned a message number. This information is evaluated when received by the pager.

ON	SME sends the number 0 for every message.
OFF	SME sends no number with the message.

IEC-bus short command `:FLEX:MESS:MNUM OFF`

MAIL DROP FLAG

Switch on/off of MAIL DROP flag

ON	The transmitted message is marked as "volatile". Thus, it is not filed in the normal message memory of the pager but in a special memory location and is not subject to normal numbering. The message overwrites the previous "volatile" one.
OFF	The message is not marked.

IEC-bus short command `:FLEX:MESS:MDR OFF`

—BIT ERRORS—

The SME allows for providing a 32-bit-word of the transferred message with bit errors for test purposes. The parameters of this section specify the erroneous bits and their positions.

ERROR BIT MASK

Entry of the erroneous bits in a 32-bit field. The transmitted decimal number (0...4294967295) is converted internally into a 32-bit binary number and thus defines the 32 bits. These bits are XORed with the word of the message which is to be falsified and thus determine which bits of this word are to be transmitted correctly or incorrectly.

Note: *XORing precedes block interleaving (see flex standard)! It is carried out in all phases of all message frames (i.e., the' X'marked frames under FRAME CONTENTS).*

IEC-bus short command `:FLEX:ERR:MASK 0`

POSITION OF ERRONEOUS WORD

Entry value for the position of the word to be falsified. The words are numbered from block 0, word 0 to block 10, word 7 of a frame. The sync part and the frame information word cannot be falsified. The falsification precedes block interleaving in all transmitted phases.

IEC-bus short command `:FLEX:ERR:WORD 0`

— MESSAGE GENERATION —

The parameters of this section determine which types of data (FLEX useful data, FLEX filler data, simulated data of other paging systems or emergency resynchronization) are sent at what time.
This can individually be determined for every frame of a cycle with the setting then being valid for all cycles. The cycle and frame numbers are generated and sent in compliance with standard for a period of one hour. Cycle 0, frame 0 contains additional information about date and time.

START IN CYCLE

Input value of number of cycle with which the message is started. With FLEX activated, transmission is always started with the frame number 0. The start cycle number (one cycle is 4 minutes) can be preset (0 to 14).

IEC-bus short command `:FLEX:CYCL 0`

FRAME CONTENTS...

Opens a window to determine the contents of 128 frames. Each frame is represented by one character. It is possible to define whether a frame is to contain FLEX useful data (X), FLEX filler data (blank spaces), simulated data of another radiocommunication service (O for OTHER) or the "Emergency Resynchronization" (A for ASYNC) specified in the FLEX standard or whether no frame is output at all (editor shows an empty hatched area).

The frame assigned to the pager is calculated from the CAPCODE according to the following formula:

Frame = (Integer(CAPCODE/16)) modulo 128

Notes:
- *The SYSTEM COLLAPSE VALUE may cause the pager to respond to much more than only its "own" frame.*
- *After *RST a character is set in the editor window for each of the 128 frames. It is possible, however, to clear characters by means of the BACKSPACE key. Correspondingly less than 128 frames are then output per cycle. Thus it is possible, for instance, to generate a three-frame test sequence if only the characters for the first three frames are output.*

IEC-bus short command `:FLEX:FCON "O,X,A"`

RECALCULATE ➔

Triggers a recalculation of the generated FLEX telegram. This action has to be triggered each time a parameter has been changed. Exception: MESSAGE GENERATION MODE and FRAME CONTENTS.

IEC-bus short command `:FLEX:STAT OFF; STAT ON`

MODE

Selection of sequence of useful and filler frames.

ALWAYS — The frames are continuously output according to the setting under FRAME CONTENTS.

IEC-bus short command `:TRIG:DM:SOUR AUTO`

SINGLE — FLEX filler data are also output in the frames under FRAME CONTENTS that are marked with X. If EXECUTE SINGLE ➔ is selected, the subsequent frame is output in the way it has been set under FRAME CONTENTS.

IEC-bus short command `:TRIG:DM:SOUR SING`
`:FLEX:TACT MESS`

EXT — FLEX filler data are also output in the frames under FRAME CONTENTS that are marked with X. In the case of an external trigger pulse, the subsequent frame is output in the way it has been set under FRAME CONTENTS.

IEC-bus short command `:TRIG:DM:SOUR EXT`
`:FLEX:TACT MESS`

EXTTRIG-ALWAYS

The units waits for a signal edge at the trigger connector. After recognition of this edge, the unit behaves as described under setting ALWAYS.

IEC-bus short command `:TRIG:DM:SOUR EXT`
`:FLEX:TACT STAR`

EXECUTE SINGLE ➔

The next frame is output in the way it has been specified under FRAME CONTENTS. This triggerable action is only displayed and active when MODE SINGLE has been selected.

IEC-bus short command `*TRG`

CLOCK SOURCE

Selection of the clock source. This setting is also valid for ERMES and POCSAG but not for the other digital modulations.

INT The clock required for signal generation is generated internally and can be tapped at the CLOCK connector.

EXT The signal applied to the CLOCK connector is used as the clock signal.

Note: *For all bit rates, i.e. for 1600 bps and 3200 bps, a symbol clock rate of 3200 Hz is always used. This applies to both the output (CLOCK SOURCE INT) and the input (CLOCK SOURCE EXT) of the clock.*

IEC-bus short command `:DM:COMP:CLOC:SOUR INT`

2.6.3.13 Radiocommunication Service POCSAG

POCSAG is a standard which in its various implementations (e.g. CITYRUF, SCALL) allows convenient paging. When equipped with the SME-B42 (POCSAG), SME-B11 (DM coder) and SME B12 (DM memory extension) options, the SME generates call signals complying to the POCSAG standard. All essential parameters and the message to be transmitted are freely selectable.

Notes: – *When POCSAG is switched on, all other DM modulations are automatically switched off.*

– *The RF frequency is not determined by the POCSAG standard, it has to be set to the desired value by means of key [FREQ].*

POCSAG settings can be accessed via DIGITAL-MOD-POCSAG menu:

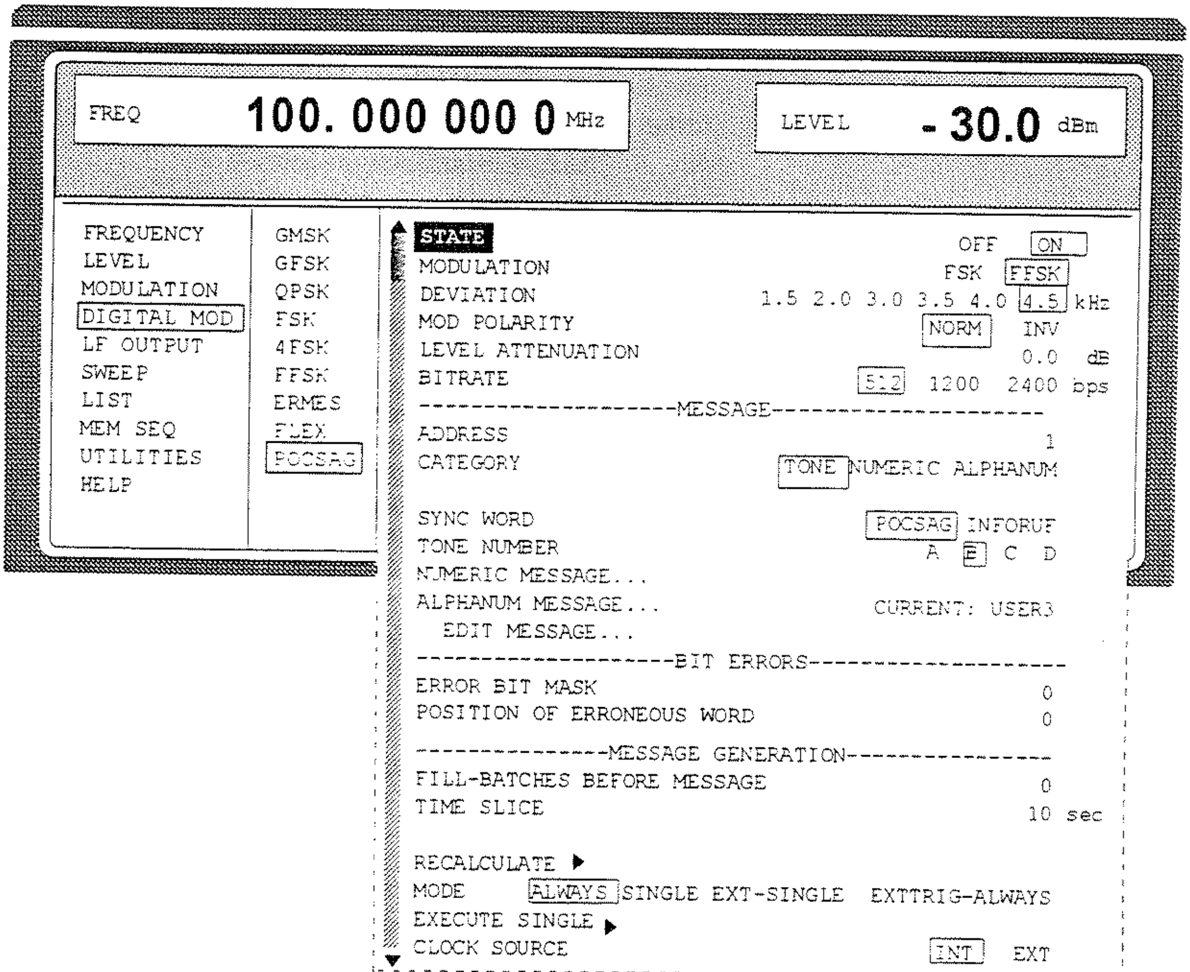


Fig. 2-50 Menu DIGITAL MOD-POCSAG

STATE

ON Switch on of POCSAG.

The RF frequency has to be set to the desired value by means of key [FREQ]. An indication appears in the status line: "PRE" stands for preamble. "MSGx" stands for message, the number "x" denotes the current batch, "- - -" stands for filler data (see POCSAG standard).

IEC-bus short command `:POCS:STAT ON`

OFF Switch off of POCSAG.

IEC-bus short command `:POCS:STAT OFF`

MODULATION

Selection of used modulation. Two types are available:

FSK The RF is directly modulated with the data signal.

FFSK An LF is first modulated, which is then used as th modulation signal for the RF.

IEC-bus short command `:POCS:MOD FSK`

DEVIATION

Input value of frequency deviation of modulation.
For FSK 4.0 kHz and 4.5 kHz are possible, for FFSK 1.5 kHz, 2.0 kHz, 3.0 kHz, 3.5 kHz, 4.0 kHz and 4.5 kHz. The instrument stores two independent deviation values (one for each type of modulation). The value which is displayed and used depends on the modulation setting.

IEC-bus short command `:POCS:DEV 4.5kHz`

MOD POLARITY

Selection of the polarity of the modulation.

NORM Polarity of modulation according to standard POCSAG.

INV Polarity of modulation inverted.

IEC-bus short command `:POCS:POL NORM`

LEVEL ATTENUATION

Input value for the level attenuation. According to FTZ 171TR1 section 4.5.4.2, the levels of the batches no. 2 up to no. 5 are reduced by the value set here.

Notes: – *This setting has an impact only, when a message or filler batches are transmitted in any of the batches 2 to 5. The unmodulated carrier emitted between the end of the message and the beginning of the next call is not attenuated. Usually, the message is transmitted in the first batch. By setting FILL-BATCHES BEFORE MESSAGE however, the filler batches can be inserted prior to the actual message.*

– *Entry of a value in this menu changes the LEVEL ATTENUATION-value of the other DM-modulations, too.*

IEC-bus short command `:DM:DATA:ALEV 0dB`

BITRATE

Selection of bitrate, at which the data should be outputted. Possible values are:
512, 1200 and 2400 baud.

IEC-bus short command `:POCS:BRAT 512bps`

— MESSAGE —

The parameters of this section are used for setting the destination address as well as the useful data of the message.

ADDRESS

Input value of the address of the pager to be called. The specified range is 0 to 2097151.

IEC-bus short command `:POCS:MESS:ADDR 1`

CATEGORY

Selection of the category of the transmitted message.

NUMERIC numeric message,

TONE tone-only message

ALPHANUMERIC alphanumeric message

IEC-bus short command `:POCS:MESS:CAT TONE`

SYNC WORD

Selection of the contents of the sync word.
This word distinguishes between the various types of paging services.

POCSAG 0x7CD215D8; also used for CITYRUF

INFORUF 0x7CD21436.

IEC-bus short command `:POCS:MESS:SWOR POCS`

TONE NUMBER

Input value of the tone which is transmitted during category TONE. Four tones are available (A, B, C, D).

Notes: – *Only true tone-only receivers can process all four possible values.*
– *Numerical and alphanumerical receivers react to tone-only pages only when tone number is B or C.*

IEC-bus short command `:POCS:MESS:TONE B`

NUMERIC MESSAGE...

Opens a window to enter the character string for a numeric or special numeric message. SME provides a maximum of 41 characters. Characters 0 to 9, U, -, [,] and blank space may be used.

IEC-bus short command `:POCS:MESS:NUM "12-17"`

ALPHANUM MESSAGE...

Opens a window to select or create an alphanumeric message. There is one common character set for FLEX (option SME-B41) and POCSAG.

FOX "The quick brown fox jumps over the lazy dog"

ALPHA "ABCD..." (complete POCSAG character set)

USER1...4 Four messages that can be freely edited by command EDIT MESSAGE.

IEC-bus short command `:POCS:MESS:ALPH:SEL "USER3"`

EDIT MESSAGE...

Opens a window to edit one of the alphanumeric messages USER1 to USER4.
The following conversions are used for the German CITYRUF network:

Hex-value	USA	Germany
0x5B	[	Ä
0x5C	\	Ö
0x5D	]	Ü
0x7B	{	ä
0x7C	|	ö
0x7D	}	ü
0x7E	~	ß

IEC-bus short command `:POCS:MESS:ALPH:DATA "Hello"`

—BIT ERRORS—

The SME allows for providing a 32-bit-word of the transferred message with bit errors for test purposes. The parameters of this section specify the erroneous bits and their positions.

ERROR BIT MASK

Entry of the erroneous bits in a 32-bit field. The transmitted decimal number (0...4294967295) is converted internally into a 32-bit binary number and thus defines the 32 bits. These bits are XORed with the word of the message which is to be falsified and thus determine which bits of this word are to be transmitted correctly or incorrectly.

IEC-bus short command `:POCS:ERR:MASK 0`

POSITION OF ERRONEOUS WORD

Entry value of the position of the word to be falsified in the batch. Values from 0 to 16 are valid. The value 0 denotes the synchronization word.

IEC-bus short command `:POCS:ERR:WORD 0`

— MESSAGE GENERATION —

The parameters of this section determine which types of data (POCSAG message, POCSAG filler data) are sent at what time.

FILL-BATCHES BEFORE MESSAGE

Input value for the number of filler batches emitted prior to the actual message.
This allows, e. g., to create a test message according to FTZ 171TR1, appendix 1, section 3.2.2, where the message must appear in the 7th batch

IEC-bus short command `:POCS:LBAT 0`

TIME SLICE

Input value of the length of the time slice.
Possible values are: 2 to 120 sec.
A preamble of 576 bits is sent at the beginning of every time slice, followed by the number of filler batches set under FILL-BATCHES BEFORE MESSAGE. Each batch has the length of 544 bits.
Depending on the settings under MODE, zero, one or two message batches follow. Then an unmodulated signal is sent up to the end of the time slice.
Due to the fact that only complete code word groups are sent, it is possible that, depending on the set bit rate, the actual length of the time slice slightly differs from the set length of the time slice.

IEC-bus short command `:POCS:TSL 10`

RECALCULATE ➔

Triggers a recalculation of the generated POCSAG telegram.
The telegram which is to be sent is recalculated using the set values. As a result of this function, a change in the settings also becomes effective in the generated signal.

IEC-bus short command `:POCS:STAT OFF;STAT ON`

MODE

Selection of sequence of messages and filler data.

ALWAYS — The message is continuously output according to the time interval which is set under TIME SLICE.
IEC-bus short command `:TRIG:DM:SOUR AUTO`

SINGLE — The time slices without message are continuously output. If EXECUTE SINGLE is selected, a time slice with the message is output once.
IEC-bus short command `:TRIG:DM:SOUR SING` `:POCS:TACT MESS`

EXT — The time slices without message are continuously output. If EXECUTE SINGLE is selected, a time slice with the message is output once.
IEC-bus short command `:TRIG:DM:SOUR EXT` `:POCS:TACT MESS`

EXTTRIG-ALWAYS
The units waits for a signal edge at the trigger connector. After recognition of this edge, the unit behaves as described under setting ALWAYS.
IEC-bus short command `:TRIG:DM:SOUR EXT` `:POCS:TACT STAR`

EXECUTE SINGLE →

The set message is output exactly once at the next possible point of time. This triggerable action is only displayed and active when MODE SINGLE has been selected.

IEC-bus short command `*TRG`

CLOCK SOURCE

Selection of the clock source. This setting is also valid for ERMES and FLEX but not for the other digital modulations.

INT — The clock required for signal generation is generated internally and can be tapped at the CLOCK connector.

EXT — The signal applied to the CLOCK connector is used as the clock signal.

Note: *For all bit rates, i.e. for 1600 bps and 3200 bps, a symbol clock rate of 3200 Hz is always used. This applies to both the output (CLOCK SOURCE INT) and the input (CLOCK SOURCE EXT) of the clock.*

IEC-bus short command `:DM:COMP:CLOC:SOUR INT`

2.7 LF-Output

Depending on which options are fitted (cf. table 2-4), internal LF generator 1 and/or 2 are available as a signal source for the LF output.

Menu LF OUTPUT offers access to the settings of the LF output.

Notes:
- *An alteration of the waveform or frequency of the internal modulation generators in the LF-output menu has a parallel effect on the modulation for which the respective generator is selected as modulation source.*
- *The SWEEP function of LF generator 2 can be activated in menu SWEEP-LF-GEN2.*
- *Key [G/n] dBμ switches the unit of the display / LF level output voltage setting to dBu.*

Menu selection: LF OUTPUT

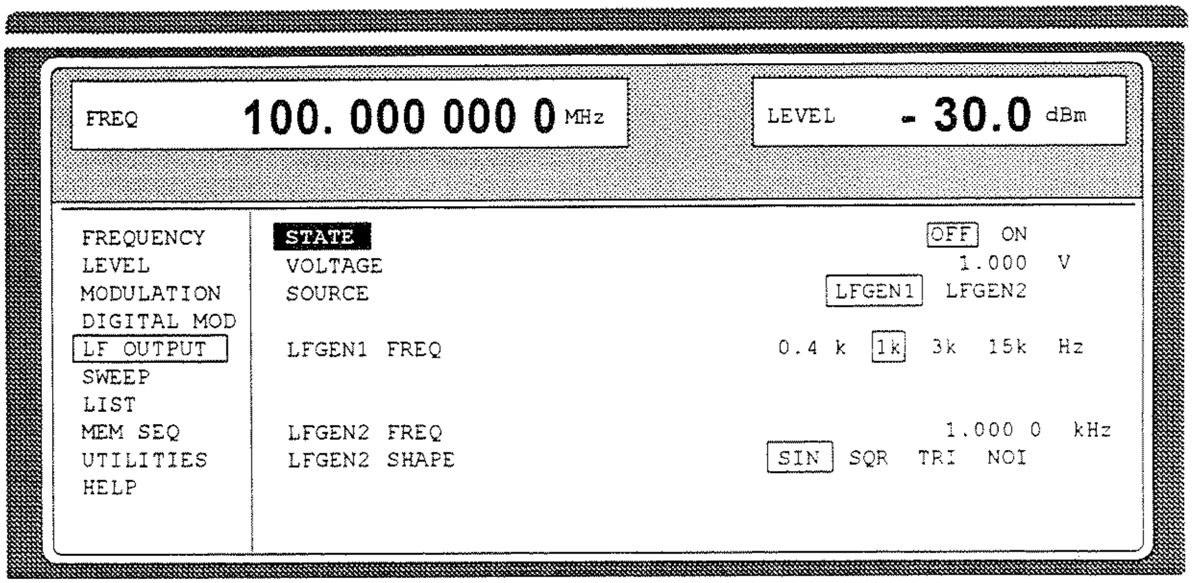


Fig. 2-51 Menu LF OUTPUT (preset setting), fitted with option SM-B6, multifunction generator

STATE Switching on/off the LF output. Parameter LF STATE has no influence on the modulation settings.

IEC bus short command `:OUTP2 ON`

VOLTAGE Input value of the output voltage of the LF output. The input is effected in the form of a peak voltage. If no LF generator option is fitted, the constant output voltage of the standard generator (V_S = 1 V) is indicated.

IEC Bus short command `:OUTP2:VOLT 1V`

Notes: *If LF generator 2 (LFGEN2) is selected as source and*

- *STEREO operating mode is activated, the voltage of the LF output depends on the setting of the wanted and the pilot deviation and cannot be changed in this menu. The output voltage is 6 dBu (1.55 VRMS at 600 ?) per 40 kHz of set sum deviation. The following is displayed:*

  `VOLTAGE (STEREO)              6dBu / 40 kHz`

- *one of operating modes VOR, ILS-GS or ILS-LOC is activated, the input of the output voltage of the LF output is effected relative to the set sum modulation depth. The following is displayed, e.g. in the case of VOR modulation:*

  `VOLTAGE (VOR/ILS) per 100% DEPTH     1.000 V`

LF SOURCE

Selection of the signal source for the LF output.

IEC bus short command `:OUTP2:SOUR 0` (Selection of LF generator 1)
`:OUTP2:SOUR 2` (Selection of LF generator 2)

LFGEN1 FREQ

Input value of the frequency of internal modulation generator 1.

IEC bus short command `:SOUR0:FREQ 1kHz`

LFGEN1 SHAPE

Input value of the signal shape for modulation generator 1. The signal shape of modulation generator 1 can only be set if two modulation generator options are fitted.

IEC bus short command `:SOUR0:FUNC SIN`

LFGEN2 FREQ

Input value of the frequency of internal modulation generator 2. This parameter is only displayed if a modulation generator option is fitted.

IEC bus short command `:SOUR2:FREQ 1kHz`

Note: *In operating modes Stereo, VOR, ILS... or LF-Sweep the value indication is replaced by "STEREO", "VOR", "ILS.." or "SWEEP".*

LFGEN2 SHAPE

Input value of the signal shape of modulation generator 2. This parameter is only displayed if a modulation generator option is fitted.

IEC bus short command `:SOUR2:FUNC SIN`

Notes:

- *A selection of signal shape NOI in the LF-SWEEP operating mode automatically leads to this operating mode being aborted.*
- *In operating modes STEREO, VOR, ILS.. an indication of this parameter is eliminated. Instead, a selection between STEREO OUTPUT MPX and PILOT is possible (see below).*

STEREO OUTPUT

Selection of the stereo signal at the LF output. This parameter is only displayed if STEREO modulation is activated.

MPX Output of the complete Stereo multiplex signal.

PILOT Output of the pilot tone.

IEC bus short commands `:STER:STAT ON;`
`:OUTP2:SOUR 2;`
`:OUTP2:SOUR:STER MPX`

2.8 Sweep

The SME offers a digital step-by-step sweep for parameters:

- RF frequency
- LF frequency
- RF level

In addition to the digital step-by-step sweep, an analog sweep for RF frequency and RF level is possible by switching on frequency or amplitude modulation with an internal saw tooth.

Setting a sweep is effected in five basic steps which are shown in the following example, the setting of a frequency sweep:

1. Set sweep range (START and STOP or CENTER and SPAN).
2. Select linear or logarithmic sequence (SPACING).
3. Set step width (STEP) and dwell time (DWELL).
4. Activate marker if desired (MARKER).
5. Switch on sweep (MODE set to AUTO, SINGLE or STEP).

2.8.1 Setting the Sweep Range (START, STOP, CENTER and SPAN)

The sweep range of the RF sweep can be entered in two different ways. Either by entering the START and STOP value or by entering CENTER and SPAN. Please observe that the two parameter sets influence one another. The influence is exerted in the following way:

• START frequency altered:	STOP =	unaltered
	CENTER =	(START + STOP)/2
	SPAN =	(STOP - START)
• STOP frequency altered:	START =	unaltered
	CENTER =	(START + STOP)/2
	SPAN =	(STOP - START)
• CENTER frequency altered	SPAN =	unaltered
	START =	(CENTER - SPAN/2)
	STOP =	(CENTER + SPAN/2)
• SPAN frequency altered:	CENTER =	unaltered
	START =	(CENTER - SPAN/2)
	STOP =	(CENTER + SPAN/2)

2.8.2 Selecting the Sweep Run (SPACING LIN, LOG)

The sweep run, linear or logarithmic, can be selected using SPACING. For the RF and LF sweep, a linear or logarithmic run is possible. For level sweep, only the logarithmic run is possible.

With the logarithmic sweep, step width STEP is equal to a constant fraction of the present setting. The logarithmic step width is entered in unit % with RF or LF sweep, in unit dB with level sweep.

2.8.3 Operating Modes (MODE)

The following sweep operating modes are available:

AUTO

Sweep from the starting point to the stop point, with automatic restart at the starting point. If another sweep operating mode was activated prior to the AUTO operating mode, continuation is made from the current sweep setting (cf. Fig. 2-52).

IEC bus short commands:

RF sweep:	LF sweep:	Level sweep:
`FREQ:MODE SWE`	`SOUR2:FREQ:MODE SWE`	`POW:MODE SWE`
`SWE:MODE AUTO`	`SOUR2:SWE:MODE AUTO`	`SWE:POW:MODE AUTO`
`TRIG:SOUR AUTO`	`TRIG2:SOUR AUTO`	`TRIG:SOUR AUTO`

SINGLE

Single run from the starting point to the stop point. If SINGLE is selected, the run is not started yet. Function EXECUTE SINGLE SWEEP → to be executed, which can be used to start the run, is displayed below the MODE line (cf. Fig. 2-53).

IEC bus short commands:

RF sweep:	LF sweep:	Level sweep:
`FREQ:MODE SWE`	`SOUR2:FREQ:MODE SWE`	`POW:MODE SWE`
`SWE:MODE AUTO`	`SOUR2:SWE:MODE AUTO`	`SWE:POW:MODE AUTO`
`TRIG:SOUR SING`	`TRIG2:SOUR SING`	`TRIG:SOUR SING`

STEP

Step-by-step, manual run within the sweep limits. Activating STEP stops a running sweep and the cursor wraps to the indication value of CURRENT. The sweep run can now be controlled upwards or downwards in discrete steps using the rotary knob or the numeric keys.

IEC bus short commands:

RF sweep:	LF sweep:	Level sweep:
`FREQ:MODE SWE`	`SOUR2:FREQ:MODE SWE`	`POW:MODE SWE`
`SWE:MODE STEP`	`SOUR2:SWE:MODE STEP`	`SWE:POW:MODE STEP`
`TRIG:SOUR SING`	`TRIG2:SOUR SING`	`TRIG:SOUR SING`

EXT-SINGLE

Single run from the starting point to the stop point as in the case of SINGLE, but triggered by an external trigger signal.

IEC-bus short commands:

RF sweep:	LF sweep:	Level sweep:
`FREQ:MODE SWE`	`SOUR2:FREQ:MODE SWE`	`POW:MODE SWE`
`SWE:MODE AUTO`	`SOUR2:SWE:MODE AUTO`	`SWE:POW:MODE AUTO`
`TRIG:SOUR EXT`	`TRIG2:SOUR EXT`	`TRIG:SOUR EXT`

EXT-STEP Step-by-step run by means of the external trigger signal. Each trigger event triggers a single step.

IEC-bus short commands:

RF sweep:	LF sweep:	Level sweep:
`FREQ:MODE SWE`	`SOUR2:FREQ:MODE SWE`	`POW:MODE SWE`
`SWE:MODE STEP`	`SOUR2:SWE:MODE STEP`	`SWE:POW:MODE STEP`
`TRIG:SOUR EXT`	`TRIG2:SOUR EXT`	`TRIG:SOUR EXT`

OFF The sweep operating mode is switched off.

IEC-bus short commands:

RF sweep:	LF sweep:	Level sweep:
`FREQ:MODE CW`	`SOUR2:FREQ:MODE CW`	`POW:MODE CW`

2.8.4 Trigger Input

An external signal at the rear input triggers the sweep in the EXT-SINGLE and EXT-STEP operating modes. The polarity of the active trigger edge can be set in menu UTILITIES - AUX I/O EXT TRIG SLOPE .

2.8.5 Sweep Outputs

Outputs X-AXIS, BLANK and MARKER are available at the rear of the instrument to control and trigger oscilloscopes or XY recorders.

X-AXIS With sweep switched on, this output supplies a voltage ramp of 0 to 10 V for the X-deflection of an oscilloscope or an XY recorder.

BLANK This output supplies a signal (0V/5V) to trigger and blank an oscilloscope or for the PEN LIFT control of an XY recorder. The polarity and the period of the signal can be set under UTILITIES - AUX I/O - BLANK POLARITY and - BLANK TIME.

MARKER This output becomes active when the sweep run has reached the mark. The MARKER signal can be used for the brightness control of an oscilloscope. Up to three marks can be set in order to mark certain positions in the sweep run. The polarity of the signal can be set in menu UTILITIES - AUX I/O - MARKER POLARITY. The period of the active signal is equal to the dwell time (DWELL) of a step.

Signal examples:

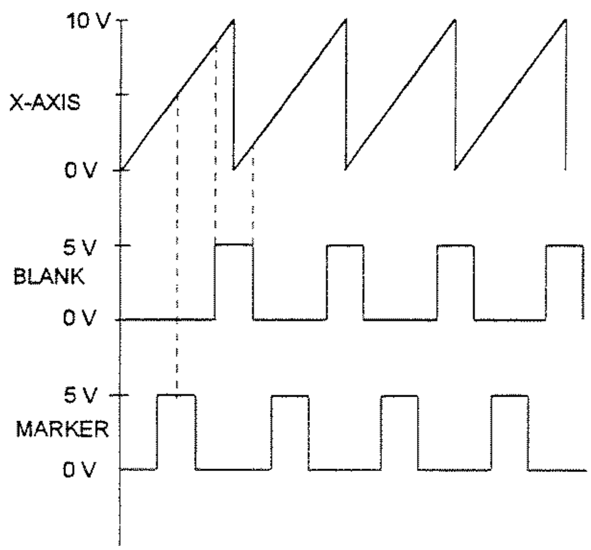


Fig. 2-52 Signal example sweep: MODE = AUTO, BLANK TIME = NORMAL

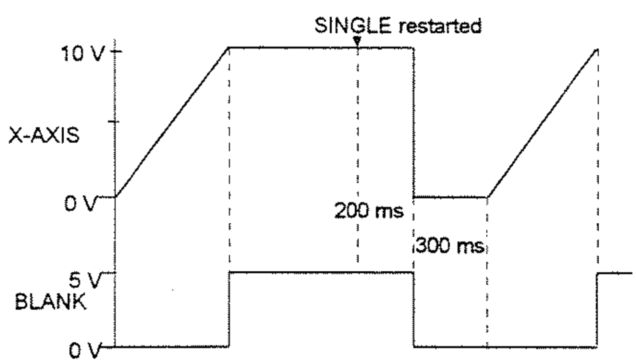


Fig. 2-53 Signal example sweep: MODE = SINGLE, BLANK TIME = LONG

2.8.6 RF-Sweep

Menu SWEEP - FREQ offers access to settings for RF sweep.

Menu selection: SWEEP - FREQ

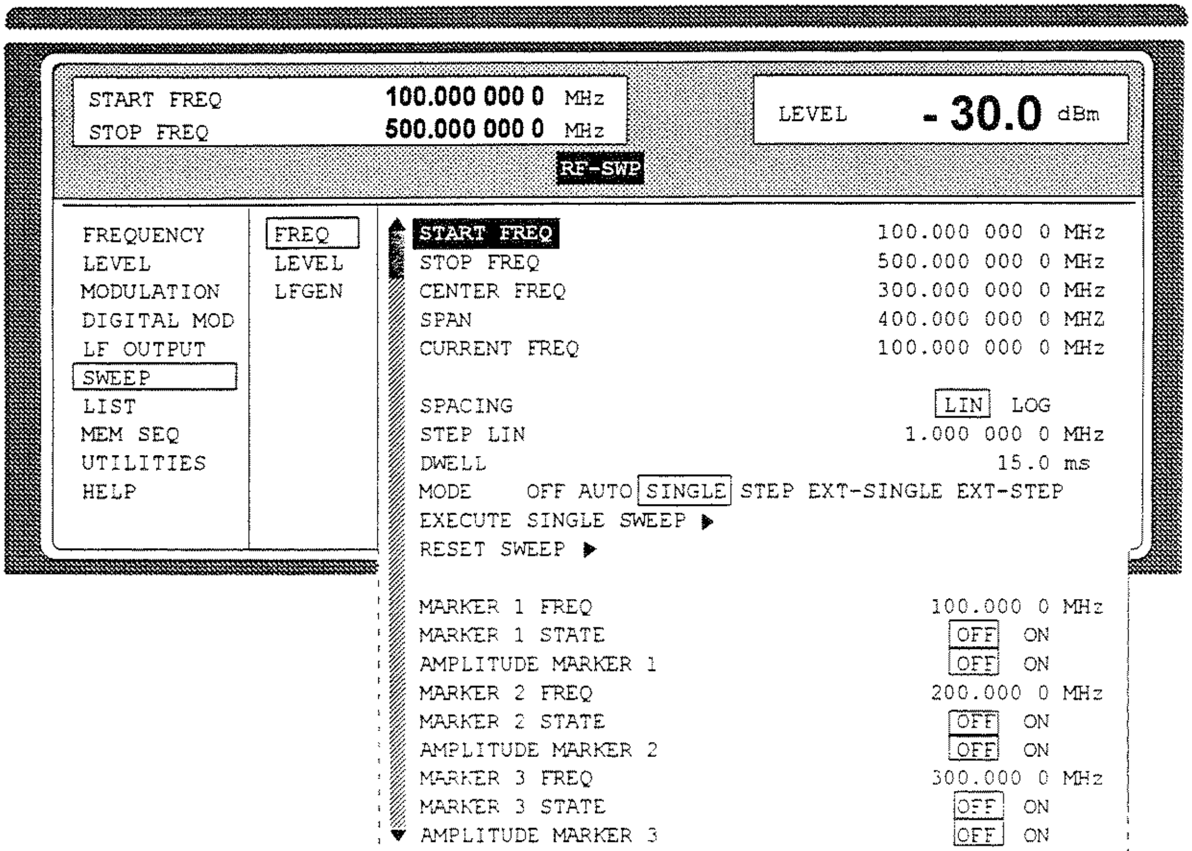


Fig. 2-54 Menu SWEEP - FREQ

START FREQ Input value of the starting frequency.
IEC bus short command `:FREQ:STAR 100MHz`

STOP FREQ Input value of the stop frequency.
IEC bus short command `:FREQ:STOP 500MHz`

CENTER FREQ Input value of the center frequency.
IEC bus short command `:FREQ:CENT 300MHz`

SPAN Input value of the span.
IEC bus short command `:FREQ:SPAN 100MHz`

CURRENT FREQ Indication of the current frequency value.
Operating mode STEP: Input value of the frequency.

STEP LIN (LOG) Input value of the step width. Depending on whether SPACING LIN or LOG is selected, STEP LIN or STEP LOG is displayed.
IEC bus short command `:SWE:STEP:LIN 1MHz`

DWELL	Input value of the dwell time per step. IEC bus short command `:SWE:DWEL 10ms`
SPACING	Input value of the dwell time per step. IEC bus short command `:SWE:SPAC LIN`
MODE	Selection of the sweep operating mode (cf. Section 2.8.3).. IEC bus short commands `:FREQ:MODE SWE; :SWE:MODE AUTO;` `:TRIG:SOUR SING`
EXECUTE SINGLE SWEEP ↗	Starts a single sweep run. This action to be executed is only indicated and is only effective if MODE SINGLE has been selected. IEC bus short command `:TRIG`
RESET SWEEP ↗	Sets the starting frequency. IEC bus short command `:ABOR`
MARKER 1 FREQ **MARKER 2 FREQ** **MARKER 3 FREQ**	Input value of the frequency for the marker selected IEC bus short command `:MARK1:FREQ 100MHz`
MARKER 1 STATE **MARKER 2 STATE** **MARKER 3 STATE**	Switching on/off the marker selected IEC bus short command `:MARK1 OFF`
AMPLITUDE MARKER1 **AMPLITUDE MARKER 2** **AMPLITUDE MARKER 3**	Switching on/off the amplitude marker selected OFF Input value of the frequency for the marker selected ON Amplitude marker is switched on. On reaching the mark the output level is reduced by 1 dB. IEC bus short command `:MARK1:AMPL OFF`

2.8.7 LEVEL Sweep

Menu SWEEP - LEVEL offers access to settings for LEVEL sweep.

Menu selection: SWEEP - LEVEL

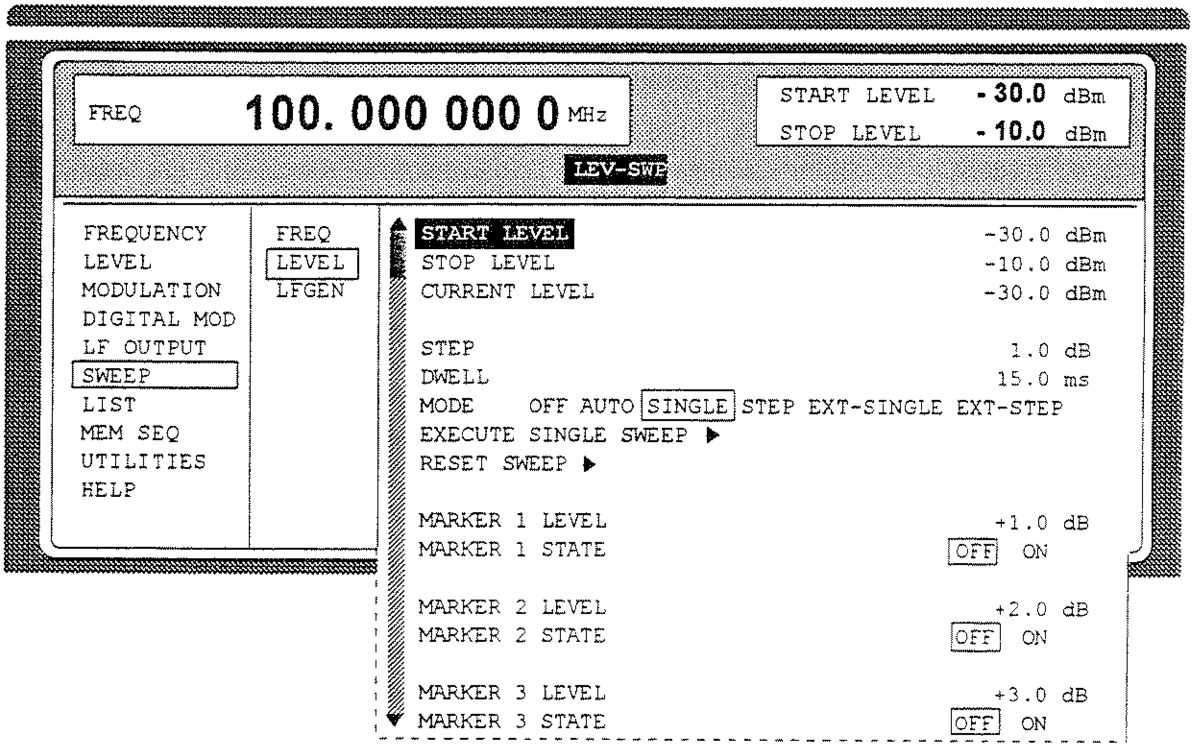


Fig. 2-55 Menu SWEEP - LEVEL

START LEVEL

Input value of the starting level.

IEC bus short command `:POW:STAR -30dBm`

STOP LEVEL

Input value of the stop levell.

IEC bus short command `:POW:STOP -10dBm`

CURRENT LEVEL

Indication of the current level.
Operating mode STEP: Input value of the level.

STEP

Input value of the step width.

IEC bus short command `:SWE:POW:STEP 1dB`

DWELL

Input value of the dwell time per step

IEC bus short command `:SWE:POW:DWEL 15ms`

MODE

Selection of the sweep operating mode (cf. Section 2.8.3).

IEC bus short command `:POW:MODE SWE;`
`:SWE:POW:MODE AUTO;`
`:TRIG:SOUR SING`

EXECUTE SINGLE SWEEP ➔ Starts a single sweep run. This action to be executed is only indicated and is only effective if MODE SINGLE is selected.
IEC bus short command `:TRIG`

RESET SWEEP ➔ Sets the starting level.
IEC bus short command `:ABOR`

MARKER 1 LEVEL
MARKER 2 LEVEL
MARKER 3 LEVEL
Input value of the level for the marker selected.
IEC bus short command `:MARK1:PSW:POW 0dBm`

MARKER 1 STATE
MARKER 2 STATE
MARKER 3 STATE
Switching on/off the marker selected.
IEC bus short command `:MARK1:PSW OFF`

2.8.8 LF-Sweep

Menu SWEEP - LF GEN offers access to settings for LF sweep.

Note: *Settings LF SWEEP and SOURCE LFGEN2 SHAPE NOI deactivate one another.*

Menu selection: SWEEP - LF GEN2

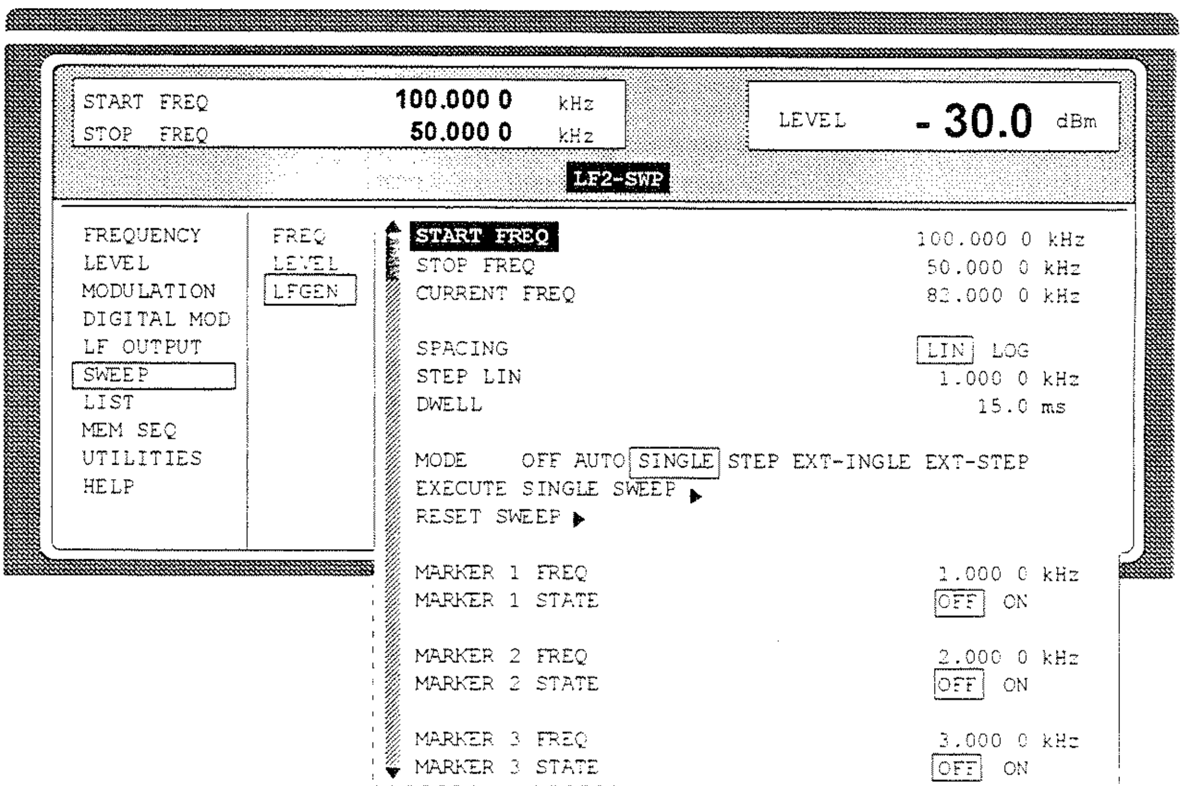


Fig. 2-56 Menu SWEEP - LF GEN

START FREQ	Input value of the starting frequency. IEC bus short command `:SOUR2:FREQ:STAR 100kHz`
STOP FREQ	Input value of the stop frequency. IEC bus short command `:SOUR2:FREQ:STOP 50kHz`
CURRENT FREQ	Indication of the current frequency value. Operating mode STEP: Input value of the frequency.
STEP	Input value of the step width. IEC bus short command `:SOUR2:SWE:STEP:LIN 1kHz`
DWELL	Input value of the dwell time per step. IEC bus short command `:SOUR2:SWE:DWEL 15ms`
SPACING	Selection of the sweep run, linear or logarithmic. IEC bus short command `:SOUR2:SWE:SPAC LIN`

MODE	Selection of the sweep operating mode (cf. Section 2.8.3).
	IEC bus short command `:SOUR2:FREQ:MODE SWE`
	`:SOUR2:SWE:MODE AUTO`
	`:TRIG2:SOUR SING`

EXECUTE SINGLE SWEEP →	Starts a single sweep run. This action to be executed is only indicated and is only effective if MODE SINGLE is selected. IEC bus short command `:TRIG`
RESET SWEEP →	Sets the starting frequency. IEC bus short command `:ABOR`
MARKER 1 FREQ **MARKER 2 FREQ** **MARKER 3 FREQ**	Input value of the frequency for the marker selected. IEC bus short command `:SOUR2:MARK1:FREQ 1kHz`
MARKER 1 STATE **MARKER 2 STATE** **MARKER 3 STATE**	Switching on/off the marker selected. IEC bus short command `:SOUR2:MARK1 OFF`

2.9 LIST Mode

A sequence of predefined frequency and level points is executed in the LIST mode, similar as in a sweep. Differently from the sweep, however, a list with freely selectable pairs of values (frequency and level) can be generated. The specified range of the frequency comprises the entire adjustable frequency range of the instrument. The specified range of the level covers a 20-dB range. If the permissible variation range is exceeded, the level error increases.

Caution: *After the generation or change of a list in the LIST mode, function LEARN has to be started to ensure that the new settings are transferred to the hardware.*

Table 2-6 LIST mode; Example of a list

Index	Frequency	Level
0001	100 MHz	0 dBm
0002	575 MHz	13 dBm
0003	235 MHz	7 dBm
0100	333 MHz	5 dBm
:	:	:

Up to 10 lists can be created. The total amount of possible pairs of values including all lists may maximally be 2000. I.e., a list may have 2000 entries at the most, or less if several lists have been created.

Each list is identified by a separate name and selected via this name. A detailed description how to process the lists can be found in Section 2.2.4, List Editor.

2.9.1 Operating Modes (MODE)

The following LIST-operating modes are available:

AUTO Run from the beginning to the end of the list with automatic restart at the beginning. If another mode was activated prior to the AUTO operating mode, continuation is made from the current index.

IEC bus short commands:
```
:FREQ:MODE LIST
:LIST:MODE AUTO
:TRIG:LIST:SOUR AUTO
```

SINGLE Single run from the beginning to the end of the list. If SINGLE is selected, the run is not yet started. Function EXECUTE SINGLE LIST ↗ to be executed, which can be used to start the run, is displayed below the MODE line.

IEC bus short commands:
```
:FREQ:MODE LIST
:LIST:MODE AUTO
:TRIG:LIST:SOUR SING
```

STEP Step-by-step manual processing of the list. Activating STEP stops a list running and the cursor wraps to the indication value of CURRENT INDEX. The list can now be controlled upwards or downwards in discrete steps using the rotary knob or the numeric keys.

IEC bus short commands: `:FREQ:MODE LIST`
`:LIST:MODE STEP`
`:TRIG:LIST:SOUR SING`

EXT-SINGLE Single run from the beginning to the end of the list as with SINGLE, but triggered by an external trigger signal.

IEC bus short commands: `:FREQ:MODE LIST;`
`:LIST:MODE AUTO`
`:TRIG:LIST:SOUR EXT`

EXT-STEP Step-by-step run by means of the external trigger signal. Each trigger event triggers a single step.

IEC bus short commands: `:FREQ:MODE LIST`
`:LIST:MODE STEP`
`:TRIG:LIST:SOUR EXT`

OFF Operating mode LIST is switched off.

IEC bus short command: `:FREQ:MODE CW`

2.9.2 Inputs/Outputs

TRIGGER input and BLANK output are available at the rear of the instrument for synchronization with other instruments.

TRIGGER An external signal at this input triggers the LIST mode in operating modes EXT-SINGLE and EXT-STEP. The polarity of the active trigger edge can be set in the UTILITIES - AUX I/O - EXT TRIG SLOPE menu.

BLANK This output supplies a signal (0 V/5 V) to blank the settling process by means of pulse modulation or AM. The signal can also be used to synchronize other instruments. The polarity of the signal can be set in the UTILITIES - AUX I/O - BLANK POLARITY menu.

MARKER At the first step of the LIST mode, this output provides an approx. 200 µs trigger signal immediately after blanking. At small DWELL times, this signal can be used for an accurate synchronization to trigger other devices and shows the first stable output frequency. The delay to the fed-in signal at the TRIGGER input for EXT-SINGLE or EXT-STEP is 1.5 to 2 ms and has a jitter of 0.5 ms.

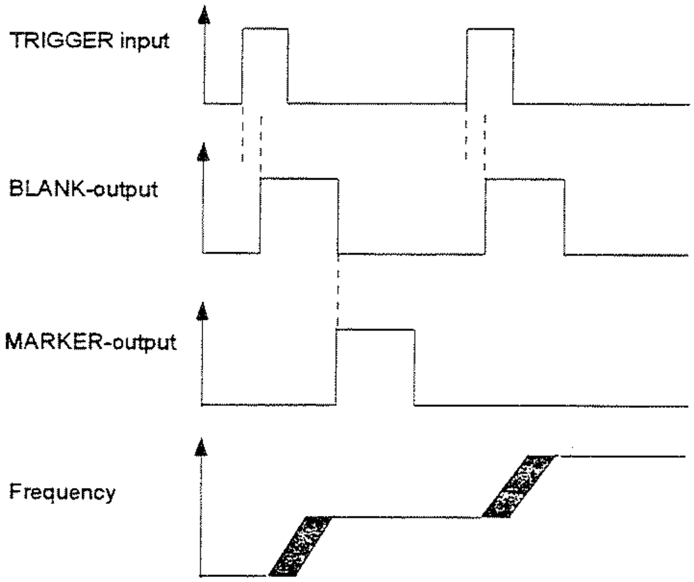


Fig. 2-57 Signal example LIST mode: MODE = EXT-STEP

The LIST menu offers access to settings for the LIST mode.

Menu selection: LIST

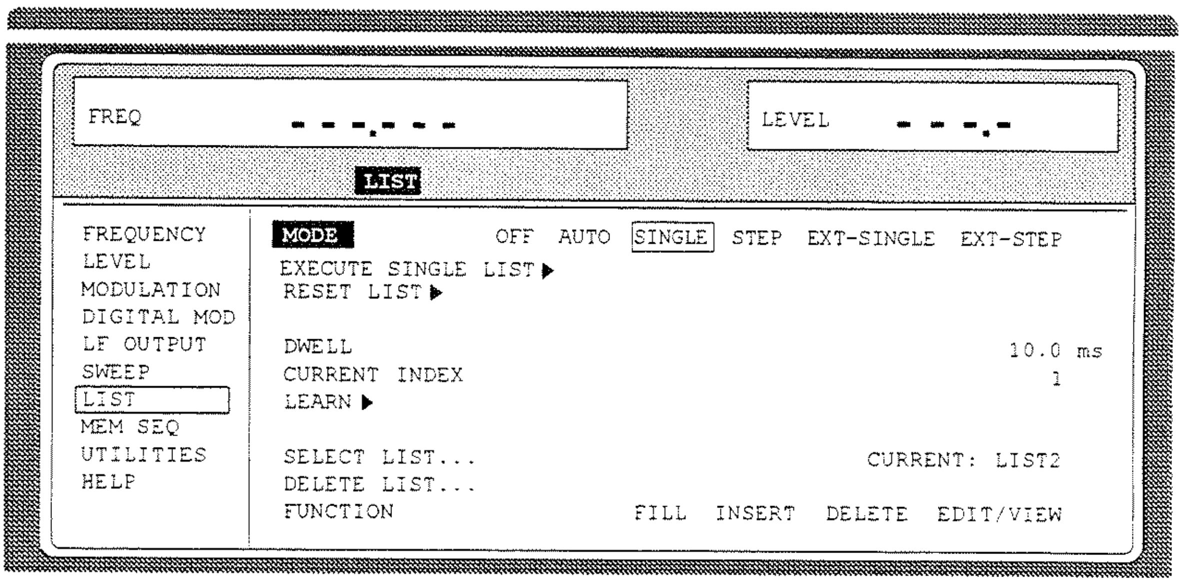


Fig. 2-58 Menu LIST - OPERATION page

MODE

Selection of the operating mode (cf. Section 2.9.1, operating modes).

IEC bus short commands : `:FREQ:MODE LIST;`
`:LIST:MODE AUTO;`
`:TRIG:LIST:SOUR SING`

EXECUTE SINGLE LIST ➔

Starts a single run of a list. This menu option is only visible if MODE SINGLE is selected.

IEC bus short command : `:TRIG:LIST`

RESET LIST → Sets the starting point.
IEC-bus short command `:ABOR:LIST`

DWELL Input value of the dwell time per step.
IEC-bus short command `:LIST:DWEL 10ms`

CURRENT INDEX Indication of the current list index. Setting value of the current list index in the STEP operating mode.

LEARN → Starts the LEARN function. All value pairs of the active list are subsequently set by the instrument with the current additional parameters, and the hardware setting data are stored.

Caution: *This function must be called after every creating and altering the list (or the remaining setting data).*

IEC-bus short command `:LIST:LEAR`

SELECT LIST... Selection of a list or creation of a new list (cf. Section 2.2.4, List Editor).
IEC-bus short command `:LIST:SEL "LIST2"`

DELETE LIST... Deletion of a list (cf. Section 2.2.4, List Editor).
IEC-bus short command `:LIST:DEL "LIST1"`

FUNCTION Selection of the editor functions to process a list (cf. Section 2.2.4, List Editor).
IEC-bus short command `:LIST:FREQ 100MHz, 1.2GHz; POW 0dBm, 6dBm`

The second page of the LIST menu, the EDIT page is automatically activated if one of the editor functions of line FUNCTION is selected. The list which is displayed as CURRENT LIST in the SELECT LIST line is shown.

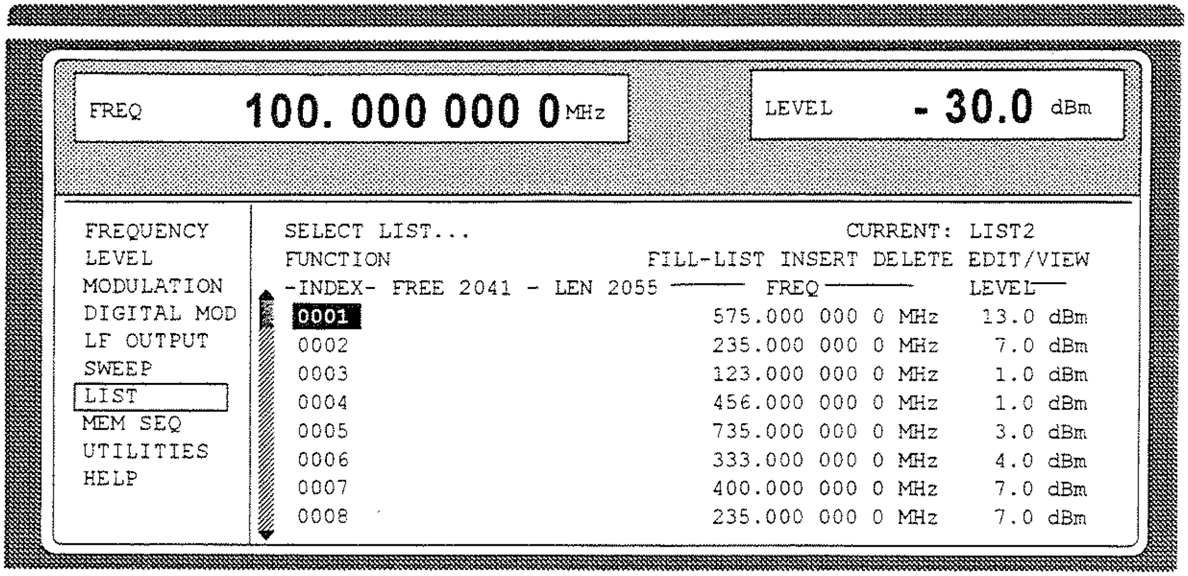


Fig. 2-59 Menu List - EDIT page

INDEX Index of the list.

FREE Indication of the list entries still vacant.

LENGTH Length of the current list.

FREQ Parameter: Frequency.

LEVEL Parameter: Level; specified range 20 dB.

2.10 Memory Sequence

In the memory-sequence operating mode the instrument automatically services a list with stored instrument settings. Memory locations 1 to 50, which are loaded using SAVE and whose stored settings are called either separately using RECALL or automatically and subsequently in the SEQUENCE mode, are available.

The list is continuously serviced from the beginning to the end with a continual index. The order of the memories to be passed through is arbitrary. Each setting can be assigned a freely selectable dwell time. The dwell time determines the duration of the setting, its minimal value is 50 ms, its maximal value 60 sec.

The list is divided up into 3 columns for list index, memory location number (Memory) and dwell time (Dwell).. The beginning of the list has index 1.

Table 2-7 MEMORY SEQUENCE; Example of a list

Index	Memory	Dwell
001	09	50.0 ms
002	02	50.0 ms
003	01	75.0 ms
004	10	75.0 ms
...	...	...

Up to 10 sequence lists can be created. The total number of possible list elements is maximally 256. I.e., a list can have 256 entries at the most, or less if several lists have been created.

Each list is identified by a separate name and selected via this name. A detailed description how to process the lists can be found in Section 2.2.4, List Editor.

Note: *Frequently changing the level in the operating mode MEMORY SEQUENCE can stress the mechanically switched attenuator. The attenuator is also actuated when AM is switched on or off. For this reason we recommend that you make use of the non-interrupting level setting as much as possible and that you use the setting AM 0% instead of switching AM off.*

Operating Modes (MODE)

The following operating modes are available:

AUTO Run from the beginning to the end of the list with automatic restart at the beginning. If another mode was activated prior to the AUTO operating mode, continuation is made from the current index.

IEC-bus short command: `:SYST:MODE MSEQ;`
`:SYST:MSEQ:MODE AUTO`
`:TRIG:MSEQ:SOUR AUTO`

SINGLE

Single run from the beginning to the end of the list. If SINGLE is selected, the run is not yet started. Below the MODE line, function EXECUTE SINGLE SEQUENCE ↗ to be executed is displayed which can be used to start the run.

IEC-bus short command `:SYST:MODE MSEQ;`
`:SYST:MSEQ:MODE AUTO`
`:TRIG:MSEQ:SOUR SING`

STEP

Step-by-step manual processing of the list. Activating STEP stops an automatic run and the cursor wraps to the indication value of CURRENT INDEX. The list can now be passed through upwards or downwards step by step using the rotary knob.

IEC-bus short command `:SYST:MODE MSEQ;`
`:SYST:MSEQ:MODE STEP`
`:TRIG:MSEQ:SOUR SING`

EXT-SINGLE

Single run from the beginning to the end of the list as with SINGLE, but triggered by an external trigger signal.

IEC-bus short command `:SYST:MODE MSEQ;`
`:SYST:MSEQ:MODE AUTO`
`:TRIG:MSEQ:SOUR EXT`

EXT-STEP

Step-by-step run using the external trigger signal. Each trigger event triggers a single step.

IEC-bus short command `:SYST:MODE MSEQ;`
`:SYST:MSEQ:MODE STEP`
`:TRIG:MSEQ:SOUR EXT`

OFF

Step-by-step run using the external trigger signal. Each trigger event triggers a single step.

IEC-bus short command `:SYST:MODE FIX`

External Trigger

An external signal at the rear input TRIGGER triggers the MEMORY SEQUENCE in the EXT-SINGLE and EXT-STEP operating modes. The polarity of the active trigger edge can be set in the UTILITIES - AUX I/O - EXT TRIG SLOPE menu.

Menu MEM SEQ with the two menu pages OPERATION and EDIT offers access to the memory-sequence operating mode.

Menu selection: MEM SEQ

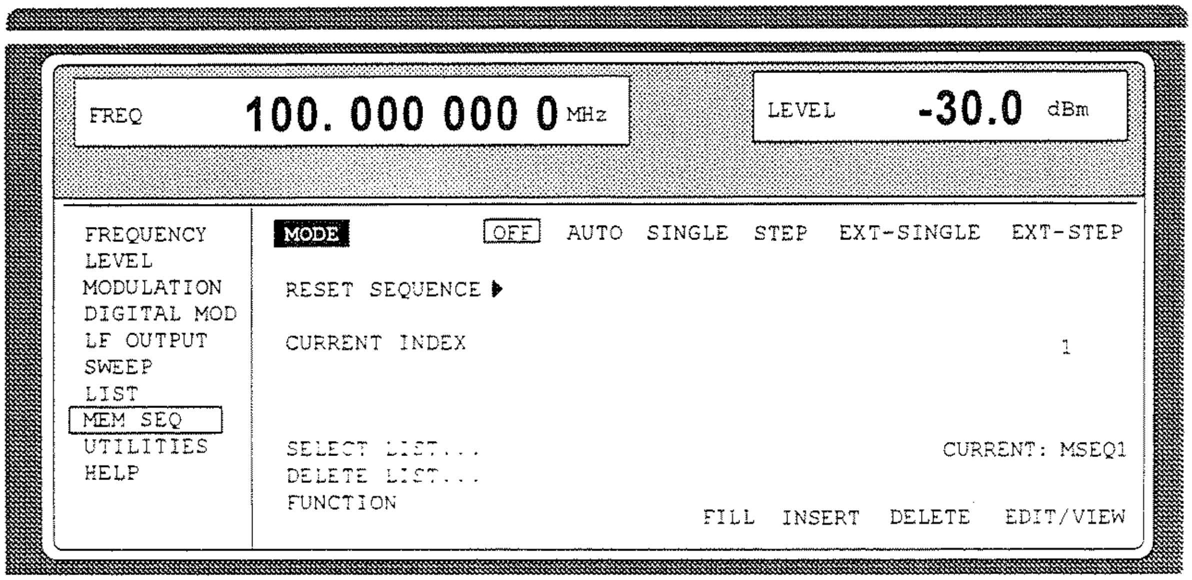


Fig. 2-60 Menu MEM SEQ -OPERATION-page (preset setting)

MODE

Selection of the operating mode; setting the operating mode regards various command systems at the IEC bus (cf. above).

EXECUTE SINGLE SEQUENCE →

Starts the single run of a memory sequence. This menu option is only visible if MODE SINGLE is selected.

IEC-bus short command `:TRIG:MSEQ`

RESET SEQUENCE →

Wrap to the beginning of the list.

IEC-bus short command `:ABOR:MSEQ`

CURRENT INDEX

Indication of the current list index. Setting value of the current list index in the MODE STEP operating mode.

SELECT LIST...

Selection of a list or generation of a new list (cf. Section 2.2.4, List Editor).

IEC-bus short command `:SYST:MSEQ:SEL "MSEQ1"`

DELETE LIST...

Deletion of a list (cf. Section 2.2.4, List Editor).

IEC-bus short command `:SYST:MSEQ:DEL "MSEQ2"`

FUNCTION

Selection of the editor functions to process a list (cf. Section 2.2.4, List Editor).

IEC-bus short command `:SYST:MSEQ 9,2,...;`
`:SYST:MSEQ:DWEL 50ms, 50ms,.`

The second page of menu MEM SEQ, the EDIT page, is automatically activated if one of the editor functions of the FUNCTION line is selected. The list which is entered as CURRENT LIST in the SELECT LIST line is shown.

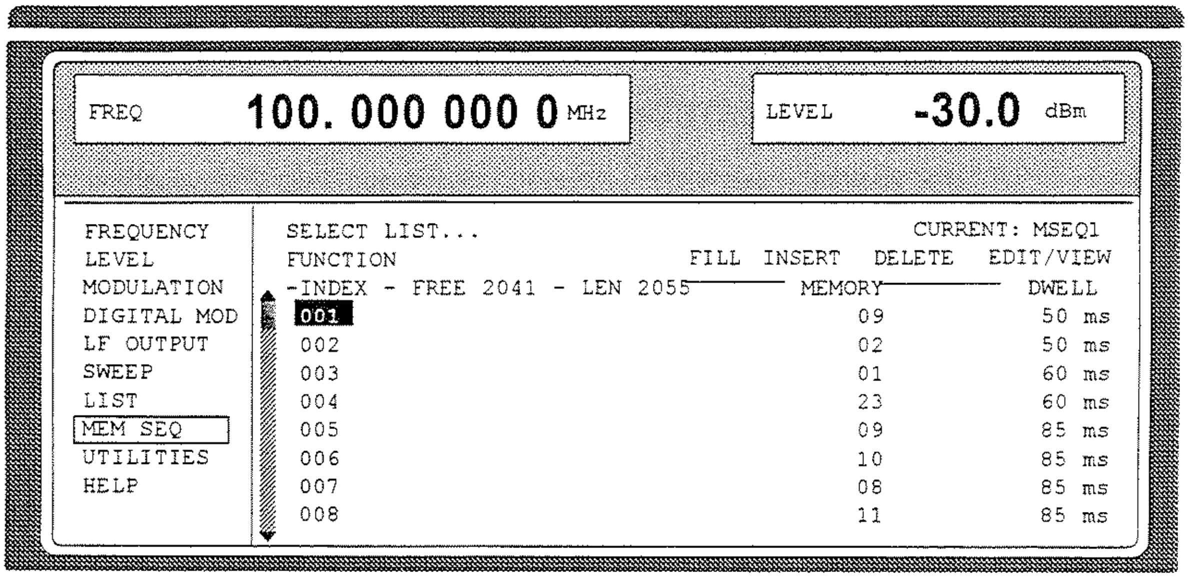


Fig. 2-61 Menu MEM SEQ - EDIT page

INDEX Index of the list.

FREE Indication of the list entries still vacant.

LEN Length of the current list.

MEMORY Parameter: number of memory location; range 1 to 50.

DWELL Parameter: dwell time; specified range 50 ms to 60 sec, step width 1 ms.

2.11 Utilities

The UTILITIES menu contains submenus for general functions which do not directly relate to the signal generation.

2.11.1 IEC-Bus Address (SYSTEM-GPIB)

Submenu SYSTEM-GPIB offers access to the remote-control address. The setting range is 0 to 30. At the point of delivery address 28 is set.

Menu selection: UTILITIES -SYSTEM -GPIB

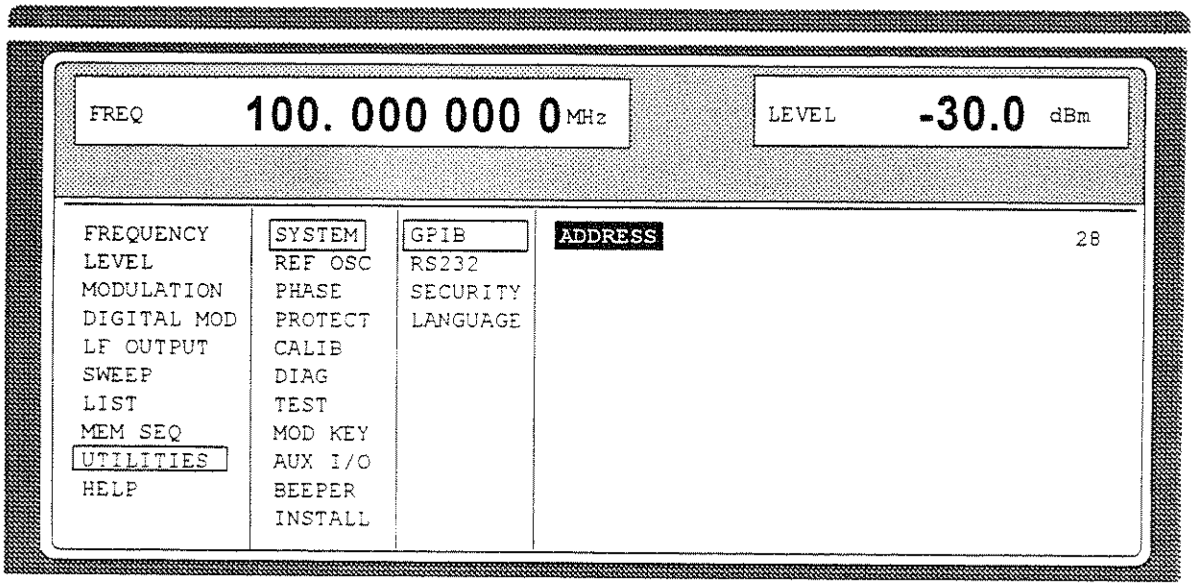


Fig. 2-62 Menu UTILITIES -SYSTEM -GPIB

ADDRESS Input value of the IEC-bus address

IEC-bus short command `:SYST:COMM:GPIB:ADDR 28`

2.11.2 Parameter of the RS232 Interface (SYSTEM-RS232)

Submenu SYSTEM-RS232 offers access to the configuration of the RS-232 interface. The pin assignment of the interface corresponds to the pin assignment of a PC.

Menu selection: UTILITIES - SYSTEM - RS232

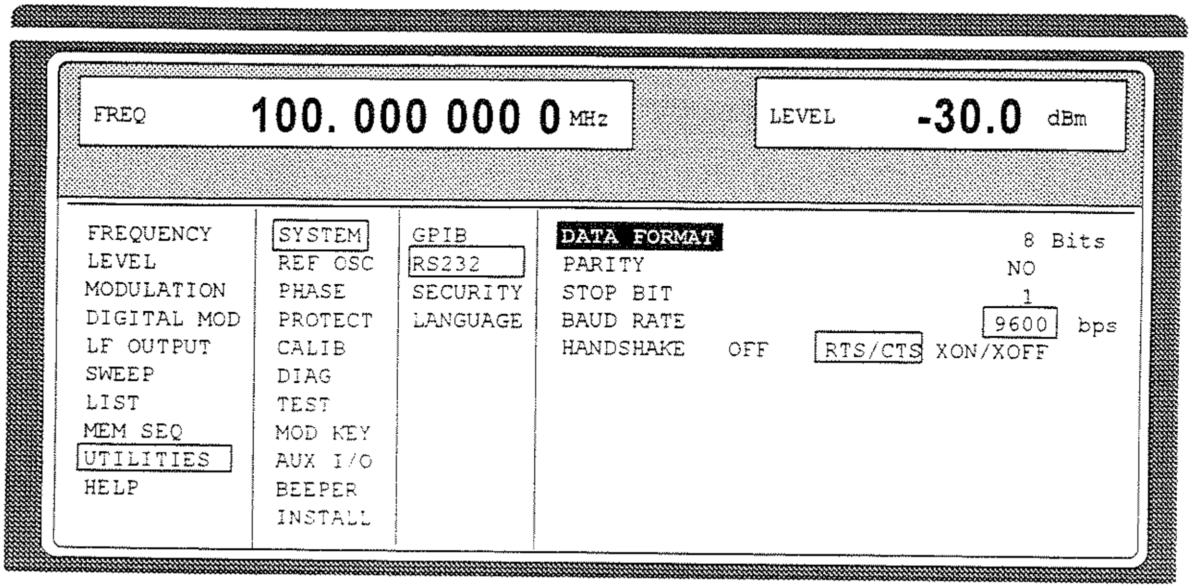


Fig. 2-63 Menu UTILITIES - SYSTEM - RS232

DATA FORMAT Indication of the number of data bits. This value cannot be changed.

PARITY Indication of parity. This value cannot be changed.

STOP BIT Indication of the number of stop bits. This value cannot be changed.

BAUD RATE Selection of the baud rate.
IEC-bus short command `:SYST:COMM:SER:BAUD 9600`

HANDSHAKE Selection of the handshake.

OFF No handshake
IEC-bus short command `:SYST:COMM:SER:PACE NONE`
`:SYST:COMM:SER:CONT:RTS ON`

RTS/CTS Hardware handshake using the interface lines RTS and CTS. This mode always is to be preferred to XON/XOFF mode, if permitted by the configuration of the host computer.
IEC-bus short command `:SYST:COMM:SER:CONT:RTS RFR`

XON/XOFF Software handshake using the ASCII codes 11h <XON> and 13h <XOFF>. This mode is not recommended for binary data and for baud rates above 9600 baud.
IEC-bus short command `:SYST:COMM:SER:PACE XON`

2.11.3 Suppressing Indications and Deleting Memories (SYSTEM-SECURITY)

For security interests, indications can be suppressed and memories deleted in the SYSTEM-SECURITY submenu.

Menu selection: UTILITIES - SYSTEM-SECURITY

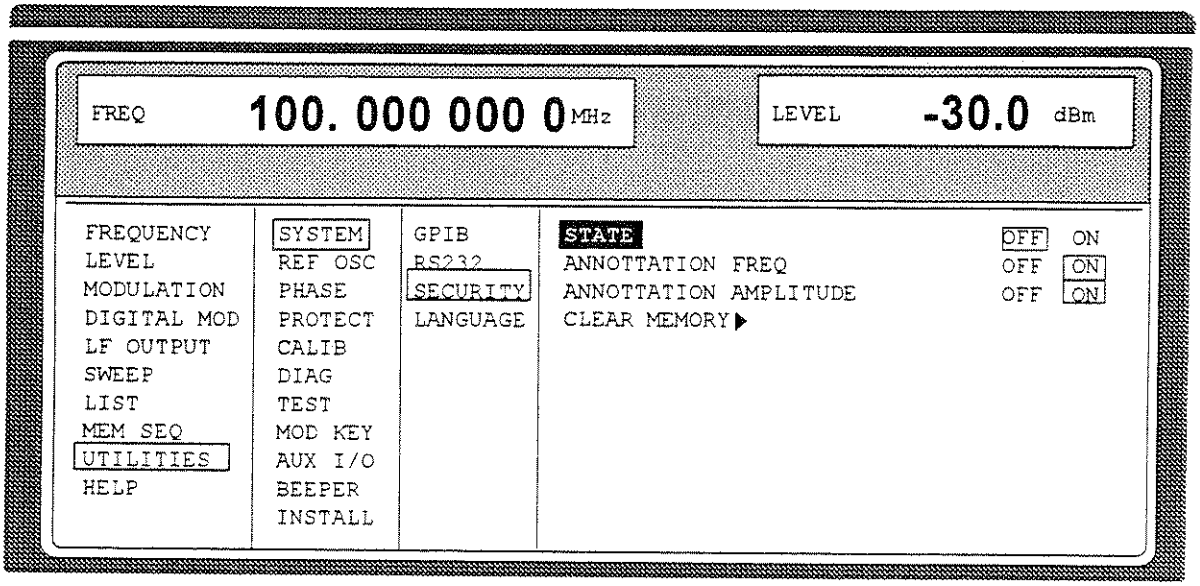


Fig. 2-64 Menu UTILITIES - SYSTEM-SECURITY

STATE

Selection of the SECURITY state

ON — Locks the suppression of the indications. Can only be set via IEC bus.

OFF — Deactivates the interlock of the indication suppression. The preset state is set in the transition ON→OFF, and all data stored such as settings, with the exception of the DM lists are deleted. Can only be set via IEC bus.

IEC-bus short command `:SYST:SEC OFF`

ANNOTATION FREQ

OFF — All frequency indications are suppressed.

ON — The frequency setting is displayed..

IEC-bus short command `:DISP:ANN:FREQ ON`

ANNOTATION AMPLITUDE

OFF — All level indications are suppressed.

ON — The level setting is displayed.

IEC-bus short command `:DISP:ANN:AMPL ON`

CLEAR MEMORY ➔

Deletion of all data stored such as settings, user correction and list settings stored, with the exception of the DM lists.

For this action, two commands are necessary at the IEC bus:

IEC-bus short command `:SYST:SEC ON; SEC OFF`

2.11.4 Indication of the IEC-Bus Language (LANGUAGE)

Submenu UTILITIES-SYSTEM LANGUAGE indicates the IEC-bus language and the current SCPI version.

2.11.5 Reference Frequency Internal/External (REF OSC)

In the internal-reference operating mode, the internal reference signal at a frequency of 10 MHz is available at the REF socket (rear of the instrument).

Signal level: V_{eff} (EMF, sine) = 1 V.

The frequency of the internal reference oscillator can be detuned via the TUNE input (rear of the instrument). Input voltage range ±10 V, pulling range $\pm 1\times 10^{-6}$.
The external detuning is possible in both states of the ADJUSTMENT STATE (ON or OFF) unless option SM-B1, reference oscillator OCXO, is fitted. If option SM-B1, reference oscillator OCXO, is fitted, the detuning via the TUNE input is only possible if the ADJUSTMENT STATE selection has been switched to ON in the UTILITIES-REF OSC menu.

In the external-reference operating mode, an external signal at a frequency of 1 MHz to 16 MHz (spacing 1 MHz) is to be fed into socket REF. The setting to external frequency is effected in the UTILITIES-REF OSC menu.

Signal level: V_{eff} = 0.1 to 2 V

The message "EXT REF" is displayed in the status line in the header field of the display in the external-reference operating mode.

Menu selection: UTILITIES - REF OSC

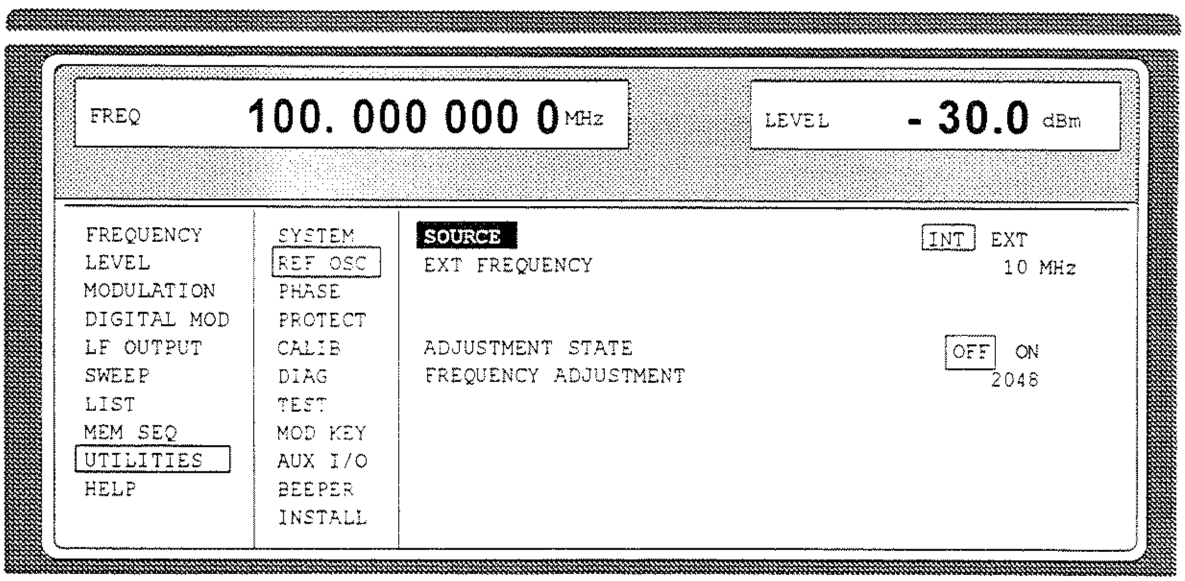


Fig. 2-65 Menu UTILITIES - REF OSC (preset setting)

SOURCE

Selection of the operating mode.

INT Internal-reference operating mode

EXT External-reference operating mode

IEC-bus short command `:ROSC:SOUR INT`

EXT FREQUENCY

Input value of the external reference frequency (1 MHz to 16 MHz, spacing 1 MHz).

IEC-bus short command `:ROSC:EXT:FREQ 10E6`

ADJUSTMENT STATE

OFF Tuning value of the internal reference frequency as calibrated (cf. menu UTILITIES-CALIB)

ON Tuning value according to setting value FREQUENCY ADJUSTMENT. Option SM-B1, reference oscillator OCXO, is switched off. Only the standard reference oscillator is in operation.

IEC-bus short command `:ROSC:ADJ:STAT ON`

FREQUENCY ADJUSTMENT

Input value in the range 0 to 4095 to set the internal reference frequency. Pulling range $\pm 4 \times 10^{-6}$

IEC-bus short command `:ROSC:ADJ:VAL 2048`

2.11.6 Phase of the Output Signal (PHASE)

Menu UTILITIES-PHASE offers access to the phase setting of the RF output signal with respect to a reference signal of the same frequency.

Menu selection: UTILITIES - PHASE

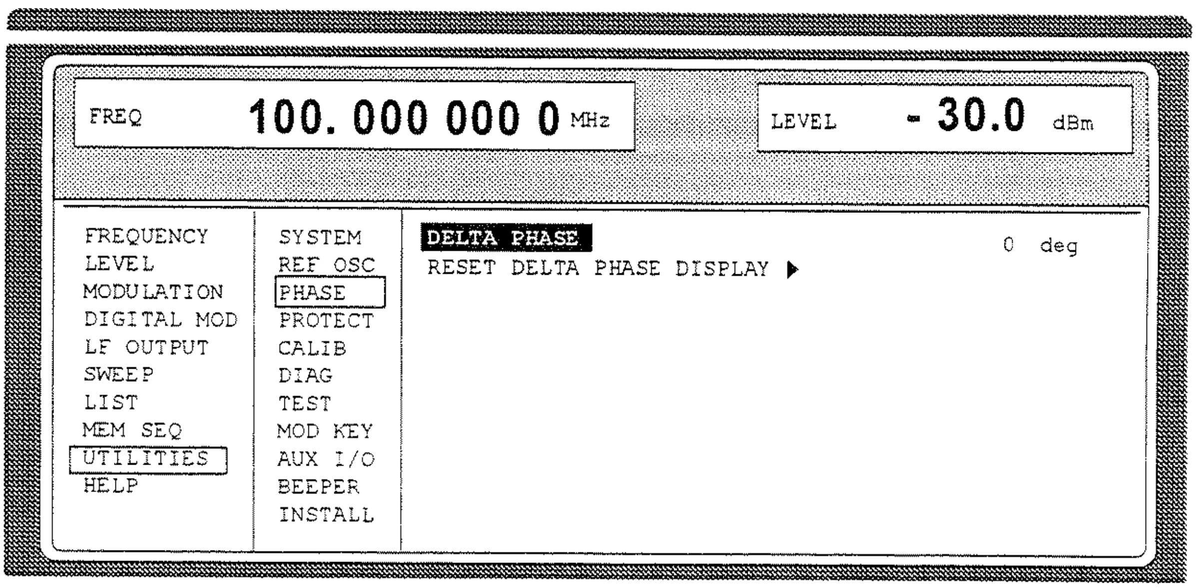


Fig. 2-66 Menu UTILITIES - PHASE (preset setting)

DELTA PHASE

Setting value of the phase.
IEC-bus short command `:PHAS 0`

RESET DELTA PHASE DISPLAY →

Sets the display of the DELTA PHASE to 0 without the phase of the output signal being influenced.
IEC-bus short command `:PHAS:REF`

2.11.7 Password Input With Functions Protected (PROTECT)

The execution of calibrating and service functions is protected by a password. To unlock the lock-out, the correct password, a 6-digit number, has to be entered and then the [ENTER] key has to be pushed. After the instrument has been switched on, the lock-out is automatically activated.

Password 1 unlocks the lock-out for calibrations LEV PRESET, VCO SUM and PULSE GEN.

Password 2 unlocks the lock-out for calibration REF OSC.

Password 3 permits the input of the serial number and the value of the counter for POWER ON, operating hours and attenuator circuits.

Menu UTILITIES-PROTECT offers access to the unlocking of protected functions.

Menu selection: UTILITIES - PROTECT

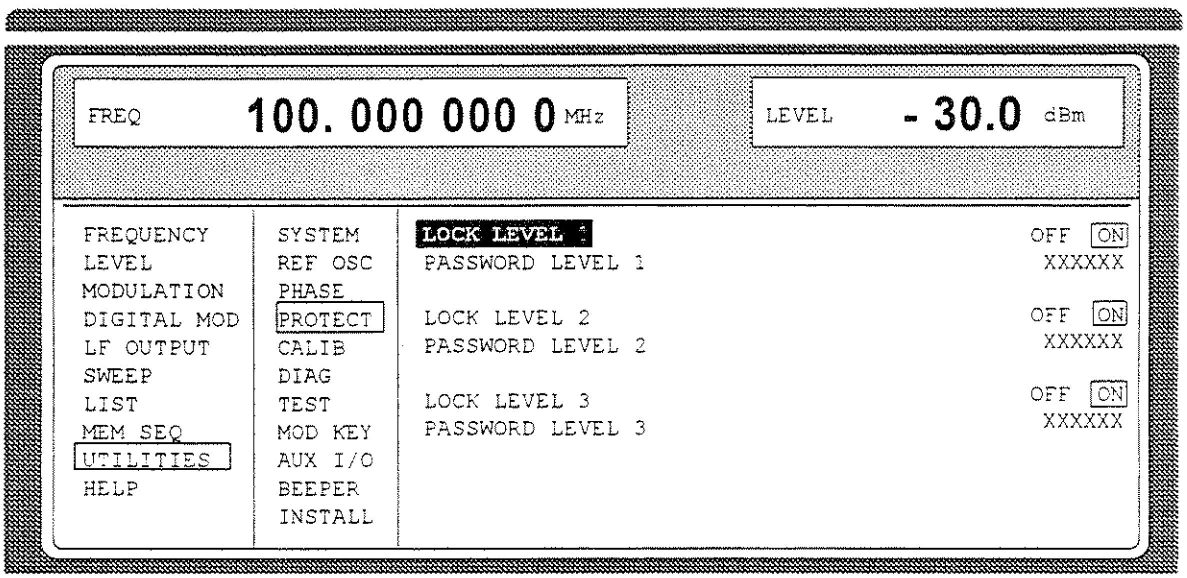


Fig. 2-67 Menu UTILITIES - PROTECT (preset setting)

LOCK LEVEL x

Activating/deactivating the lock-out.

ON The lock-out is activated.

OFF The cursor automatically wraps to the input of the password. After the password has been entered, the lock-out is deactivated.

IEC-bus short command `:SYST:PROT1 ON`

PASSWORD LEVEL x

Input of the password; termination with [ENTER] key.

IEC-bus short command `:SYST:PROT1 OFF, 123456`

2.11.8 Calibration (CALIB)

For servicing, the following menus offer access to calibrating routines and correction values:

UTILITIES - CALIB - VCO SUM
LEV PRESET
PULSE GEN
REF OSC (cf. service manual)
QPSK
LEVEL (cf. service manual)

Internal calibration routines LEV PRESET, VCO SUM, QPSK and PULSE GEN are protected by a password. They can only be executed if the lock-out in the UTILITIES - PROTECT menu has been unlocked. The password is PASSWORD LEVEL 1 = "123456".

Caution: *Execute calibration routines only when the instrument has warmed up*

Calibration routines LEVEL and REF OSC are described in the service manual (stock no. 1039.1856.24).

Calibration VCO SUM

To synchronize the summing loop, the frequency the oscillator generates must be so close to the rated frequency that the phase control can lock in. This is effected by means of presetting values. The presetting values are stored in a table and can be renewed using internal calibration routine VCO SUM. The calibration routine needs only be executed after a data loss in the RAM or after an exchange of modules.

Function: In a 10-MHz division scale, the VCOs are synchronized with the rated frequency and the presetting voltage readjusted until the difference to the tuning voltage becomes minimal. The value hence achieved is entered into the table. The routine takes approx. 10 seconds.

Menu selection: UTILITIES - CALIB - VCO SUM

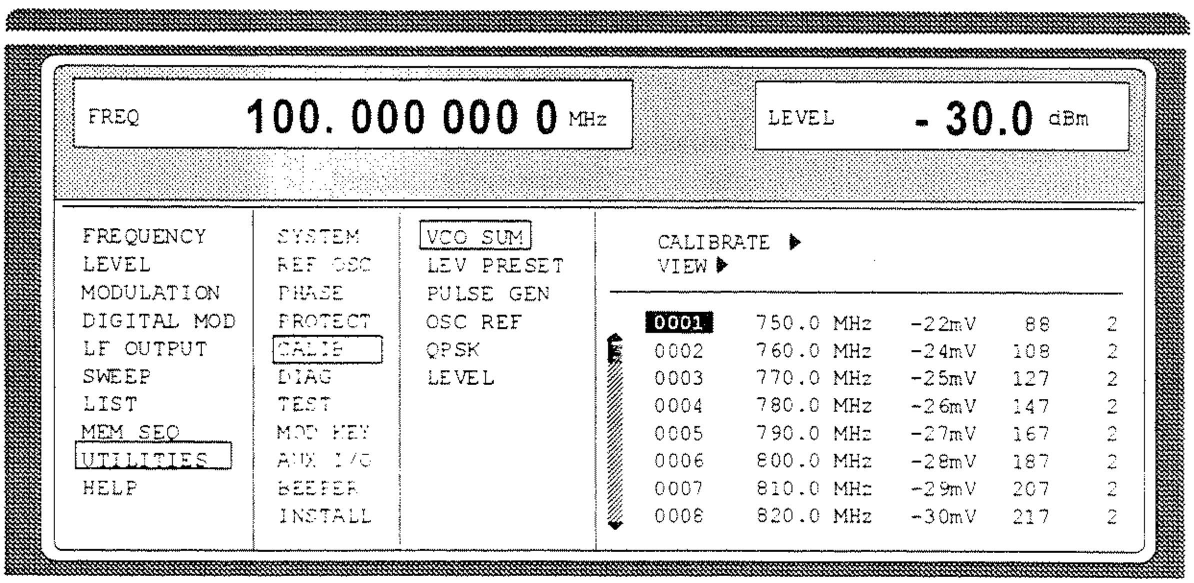


Fig. 2-68 Menu UTILITIES - CALIB - VCO SUM

CALIBRATE → Triggers the calibration for the VCO summing loop
IEC-bus short command `:CAL:VSUM?`

VIEW → Indication of the list of correction values.
The cursor wraps to index 1 of the list. The list can be executed using the rotary knob. This index can be obtained by entering the index value on the digit block.
IEC-bus short command `:CAL:VSUM:OFFS?`
`:CAL:VSUM:DAC?`
`:CAL:VSUM:KOS?`

Calibration LEV PRESET

In order to hold the amplitude modulator in the optimal working point with all frequency and level settings, a second control element is mounted by means of which the level before the modulator is set in such a way that the modulator always works in the best part of its characteristic. The setting values for the second control element are stored in a table and can be renewed using internal calibration routine LEV PRESET. The calibration routine needs only be executed in the case of a data loss in the RAM or after an exchange of modules.

Function: By alternately adjusting the two level control elements, the calibration routine determines the value for the presetting in which the amplitude modulator is operated at the attenuation demanded. The calibration is executed according to a given frequency table at levels of 13dBm to -2dBm in steps of 3 dB. The routine takes approx. 2 min.

Menu selection: UTILITIES - CALIB - LEV PRESET

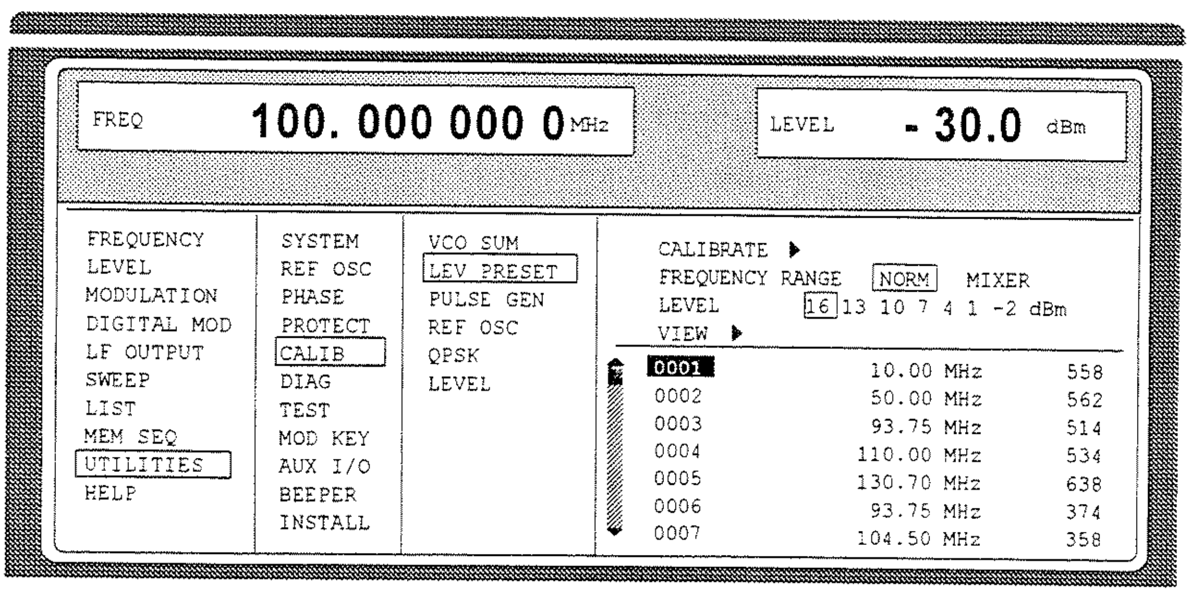


Fig. 2-69 Menu UTILITIES - CALIB - LEV PRESET

CALIBRATE → Triggers the calibration for level preset.
IEC-bus short command `:CAL:LPR?`

FREQUENCY RANGE Selection of the correction values displayed by VIEW

NORM	Correction values, with the exception of the mixer range.
MIXER	Correction values of the mixer range.

LEVEL Selection of the level for which the correction values are indicated.

VIEW ➔ The cursor wraps to index 1 of the list. The list can be executed using the rotary knob. This index can be directly obtained by entering the index value on the digit block.

IEC-bus short command :CAL:LPR:DATA?

Calibration PULSE GEN

A programmable oscillator determines the accuracy of the pulse width and the pulse delay of the pulse generator. To compensate for the temperature dependence of the oscillator (approx. 0.2%/degree) an internal calibration is offered. The adjustment accuracy is approx. ±0.5%. The calibration routine is to be executed even after a data loss in the RAM or after an exchange of modules.

Function: The frequency of the oscillator is measured using a counter which is synchronized with the crystal reference. The oscillator is readjusted until the deviation is minimized. The calibration value thus achieved is stored.

Menu selection: UTILITIES - CALIB - PULSE GEN

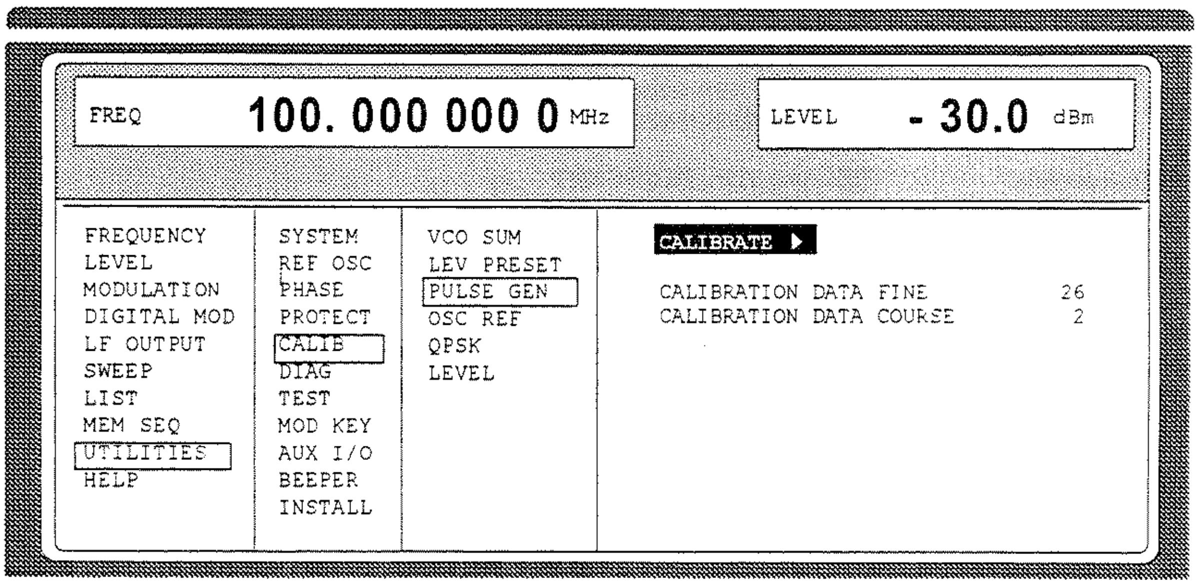


Fig. 2-70 Menu UTILITIES - CALIB - PULSE GEN

CALIBRATE ➔ Triggers the calibration for the pulse generator.

IEC-bus short command :CAL:PULS?

CALIBRATION DATA FINE Indication of the fine adjustment in decimal form.

IEC-bus short command :CAL:PULS:DATA?

CALIBRATION DATA COURSE Indication of the coarse adjustment in decimal form.

IEC-bus short command :CAL:PULS:DATA?

CALIBRATION QPSK

QPSK modulation is generated by means of frequency modulation and amplitude modulation. The delay of FM and AM signal must be tuned to each other. As the delay of the AM signal is subjected to manufacturing tolerances, the delay of the FM signal can be adjusted electronically.

Menu UTILITIES-CALIB-QPSK offers access to the delay calibration. The delay can be set in the range 0 to 10 µs in steps of 20 ns. The delay is set correctly if the spectrum of the PRBS-modulated QPSK signal at the RF output is symmetric. The typical value of the delay is 2.60 µs.

Menu selection: UTILITIES - CALIB - QPSK

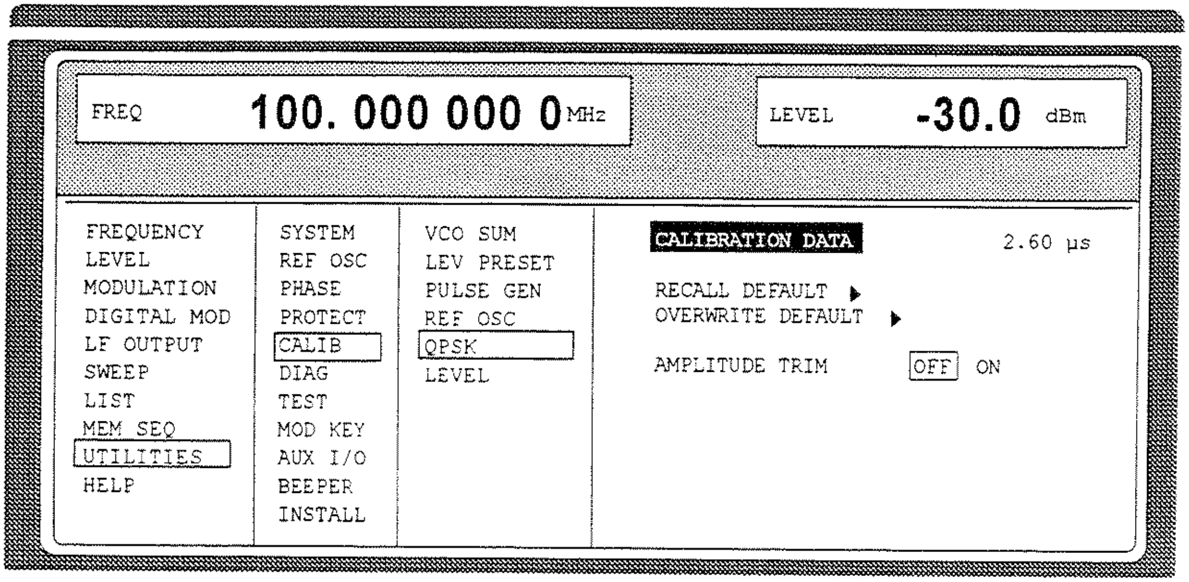


Fig. 2-71 Menu UTILITIES - CALIB - QPSK

CALIBRATION DATA

Input value of the delay compensation.

IEC-bus short command `:CAL:QPSK 2.60us`

RECALL DEFAULT →

Sets the DEFAULT value (factory setting).

IEC-bus short command `:CAL:QPSK DEF`

OVERWRITE DEFAULT →

Overwrites the DEFAULT value in the Flash-EPROM with the current DELAY value. The function is protected by PASSWORD LEVEL 2.

IEC-bus short command `:CAL:QPSK:STOR`

AMPLITUDE TRIM

Switches on/off the service function for the adjustment of the amplitude content with QPSK.

Note: *If the service function "AMPLITUDE TRIM" is switched on, this is indicated by displaying "QPSK AMPLITUDE TRIM" in the status line. An activated AM is deactivated by switching on AMPLITUDE TRIM.*

2.11.9 Indications of Module Variants (DIAG-CONFIG)

For service purposes, the modules installed can be indicated with their variants and states of modification. Submenu DIAG-CONFIG offers access to the module indication.

IEC-bus short command `:DIAG:INFO:MOD?`

Menu selection: UTILITIES - DIAG - CONFIG

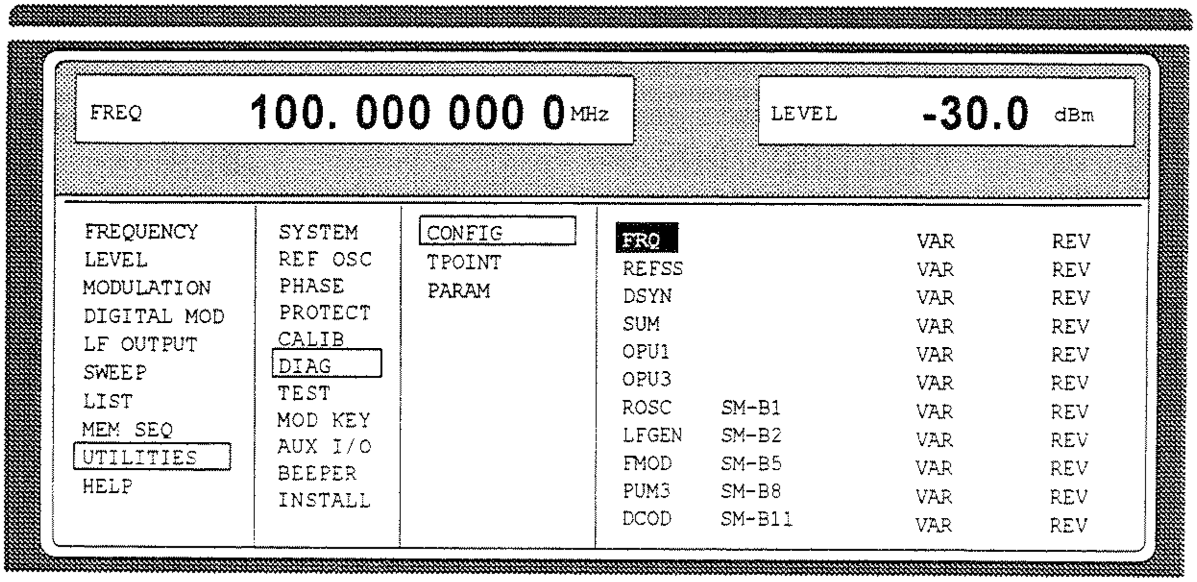


Fig. 2-72 Menu UTILITIES - DIAG - CONFIG

2.11.10 Voltage Indication of Test Points (DIAG-TPOINT)

Submenu DIAG-TPOINT offers access to internal test points. If a test point is switched on, the voltage indication is displayed in a window in the header field. For greater detail, see service manual (stock no. 1039.1856.24).

Menu selection: UTILITIES - DIAG - TPOINT

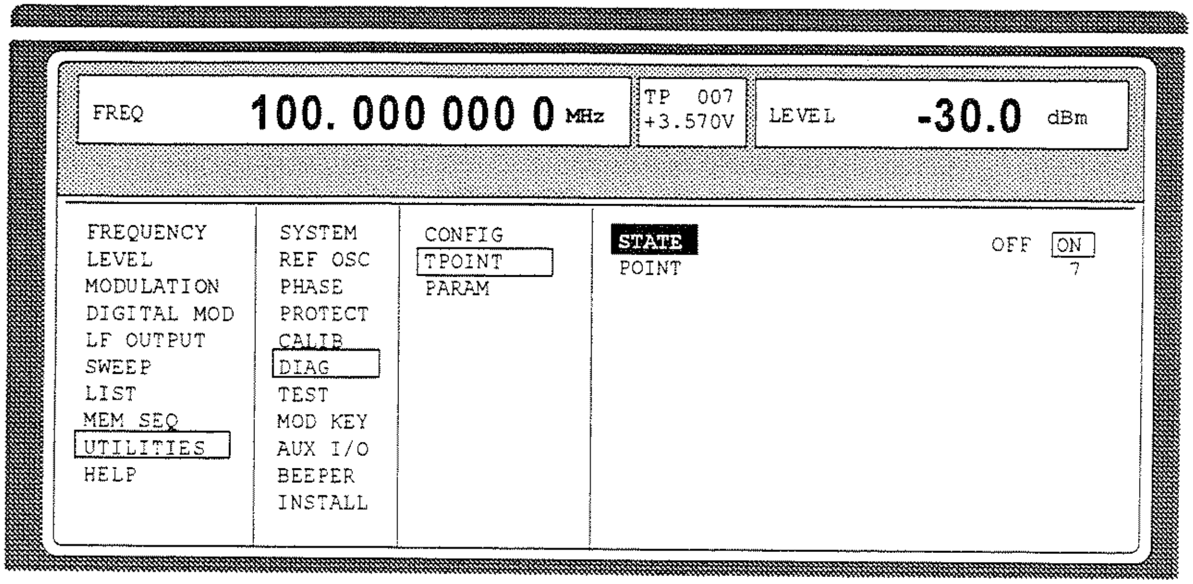


Fig. 2-73 Menu UTILITIES - DIAG - TPOINT

STATE Switching on/off the voltage indication.

POINT........... Input value of the test point.
IEC-bus short command `:DIAG:POINxx?`

2.11.11 Indications of Service Data (DIAG-PARAM)

Submenu DIAG-PARAMETER offers access to different parameters such as serial number, software version, operating-hours counter and attenuator circuits.

Menu selection: UTILITIES - DIAG - PARAM

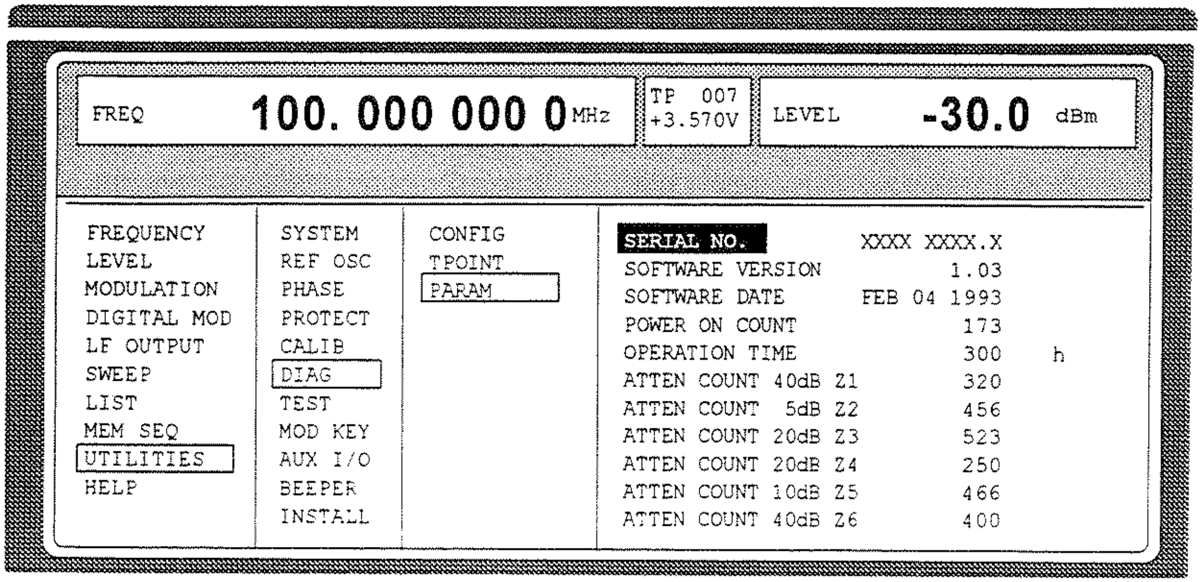


Fig. 2-74 Menu UTILITIES - DIAG - PARAM

For IEC-bus commands, cf. Chapter 3, Section "DIAGnostic System".

2.11.12 Test (TEST)

(cf. Chapter 4, Section "Functional Test")

2.11.13 Assigning Modulations to the [MOD ON/OFF] Key (MOD-KEY)

The modulations can be switched on/off in the individual modulation menus and parallely by means of the [MOD ON/OFF] key.

For which modulations the [MOD ON/OFF] key is effective can be defined in the UTILITIES-MOD KEY menu. The key can either be effective for all modulations or for a selected one.

Function of the [MOD ON/OFF] key if effective for a type of modulation:

➢ Every pressing a key alters the state (ON or OFF) of the selected modulation.

Function of the [MOD ON/OFF] key if effective for all types of modulation (ALL):

➢ If at least one modulation is switched on, pressing the [MOD ON/OFF] key switches the modulation/s off. Which modulations were switched on is stored.

  If no modulation is switched on, pressing the [MOD ON/OFF] key switches on the modulations which were last switched off using the [MOD ON/OFF] key.

On switching on using the [MOD ON/OFF] key, the modulation sources are used as defined in the modulation menus.

Access to the selection of the modulation to be switched using the [MOD ON/OFF] key is possible in the UTILITIES-MOD KEY menu.

Menu selection: UTILITIES - MOD KEY

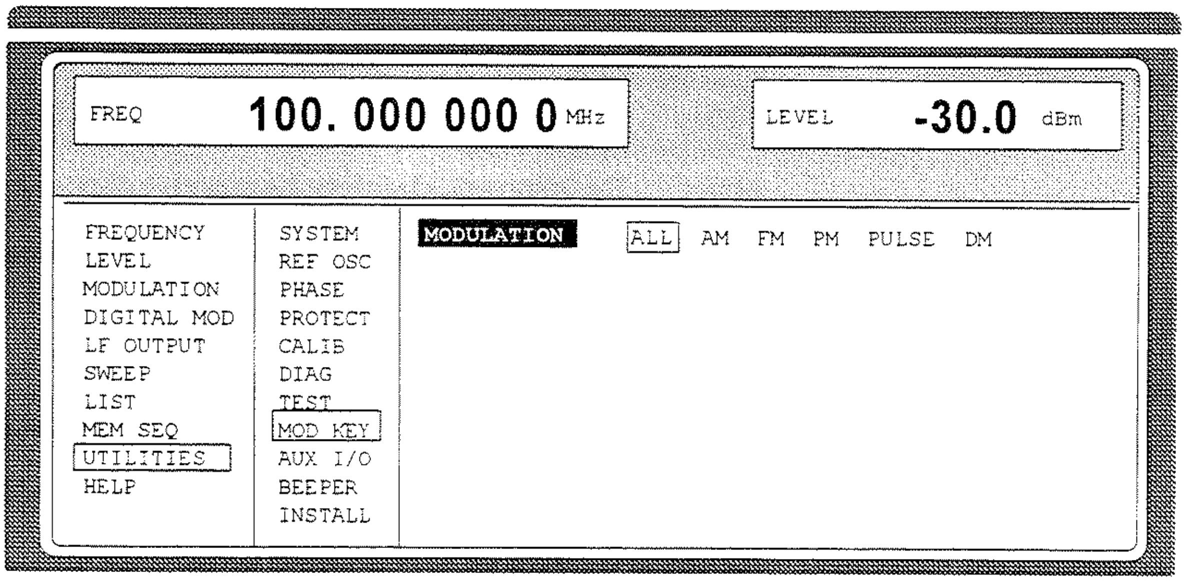


Fig. 2-75 Menu UTILITIES - MOD KEY (preset setting)

MODULATION Selection for which modulation the [MOD ON/OFF] key is to be effective.

Note: *Preset switches off all modulations, sets the selection to ALL and stores AM 30%, AM SOURCE INT: LF GEN1 as default setting.*

2.11.14 Setting Auxiliary Inputs/Outputs (AUX-I / O)

Menu UTILITIES - AUX I/O offers access to settings for the TRIGGER input, BLANK output and MARKER output. Sections Sweep, List Mode and Memory Sequence provide further information.

Menu selection: UTILITIES - AUX I/O

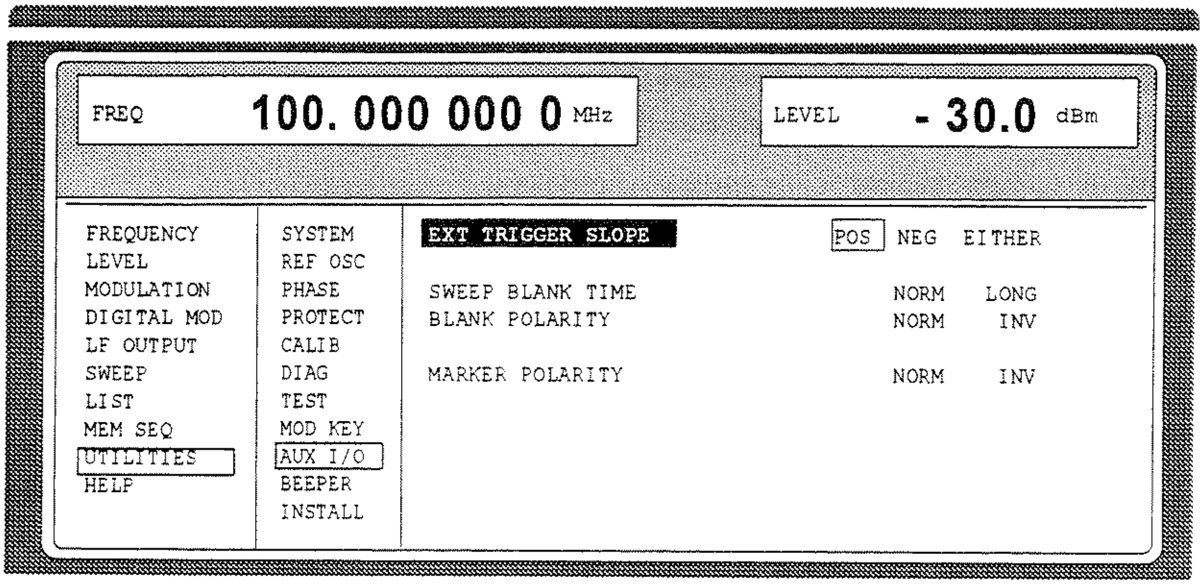


Fig. 2-76 Menu UTILITIES - AUX I/O

EXT TRIGGER SLOPE

Selection of the active edge of the external trigger signal.

POS The instrument triggers on the positive edge of the external signal.

NEG The instrument triggers on the negative edge of the external signal.

EITHER The instrument triggers on both edges of the external signal.

IEC-bus short command `:TRIG:SLOP POS`

SWEEP BLANK TIME

Selection of the blank duration.

NORM BLANK duration is set to the shortest duration possible.

LONG The BLANK duration is set for the PEN LIFT control of an XY recorder (approx. 500ms).

IEC-bus short command `:SOUR2:SWE:BTIM NORM`

BLANK POLARITY

Selection of the polarity for the blank signal.

NORM With active BLANK, the output signal is HIGH.

INV Polarity is inverted.

IEC-bus short command `:OUTP:BLAN NORM`

MARKER POLARITY

Selection of the polarity for the marker signal.

NORM The output signal is HIGH when the sweep cycle reaches the mark.

INV Polarity is inverted.

IEC-bus short command `:MARK:POL NORM`

2.11.15 Switching On/Off Beeper (BEEPER)

Menu UTILITIES-BEEPER offers access to the switching on/off of the beeper.

Note: *Preset does not alter the current state (ON or OFF).*

Menu selection: UTILITIES - BEEPER

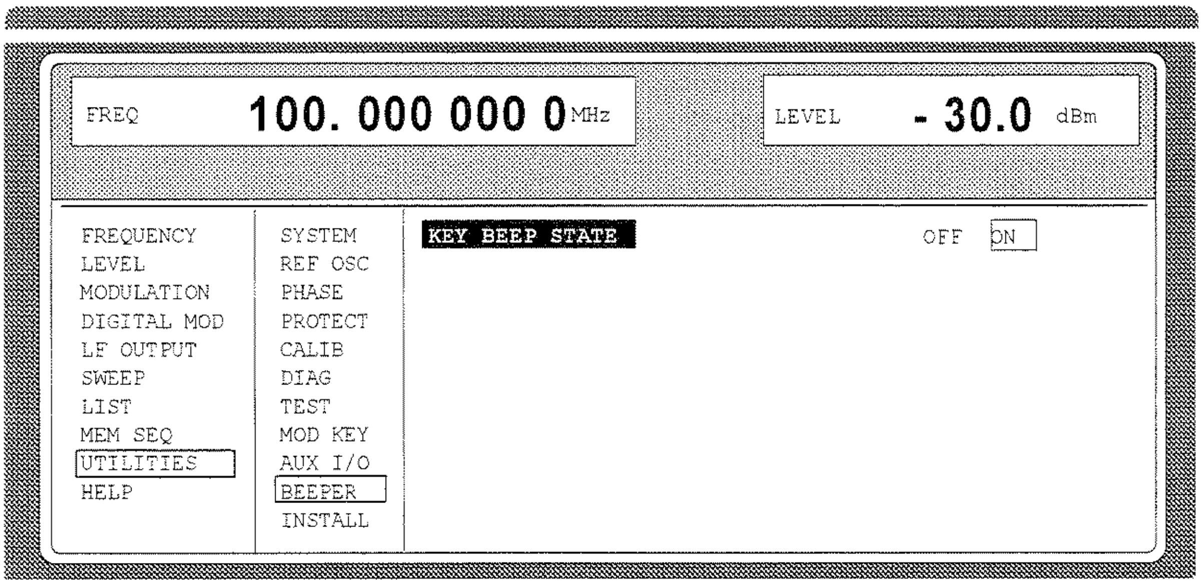


Fig. 2-77 Menu UTILITIES - BEEPER

KEY BEEP STATE Switching on/off the beeper
IEC-bus command `:SYST:BEEP:STAT ON`

2.11.16 Installation of Software Option

s are installed in the menu UTILITIES-INSTALL by means of a keyword. The keyword is part to the equipment supplied in case of a follow-up order.

Menu UTILITIES-INSTALL gives access to the keyword entry.

Menu selection: UTILITIES - INSTALL

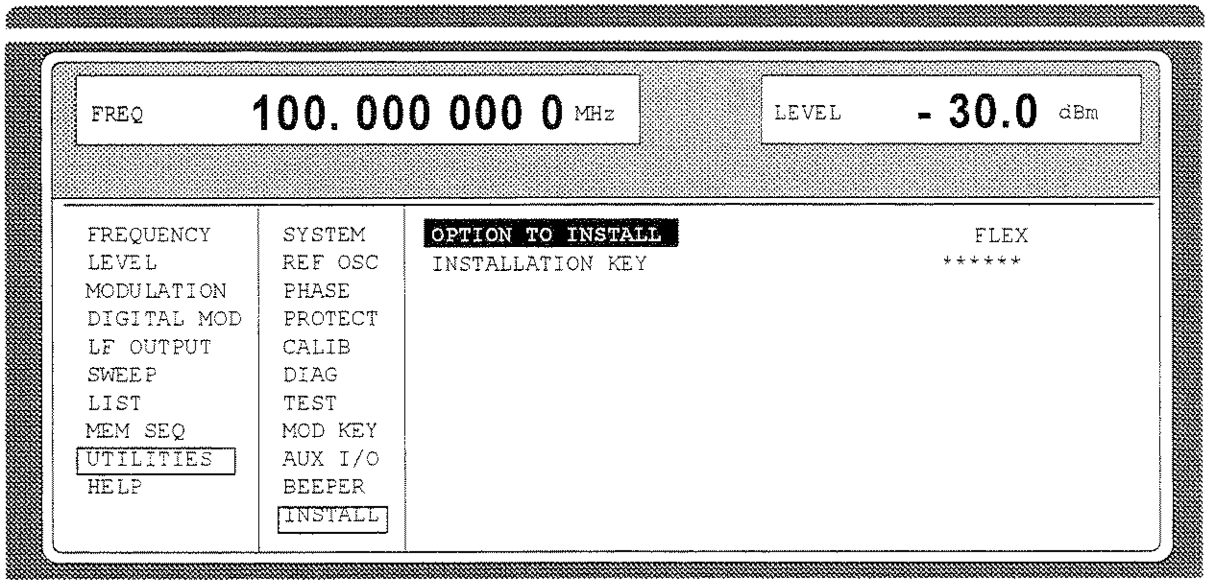


Fig. 2-78 Menu UTILITIES - INSTALL, fitted with options

OPTION TO INSTALL Selection of the option to be installed.

INSTALLATION KEY Entry of the keyword; after entry, press key [ENTER].

2.12 The Help System

The SME has two help systems. On the one hand the context-sensitive help which is called by means of the HELP key and which gives information on the current menu. On the other hand, auxiliary texts can be selected according to headwords in alphabetical order by accessing menu HELP.

HELP Key

The yellow HELP key can be pressed at any point in time. The current setting menu is faded out and context-sensitive text faded in. The help panel can be exited by means of the RETURN key.

Menu HELP

After calling the help menu, access to all auxiliary texts is possible via an index. Operation is analog to menu operation.

➢ Set the menu cursor to the index desired using the shaft encoder.

➢ Press the [SELECT] key.

➢ The information for the index marked is displayed.

➢ Press the [RETURN] key to exit the menu.

2.13 Status

By means of a STATUS page, the SME permits an overview over all settings of the instrument. The settings are displayed in an abbreviated form. The STATUS page is called by pressing the [STATUS] key. Return to the preceding menu is effected using the [RETURN] key.

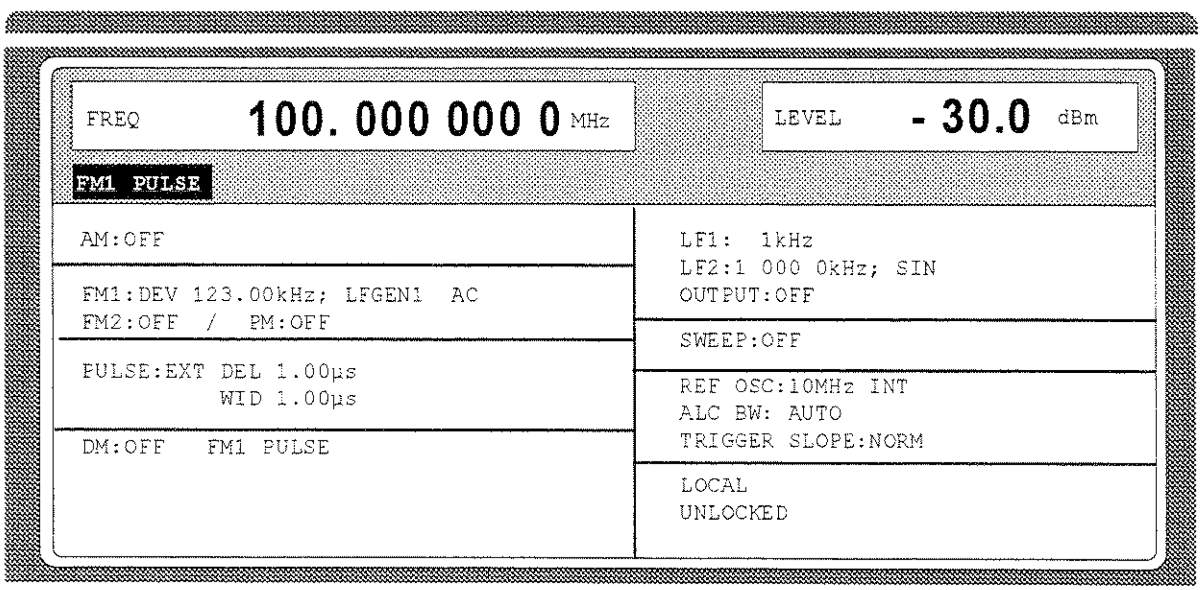


Fig. 2-79 Menu STATUS page

2.14 Error Messages

The SME displays error and caution messages in a different manner, depending on how long, for a short period of time or permanently, the cause exists.

Short-term message

The short-term message is displayed in the status line. Part of it overwrites the status indications and disappears after approx. 2 seconds or in the case of a new entry.
The instrument shows, e.g., short-term messages if the attempt is made to enter an overrange or if incompatible operating modes deactivate one another.

Long-term message

The long-term message is displayed in the status line by means of the message "WARNING" or "ERROR". Pressing the [ERROR] key calls the ERROR page in which the messages are entered. Several messages can be entered at the same time. The long-term message remains existing until there is no cause any more. The ERROR page is exited using the [RETURN] key.
The instrument displays, e.g., the long-term message "ERROR" if there is a hardware error or "WARNING" if overrange settings have been made.

Notes: – *An error message "ERROR" does not necessarily point to a defect instrument. There are various operating states which can cause an ERROR message. E. g. if the instrument is set to external reference but no external reference is connected.*

– *Error 313 indicates the loss of calibration data and is also applicable in case of a cold start (key [PRESET] is pressed during switch-on). The calibration values can be restored with internal calibration routines. These routines are accessible via menu UTILITIES-CALIB (see section on calibration).*

The ERROR page offers access to long-term messages if the [ERROR] key is pressed.

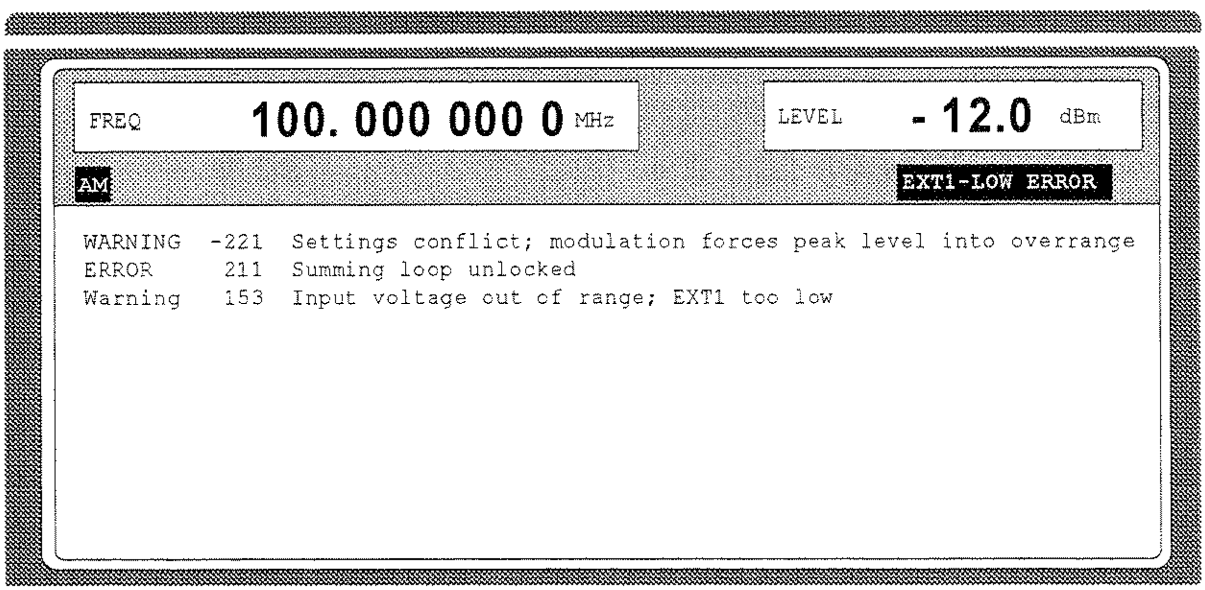


Fig. 2-80 ERROR page

A list of the possible error messages is to be found in annex B.

3 Remote Control

3.1 Introduction

The instrument is equipped with an IEC-bus interface according to standard IEC 625.1/IEEE 488.2 and a RS-232 interface. The connectors are located at the rear of the instrument and permit to connect a controller for remote control. The instrument supports the SCPI version 1994.0 (Standard Commands for Programmable Instruments). The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers (see Section 3.5.1).

This section assumes basic knowledge of IEC-bus programming and operation of the controller. A description of the interface commands is to be obtained from the relevant manuals.
The requirements of the SCPI standard placed on command syntax, error handling and configuration of the status registers are explained in detail in the respective sections. Tables provide a fast overview of the commands implemented in the instrument and the bit assignment in the status registers. The tables are supplemented by a comprehensive description of every command and the status registers. Detailed program examples of the main functions are to be found in annex D. The program examples for IEC-bus programming are all written in QuickBASIC.

Note: *In contrast to manual control, which is intended for maximum possible operating convenience, the priority of remote control is the predictability of the device status. This means that when incompatible settings (e.g. activation of PM and FM at the same time) are attempted, the command is ignored and the device status remains unchanged, i.e. is not adapted to other settings. Therefore, IEC/IEEE-bus control programs should always define an initial device status (e.g. with command *RST) and then implement the required settings.*

3.2 Brief Instructions

The short and simple operating sequence given below permits fast putting into operation of the instrument and setting of its basic functions.

3.2.1 IEC-Bus

It is assumed that the IEC-bus address, which is factory-set to 28 has not yet been changed.

1. Connect instrument and controller using IEC-bus cable.
2. Write and start the following program on the controller:

```
CALL IBFIND("DEV1", generator%)                 Open port to the instrument
CALL IBPAD(generator%, 28)                      Inform controller about instrument address
CALL IBWRT(generator%, "*RST;*CLS")             Reset instrument
CALL IBWRT(generator%, "FREQ 50MHz")            Set frequency to 50 MHz
CALL IBWRT(generator%, "POW -7.3dBm")           Set output level -7.3m dBm
CALL IBWRT(generator%, "AM:SOUR INT1")          Set AM modulation source LFGEN1
CALL IBWRT(generator%, "AM:INT1:FREQ 15kHz")    Set AM modulation source LFGEN1
CALL IBWRT(generator%, "AM 30PCT")              Set AM modulation depth 30%
CALL IBWRT(generator%, "AM:STAT ON")            Switch on AM
```

   An amplitude-modulated signal is now applied at the output of the instrument.
3. To return to manual control, press the LOCAL key at the front panel.

3.2.2 RS-232 Interface

It is assumed that the configuration of the RS-232 interface at the unit has not yet been changed.

1. Connect unit and controller using the 0-modem cable.
2. Enter the following command at the controller to configure the controller interface:
   mode com1: 9600, n, 8, 1
3. Create the following ASCII file:

	Switch instrument to remote control (Return key)
`*RST;*CLS`	Reset instrument
`FREQ 50MHz`	Set frequency 50 MHz
`POW -7.3dBm`	Set output level -7.3 dBm
`OUTP:STAT ON`	Switch on RF output
`AM:SOUR INT1`	Set AM modulation source LFGEN1
`AM:INT1:FREQ 15kHz`	Set modulation frequency 15 kHz
`AM 30PCT`	Set AM modulation depth 30%
`AM:STAT ON`	Switch on AM
	(Return key)

4. Transfer ASCII file to unit via RS-232 interface. Enter the following command at the controller:
   copy <filename> com1:
   An amplitude-modulated signal is now applied at the output of the instrument.
5. To return to manual control, press the [LOCAL] key at the front panel.

3.3 Switchover to Remote Control

On power-on, the instrument is always in the manual operating state ("LOCAL" state) and can be operated via the front panel.

The instrument is switched to remote control ("REMOTE" state)

IEC-bus as soon as it receives an addressed command from a controller.

RS-232 as soon as it receives either a carriage return <CR> (=0Dh) or a line feed <LF> (0Ah) from a controller.

During remote control, operation via the front panel is disabled. The instrument remains in the remote state until it is reset to the manual state via the front panel or via IEC bus (see Sections 3.3.1.3 and 3.3.2.3). Switching from manual operation to remote control and vice versa does not affect the remaining instrument settings.

3.3.1 Remote Control via IEC Bus

3.3.1.1 Setting the Device Address

The IEC-bus address of the instrument is factory-set to 28. It can be changed manually in the UTILITIES-SYSTEM-GPIB-ADDRESS menu or via IEC bus. Addresses 0 to 30 are permissible.

Manually:

- ➢ Call UTILITIES-SYSTEM-GPIB-ADDRESS menu
- ➢ Enter desired address
- ➢ Terminate input using the [1x/ENTER] key

Via IEC bus:

`CALL IBFIND("DEV1", generator%)`	Open port to the instrument
`CALL IBPAD(generator%, 28)`	Inform controller about old address
`CALL IBWRT(generator%, "SYST:COMM:GPIB:ADDR 20")`	Set instrument to new address
`CALL IBPAD(generator%, 20)`	Inform controller about new address

3.3.1.2 Indications during Remote Control

The state of the remote control is evident by the words "IEC REMOTE" or "LOCAL" on the STATUS page. The STATUS page is always displayed in the REMOTE state.
LOCKED indicates that the key [LOCAL] is disabled, i.e. switchover to manual operation is only possible via IEC/IEEE bus. With UNLOCKED indicated, switchover to manual control is possible via the key [LOCAL] (see also section 3.3.1.3).

3.3.1.3 Return to Manual Operation

Return to manual operation is possible via the front panel or the IEC bus.

Manually: ➢ Press the [LOCAL] key.

Notes:

- *Before switchover, command processing must be completed as otherwise switchover to remote control is effected immediately.*
- *The [LOCAL] key can be disabled by the universal command LLO (see annex A) in order to prevent unintentional switchover. In this case, switchover to manual mode is only possible via the IEC bus.*
- *The [LOCAL] key can be enabled again by deactivating the REN control line of the IEC bus (see annex A).*

Via IEC bus:

```
...
CALL IBLOC(generator%)        Set instrument to manual operation.
...
```

3.3.2 Remote Control via RS-232-Interface

3.3.2.1 Setting the Transmission Parameters

To enable an error-free and correct data transmission, the parameters of the unit and the controller should have the same setting. To prevent any problems during binary data transmission, the RS-232 interface is set for 8 data bits, no parity and 1 stop bit. This data format corresponds to the current IEEE P1174 standard. Parameters baud rate and handshake can be manually changed in menu UTILITIES-SYSTEM-RS-232.

- ➢ Call UTILITIES-SYSTEM-GPIB-RS232 menu
- ➢ Select desired baudrate and handshake
- ➢ Terminate input using the [1x/ENTER] key

3.3.2.2 Indications during Remote Control

The state of the remote control is evident by the words "RS-232 REMOTE" or "LOCAL" on the STATUS page. The STATUS page is always displayed in the REMOTE state.

3.3.2.3 Return to Manual Operating

Return to manual operation is possible via the front panel.

➢Press the [LOCAL] key.

Note: *Before switchover, command processing must be completed as otherwise switchover to remote control is effected immediately.*

3.4 Messages

The messages transferred via the data lines of the IEC bus (see annex A) can be divided into two groups:

- **interface messages** and
- **device messages.**

3.4.1 Interface Message

Interface messages are transferred on the data lines of the IEC bus, the ATN control line being active. They are used for communication between controller and instrument and can only be sent by a controller which has the IEC-bus control. Interface commands can be subdivided into

- **universal commands** and
- **addressed commands.**

Universal commands act on all devices connected to the IEC bus without previous addressing, addressed commands only act on devices previously addressed as listeners. The interface messages relevant to the instrument are listed in annex A.

Some control characters are defined for the control of the RS-232-interface (see annex A)

3.4.2 Device Messages (Commands and Device Responses)

Device messages are transferred on the data lines of the IEC bus, the "ATN" control line not being active. ASCII code is used. The device messages are largely identical for the two interfaces (IEC bus and RS232) .
A distinction is made according to the direction in which they are sent on the IEC bus:

– **Commands** are messages the controller sends to the instrument. They operate the device functions and request information.
The commands are subdivided according to two criteria:

1. According to the effect they have on the instrument:

   Setting commands cause instrument settings such as reset of the instrument or setting the output level to 1 volt.

   Queries cause data to be provided for output on the IEC-bus, e.g. for identification of the device or polling the active input.

2. According to their definition in standard IEEE 488.2:

   Common Commands are exactly defined as to their function and notation in standard IEEE 488.2. They refer to functions such as management of the standardized status registers, reset and selftest.

   Device-specific commands refer to functions depending on the features of the instrument such as frequency setting. A majority of these commands has also been standardized by the SCPI committee (cf. Section 3.5.1).

– **Device responses** are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status (cf. Section 3.5.4).

Structure and syntax of the device messages are described in Section 3.5. The commands are listed and explained in detail in Section 3.6.

3.5 Structure and Syntax of the Device Messages

3.5.1 SCPI Introduction

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming instruments, irrespective of the type of instrument or manufacturer. The goal of the SCPI consortium is to standardize the device-specific commands to a large extent. For this purpose, a model was developed which defines the same functions inside a device or for different devices. Command systems were generated which are assigned to these functions. Thus it is possible to address the same functions with identical commands. The command systems are of a hierarchical structure. Fig. 3-1 illustrates this tree structure using a section of command system SOURce, which operates the signal sources of the devices. The other examples concerning syntax and structure of the commands are derived from this command system.
SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic basic elements as well as the common commands defined in this standard. Part of the syntax of the device responses is defined with greater restrictions than in standard IEEE 488.2 (see Section 3.5.4, Responses to Queries).

3.5.2 Structure of a Command

The commands consist of a so-called header and, in most cases, one or more parameters. Header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

Note: *The commands used in the following examples are not in every case implemented in the instrument.*

Common Commands

Common commands consist of a header preceded by an asterisk "*" and one or several parameters, if any.

Examples:

`*RST`	RESET, resets the device
`*ESE 253`	EVENT STATUS ENABLE, sets the bits of the event status enable registers
`*ESR?`	EVENT STATUS QUERY, queries the contents of the event status register.

Device-specific commands

Hierarchy:

Device-specific commands are of hierarchical structure (see Fig. 3-1). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system.

Example: `SOURce` This key word denotes the command system `SOURce`.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual key words being separated by a colon ":".

Example: `SOURce:FM:EXTernal:COUPling AC`

This command lies in the fourth level of the SOURce system. It sets the coupling of the external signal source to AC.

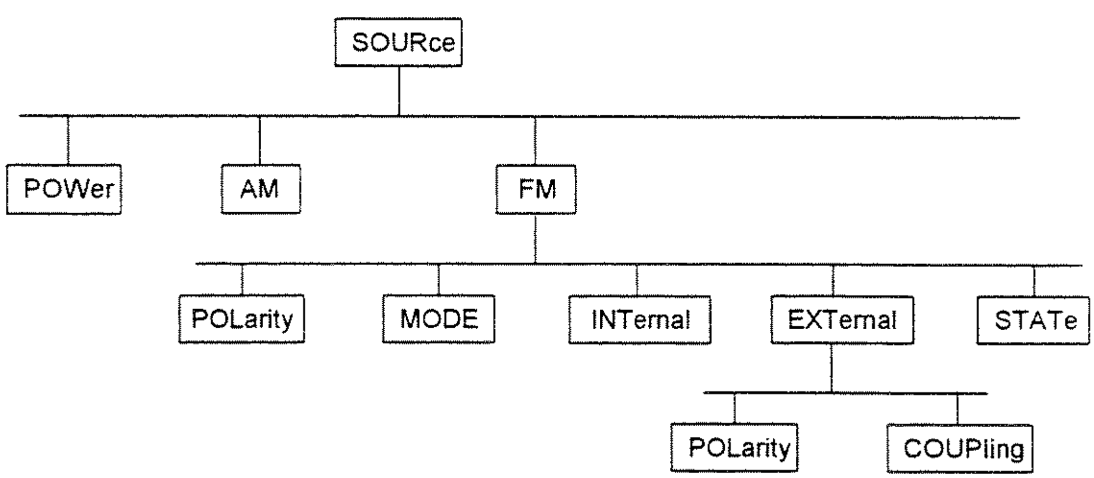


Fig. 3-1 Tree structure of the SCPI command systems using the SOURce system by way of example

Some key words occur in several levels within one command system. Their effect depends on the structure of the command, that is to say, at which position in the header of a command they are inserted.

Example: `SOURce:FM:POLarity NORMal`
This command contains key word POLarity in the third command level. It defines the polarity between modulator and modulation signal.

`SOURce:FM:EXTernal:POLarity NORMal`
This command contains key word POLarity in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated.

Optional key words: Some command systems permit certain key words to be optionally inserted into the header or omitted. These key words are marked by square brackets in the description. The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by these optional key words.

Example: `[SOURce]:POWer[:LEVel][:IMMediate]:OFFSet 1`
This command immediately sets the offset of the signal to 1 volt. The following command has the same effect:
`POWer:OFFSet 1`

Note: *An optional key word must not be omitted if its effect is specified in detail by a numeric suffix.*

Long and short form: The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permissible.

Example: `STATus:QUEStionable:ENABle 1= STAT:QUES:ENAB 1`

Note: *The short form is marked by upper-case letters, the long form corresponds to the complete word. Upper-case and lower-case notation only serve the above purpose, the instrument itself does not make any difference between upper-case and lower-case letters.*

Parameter: The parameter must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. For a description of the types of parameter, refer to Section 3.5.5.

Example: `SOURce:POWer:ATTenuation? MAXimum` Response: `60`
This query requests the maximal value for the attenuation.

Numeric suffix: If a device features several functions or features of the same kind, e.g. inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1.

Example: `SOURce:FM:EXTernal2:COUPling AC`
This command sets the coupling of the second external signal source.

3.5.3 Structure of a Command Line

A command line may consist of one or several commands. It is terminated by a <New Line>, a <New Line> with EOI or an EOI together with the last data byte. Quick BASIC automatically produces an EOI together with the last data byte.

Several commands in a command line are separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon.

Example:
`CALL IBWRT(generator%, "SOURce:POWer:CENTer MINimum;:OUTPut:ATTenuation 10")`

This command line contains two commands. The first command is part of the SOURce system and is used to specify the center frequency of the output signal. The second command is part of the OUTPut system and sets the attenuation of the output signal.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels (see also Fig. 3-1). The colon following the semicolon must be omitted in this case.

Example:
`CALL IBWRT(generator%, "SOURce:FM:MODE LOCKed;:SOURce:FM:INTernal:FREQuency 1kHz")`

This command line is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SOURce command system, subsystem FM, i.e. they have two common levels.
When abbreviating the command line, the second command begins with the level below SOURce:FM. The colon after the semicolon is omitted.

The abbreviated form of the command line reads as follows:

`CALL IBWRT(generator%, "SOURce:FM:MODE LOCKed;INTernal:FREQuency 1kHz")`

However, a new command line always begins with the complete path.

Example:
```
CALL IBWRT(generator%, "SOURce:FM:MODE LOCKed")
CALL IBWRT(generator%, "SOURce:FM:INTernal:FREQuency 1kHz")
```

3.5.4 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

1. The requested parameter is transmitted without header.
   Example: `SOURce:EXTernal:COUPling?` Response: `AC`
2. Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.
   Example: `FREQuency? MAX` Response: `10E3`
3. Numerical values are output without a unit. Physical quantities are referred to the basic units or to the units set using the Unit command.
   Example: `FREQuency?` Response: `1E6` for 1 MHz
4. Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).
   Example: `OUTPut:STATe?` Response: `1`
5. Text (character data) is returned in a short form (see also Section 3.5.5).
   Example: `SOURce:FM:SOURce?` Response: `INT1`

3.5.5 Parameter

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numerical values, Boolean parameters, text, character strings and block data. The type of parameter required for the respective command and the permissible range of values are specified in the command description (see Section 3.6).

Numerical values

Numerical values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not permissible. In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also permissible), K (kilo), M (milli), U (micro) and N (nano). It the unit is missing, the basic unit is used.

Example: `SOURce:FREQuency 1.5 kHz = SOURce:FREQuency 1.5E3`

Special numerical values

The texts MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numerical values.

In the case of a query, the numerical value is provided.

Example: Setting command: `SOURce:VOLTage MAXimum`
Query: `SOURce:VOLTage?` Response: `15`

MIN/MAX — MINimum and MAXimum denote the minimum and maximum value.

DEF — DEFault denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the *RST command.

UP/DOWN — UP, DOWN increases or reduces the numerical value by one step. The step width can be specified via an allocated step command (see annex C, List of Commands) for each parameter which can be set via UP, DOWN.

INF/NINF — INFinity, Negative INFinity (NINF) represent the numerical values -9.9E37 or 9.9E37, respectively. INF and NINF are only sent as device responses.

NAN — Not a Number (NAN) represents the value 9.91E37. NAN is only sent as device response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Boolean Parameters

Boolean parameters represent two states. The ON state (logically true) is represented by ON or a numerical value unequal to 0. The OFF state (logically untrue) is represented by OFF or the numerical value 0. 0 or 1 is provided in a query.

Example: Setting command: `SOURce:FM:STATe ON`
Query: `SOURce:FM:STATe?` Response: `1`

Text

Text parameters observe the syntactic rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example: Setting command: `OUTPut:FILTer:TYPE EXTernal`
Query: `OUTPut:FILTer:TYPE?` Response: `EXT`

Strings

Strings must always be entered in quotation marks (' or ").

Example: `SYSTem:LANGuage "SCPI"` or
`SYSTem:LANGuage 'SCPI'`

Block data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example: `HEADer:HEADer #45168xxxxxxxx`

ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all End or other control signs are ignored until all bytes are transmitted. Data elements comprising more than one byte are transmitted with the byte being the first which was specified by SCPI command "`FORMat:BORDer`".

The format of the binary files within the block depends on the IEC-bus command
The commands

:SOURce:LIST:DWELl
:SOURce:LIST:FREQuency
:SOURce:LIST:POWer
:SOURce:CORRection:CSET:DATA:FREQuency
:SOURce:CORRection:CSET:DATA:POWer
:SYSTem:MSEQuence:DWELl
:SYSTem:MSEQuence:RCL

use the IEEE-754 format for double precision floating point numbers. Each number is represented by 8 bytes.

Example:

a# = 125.345678E6
b# = 127.876543E6

```
CALL IBWRT(generator%, "SOURCE:CORRECTION:CSET:DATA:FREQ #216" + MKD$(a#) + MKD$(b#))
```

- '#' in the command string introduces the binary block,
- '2' indicates that 2 digits specifying the length will follow next,
- '16' is the length of the binary block (in bytes), here: 2 double precision floating pooint number with 8 bytes each.
- The actual binary data follow now. As the function IBWRT requires a text string, MKD$ is used for the type conversion.

The following ASCII format has the same effect:

```
CALL IBWRT(generator%, "SOURCE:CORRECTION:CSET:DATA:FREQ 125.345678E6, 127.876543E6")
```

The commands

:SOURce:DM:DATA:DATA
:SOURce:DM:DATA:ATTenuate
:SOURce:DM:DATA:BURSt

use a bit-by-bit format. The data transmitted are evaluated byte by byte from the left to the right and from the MSBit to the LSBit.

Example:

The following sequence of modulation data is to be transmitted as a binary block:

01010101	00110011	00001111	11111111	00000000	(binary representation)
55	33	0F	FF	00	(hexadecimal rep.)

The QuickBASIC-command reads:

```
CALL  IBWRT(generator%,  "SOURCE:DM:DATA:DATA    #15"+CHR$
(&h55)+CHR$(&h33)+CHR$(&h0F) +CHR$(&hFF)+CHR$(&h00))
```

- "#' introduces the binary block.
- "1' indicates that 1 digit specifying the length will follow next,
- "5' is the length of the binary block (in bytes).
- 'The actual binary data follow now. As the function IBWRT requires a text string, CHR$ is used for the type conversion.

The following ASCII format has the same effect:

```
CALL  IBWRT(generator%,  "SOURCE:DM:DATA:DATA    0,1,0,1,0,
1,0,1,0,0,1,1,0,0,1,1,0,0,0,0,1,1,1,1,
1,1,1,1,1,1,1,1,0,0,0,0,0,0,0,0")
```

However, the binary representation is more compact and transmitted faster.

The number of data bits must be an integer multiple of 8 because, according to IEEE 488.2, binary blocks allow transmission of integer bytes only. Eventually, the binary block must be filled up to the next byte; the spare bits can then be deleted manually.

3.5.6 Overview of Syntax Elements

The following survey offers an overview of the syntax elements.

:	The colon separates the key words of a command. In a command line the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands of a command line. It does not alter the path.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*	The asterix marks a common command.
"	Quotation marks introduce a string and terminate it.
#	ASCI character # introduces block data.
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.

3.6 Description of Commands

3.6.1 Notation

In the following sections, all commands implemented in the instrument are first listed in tables and then described in detail, separated according to the command system. The notation corresponds to the one of the SCPI standards to a large extent. The SCPI conformity information can be taken from the list of commands in annex C.

Table of Commands

Command: In the command column, the table provides an overview of the commands and their hierarchical arrangement (see indentations).

Parameter: In the parameter column the requested parameters are indicated together with their specified range.

Unit: The unit column indicates the basic unit of the physical parameters.

Remark: In the remark column an indication is made on
- whether the command does not have a query form,
- whether the command has only one query form ,
- whether this command is implemented only with a certain option of the instrument.

Indentations

The different levels of the SCPI command hierarchy are represented in the table by means of indentations to the right. The lower the level is, the farther the indentation to the right is. Please observe that the complete notation of the command always includes the higher levels as well.

Example: `SOURce:FM:MODE` is represented in the table as follows:

`SOURce`	first level
`  :FM`	second level
`    :MODE`	third level

In the individual description, the complete notation of the command is given. An example for each command is written out at the end of the individual description.

Upper/lower case notation

Upper/lower case letters serve to mark the long or short form of the key words of a command in the description (see Section 3.5.2). The instrument itself does not distinguish between upper and lower case letters.

Special characters |

A selection of key words with an identical effect exists for several commands. These key words are indicated in the same line, they are separated by a vertical stroke. Only one of these key words has to be indicated in the header of the command. The effect of the command is independent of which of the key words is indicated.

Example:
```
SOURce
:FREQuency
    :CW|:FIXed
```

The two following commands of identical meaning can be formed. They set the frequency of the constantly frequent signal to 1 kHz:

`SOURce:FREQuency:CW 1E3 = SOURce:FREQuency:FIXed 1E3`

A vertical stroke in indicating the parameters marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is entered.

Example: Selection of the parameters for the command
`SOURce:COUPling AC | DC`

If parameter AC is selected, only the AC content is fed through, in the case of DC, the DC as well as the AC content.

[ ] Key words in square brackets can be omitted when composing the header (cf. Section 3.5.2, Optional Keywords). The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.
Parameters in square brackets can optionally be incorporated in the command or omitted as well.

{ } Parameters in braces can optionally be incorporated in the command either not at all, once or several times.

3.6.2 Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. Same commands have the same effect on different devices. The headers of these commands consist of an asterisk "*" followed by three letters. Many common commands refer to the status reporting system which is described in detail in Section 3.8.

Table 3-1 Common Commands

Command	Parameter	Unit	Remark
*CLS			No query
*ESE	0 to 255		
*ESR?			Only query
*IDN?			Only query
*IST?			Only query
*OPC			
*OPT?			Only query
*PRE	0 to 255		
*PSC	0 | 1		
*RCL	0 to 50		No query
*RST			No query
*SAV	1 to 50		No query
*SRE	0 to 255		
*STB?			Only query
*TRG			No query
*TST?			Only query
*WAI			

***CLS**

CLEAR STATUS sets the status byte (STB), the standard event register (ESR) and the EVENt-part of the QUEStionable and the OPERation register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer

***ESE** 0 to 255

EVENT STATUS ENABLE sets the event status enable register to the value indicated. Query *ESE? returns the contents of the event status enable register in decimal form.

***ESR?**

STANDARD EVENT STATUS QUERY returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.

***IDN?**

IDENTIFICATION QUERY queries the instrument identification.
The device response is for example: `"Rohde&Schwarz, SME03,00000001, 1.03"`
03 = variant identification
00000001= serial number
1.03 = firmware version number

***IST?**

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form (0 | 1). The IST flag is the status bit which is sent during a parallel poll (cf. Section 3.8.3.2).

***OPC**

OPERATION COMPLETE sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request (cf. Section 3.7).

***OPT?**

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas. For every option, a fixed position is provided in the response.

Table 3-2 Device Response to *OPT?

Position	Option	
1	SM-B1	Reference oscillator OCXO
2	SM-B2	LF generator
3	SM-B2	2nd LF generator
4	SM-B3	Pulse modulator 1.5 GHz
5	SM-B4	Pulse generator
6	SM-B5	FM/PM modulator
7	SM-B6	Multifunction generator
8	SM-B8	Pulse modulator 3 GHz
9	SM-B9	Pulse modulator 6 GHz
10	SME-B11	DM coder
11	SME-B12	DM memory extension

Example for a device response: 0,SM-B2,0, 0,0,SM-B5,0,0,0,0,0

***PRE** 0 to 255

PARALLEL POLL REGISTER ENABLE sets the parallel poll enable register to the value indicated. Query *PRE? returns the contents of the parallel poll enable register in decimal form.

***PSC** 0 | 1

POWER ON STATUS CLEAR determines whether the contents of the ENABle registers is maintained or reset in switching on.

*PSC = 0	causes the contents of the status registers to be maintained. Thus a service request can be triggered in switching on in the case of a corresponding configuration of status registers ESE and SRE.
*PSC ≠ 0	resets the registers.

Query *PSC? reads out the contents of the power-on-status-clear flag. The response can be 0 or 1.

***RCL** 0 to 50

RECALL calls the instrument state which was stored under the number supplied using command *SAV. 50 instrument states can be stored.

***RST**

RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the [PRESET] key. The state of the RF-output is an exception: The RF-output is deactivated after *RST, however, it is activated after the [RESET] key has been pressed. The default setting is indicated in the description of the commands.

***SAV** 1 to 50

SAVE stores the current instrument state under the number indicated (cf. *RCL as well).

***SRE** 0 to 255

SERVICE REQUEST ENABLE sets the service request enable register to the value indicated. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is triggered. Query *SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

***STB?**

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

***TRG**

TRIGGER triggers all actions waiting for a trigger event. Special trigger events can be started by command system "TRIGger" (see section "TRIGger System").

***TST?**

SELF TEST QUERY triggers all selftests of the instrument indicated in Chapter 4, Section "Functional Test" and outputs an error code in decimal form.

***WAI**

WAIT-to-CONTINUE only permits the servicing of the subsequent commands after all preceding commands have been executed and all signals have settled (cf. Section 3.7 and "*OPC" as well).

3.6.3 ABORt System

The ABORt system contains the commands to abort actions triggered. After an action has been aborted, it can be triggered again at once. All commands trigger an event, thus they have no *RST value.

Further commands for the trigger system of the SME can be found in the TRIGger system.

Command	Parameter	Default Unit	Remark
:ABORt			
[:SWEep]			No query
:LIST			No query
:MSEQuence			No query
:DM			No query / option SME-B11
:XMEM			No query / option SME-B12

:ABORt[:SWEep]

The command aborts a sweep.

Example: `:ABOR:SWE`

:ABORt:LIST

The command aborts a list execution.

Example: `:ABOR:LIST`

:ABORt:MSEQuence

The command aborts a Memory Sequence.

Example: `:ABOR:MSEQ`

:ABORt:DM

The command aborts the single execution of a DM list. The command always relates to the digital type of modulation currently set using `SOURce:DM:TYPE` .

Example: `:ABOR:DM`

:ABORt:XMEM

The command aborts the recording of data into the DM memory extension, list "XMEM".

Example: `:ABOR:XMEM`

3.6.4 CALibration-System

The CALibration system contains the commands to calibrate the SME. On triggering the calibration by means of `:MEASure` , response "0" displays a faultless calibration, response "1" means that an error has occurred during calibration. As to the meaning of the data in the case of query `:DATA?`, cf. Chapter 2, Section "Calibration".

Command	Parameter	Default Unit	Remark
:CALibration			
:QPSK			Option SME-B11
[:DATA]	0 to 10 000 ns | DEFault	s	
:STORe			
:LEVel			
:DATA?			Query only
:FRANge	NORMal | MIXer		
:PMODulator	ON | OFF		
:STATe	ON | OFF		
:LPReset			
[:MEASure]?			Query only
:DATA?			Query only
:PULSe			Option SM-B4
[:MEASure]?			Query only
:DATA?			Query only
:ROSCillator			
[:DATA]	0 to 4095		
:VSUMmation			
[:MEASure]?			Query only
:OFFS?			Query only
:DAC?			Query only
:KOS?			Query only

:CALibration:QPSK

The commands to set the calibration value for the QPSK modulator are under this node.

:CALibration:QPSK[:DATA] 0 to 10 000 ns | DEFault

The command enters the calibration data. The number specifies a delay for the digital FM signal. DEFault can also be indicated instead of a time. Then the value saved in the FLASH memory is used.

Example: `:CAL:QPSK:DATA 10 000ns`

:CALibration:QPSK:STORe

The command saves the delay presently set under [:DATA] as a default value in the FLASH memory.

Example: `:CAL:QPSK:STOR`

:CALibration:LEVel

This node provides the commands for the management of the level correction table. The corresponding data are permanently stored in the instrument and cannot be changed. The instrument includes different level correction tables. The tables to be used are selected depending on the set frequency and the pulse modulator switched on (internal or external). The `:FRANge` and `:PMODulator` commands select the level correction tables to be read out using the `DATA?` command. These commands simulate the current instrument status but do not have any influence on the instrument setup. The `:STATe ON` command activates the level correction table corresponding to the real instrument setup.

:CALibration:LEVel:DATA?

The command queries the level correction data. It returns all level correction data in the format fixed in the :FORMat system. The other commands under this node determine the list that is returned.

Example: `:CAL:LEV:DATA?`

:CALibration:LEVel:FRANge NORMal | MIXer

The command selects the level correction table valid for a frequency in the NORMal or in the MIXer range.

Example: `:CAL:LEV:FRAN NORM` *RST value is NORMal

:CALibration:LEVel:PMODulator ON | OFF

The command selects the level correction table valid for an instrument setup with the pulse modulator ON or OFF.

Example: `:CAL:LEV:PMOD OFF` *RST value is OFF

:CALibration:LEVel:STATe ON | OFF

The command switches on or off internal level correction. *RST value is ON.

Example: `:CAL:LEV:STAT OFF`

:CALibration:LPReset

The commands to measure the values for the level presetting table are under this node (Level PReset).

:CALibration:LPReset[:MEASure]?

The command triggers a calibration measurement. The command triggers an event and thus has no *RST value.

Example: `:CAL:LPR:MEAS?` Response: 0

:CALibration:LPReset:DATA?

The command queries the correction data. It returns all correction data in the format fixed in the :FORMat system.

Example: `:CAL:LPR:DATA?`

:CALibration:PULSe

The commands to calibrate the pulse generator are under this node (option SM-B4).

:CALibration:PULSe[:MEASure]?

The command triggers a calibration measurement. The command triggers an event and thus has no *RST value.

Example: `:CAL:PULS:MEAS?` Response: `0`

:CALibration:PULSe:DATA?

The command queries the correction data. It returns the correction data as two integers separated by a comma. The first number indicates the fine adjustment, the second the coarse adjustment.

Example: `:CAL:PULS:DATA?` Response: `26,2`

:CALibration:ROSCillator

The commands to calibrate the reference oscillator are under this node.

:CALibration:ROSCillator[:DATA] 0 to 4095

The command enters the correction data. For an exact definition of the calibration value, cf. Section 2.

Example: `:CAL:ROSC:DATA 2048`

:CALibration:VSUMmation

The commands to determine the support values for the frequency setting are under this node.

:CALibration:VSUMmation[:MEASure]?

The command triggers a calibration measurement. The command triggers an event and thus has no default setting value.

Example: `:CAL:VSUM:MEAS?` Response: `0`

:CALibration:VSUMmation:OFFS?
:CALibration:VSUMmation:DAC?
:CALibration:VSUMmation:KOS?

The commands query the calibration data (refer to service manual 1039.1856.24). They output all calibration data in the format set in FORMat system.

Example: `:CAL:VSUM:OFFS?`

3.6.5 DIAGnostic-System

The DIAGnostic system contains the commands for diagnostic test and service of the instrument. SCPI does not define DIAGnostic commands, the commands listed here are SME-specific. All DIAGnostic commands are queries which are not influenced by *RST. Hence no default setting values are stated.

Command	Parameter	Default Unit	Remark
:DIAGnostic			
:INFO			
:CCOunt			
:ATTenuator1|2|3|4|5|6?			Query only
:POWer?			Query only
:MODules?			Query only
:OTIMe?			Query only
:SDATe?			Query only
[:MEASure]			
:POINt?			Query only
:XMEM			
:CHECksum			
:CALCulate?			Query only
[:TOTal]?			Query only
:DATA?			Query only
:ATTenuate?			Query only
:BURSt?			Query only

:DIAGnostic:INFO

The commands which can be used to query all information which does not require hardware measurement are under this node.

:DIAGnostic:INFO:CCOunt

The commands which can be used to query all counters in the instrument are under this node (Cycle COunt).

:DIAGnostic:INFO:CCOunt:ATTenuator 1 | 2 | 3 | 4 | 5 | 6?

The command queries the number of switching processes of the different attenuator stages. The stages are designated with Z1 to Z6 within the instrument. In this command they are differentiated by a numeric suffix whose name corresponds to the number:

Suffix	Name	Function
1	Z1	40-dB stage
2	Z2	20-dB stage
3	Z3	5-dB stage
4	Z4	20-dB stage
5	Z5	10-dB stage
6	Z6	40-dB stage

Example: `:DIAG:INFO:CCO:ATT1?` Response: `1487`

:DIAGnostic:INFO:CCOunt:POWer?

The command queries the number of switch-on processes.

Example: `:DIAG:INFO:CCO:POW?` Response: `258`

:DIAGnostic:INFO:MODules?

The command queries the modules existing in the instrument with their model and state-of-modification numbers. The response supplied is a list in which the different entries are separated by commas. The length of the list is variable and depends on the equipment of the instrument. Each entry consists of three parts which are separated by means of blanks:

1. Name of module; 2. Variant of module in the form VarXX (XX = 2 digits)
3. Revision of module in the form RevXX (XX = 2 digits)

Example `:DIAG:INFO:MOD?` Response: FRO Var01 Rev00, DSYN Var03 Rev12, to

:DIAGnostic:INFO:OTIMe?

The command reads out the internal operating-hours counter. The response supplies the number of hours the instrument has been in operation up to now.

Example: `:DIAG:INFO:OTIM?` Response: `19`

:DIAGnostic:INFO:SDATe?

The command queries the date of software creation. The response is returned in the form year, month, day.

Example: `:DIAG:INFO:SDAT?` Response: `1992, 12, 19`

:DIAGnostic:[:MEASure]

The commands which trigger a measurement in the instrument and return the measured value are under this node.

:DIAGnostic[:MEASure]:POINt?

The command triggers a measurement at a measuring point and returns the voltage measured. The measuring point is specified by a numeric suffix (cf. service manual, stock no. 1039.1856.24).

Example: `:DIAG:MEAS:POIN2?` Response: `3.52`

:DIAGnostic:XMEM:CHECksum

The command for calculating and querying the checksum are provided in this node. Contrary to the display in local mode, the values are returned as decimal numbers.

:DIAGnostic:XMEM:CHECksum:CALCulate?

This command triggers the calculation of all four checksums. The results depend on the start and stop addresses selected and on the operating mode of the memory extension. This command is recommended whenever a checksum is to be read out and when setups or memory extension data have been modified since the last calculation.

Example: `:DIAG:XMEM:CHEC:CALC`

:DIAGnostic:XMEM:CHECksum[:TOTal]?

This command queries the overall checksum for the memory extension. Beforehand, the checksum has to be calculated using `:CALCulate`.

Example: `:DIAG:XMEM:CHEC?` Response: `178034`

:DIAGnostic:XMEM:CHECksum:DATA?

This command queries the overall checksum for the DATA section of the memory extension data. In the 8M*1 mode, this checksum is identical with the overall checksum. Beforehand, the checksum has to be calculated using `:CALCulate`.

Example: `:DIAG:XMEM:CHEC:DATA?` Response: `10043`

:DIAGnostic:XMEM:CHECksum:ATTenuate?

This command queries the overall checksum for the ATTenuate section of the memory extension data. In the 8M*1 mode, this checksum is 0. Beforehand, the checksum has to be calculated using `:CALCulate`.

Example: `:DIAG:XMEM:CHEC:ATT?` Response: `97134`

:DIAGnostic:XMEM:CHECksum:BURSt?

This command queries the overall checksum for the BURSt section of the memory extension data. In the 8M*1 mode, this checksum is 0. Beforehand, the checksum has to be calculated using `:CALCulate`.

Example: `:DIAG:XMEM:CHEC:BURS?` Response: `28601`

3.6.6 DISPLAY-System

This system contains the commands to configure the screen. If system security is activated using command `SYSTem:SECurity ON`, the display cannot be switched on and off arbitrarily (cf. below)

Command	Parameter	Default Unit	Remark
:DISPlay			
:ANNotation			
[:ALL]	ON | OFF		
:AMPLitude	ON | OFF		
:FREQuency	ON | OFF		

:DISPlay:ANNotation

The commands determining whether frequency and amplitude are indicated are under this node.

Caution: *With SYSTem:SECurity ON, the indications cannot be switched from OFF to ON. In this case *RST does not influence the ANNotation settings either. With SYSTem:SECurity OFF, the *RST value is ON for all ANNotation parameters.*

:DISPlay:ANNotation[:ALL] ON | OFF

The command switches the frequency and amplitude indication on or off.

Command `:DISPlay:ANNotation:ALL ON` can only be executed if `SYSTem:SECurity` is set to `OFF`.

With `SECurity OFF` - *RST value is ON.

Example: `:DISP:ANN:ALL ON`

:DISPlay:ANNotation:AMPLitude ON | OFF

The command switches on or off the amplitude indication.

Command `:DISPlay:ANNotation:AMPLitude ON` can only be executed if `SYSTem:SECurity` is set to `OFF`.

With `SYSTem:SECurity OFF` - *RST value is ON.

Example: `:DISP:ANN:AMPL ON`

:DISPlay:ANNotation:FREQuency ON | OFF

The command switches on or off the amplitude indication.

Command `:DISPlay:ANNotation:AMPLitude ON` can only be executed if `SYSTem:SECurity` is set to `OFF`.

With `SYSTem:SECurity OFF` - *RST value is ON.

Example: `:DISP:ANN:FREQ ON`

3.6.7 FORMat-System

This system contains the commands determining the format of the data the SME returns to the controller. All queries returning a list of numeric data or block data are concerned. With each of these commands, this connection is pointed to in the description.

Command	Parameter	Default Unit	Remark
:FORMat			
[:DATA]	ASCii | PACKed		
:BORDer	NORMal | SWAPped		

:FORMat[:DATA] ASCii | PACKed

The command specifies the data format, that the SME uses for returning the data. When data are transmitted from the controller to the SME, the SME recognizes the data format automatically. In this case, the value specified here has no significance.

Note: *Settings using the FORMat:DATA command are only effective for commands with which this is stated in the command description.*

ASCii Numeric data are transmitted in plain text, separated by commas.

PACKed Numerical data are transmitted as binary block data. The format of the binary data itself is command-specific. Its description can be found in Section 3.5.5.

Example: `:FORM:DATA ASC` *RST value is ASCii

:FORMat:BORDer NORMal | SWAPped

This command defines the order of bytes inside a binary block. This concerns only blocks which use the IEEE754 format internally (see section 3.5.5, paragraph "Block Data").

NORMal: The SME expects (for setting commands) and sends (for queries) first the most significant byte of each IEEE-754 floating point number, last the least significant byte. For hosts based on a 80x86 processor this corresponds to the configuration of bytes in the main memory. Thus, no further conversion is required.

SWAPped: The SME expects (for setting commands) and sends (for queries) first the least significant byte of each IEEE754 floating point number, last the most significant byte.

Example: `:FORMat:BORDer:NORMal` *RST-value is NORMal

3.6.8 MEMory System

This system contains the commands for the memory management of the SME.

Command	Parameter	Default Unit	Remark
:MEMory :NSTates?			Query only

:MEMory:NSTates?

The command returns the number of *SAV/*RCL memories available. The SME has 50 *SAV/*RCL memories in total.

Example: `:MEM:NST?` Response: `50`

3.6.9 OUTPut-System

This system contains the commands specifying the characteristics of the RF output socket and the BLANk socket. The characteristics of the LF socket are specified in the OUTPut2 system.

Command	Parameter	Default Unit	Remark
:OUTPut			
:AMODe	AUTO | FIXed		
:BLANk			
:POLarity	NORMal | INVerted		
:IMPedance?			Query only
:PROTection			
:CLEar			
:TRIPped?			Query only
[:STATe]	ON | OFF		
:PON	OFF |UNCHanged		

:OUTPut:AMODe AUTO | FIXed

The command switches over the operating mode of the attenuator at the RF output (Attenuator MODe).

AUTO The attenuator is switched whenever possible.

FIXed The attenuator is switched when certain fixed levels are exceeded/fallen below.

Example: `:OUTP:AMOD AUTO` *RST value is AUTO

:OUTPut:BLANk:POLarity NORMal | INVerted

The command sets the polarity of the BLANk signal.

NORMal The active BLANk state is indicated by the more positive or higher output voltage.

INVers The active BLANk state is indicated by the more negative or lower output voltage.

Example: `:OUTP:BLAN:POL NORM` RST value is NORM

:OUTPut:IMPedance?

The command queries the impedance of the RF output

. This permits converting the output level between units V and W. The impedances cannot be changed. With the SME, this is the fixed value of 50 Ohm for the RF output.

Example: `:OUTP:IMP?` Response: `50`

:OUTPut:PROTection

The commands to configure the protective circuit are under this node. The RF output is protected by a protective circuit which deactivates the output if an overvoltage is supplied from outside. This does not change the value of `OUTPut:STATe`.

:OUTPut:PROTection:CLEar

The command resets the protective circuit after it has been triggered. The state of the output is determined by `OUTPut:STATe` again. The command triggers an event and hence has no default setting value.

Example: `:OUTP:PROT:CLE`

:OUTPut:PROTection:TRIPped?

The command queries the state of the protective circuit. The responses mean:

"0" The protective circuit has not responded

"1" The protective circuit has responded

Example: `:OUTP:PROT:TRIP?` Response: `"1"`

:OUTPut[:STATe] ON | OFF

The command switches on or off the RF output. The RF output can also be switched off by the response of the protective circuit. But this has no influence on this parameter.

Note: *In contrast to the PRESET key, command *RST sets this value to OFF, the output is deactivated.*

Example: `:OUTP:STAT ON` *RST value is OFF

:OUTPut[:STATe]:PON OFF | UNCHanged

This command selects the state the RF output is to assume after power-on of the unit. It only exists for the RF output. *RST does not influence the set value.

OFF Output is switched off.

UNCHanged Same state as before switch- off

Example: `:OUTP:PON OFF`

3.6.10 OUTPut2 System

This system contains the commands specifying the characteristics of the LF output socket

Command	Parameter	Default Unit	Remark
:OUTPut2			
:SOURce	0 | 2		Option SM-B2
:STEReo	MPX | PILot		Option SM-B6
[:STATe]	ON | OFF		Option SM-B6
:VOLTage	0 V to 4 V	V	

:OUTPut2:SOURce 0 | 2

This command selects which LF generator is connected with the LF output socket (only with option SM-B2 and SM-B6).

0 LF generator 1

2 LF generator 2 *RST value is 0, LF-generator 1 is connected at the output.

Example: `:OUTP2:SOUR 2`

:OUTPut2:SOURce:STEReo MPX | PILot

The command determines whether the complete stereo multiplex signal (MPX) or only the pilot tone is output. The command is only effective if LF generator2 is in the STEREO operating mode and if LF generator2 is selected for OUTPut2:SOURce as well.

Example: `:OUTP2:SOUR:STER MPX` *RST value is MPX

:OUTPut2[:STATe] ON | OFF

The command switches the LF output on or off. *RST value is OFF

Example: `:OUTP2:STAT ON`

:OUTPut2:VOLTage 0V to 4V

The command sets the voltage of the LF output. The voltage is a characteristic of the output, not the source. I.e., it is maintained even if another LF generator is connected to the output.

Example: `:OUTP2:VOLT 3.0V` *RST value is 1 V

3.6.11 SOURce-System

This system contains the commands to configure the RF signal source. Keyword SOURce is optional, i.e., it can be omitted. The LF signal sources (options SM-B2 and SM-B6) are configured in the SOURce0|2 system (cf. Section 3.6.12).

The following subsystems are realized in the instrument:

Subsystem	Settings
[:SOURce]	
:AM	Amplitude modulation
:CORRection	Correction of the output level
:DM	Digital modulation
:ERMes	ERMES signal
:FLEX	FLEX signal
:FM	Frequency modulation
:FREQuency	Frequencies including sweep
:ILS	Test signals for ILS (Instrument Landing System)
:LIST	LIST operating mode
:MARKer	Marker generation with sweeps
:MBE	Marker signals (Marker Beacon)
:PHASe	Phase between output signal and reference oscillator signal
:PM	Phase modulation
:POCSag	Post Office Code Standardisation Advisory Group)
:POWer	Output level, level control and level correction
:PULM	Pulse modulation
:PULSe	Pulse generator
:ROSCillator	Reference oscillator
:STEReo	Stereo modulation
:SWEep	Sweeps
:VOR	Test signals for VOR (VHF Omnidirectional Range)

3.6.11.1 SOURce:AM Subsystem

This subsystem contains the commands to control the amplitude modulation. Up to two LF generators which serve as internal modulation sources can be fitted in the instrument (options SM-B2 and SM-B6). Part of their settings is effected under SOURce0|2.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:AM			
[:DEPTh]	0 to100PCT	PCT	
:EXTernal			
:COUPling	AC | DC		
:INTernal1|2			
:FREQuency	400 Hz, 1 kHz, 4 kHz, 15 kHz or	Hz	
	0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz		Option SM-B2 or B6
:POLarity	NORMal | INVerted		
:SOURce	EXT | INT1|2 | EXT, INT1|2		
:STATe	ON | OFF		

[:SOURce]:AM[:DEPTh] 0 to 100PCT

The command sets the modulation depth in percent. *RST value is 30PCT

Example: `:SOUR:AM:DEPT 15PCT`

[:SOURce]:AM:EXTernal

The commands to set the external AM input are under this node.

[:SOURce]:AM:EXTernal:COUPling AC | DC

The command selects the type of coupling for the external AM input.

AC The d.c. voltage content is separated from the modulation signal.

DC The modulation signal is not altered. *RST value is AC

Example: `:SOUR:AM:EXT:COUP AC`

[:SOURce]:AM:INTernal1|2

The settings for the internal AM inputs are effected under this node.

INT1 is LF generator 1,

INT2 is LF generator 2.

Here the same hardware is set for AM, PM, FM and SOURce0|2. This means that, for example, the following commands are coupled with each other and have the same effect:

```
SOUR:AM:INT2:FREQ
SOUR:FM2:INT:FREQ
SOUR:PM2:INT:FREQ
SOUR2:FREQ:CW
```

[:SOURce]:AM:INTernal1|2:FREQuency 400 Hz | 1 kHz | 3 kHz | 15 kHz or
0.1 Hz to 500 kHz (option SM-B2)or
0.1 Hz to 1MHz (option SM-B6)

The command sets the modulation frequency. Only certain specified ranges are permissible depending on the equipment of the instrument.

If neither SM-B2 nor SM-B6 are fitted, only INT1 is permissible and values 400 Hz, 1 kHz, 3 kHz and 15 kHz are true. With option SM-B2, the specified range from 0.1 Hz to 500 kHz is true, with SM-B6, from 0.1 Hz to 1 MHz. *RST value is 1 kHz

Example: `:SOUR:AM:INT:FREQ 15kHz`

[:SOURce]:AM:POLarity NORMal | INVerted

The command selects the polarity of the AM.

NORMal A positive modulation voltage generates a higher output level.

INVerted The AM polarity is inverted.

Example: `:SOUR:AM:POL NORM` *RST value is NORMal

[:SOURce]:AM:SOURce EXT | INT1|2 | EXT, INT1|2

The command selects the modulation source. INT1 is LF generator 1, INT2 LF generator 2 (option SM-B2 or SM-B6). An external and an internal modulation source can be indicated at the same time (see example). *RST value is INT1

Example: `:SOUR:AM:SOUR INT1, EXT`

[:SOURce]:AM:STATe ON | OFF

The command switches amplitude modulation on or off. *RST value is OFF

Example: `:SOUR:AM:STAT ON`

3.6.11.2 SOURce:CORRection Subsystem

The CORRection subsystem permits a correction of the output level. The correction is effected by adding user-defined table values to the output level as a function of the RF frequency. In the SME, this subsystem serves to select, transmit and switch on USER-CORRECTION tables (see Chapter 2, Section "User Correction (UCOR)" as well).

Command	Parameter	Default Unit	Remark
[:SOURce]			
:CORRection			
[:STATe]	ON | OFF		
:CSET			
:CATalog?			Query only
[:SELect]	"Name of table"		
:DATA			
:FREQuency	5 kHz to 1.5 GHz {,5 kHz to 1.5 GHz}	Hz	SME03/06: to 3/6 GHz
:POWer	-40 dBto 6dB {,-40 dBto 6dB}	dB	
:DELete	"Name of table"		

[:SOURce]:CORRection[:STATe] ON | OFF

The command switches the table selected using `SOURce:CORRection:CSET` on or off.

Example: `:SOUR:CORR:STAT ON` *RST value is OFF

[:SOURce]:CORRection:CSET

The commands to select and edit the UCOR tables are under this node.

[:SOURce]:CORRection:CSET:CATalog?ß

The command requests a list of UCOR tables. The individual lists are separated by means of commas. This command is a query and has no *RST value.

Example: `:SOUR:CORR:CAT?` Answer: `"UCOR1", "UCOR2", "UCOR3"`

[:SOURce]:CORRection:CSET[:SELect] "Name of table"

The command selects a UCOR table. This command alone does not yet effect a correction. First the table selected must be activated (cf. `:SOURce:CORRection:STATe`). If there is no table of this name, a new table is created. The name may contain up to 7 letters. This command triggers an event and hence has no *RST value.

Example: `:SOUR:CORR:CSET:SEL "UCOR1"`

[:SOURce]:CORRection:CSET:DATA

The commands to edit the UCOR tables are under this node.

[:SOURce]:CORRection:CSET:DATA:FREQuency 5 kHz to 1.5 GHz {,5 kHz to 1.5 GHz}
SME03/06: to 3/6 GHz

The command transmits the frequency data for the table selected using `:SOURce:CORRection:CSET`. *RST does not influence data lists.

Example: `:SOUR:CORR:CSET:DATA:FREQ 100MHz,102MHz,103MHz,to`

[:SOURce]:CORRection:CSET:DATA:POWer -40dB to 6dB {,-40dB to 6dB}

The command transmits the level data for the table selected using `:SOURce:CORRection:CSET`. *RST does not influence data lists.

Example: `:SOUR:CORR:CSET:DATA:POWer 1dB, 0.8dB, 0.75dB,to`

[:SOURce]:CORRection:CSET:DELete "Name of table"

The command deletes the table indicated from the instrument memory. This command triggers an event and hence has no *RST value.

Example: `:SOUR:CORR:CSET:DEL "UCOR2"`

3.6.11.3 SOURce:DM Subsystem

In this subsystem, the types of digital modulation are checked. A difference is made between basic modulations (GMSK, GFSK, QPSK, FSK, 4FSK and FFSK) and complex modulations (ERMES, FLEX, POCSAG). The common characteristics of all basic modulations are set under node [:BASic], the common characteristics of all complex modulations under :COMPlex. An external input, an internal pseudo-random sequence generator and an internal data generator are available as data source for the basic modulations.

Note: *The signal generator SME42 (Id No. 1038.6002.42) is a special model for ERMES, FLEX, FLEX-TD and POCSAG. The options SME-B11 (DM coder), SME-B12 (DM expanded memory), SME-B41 (FLEX protocol) and SME-B42 (POCSAG protocol) have been integrated in the SME42 as standard.*
Only the command MGRoup? and the commands of node SOURce:DM:COMPlex are available when using the SME42.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:DM			Option SME-B11
:MGRoup?			Query only
[:BASic]			
:TYPE	GMSK | GFSK | QPSK | FSK | FSK4 | FFSK		
:STATe	ON | OFF		
:SOURce	EXTernal | PRBS | DATA		
:CLOCk			
:MODE	BIT | SYMBol		
:POLarity	NORMal | INVerted		
:SOURce	INTernal | COUPled		
:DATA			
:CATalog?			Query only
:DELete	"Name"		
:ALL			
:FREE?			Query only
:SELect	"Name"		
:DATA	0 | 1 {, 0 | 1}		
:POINts?			Query only
:ATTenuate	0 | 1 {, 0 | 1}		
:POINts?			Query only
:BURSt	0 | 1 {, 0 | 1}		
:POINts?			Query only
:ALEVel	0 to 60 dB	dB	
:MODE	NORM | MAX		
:XMEM			Option SME-B12
:STARt	1 to 8388478 | 1 to 1048558		
:LENGth	3 to 8388480 | 3 to 1048560		
:AUTO	ON | OFF		
:MODE	DATA | ALL		
:RECord			No query
:TRIGger	ON | OFF		
:SLOPe	POSitive | NEGative		
:PRBS			
[:LENGth]	9 | 15 | 20 | 21 | 23		

Command	Parameter	Default Unit	Remark
[:SOURce]			
:DM			Option SME-B11
:COMPlex			
:CLOCk			
[:SOURce]	INT | EXT		
:GMSK			
:STANdard	GSM | PCN | CDPD | MC9 | MOBitex | DSRR | MD24 to MD192		No query
:BRATe	2.4 to 1000kb/s	b/s	
:FILTer	0.2 | 0.25 | 0.3 | 0.4 | 0.5		
:DCODer	ON | OFF		
:GSLope	ON | OFF		
:POLarity	NORMal | INVerted		
:GFSK			
:STANdard	DECT | CT2 | CT3		No query
:BRATe	10 to 585 kb/s | 640 to 1170 kb/s	b/s	
:FILTer	0.4 | 0.5 | 0.6		
:DEViation	14 | 14.4 | 18 | 20 | 25.2 | 160 | 180 | 202 | 259 | 288 | 317 | 403 kHz	Hz	
:POLarity	NORMal | INVerted		
:QPSK			
:STANdard	NADC | PDC | TFTS | APCO | TETRa | INMarsat | MSAT		No query
:TYPE	QPSK | OQPSk | PI4Qpsk | PI4Dqpsk		
:BRATe	1 to 24.3 kbps | 27.0 to 48.6 kbps	b/s	
:CODing	NADC | TFTS | PDC | APCO | TETRa | INMarsat | MSAT		
:FILTer	COS|SCOS, 0.35|0.4|0.5|0.6 | COS,0.2		
:POLarity	NORMal | INVerted		
:FSK			
:STANdard	POCSag512 | POCSag1200 | POCSag2400 | CITYruf512 | CITYruf1200 | CITYruf2400 | FLEX1600 | FLEX3200		No query
:BRATe	0.05 to 1900 kb/s | 0.05 to 90 kb/s	b/s	
:DEViation	0.01 to 400 kHz	Hz	
:FILTer	GAUSs, 2.73 | BESSel, 1.22|2.44 | OFF		
:POLarity	NORMal | INVerted		
:FSK4			
:STANdard	ERMes | APCO | MODacom | FLEX3200 | FLEX6400		No query
:CODing	ERMes | APCO | MODacom | FLEX		
:BRATe	1 to 24.3 kb/s | 27.0 to 48.6 kb/s	b/s	
:DEViation	0.01 to 400 kHz	Hz	
:FILTER	BESSel, 1.22|1.25|2.44 | COS|SCOS, 0.2		
:POLarity	NORMal | INVerted		
:FFSK			
:STANdard	POCSag		No query
:DEViation	1.5 | 2.0 | 3.0 | 3.5 | 4.0 | 4.5 kHz	Hz	
:BRATe	0.05 to 90 kb/s	b/s	

[:SOURce]:DM:MGRoup?

The command queries the selected type of modulation. „BAS" is returned for the basic modulations GFSK, GMSK, QPSK, FSK, FSK4, and FFSK. „COMP" is returned for the complex protocols ERMES, FLEX, and POCSAG. The command is a query and hence has no *RST value.

Example: `:SOUR:DM:MGR?` Response: „`BAS`"

[:SOURce]:DM[:BASic]

The commands that are also valid for modulations GMSK, GFSK, DQPSK, FSK, FSK4 and FFSK are under this node.

[:SOURce]:DM[:BASic]:TYPE GMSK | GFSK | QPSK | FSK | FSK4 | FFSK

The command selects the type of basic modulation.

GMSK Gaussian Minimum Shift Keying

GFSK Gaussian Frequency Shift Keying

QPSK Quad Phase Shift Keying, a special form of PSK. The key word :DQPSk is also accepted.

FSK Frequency modulation with exactly two states

FSK4 Frequency modulation with exactly four states, designated as 4 FSK in the manual control.

FFSK Fast Frequency Shift Keying, a special form of FSK

Example: `:SOUR:DM:BAS:TYPE FSK` *RST value is GMSK

[:SOURce]:DM[:BASic]:STATe ON | OFF

The command switches on or off the modulation selected under `:SOURce:DM[:BASic]:TYPe`.

Example: `:SOUR:DM:BAS:STAT OFF` *RST value is OFF

[:SOURce]:DM[:BASic]:SOURce EXTernal | PRBS | DATA

The command selects the data source.

Note: *Even if PRBS is selected, the burst output and the level reduction continue to be controlled by the list selected under :SOURce:DM[:**BASic**]:DATA.*

Example: `:SOUR:DM:BAS:SOUR PRBS` *RST value is PRBS

[:SOURce]:DM[:BASic]:CLOCk

The commands to set the data source for the time base used are under this node

[:SOURce]:DM[:BASic]:CLOCk:MODE BIT | SYMBol

The command sets the clock operating mode. Bit and symbol clock pulse are only different in the case of modulations possessing more than two states, i.e. requiring more than one bit to code each state. Hence the command only has an effect on QPSK and FSK4.

BIT For each bit, a complete clock cycle is executed.

SYMBol A complete clock cycle is executed for n bits each (one symbol) (symbol clock pulse). *RST value is BIT

Example: `:SOUR:DM:BAS:CLOC:MODE BIT`

[:SOURce]:DM[:BASic]:CLOCk:POLarity NORMal | INVerted

The command sets the polarity of the time base used.

NORMal The data are accepted with a rising edge (external clock) or can be tapped at the DATA socket with a rising edge (internal clock).

INVerted The data are accepted with a falling edge (external clock) or can be tapped at the DATA socket with a falling edge (internal clock).

Example: `:SOUR:DM:BAS:CLOC:POL NORM` *RST value is NORMal

[:SOURce]:DM[:BASic]:CLOCk:SOURce INTernal | COUPled

The command selects the source for the DATA clock.

INTernal The internal clock generator is used. The CLOCK socket is switched to act as an output.

COUPled The function of the CLOCK socket depends on the function of the DATA socket. This means that with an external supply of the data, the clock has to be supplied externally, with internal data generation the instrument itself generates the clock pulse. *RST value is COUPled

Example: `:SOUR:DM:BAS:CLOC:SOUR INT`

[:SOURce]:DM[:BASic]:DATA

The commands to set the data generator are under this node. The bit rate at which the data are output is to be set under the individual modulations.

The DM lists consists of a DATA, BURSt and ATTenuate content. The list contents must all be of the same length except for contents of length 1. With QPSK, the number of entries has to be an integer in addition. This is interpreted as if the content_had the same length as the other contents and all values were equal to the first value.

However, this is not valid for list "XMEM" offering access to the memory extension (cf. node `SOURce:DM:BAS:DATA:XMEM`).

[:SOURce]:DM[:BASic]:DATA:CATalog?

The command queries the data lists available. The response supplied is an enumeration of the data lists separated by commas. *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:CAT?` Answer: `"DLIST1", "DLIST2", "DLIST3"`

[:SOURce]:DM[:BASic]:DATA:DELete "Name"

This command deletes the data list indicated. *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:DEL "DLIST2"`

[:SOURce]:DM[:BASic]:DATA:DELete:ALL

This command deletes all data lists, with the exception of list "XMEM" (cf Chapter 2, Section "DM Memory Extension"). *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:DEL:ALL`

[:SOURce]:DM[:BASic]:DATA:FREE?

This command deletes all data lists, with the exception of list "XMEM" (cf Chapter 2, Section "DM Memory Extension"). *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:FREE?` Answer: `2400, 200`

[:SOURce]:DM[:BASic]:DATA:SELect "Name"

This command selects the data list indicated. Working with the data list is only possible after selection. If the list indicated does not exist yet, it is generated. The name may contain up to seven letters.

List "XMEM" calls the DM memory extension (option SME-B12) (cf. Chapter 2, Section "DM memory extension"). *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:SEL "DLIST1"`

[:SOURce]:DM[:BASic]:DATA:DATA 0 | 1 {, 0 | 1}

This command transmits the bit data the data generator outputs bit by bit to the data list selected or to the memory area of the DM memory extension indicated (selection list "XMEM", definition of the memory area under `:DM:BAS:DATA:XMEM`). Only numbers 0 or 1 are permissible. The data can also be transmitted as block data. 8 bit data each are combined to form a byte, with the first bit date having to be saved in the most significant bit of the first data byte. The following examples of commands are equal. If the data are to be returned as block data, this has to be set in the FORMat system. In the case of binary-block transmission, only lists with a length of integral multiples of 8 can be loaded; when the data are returned, the last byte is filled if necessary. RST has no influence on data lists.

Example:

`:SOUR:DM:BAS:DATA:DATA 0,1,1,0,0,0,0,1,0,1,0,1,1,0,0,0,0,0,1,0,1,1,0,1`

`:SOUR:DM:BAS:DATA:DATA #13aX-`

[:SOURce]:DM[:BASic]:DATA:DATA:POINts?

This command queries the length (in items) of the DATA list presently selected. The command is a query and thus has no *RST value.

Example: `:SOUR:DM:BAS:DATA:DATA:POIN?` Answer: `200`

[:SOURce]:DM[:BASic]:DATA:ATTenuate 0 | 1 {, 0 | 1}

This command transmits the bit edgedata the data generator uses for the decision of whether the level is to be reduced or not (see `SOURce:DM:BAS:DATA:ALEVel as well`). List "XMEM", DM memory extension, can only be written into with ATTenuate data if `DM:BAS:DATA:XMEM:MODE` is set to `ALL`.Only numbers 0 or 1 are permissible. The data can also be transmitted as block data (cf. DATA). *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:ATT 1,1,1,0,0,0,0,...`

[:SOURce]:DM[:BASic]:DATA:ATTenuate:POINts?

This command queries the length (in items) of the ATTenuate list presently selected. The command is a query and thus has no *RST value.

Example: `:SOUR:DM:BAS:DATA:ATT:POIN?` Answer: `200`

[:SOURce]:DM[:BASic]:DATA:BURSt 0 | 1 {, 0 | 1}

The command transmits the burst data output at the BURSt output socket. List "XMEM", DM memory extension, can only be written into with BURSt data if `DM:BAS:DATA:XMEM:MODE` is set to ALL. Only numbers 0 or 1 are permissible. "1" corresponds to high level at the burst socket. The data can also be transmitted as block data (cf. DATA). *RST has no influence on data lists.

Example: `:SOUR:DM:BAS:DATA:BURS 0,0,0,1,1,1,1 ...`

[:SOURce]:DM[:BASic]:DATA:BURSt:POINts?

This command queries the length (in items) of the BURSt list presently selected. The command is a query and thus has no *RST value.

Example: `:SOUR:DM:BAS:DATA:BURS:POIN?` Answer: `200`

[:SOURce]:DM[:BASic]:DATA:ALEVel 0 to 60 dB

This command (Attenuate LEVel) specifies the value in dB by which the level is reduced if a "1" occurs in the ATTenuate list presently active. The command is only active in the setting `DM:BAS:DATA:ALEVel:MODE NORM`.

Note: *The command also specifies the level reduction of the complex modulation POCSAG.*

Example: `:SOUR:DM:BAS:DATA:ALEV 3dB` *RST value is 0 dB

[:SOURce]:DM[:BASic]:DATA:ALEVel:MODE NORM | MAX

This command specifies the operating mode for the level reduction. In GMSK modulation, the command is only active in the setting `DM:GMSK:GSLope = OFF`.

NORM The level reduction is specified by the command `DM:BAS:DATA:ALEVel`.

MAX The level reduction is set to a maximum attenuation of >80 dB.

Example: `:SOUR:DM:BAS:DATA:ALEV:MODE MAX` *RST value is NORM

[:SOURce]:DM[:BASic]:DATA:XMEM

The commands to configure option SME-B12, DM memory extension are under this node.

[:SOURce]:DM[:BASic]:DATA:XMEM:STARt 1 to 8388478 (`XMEM:MODE = DATA`) |
1 to 1048558 (`XMEM:MODE = ALL`)

This command indicates the start address for reading and outputting the data.

Example: `:SOUR:DM:BAS:DATA:XMEM:STAR 256` *RST value is 1

[:SOURce]:DM[:BASic]:DATA:XMEM:LENGth 3 to 8388480 (`XMEM:MODE = DATA`) |
3 to 1048560 (`XMEM:MODE = ALL`)

This command indicates the length of the data sequence to be input or output. The command is only effective if `:SOUR:DM:BAS:DATA:XMEM:LENG:AUTO` is set to `OFF`. The length maximally possible depends on the selected mode of the memory space allocation and on the selected start address (cf. Chapter 2, Section "DM Memory Extension"). The minimal length is 3.

Example: `:SOUR:DM:BAS:DATA:XMEM:LENG 524280` *RST value is 3

[:SOURce]**:DM[:BASic]:DATA:XMEM:LENGth:AUTO** ON | OFF

This command switches the automatic length identification in recording the data on or off. The command is only effective with a data transmission via IEC bus, however, if the data are recorded from an external source, it is not.

ON The transmitted data specify the length of the data sequence. The instrument adjusts the value of LENGth accordingly.

OFF LENGth specifies the length of the sequence. The instrument ignores surplus data; if the data quantity is too small, it copies as many data from the beginning of the sequence as is necessary to achieve the specified sequence length.

Example: `:SOUR:DM:BAS:DATA:XMEM:LENG:AUTO OFF` *RST value is ON

[:SOURce]:DM[:BASic]:DATA:XMEM:MODE DATA | ALL

This command specifies the memory space allocation.

DATA The memory is 1 bit broad and only contains DATA data. The memory depth is 8 MBit.

ALL The memory is 3 bits broad and contains lists of all three types of data (DATA, ATTenuate and BURSt) The memory depth is 1 MBit.

Example: `:SOUR:DM:BAS:DATA:XMEM:MODE DATA` *RST value is ALL

[:SOURce]:DM[:BASic]:DATA:XMEM:RECord

This command starts the recording of external data. The data are directly transferred to the memory extension, list XMEM. The recording automatically stops when the end address is reached. The recording can be aborted using command `:ABORt:XMEM`. The setting under `:DM:BAS:DATA :XMEM:LENG:AUTO` has no influence. The external data generator can be synchronized via the CLOCK output of the SME. The command triggers an event and thus has no *RST value.

Example: `:SOUR:DM:BAS:DATA:XMEM:REC`

[:SOURce]:DM[:BASic]:DATA:XMEM:TRIGger ON | OFF

This command switches the external trigger facility on or off.

ON — The run of the list is triggered by an external trigger signal. Each trigger signal starts a new run, which starts with the start address.

OFF — The external trigger mode is switched off.

Example: `:SOUR:DM:BAS:DATA:XMEM:TRIG OFF` *RST value is OFF

:[SOURce]:DM[:BASic]:DATA:XMEM:TRIGger:SLOPe POSitive | NEGative

This command selects the active edge of the external trigger signal.

POSitive — The run of the list starts with the positive edge of the trigger signal.

NEGative — The run of the list starts with the negative edge of the trigger signal.

Example: `:SOUR:DM:BAS:DATA:XMEM:TRIG:SLOP POS` *RST value is POSitive

[:SOURce]:DM[:BASic]:PRBS

The commands to set the pseudo random sequence generator are under this node.

[:SOURce]:DM[:BASic]:PRBS:LENGth 9 | 15 | 20 | 21 | 23

The command specifies the length of the pseudo random sequence according to the following equation:

Length = $(2^{\text{LENGth}}) - 1$

Example: `:SOUR:DM:BAS:PRBS:LENG 9` *RST value is 9 Bit

:SOURce]:DM:COMPlex:CLOCk:SOURce INT | EXT

The command selects the clock source for radiocommunication services ERMes, FLEX and POCSag.

INT — The clock required for signal generation is generated internally. The CLOCK connector is switched to be an output.

EXT — The clock required for signal generation is applied to the CLOCK connector.

Example: `:SOUR:DM:COMP:CLOC:SOUR INT` *RST value is INT

[:SOURce]:DM:GMSK

The commands to set the data source for the digital type of modulation GMSK are under this node. GMSK (Gaussian Minimum Shift Keying) always has exactly two states. The bit rate of the data source is fixedly set, the phase displacement as well.

[:SOURce]:DM:GMSK:STANdard GSM|PCN | CDPD | MC9 | MOBitex | MD24N | MD24W | MD36N | MD36W | MD48N | MD48W | MD80W | MD96N | MD96W | MD100W | MD120W | DSRR | DSRR4K

This short-form command sets the parameters shown in the table to the values specified by the standards (cf. table). The command is an abbreviation of the commands listed in the table. Hence it has no query form or *RST value.

Short command	Command sequence
:DM:GMSK:STANdard GSM | PCN	:DM:GMSK:FILTer 0,3 :DM:GMSK:BRATe 270,833kb/s :DM:GMSK:DCODer ON :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard CDPD | MD192	:DM:GMSK:FILTer 0,5 :DM:GMSK:BRATe 19,2 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MC9	:DM:GMSK:FILTer 0,3 :DM:GMSK:BRATe 8 kb/s :DM:GMSK:DCODer ON :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MOBitex | MD80N	:DM:GMSK:FILTer 0,3 :DM:GMSK:BRATe 8 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD24N	:DM:GMSK:FILTer 0,3 :DM:GMSK:BRATe 2,4 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD24W	:DM:GMSK:FILTer 0,5 :DM:GMSK:BRATe 2,4 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD36N	:DM:GMSK:FILTer 0,3 :DM:GMSK:BRATe 3,6 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD36W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 23.6 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD48N	:DM:GMSK:FILTer 0.3 :DM:GMSK:BRATe 4.8 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD48W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 4.8 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD48W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 4.8 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM

[:SOURce]:DM:GMSK:STANdard

Short command	Command sequence
:DM:GMSK:STANdard MD80W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 8 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD96N	:DM:GMSK:FILTer 0.3 :DM:GMSK:BRATe 9.6 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD96W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 9.6 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD100W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 10.0 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard MD120W	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 12.0 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard DSRR | MD160	:DM:GMSK:FILTer 0.3 :DM:GMSK:BRATe 16.0 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM
:DM:GMSK:STANdard DSSR4K	:DM:GMSK:FILTer 0.5 :DM:GMSK:BRATe 4.0 kb/s :DM:GMSK:DCODer OFF :DM:GMSK:POLarity NORM

Example: `:SOUR:DM:GMSK:STAN PCN`

[:SOURce]:DM:GMSK:BRATe 2.4 kb/s to 1000 kb/s

The command sets the bit rate of the modulation. The value of `SOURce:DM:GMSK: FILTer` is adapted if necessary to obtain a valid setting. Valid setting are listeted in the table to Section "GMSK Modulation" in Chapter 2.

Example: `:SOUR:DM:GMSK:BRAT 8000b/s` *RST value is 270.833kb/s

[:SOURce]:DM:GMSK:DCODer ON | OFF

Command (Differential Encoder) specifies the state coding.

ON Difference coding of the states according to regulation GSM is switched on.

OFF No difference coding. *RST value is ON

Example: `:SOUR:DM:GMSK:DCOD OFF`

[:SOURce]:DM:GMSK:FILTer 0.2 | 0.25 | 0.3 | 0.4 | 0.5

The command specifies B x T of the Gaussian filter used. The value of `SOURce:DM: GMSK:FILTer` is adapted if necessary to obtain a valid setting.

Valid settings are listed in the table to Section "GMSK Modulation" in Chapter 2.

Example: `:SOUR:DM:GMSK:FILT 0.2` *RST value is 0.3

[:SOURce]:DM:GMSK:GSLope ON | OFF

The command specifies the level reduction for the modulation.

ON The rise and fall time of the level reduction correspond to GSM power ramping.

OFF Command `DM:DATA:ALEVel:MODE` specifies the level reduction.

Example: `:SOUR:DM:GMSK:GSL ON` *RST value is OFF

[:SOURce]:DM:GMSK:POLarity NORMal | INVerted

The command specifies the polarity of the modulation.

NORMal A "1" from the data source generates a positive deviation, a "0" a negative deviation.

INVerted A "1" from the data source generates a negative deviation, a "0" a positive deviation. *RST value is NORMal

Example: `:SOUR:DM:GMSK:POL INV`

[:SOURce]:DM:GFSK

The commands to set the data source for the digital type of modulation GFSK are under this node. GFSK (Gaussian Frequency Shift Keying) always has exactly two states.

[:SOURce]:DM:GFSK:STANdard DECT | CT2 | CT3

This short-form command sets the parameters shown in the table to the values specified by the standards (cf. table). The command is an abbreviation of the commands listed in the table. Hence it neither has a query form nor an *RST value.

Short command	Command sequence
:DM:GFSK:STANdard DECT	:DM:GFSK:FILTer 0.5 :DM:GFSK:BRATe 1125 kb/s :DM:GFSK:DEViation 288kHz :DM:GFSK:POLarity NORM
:DM:GFSK:STANdard CT2	:DM:GFSK:FILTer 0.5 :DM:GFSK:BRATe 72 kb/s :DM:GFSK:DEViation 18 kHz :DM:GFSK:POLarity NORM
:DM:GFSK:STANdard CT3	:DM:GFSK:FILTer 0.5 :DM:GFSK:BRATe 640 kb/s :DM:GFSK:DEViation 160 kHz :DM:GFSK:POLarity NORM

Example: `:SOUR:DM:GFSK:STAN DECT`

[:SOURce]:DM:GFSK:BRATe 10 to 585 kb/s and 640 to 1170 kb/s

The command sets the bit rate for the modulation in bits per second. With setting FILTer 0.5 and DEViation 14.0 kHz or 25.2 kHz the range is 0.05...90 kb/s

Example: `:SOUR:DM:GFSK:BRAT 1122 kb/s` *RST value is 1170 kb/s

[:SOURce]:DM:GFSK:DEViation 14 | 14.4 | 18 | 20.0 | 25.2 | 160 | 180 | 202 | 259 | 288 | 317 | 403 kHz

The command sets the frequency deviation of the modulation. The value of `:SOURce:DM:GMSK:DEViation` is adapted if necessary in order to achieve a valid setting.

Valid settings are:

DEViation	FILTer	DEViation	FILTer
14 kHz	0.5	180 kHz	0.5
14.4 kHz	0.7	202 kHz	0.5
18 kHz	0.5	259 kHz	0.5
20.0 kHz	0.5	288 kHz	0.4, 0.5, 0.6
25.2 kHz	0.4, 0.5	317 kHz	0.5
160 kHz	0.5	403 kHz	0.5

Example: `:SOUR:DM:GMSK:DEV 288E3` *RST value is 288 kHz

[:SOURce]:DM:GFSK:FILTer 0.4 | 0.5 | 0.6 | 0.7

The command specifies B x T of the filter used. The value of `:SOURce:DM:GMSK:DEViation` is adapted if necessary in order to achieve a valid setting

Valid settings are:

FILTer	DEViation
0.4	25.2 kHz, 288 kHz
0.5	14 kHz, 18 kHz, 20.0 kHz, 25.2 kHz, 160 kHz, 180 kHz, 202 kHz, 259 kHz, 288 kHz, 317 kHz, 403 kHz
0.6	288 kHz
0.7	14.4 kHz

*RST value is 0.5

Example: `:SOUR:DM:GFSK:FILT 0.4`

[:SOURce]:DM:GFSK:POLarity NORMal | INVerted

The command specifies the polarity of the modulation.

NORMal A "1" from the data source results in a positive deviation

INVerted A "1" from the data source results in a negative deviation

Example: `:SOUR:DM:GMSK:POL INV` *RST value is NORMal

[:SOURce]:DM:QPSK

The commands to set the data source for the digital type of modulation QPSK (Quad Phase Shift Keying) are under this node. The key word :DQPSk is also accepted..

[:SOURce]:DM:QPSK:STANdard NADC | PDC | TFTS | TETRa | APCO | MSAT | INMarsat

This short-form command sets parameters shown in the table to the values specified by standards (cf. table). The command is an abbreviation of the commands listed in the table. Hence it neither has a query form nor an *RST value.

NADC	North American Digital Cellular
PDC	Personal Digital Cellular
TFTS	Terrestrial Flight Telephone System
TETRa	Trans European Trunk Radio
APCO25	Association of Public Safety Communications Officers, Project 25
MSAT	Mobile Satellite
INMarsat	International Maritime Satellite

[:SOURce]:DM:QPSK:STANdard

Short command	Command sequence
:DM:QPSK:STANdard NADC	:DM:QPSK:TYPE PI4Dqpsk :DM:QPSK:BRATe 48.6 kb/s :DM:QPSK:CODing NADC :DM:QPSK:FILTer SCOS, 0.35 :DM:QPSK:POLarity NORM
:DM:QPSK:STANdard APCO	:DM:QPSK:TYPE PI4Dqpsk :DM:QPSK:BRATe 9.6 kb/s :DM:QPSK:CODing NADC :DM:QPSK:FILTer COS, 0.2 :DM:QPSK:POLarity NORM
:DM:QPSK:STANdard PDC	:DM:QPSK:TYPE PI4Dqpsk :DM:QPSK:BRATe 42 kb/s :DM:QPSK:CODing NADC :DM:QPSK:FILTer SCOS, 0.5 :DM:QPSK:POLarity NORM
:DM:QPSK:STANdard TETRa	:DM:QPSK:TYPE PI4Dqpsk :DM:QPSK:BRATe 36 kb/s :DM:QPSK:CODing NADC :DM:QPSK:FILTer SCOS, 0.35 :DM:QPSK:POLarity NORM
:DM:QPSK:STANdard TFTS	:DM:QPSK:TYPE PI4Dqpsk :DM:QPSK:BRATe 44.2 kb/s :DM:QPSK:CODing TFTS :DM:QPSK:FILTer SCOS, 0.4 :DM:QPSK:POLarity NORM
:DM:QPSK:STANdard MSAT	:DM:QPSK:TYPE QPSK :DM:QPSK:BRATe 6.75 kb/s :DM:QPSK:CODing MSAT :DM:QPSK:FILTer SCOS, 0.6 :DM:QPSK:POLarity NORM
:DM:QPSK:STANdard INMarsat	:DM:QPSK:TYPE OQPSk :DM:QPSK:BRATe 8 kb/s :DM:QPSK:CODing INMarsat :DM:QPSK:FILTer SCOS, 0.6 :DM:QPSK:POLarity NORM

Example: `:SOUR:DM:QPSK:STAN PDC`

[:SOURce]:DM:QPSK:TYPE QPSK | OQPSk | PI4Qpsk | PI4Dqpsk

The command specifies the used QPSK modulation type in detail.

Example: `:SOUR:DM:QPSK:TYPE QPSK` *RST value is PI4Dqpsk

[:SOURce]:DM:QPSK:BRATe 1 to 24.3 kb/s and 27.0 to 48.6 kb/s

The command indicates the bit rate for the modulation in bits per second. The resolution is 100 b/s. *RST value is 48.6 kb/s

Example: `:SOUR:DM:QPSK:BRAT 42kb/s`

[:SOURce]:DM:QPSK:CODing NADC | PDC | TFTS | TETRa | APCO | MSAT | INMarsat

The command specifies the coding between the binary data and the generated signal (difference coding).

Example: `:SOUR:DM:QPSK:COD NADC` *RST value is NADC

[:SOURce]:DM:QPSK:FILTer COSine|SCOSine , 0.35|0.4|0.5|0.6 | COSine, 0.2

The command specifies the filter characteristics (characteristic and "roll-off factor"). Values COSine (cosine) and SCOSine (square root cosine) are permissible for characteristic. For roll-off, 0.2, 0.35, 0.4, 0.5 and 0.6 are permissible.

Example: `:SOUR:DM:QPSK:FILT COS,0.35.` *RST value is SCOSine, 0.35

[:SOURce]:DM:QPSK:POLarity NORMal | INVerted

The command specifies the polarity of the modulation.

NORMal A "1" from the data source generates a positive deviation
INVerted A "1" from the data source generates a negative deviation

Example: `:SOUR:DM:QPSK:POL NORM` *RST value is NORMal

[:SOURce]:DM:FSK

The commands to set the data source for the digital frequency modulation are under this node. FSK (Frequency Shift Keying) always has exactly two states. In contrast to the other types of modulation, there are trigger commands for FSK and FSK4 which also permit a single processing of the data list (cf. TRIGger system, Section 3.6.16).

[:SOURce]:DM:FSK:STANdard POCSag512| POCSag1200| POCSag2400| CITYruf512| CITYruf1200| CITYruf2400 | FLEX1600 | FLEX3200

This short-form command sets parameters shown in the table to the values specified by the standards (cf. table). The command is an abbreviation of the commands listed in the table. Hence it neither has a query form nor an *RST value.

Short command	Command sequence

`:DM:FSK:STANdard POCSag512`	`:DM:FSK:BRATe 512`
	`:DM:FSK:DEViation 4.5 kHz`
	`:DM:FSK:FILTER GAUSs, 2.73`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard POCSag1200`	`:DM:FSK:BRATe 1200`
	`:DM:FSK:DEViation 4.5 kHz`
	`:DM:FSK:FILTER GAUSs, 2.73`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard POCSag2400`	`:DM:FSK:BRATe 2400`
	`:DM:FSK:DEViation 4.5 kHz`
	`:DM:FSK:FILTER GAUSs, 2.73`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard CITYruf512`	`:DM:FSK:BRATe 512`
	`:DM:FSK:DEViation 4 kHz`
	`:DM:FSK:FILTER GAUSs, 2.73`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard CITYruf1200`	`:DM:FSK:BRATe 1200`
	`:DM:FSK:DEViation 4 kHz`
	`:DM:FSK:FILTER GAUSs, 2.73`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard CITYruf2400`	`:DM:FSK:BRATe 2400`
	`:DM:FSK:DEViation 4 kHz`
	`:DM:FSK:FILTER GAUSs, 2.73`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard FLEX1600`	`:DM:FSK:BRATe 1600`
	`:DM:FSK:DEViation 4.8 kHz`
	`:DM:FSK:FILTER BESSel, 2.44`
	`:DM:FSK:POLarity INVerted`

`:DM:FSK:STANdard FLEX3200`	`:DM:FSK:BRATe 3200`
	`:DM:FSK:DEViation 4.8 kHz`
	`:DM:FSK:FILTER BESSel, 1.22`
	`:DM:FSK:POLarity INVerted`

Example: `:SOUR:DM:FSK:STAN POCS512`

[:SOURce]:DM :FSK:BRATe 0.05 to 1900 kb/s (with FILTer OFF),
0.05 to 90 kb/s (with FILTer switched on)

The command sets the bit rate for the modulation in bits per second. If this value does not correspond to the standard selected, the FILTer is deactivated automatically (OFF).

Example: `:SOUR:DM:FSK:BRAT 2400` *RST value is 1200b/s

[:SOURce]:DM:FSK:DEViation 0 to 400 kHz

This command sets the frequency deviation of the modulation. If this value does not correspond to the standard selected, the FILTer is deactivated automatically (OFF).

Example: `:SOUR:DM:FSK:DEV 3kHz` *RST value is 4.5 kHz

[:SOURce]:DM:FSK:FILTer GAUSs, 2.73 | BESSel, 1.22 | BESSel, 2.44 | OFF

The command activates or deactivates the selected filter. Deactivating the filter is possible at any time. Activating the filter is only possible when values DEViation and BITRate correspond to the standard values.

Example: `:SOUR:DM:FSK:FILT GAUS,2.73` *RST value is OFF

[:SOURce]:DM:FSK:POLarity NORMal | INVerted

The command specifies the polarity of the modulation.

NORMal Logic "0" reduces the frequency, logic "1" increases it.

INVerted Logic "1" reduces the frequency, logic "0" increases it.

Example: `:SOUR:DM:FSK:POL INV` *RST value is NORMal

[:SOURce]:DM:FSK4

The commands to set the data source for the digital frequency modulation with exactly four states are under this node. In contrast to the other modulations, there are trigger commands for FSK and FSK4 which also permit a single processing of the data list.

[:SOURce]:DM:FSK4:STANdard ERMes | APCO| MODacom | FLEX3200 | FLEX6400

This short -form command sets parameters shown in the table to the values specified by the standards (cf. table). The command is an abbreviation of the commands listed in the table. Hence it neither has a query form nor an *RST value.

Short command	Command sequence

`:DM:FSK4:STANdard ERMes`	`:DM:FSK4:BRAT 6.25 kb/s`
	`:DM:FSK4:FILTer BESSel, 1.25`
	`:DM:FSK4:DEViation 4.68756kHz`

`:DM:FSK4:STANdard APCO`	`:DM:FSK4:BRAT 9.6 kb/s`
	`:DM:FSK4:FILTer COS, 0.2`
	`:DM:FSK4:DEViation 1.800kHz`

`:DM:FSK4:STANdard MODacom`	`:DM:FSK4:BRAT 9.6 kb/s`
	`:DM:FSK4:FILTer SCOS, 0.2`
	`:DM:FSK4:DEViation 2.0kHz`

`:DM:FSK4:STANdard FLEX3200`	`:DM:FSK4:BRAT 3.2 kb/s`
	`:DM:FSK4:FILTer BESSel, 1.22`
	`:DM:FSK4:DEViation 4.8kHz`

`:DM:FSK4:STANdard FLEX6400`	`:DM:FSK4:BRAT 6.4 kb/s`
	`:DM:FSK4:FILTer BESSel, 2.44`
	`:DM:FSK4:DEViation 4.8kHz`

Example: `:SOUR:DM:FSK4:STAN ERM`

[:SOURce]:DM:FSK4:BRATe 1 to 24.3 kb/s | 27.0 to 48.6 kb/s

The command sets the bit rate for the modulation.

Example: `:SOUR:DM:FSK4:BRAT 6.25 kb/s` *RST value is 6.25 kb/s

[:SOURce]:DM:FSK4:CODing ERMes | APCO| MODacom | FLEX

The command specifies according to which standard the coding between binary data and generated signal is performed.

Example: `:SOUR:DM:FSK4:COD ERM` *RST value is ERMes

[:SOURce]:DM:FSK4:DEViation 0.01 to 400 kHz

This command sets the frequency deviation of the modulation.

Example: `:SOUR:DM:FSK4:DEV 4.6875kHz` *RST value is 4687.5

[:SOURce]:DM:FSK4:FILTer BESSel, 1.22|1.25|2.44 | COS|SCOS, 0.2

This command selects the filter of the modulation.

Example: `:SOUR:DM:FSK4:FILT COS, 0.2` *RST value is BESSel, 1.25

[:SOURce]:DM:FSK4:POLarity NORMal | INVerted

The command specifies the polarity of the modulation.

NORMal A "0" from the data source reduces the frequency, "1" increases it.

INVerted A "1" from the data source reduces the frequency, "0" increases it.

Example: `:SOUR:DM:FSK4:POL INV` *RST value is NORMal

[:SOURce]:DM:FFSK

The commands to check the two-stage modulation FFSK are under this node. An LF signal is FSK-modulated and then serves as an input signal for an FM modulation of the actual carrier.

[:SOURce]:DM:FFSK:STANdard POCSag

This short-form command sets parameter shown in the table to the value specified by the standard (cf. table). The command is an abbreviation of the commands listed in the table. Hence it neither has a query form nor an *RST value.

Short command	Command sequence
`:DM:FSK4:STANdard POCSag`	`:DM:FFSK:DEViation 4.5 kHz`

Example: `:SOUR:DM:FFSK:STAN POCS`

[:SOURce]:DM:FFSK:BRATe 0.05 to 90 kb/s

This command sets the bit rate of the modulation.

Example: `:SOUR:DM:FFSK:BRAT 2400` *RST value is: 1200 b/s

[:SOURce]:DM:FFSK[:DEViation] 1.5 kHz | 2.0 kHz | 3.0 kHz | 3.5 kHz | 4.0 kHz | 4.5 kHz

The command sets the frequency deviation of the modulation. *RST value is: 4.5 kHz

Example: `:SOUR:DM:FFSK:DEV 100kHz`

3.6.11.4 SOURce:ERMes Subsystem

This subsystem contains the commands to set the ERMES signal. ERMES uses a 4FSK modulation. The parameters of the DM:FSK4 subsystem, however, are not influenced by settings in the ERMes subsystem. Switchover between the output of useful or filler subsequences is by means of the TRIGger:DM subsystem.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:ERMes			Option SME-B11/
:STATe	ON | OFF		SME-B12
:AUTO	ON | OFF		
:CHANnel	0 to 15		
:ERRor			
:MASK	0 to 1073741823		
:BATCh	A to P		
:WORD	0 to 153 (0 to 189 for long batch)		
:MESSage			
:CATegory	TONE | NUMeric | ALPHanumeric		
:ALPHanumeric			
:DATA	"String"		
[:SELect]	"FOX"|"ALPHA"|"LONG"| "USER1 to 3"		
:IA | IADDress	0 to 262143		
:NUMeric	"String"		
:TONE	0 to 15		
:NINFormation			
:OPERator	0 to 7		
:PA | PARea	0 to 63		
:ZCOuntry	0 to 799		
:SEQuence			
:DBATch	A to P {,A to P}		
:SI | SINFormation			
:ETI	ON | OFF		
:BAI	ON | OFF		
:FSI	0 to 30		
:DOMonth	1 to 31		
:TIME	00,00 to 23,59		
:TACTion	MESSage | STARt		

[:SOURce]:ERMes:STATe ON | OFF

The command switches on the ERMES signal and hence switches off all other active DM modulations. The RF frequency is set to the value determined by command `SOURce:ERMes:CHANnel`.

If `STATe:AUTO` is `ON` with every change from OFF to ON, the data for the memory extension are recalculated and written into list "XMEM". Every change of one of the ERMES parameters requires the data to be recalculated, i.e. a brief switchover to STATe OFF after every change.

Example: `:SOUR:ERM:STAT ON` *RST value is OFF

[:SOURce]:ERMes:STATe:AUTO ON | OFF

The command specifies wether the ERMES data are to be newly calculated on switching from `ERMes:STATe OFF to :STATe ON`.

ON The data are newly recalculated and written into list "XMEM"

OFF The existing contents are kept in the memory extension. This can be used to transfer data generated or changed by an external program to the memory extension and thus generate a ERMes telegram. *RST value is ON

Example: `:SOUR:ERM:STAT:AUTO ON`

[:SOURce]:ERMes:CHANnel 0 to 15

The command determines the channel and thus the transmitter frequency for ERMes (cf. Chapter 2, Section "Radiocommunication Service ERMES"). This command also influences the structure of the ERMES data. This is why the channel cannot be changed by adjusting the frequency using command `SOURce:FREQuency` but only using command `SOURce:ERMes:CHANnel` and then changing to STATe OFF and then to STATe ON again.

Example: `:SOUR:ERM:CHAN 1` *RST value is 0

[:SOURce]:ERMes:ERRor

The SME offers the possibility of entering bit errors into a 30-bit word of the message transmitted for test purposes. The commands to specify the bit errors and their position are under this node.

[:SOURce]:ERMes:ERRor:MASK 0 to 1073741823

The command specifies the faulty bits of the word of the message selected using `ERRor:WORD`. 30 bits can be defined as faulty (1) or perfect (0). The decimal number transmitted is converted internally into a 30-bit binary number and thus determines the 30 bits. These bits are XORed with the word to be corrupted and hence determine which bits of this word are transmitted correctly or wrongly. *RST value is 0

Example: `:SOUR:ERM:ERR:MASK 5`

[:SOURce]:ERMes:ERRor:BATCh A to P {,A to P}

The command specifies in which of batches A to P the faulty word is. The faulty word is determined by command `SOURce:ERMes:ERRor:WORD`. *RST does not influence this setting.

Example: `:SOUR:ERM:ERR:BATC P`

[:SOURce]:ERMes:ERRor:WORD 0 to 153 (0 to 189 for long batch)

The command determines the faulty word in the batch selected by means of command `SOURce:ERMes:ERRor:BATC`. *RST value is 0

Example: `:SOUR:ERM:ERR:WORD 111`

[:SOURce]:ERMes:MESSage

The commands to set the destination address and to determine the message data are under this node.

[:SOURce]:ERMes:MESSage:IA | IADDress 0 to 262143

The command determines the address ("Inital ADDress") of the pager addressed. Each pager has an own, nonrecurring address. 0 are 262143 are valid values, i.e. all numbers which can be indicated using 18 bits. *RST value is 0

Example: `:SOUR:ERM:MESS:IA 0`

[:SOURce]:ERMes:MESSage:CATegory ALPHanumeric | NUMeric | TONE

The command specifies the category of the message to be sent.

ALPHanumeric	Alphanumeric message
NUMeric	Numeric message
TONE	Tone-only message

Example: `:SOUR:ERM:MESS:CAT NUM` *RST value is TONE

[:SOURce]:ERMes:MESSage:ALPHanumeric

The commands to specify the contents of the alphanumeric message are under this node. These commands are only effective if `ERMes:MESSage:CATegory ALPHanumeric` is selected.

[:SOURce]:ERMes:MESSage:ALPHanumeric[:SELect] "FOX" | "ALPHA" | "LONG" | "USER 1" | "USER2" | "USER3"

The command selects the alphanumeric message. The following is available:

"FOX"	The quick brown fox jumps over the lazy dog
"ALPHA"	ABCD to (complete ERMES character set)
"LONG"	Message completely filling a batcht
"USER1to3"	Three messages which can be edited freely using command `ALPHanumeric:DATA`

Example: `:SOUR:ERM:MESS:ALPH:SEL FOX` *RST value is USER3

[:SOURce]:ERMes:MESSage:ALPHanumeric:DATA "String"

The command permits the input of an arbitrary character string into one of the alphanumeric messages USER1 to 3. This message must be selected before using `ALPHanumeric:SELect`.

*RST value is "" (i.e., empty message)

Example: `:SOUR:ERM:MESS:ALPH:DATA "Hello"`

[:SOURce]:ERMes:MESSage:NUMeric "string"

The command specifies which character string the numeric message consists of. The SME permits maximally 16 digits. In addition to the 10 digits "0" to "9", the signs forward slash "/", upper-case letter "U", hyphen "-", period ".", percent "%" and blank can be used. This command is only effective if CATegory NUMeric has been selected.

Example: `:SOUR:ERM:MESS:NUM "12% 15-17"` *RST value is "" (i.e., empty message)

[:SOURce]:ERMes:MESSage:TONE 0 to 15

The command specifies which of the 16 tones possible (8 normal, 8 urgent) are transmitted in an tone-only message. This command is only effective if CATegory TONE has been selected.

Example: `:SOUR:ERM:MESS:TONE 7` *RST value is 0

[:SOURce]:ERMes:NINFormation

The commands to set the data denoting the network (the SME simulates) in greater detail are under this node. These data are part of every message sent (cf. ERMES standard).

[:SOURce]:ERMes:NINFormation:OPERator 0 to 7

The command sets the code of the network operator. *RST value is 0

Example: `:SOUR:ERM:NINF:OPER 1`

[:SOURce]:ERMes:NINFormation:PA | PARea 0 to 63

The command sets the paging area. *RST value is 0

Example: `:SOUR:ERM:NINF:PA 4`

[:SOURce]:ERMes:NINFormation:ZCOuntry 0 to 799

The command sets the zone and the country code in the message to be sent. Germany has code 262 *RST value is 262

Example: `:SOUR:ERM:NINF:ZCO 799`

[:SOURce]:ERMes:SEQuence

The commands specifying the structure of the message subsequences are under this node. The control of the subsequence (message or fill subsequences, cf. Chapter 2, Section "Radiocommunication Service ERMES") is effected via the TRIGger system.

[:SOURce]:ERMes:SEQuence:DBATch A to P {,A toP}

The command indicates the batches which are to contain message data.

After *RST value, no batch contains user data

Example: `SOUR:ERM:SEQ:DBAT A, B, C, G, H, M, P`

[:SOURce]:ERMes:SI|SINFormation

The commands to set the sending system are under this node (cf. ERMES standard). The data are part of every message sent.

[:SOURce]:ERMes:SI|SINFormation:BAI ON | OFF

The command sets the Border Area Indicator Bit. *RST value is OFF

Example: `SOUR:ERM:SI:BAI ON`

[:SOURce]:ERMes:SI|SINFormation:ETI ON | OFF

The command sets the External Traffic Indicator Bit. *RST value is OFF

Example: `SOUR:ERM:SI:ETI ON`

[:SOURce]:ERMes:SI|SINFormation:FSI 0 to 30

The command sets the Frequency Subset Indicator. According to the standard, one-channel networks have an FSI of 30. *RST value is 30

Example: `SOUR:ERM:SI:FSI 20`

[:SOURce]:ERMes:SI|SINFormation:DOMonth 1 to 31

The command sets the date (day of month). *RST value is 1

Example: `SOUR:ERM:SI:DOM 24`

[:SOURce]:ERMes:SI|SINFormation:TIME 00,00 to 23,59

The command sets the time. *RST value is 00,00

Example: `SOUR:ERM:SI:TIME 12,00`

[:SOURce]:ERMes:TACTion MESSage | STARt

This command (Trigger ACTion) determines the action which is activated by a trigger event. The valid trigger events are specified by command `TRIGger:DM:SOURce`. This command also defines the allocation between manual and remote-control operations.

MESSage A trigger event switches from filler data output to useful data output for the duration of a subsequence (12 s). The filler data are then output again.

STARt Digital modulation is started by a trigger event. Useful data are then continuously output according to the settings.
This setting is suitable, for example, for a synchronous start of several units.

Example: `SOUR:ERM:TACT MESS` *RST value is MESSage

3.6.11.5 SOURce:FLEX Subsystem

This subsystem contains the commands for setting the FLEX signal. Like ERMES, FLEX is a radiocommunication service that makes for convenient paging. When equipped with the SME-B41 (FLEX), SME-B11 (DM coder) and SME B12 (DM memory extension) options, the SME generates call signals complying to the FLEX standard. All essential parameters and the message to be transmitted are freely selectable. Switchover between the output of useful or filler signals is by means of the TRIGger:DM subsystem.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:FLEX			Options SME-B11/
:STATe	ON | OFF		SME-B12/SME-B41
:AUTO	ON | OFF		
:CYCLe	0 to 14		
:DEViation	2.0 to 10.0 kHz	Hz	
:ERRor			
:MASK	0 to 4294967295		
:WORD	0 to 87		
:FCONtent	"X | O | A | space [,X | O | A | space]"		
:AUTO	ON | OFF		
:MODulation	1600, FSK2 | 3200, FSK2 | 3200,FSK4 | 6400,FSK4		
:PHASe	A | B | C | D | AB | AC | AD | BC | BD | CD | ABC | ABD | ACD | BCD | ABCD |		
:AUTO	ON | OFF		
:MESSage			
:CAPCode	"A0 000 001 to 999 999 999"		
:CATegory	ALPHanumeric | SECure | BINary | NUMeric | SNUMeric | TONE		
:ALPHanumeric			
[:SELect]	'FOX' | 'ALPHA' | 'USER 1...4'		
:CATalog?			
:DATA	"Alphanumeric data"		Query only
:BINary			
[:SELect]	" Name"		
:BLENgth	1 to 16		
:CATalog?			
:DATA	"0 | 1 [,0 |1]"		Query only
:TYPE	LEFT | RIGHt | TRANsparent | THEader		
:MNUMbering	ON | OFF		
:MDRop	ON | OFF		
:NUMeric	" string"		
:REPeats	0 to 3		
:TONE	0 to 7		
:SI | SINFormation			
:COLLapse	0 to 7		
:DATE	Year, month, day		
:LCHannel	0 to 511		
:TIME	00,00 to 23,59		
:CZONe	0 to 31		
:TACTion	MESSage | STARt		

[:SOURce]:FLEX:STATe ON | OFF

The command switches the FLEX signal on; all other activated DM modulations are switched off. In contrast to ERMES, the RF frequency is not changed.

Every switchover from OFF to ON results in a recalculation of the memory extension data and their entry into the list "XMEM" if `:FLEX:STATe:AUTO` is set to `ON`. Every change of a FLEX parameter except for `:FLEX:FCONtent` requires a recalculation of data, ie after every parameter change, `STATe OFF` has to be briefly activated.

Example: `:SOUR:FLEX:STAT ON` *RST value is OFF

[:SOURce]:FLEX:STATe:AUTO ON | OFF

The command determines whether the FLEX data have to be recalculated after switchover from `FLEX:STATe OFF` to `STATe ON`.

ON The data are recalculated and entered into the memory extension.

OFF The previous memory extension contents are not cleared. This feature can be used for data generated or altered by an external program and then transmitted into the memory extension to generate a FLEX telegram. *RST value is ON

Example: `:SOUR:FLEX:STAT:AUTO ON`

[:SOURce]:FLEX:CYCLe 0 to 14

The command determines which number is assigned to the first cycle after switch on of FLEX. Frame numbering always starts with 0.

Example: `:SOUR:FLEX:CYCL 0` *RST value is 0

[:SOURce]:FLEX:DEViation 2.0 to 10.0 kHz

The command determines the frequency deviation of the modulation. The deviation specifies the spacing from the carrier for the two far-placed symbols in 4FSK. The FLEX standard specifies 4800 Hz for this value which may be varied for testing.

Example: `:SOUR:FLEX:DEV 4.8kHz` *RST value is 4800 Hz

[:SOURce]:FLEX:ERRor:MASK 0 to 4294967295

The command determines the erroneous bits in a 32-bit field. The transmitted decimal number (0...4294967295) is converted internally into a 32-bit binary number and thus defines the 32 bits. These bits are XORed with the word of the message which is to be falsified and thus determine which bits of this word are to be transmitted correctly or incorrectly.

Note: *XORing precedes block interleaving (see flex standard)! It is carried out in all phases of all message frames (i.e., the' X'marked frames under FRAME CONTENTS).*

Example: `FLEX:ERRor:MASK 0` *RST value is 0.

[:SOURce]:FLEX:ERRor:WORD 0 to 87

The command determines the position of the word to be falsified. The words are numbered from block 0, word 0 to block 10, word 7 of a frame. The sync part and the frame information word cannot be falsified. The falsification precedes block interleaving in all transmitted phases.

Example: `FLEX:ERRor:WORD 0` *RST value is 0.

[:SOURce]:FLEX:FCONtent "X | blank spaces | O | A [,X| blank spaces | O| A]"

This command determines the contents of the 128 frames. Each frame is represented by a character. If less than 128 values are indicated, the output cycle is shortened correspondingly.

X	Flex useful data
Space	Flex filler data
O	Simulated data of another radiocommunication service (O for OTHER)
A	"Emergency Resynchronization" specified in the FLEX standard (A stands for ASYNC)

The frame assigned to the pager is calculated from the value of `FLEX:MESSage:CAPCode` according to the following formula:

Frame = (Integer(CAPCODE/16)) modulo 128

Notes:
- *The SINFormation:COLLapse value may cause the pager to respond to much more than merely its "own" frame.*
- *As the FLEX signal generation is subject to the trigger system, the settings under TRIGger:DM, determine whether the specified frame contents or only the filler frames are output.*

Example: `:SOUR:FLEX:FCON "X, , ,O,O,O,O,O,X,X,X,A,A,A, ,X"`

[:SOURce]:FLEX:FCONtent:AUTO ON | OFF

This command determines the influence of changes of CAPCODE on FRAME CONTENT.

ON	FRAME CONTENT is set so that in all frames evaluated by the reciever (and only in those) FLEX data are also transmitted. All the other frames only contain filler data.
OFF	A change of CAPCODE has no influence on FRAME CONTENT.

Example: `:SOUR:FLEX:FCON:AUTO ON` *RST value is ON

[:SOURce]:FLEX:MODulation 1600, FSK2 | 3200, FSK2 | 3200,FSK4 | 6400,FSK4

The command determines the used bit rate and modulation. FLEX recognizes four modulations:

1600bps/2FSK 3200bps/2FSK 3200bps/4FSK 6400bps/4FSK

Example: `:SOUR:FLEX:MOD 1600,FSK2` *RST value is 1600,2FSK

[:SOURce]:FLEX:PHASe A | B | C | D | AB | AC | AD | BC | BD | CD | ABC | ABD | ACD | BCD | ABCD |

The command determines in which phase (A to D) the message is to be transmitted. Since each frame lasts 1.875 sec independent of the modulation and more data can be transmitted at bit rates higher than 1600 bps, several independent channels ("phases") are bit-multiplexed. With 1600 bps, the message is transmitted for every setting in phase A. With 3200 bps, the message is transmitted in phase A if A and B are set, and transmitted in phase C if C and D are set. With 6400 bps, the message is transmitted in all the four phases depending on the relevant setting. Each pager is set to one phase. The phase can be calculated from the CAPCODE of a pager as shown below:

Phase = (Integer(CAPCODE/4)) modulo 4, with 0=A, 1=B, etc.

Example: `:SOUR:FLEX:PHAS A` *RST value is A

[:SOURce]:FLEX:PHASe:AUTO ON | OFF

This command determines whether the phase setting is coupled to the CAPCODE.

ON The phase is adjusted to the value contained in the CAPCODE whenever the CAPCODE is used (see FLEX standard).

OFF Using the CAPCODE has no effect on the phase.

Example: `:SOUR:FLEX:PHAS:AUTO ON` *RST value is ON

[:SOURce]:FLEX:MESSage

Under this node there are commands to set the destination address and to determine the useful data of the message.

[:SOURce]:FLEX:MESSage:CAPCode "Capcode string"

Input value of the CAPCODE of the pager to be called as printed on the receiver. CAPCODE is defined in the FLEX standard. It contains the addresses of the receiver as well as frame and phase information.

Example: `:SOUR:FLEX:MESS:CAPC "A0000001"` *RST value is "A0000001"

[:SOURce]:FLEX:MESSage:CATegory ALPHanumeric | SECure | BINary | NUMeric | SNUMeric | TONE

The command determines the category of the message to be transmitted.

ALPHanumeric Alphanumeric message

SECure Secured alphanumeric message

BINary Binary message

NUMeric Numeric message (with 3 figures = "short message" according to FLEX standard)

SNUMeric Special numeric message

TONE Only-tone message

Example: `:SOUR:FLEX:MESS:CAT NUM` *RST value is TONE

[:SOURce]:FLEX:MESSage:ALPHanumeric|SECure

This node contains commands for the determination of the contents of the alphanumeric and the secured messages. There is one common character set for the two types of messages. These commands can only be activated if `FLEX:MESSage:CATegory ALPHanumeric` or `SECure` is selected.

[:SOURce]:FLEX:MESSage:ALPHanumeric[:SELect] "FOX" | "ALPHA" | "USER 1" | "USER2" | "USER3" | "USER4"

This node contains commands for the determination of the contents of the alphanumeric and the secured messages. There is one common character set for the two types of messages. These commands can only be activated if `FLEX:MESSage:CATegory ALPHanumeric` or SECure is selected.:

"FOX" The quick brown fox jumps over the lazy dog

"ALPHA" ABCD to (complete FLEX character set)

"USER1 to 4" Four messages that can be freely edited by command `ALPHanumeric:DATA`.

Example: `:SOUR:FLEX:MESS:ALPH:SEL "FOX"` *RST value is USER3

[:SOURce]:FLEX:MESSage:ALPHanumeric:CATalog?

The command queries the alphanumeric and secured alphanumeric messages available. It causes a list to be returned on which the entries are separated by commas. The command is a query command and thus has no *RST value.

Example: `:SOUR:FLEX:MESS:ALPH:CAT?` Answer: FOX, ALPHA, USER1

[:SOURce]:FLEX:MESSage:ALPHanumeric:DATA "String"

The command allows any character string to be entered into one of the alphanumeric messages USER 1 to 4. This message has to be selected first with the command `ALPHanumeric:SELect`.

*RST value is "" (eg, empty message)

Example: `:SOUR:FLEX:MESS:ALPH:DATA "Hallo"`

[:SOURce]:FLEX:MESSage:BINary

This node contains commands for the determination of the contents of the binary messages. The commands can only be activated if `FLEX:MESSage:CATegory BINary` is selected.

[:SOURce]:FLEX:MESSage:BINary[:SELect] "USER1" | "USER2"

The command selects the binary messages. *RST value is USER1

Example: `:SOUR:FLEX:MESS:BIN:SEL "USER1"`

[:SOURce]:FLEX:MESSage:BINary:BLENgth 1 to 16

The command sets the number of bits to be interpreted as a unit (character). This value has no significance for SME. It is transmitted to the pager and evaluated there. *RST value is 1

Example: `:SOUR:FLEX:MESS:BIN:BLEN 16`

[:SOURce]:FLEX:MESSage:BINary:CATalog?

The command queries the binary messages available. It causes a list to be returned on which the entries are separated by commas. The command is a query command and thus has no *RST value.

Example: `:SOUR:FLEX:MESS:BIN:CAT?` Answer: `USER1`

[:SOURce]:FLEX:MESSage:BINary:DATA "0 | 1 [,0 | 1]"

The command allows the entry of any binary data into one of the binary messages. Values 0 and 1 are available. Each value represents 1 bit. The maximum length of the message is 460 bit.This message has to be selected first with the command BINary:SELect.

Example: `:SOUR:FLEX:MESS:BIN:DATA "111101"` *RST value is "" (i.e., empty message)

[:SOURce]:FLEX:MESSage:BINary:TYPE LEFT | RIGHt | TRANsparent | THEader

The command determines the type of binary messages.

LEFT	Display from left to right.
RIGHt	Display from right to left.
TRANsparent	Data are not interpreted.
THEader	Transparent data with text header. *RST value is LEFT
Example:	`:SOUR:FLEX:MESS:BIN:TYPE LEFT`

[:SOURce]:FLEX:MESSage:MNUMbering ON | OFF

The command determines whether every message is to be assigned with a number and whether this information is to be evaluated when received by the pager.

ON SME sends the number 0 for every message.

OFF No number is sent.

Example: `:SOUR:FLEX:MESS:MNUM OFF` *RST value is OFF

[:SOURce]:FLEX:MESSage:MDRop ON | OFF

The command determines whether or not the messages are to be marked with a MAIL-DROP flag (see chapter 2, section "Radiocommunication Service FLEX").

ON The messages are marked as "volatile".

OFF The messages are not marked.

Example: `:SOUR:FLEX:MESS:MDR OFF` *RST value is OFF

[:SOURce]:FLEX:MESSage:NUMeric "String"

The command determines the type of character string the numeric message may consist of. SME allows a maximum of 41 characters. In addition to the 10 figures "0" to "9" other characters such as square brackets right and left "[", "]", upper case letter "U", hyphen "-" and blank space " " can be used. This command can only be activated if `FLEX:MESSage:CATegory NUMeric` is selected. *RST value is "0123456789 U-[]"

Example: `:SOUR:FLEX:MESS:NUM "15-17"`

[:SOURce]:FLEX:MESSage:TONE 0 to 7

The command determines which of the 8 possible tones is to be transmitted in case of an only-tone message. This command can only be activated if `FLEX:MESSage:CATegory TONE` is selected.

Example: `:SOUR:FLEX:MESS:TONE 7` *RST value is 0

[:SOURce]:FLEX:MESSage:REPeats 0 to 3

The command determines the number of calls following the first call according to FLEX-TD. For the value 0 (no repeat), normal flex frames are transmitted, whereas subframes according to FLEX-TD are used with other values (cf. Section 2.6.3.12, Radiocommunication Service FLEX).

Example: `:SOUR:FLEX:MESS:REP 0` *RST value is 0

[:SOURce]:FLEX:SI|SINFormation

This node contains commands used to set the data of the transmitting system (see FLEX standard). These data are sent to the pager. CZONe, DATE, and TIME are transmitted every hour in cycle 0, frame 0.

[:SOURce]:FLEX:SI|SINFormation:COLLapse 0 to 7

The command indicates the number of bits (0 to 7) the pager uses to compare its "built-in" frame number with the received frame number. The value 7 signifies that the pager only accepts messages in one of the 128 frames (provided that its pager collapse value is not below 7). With the value 0 the pager receives messages in any frame. *RST value is 4

Example: `:SOUR:FLEX:SI:COLL 4`

[:SOURce]:FLEX:SI|SINFormation:DATE Year, month, day

The command sets the date. *RST value is 1994,01,01

Example: `:SOUR:FLEX:SI:DATE 1994,01,01`

[:SOURce]:FLEX:SI|SINFormation:LCHannel 0 to 511

The command indicates the number of the "local channel". This value has no significance for SME, it is solely transmitted to the pager.

Example: `:SOUR:FLEX:SI:LCH 1` *RST value is 0

[:SOURce]:FLEX:SI|SINFormation:TIME 00,00 to 23,59

This command sets the time. *RST value is 12,00

Example: `:SOUR:FLEX:SI:TIME 12,00`

[:SOURce]:FLEX:SI|SINFormation:CZONe 0 to 31

This command determines the coverage zone. *RST value is 0

Example: `:SOUR:FLEX:SI:CZON 0`

[:SOURce]:FLEX:TACTion MESSage | STARt

This command (Trigger ACTion) determines the action which is activated by a trigger event. The valid trigger events are specified by command `TRIGger:DM:SOURce`. This command also defines the allocation between manual and remote-control operations.

MESSage — A trigger event switches from filler data output to useful data output for the duration of a batch (1.875 s). The filler data are then output again.

STARt — Digital modulation is started by a trigger event. Useful data are then continuously output according to the settings. This setting is suitable, for example, for a synchronous start of several units.

Example: `:SOUR:FLEX:TACT MESS` *RST value is MESSage

3.6.11.6 SOURce:FM Subsystem

This subsystem contains the commands to check the frequency modulation and to set the parameters of the modulation signal. The SME can be equipped with two independent frequency modulators (option SM-B5). They are differentiated by a suffix after FM.

SOURce:FM1
SOURce:FM2

Command	Parameter	Default Unit	Remark
[:SOURce]			
:FM1|2			
[:DEViation]	0 to 1MHz; SME03: 0 to 2MHz, SME06: 0 to 4MHz	Hz	Option SM-B5
:EXTernal1|2			
:COUPling	AC | DC		
:INTernal			
:FREQuency	400 Hz | 1 kHz | 3 kHz | 15 kHz	Hz	
	0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz		Option SM-B2 or -B6
:PREemphasis	0 | 50us | 75us		
:SOURce	INT | EXT1 | EXT2		
:STATe	ON | OFF		

[:SOURce]:FM1|2[:DEViation] 0 to 1 MHz; SME03: 0 to 2 MHz; SME06: 0 to 4 MHz

The command specifies the frequency variation caused by the FM. Although the LF generators are used as modulation sources, the frequency variation is independent of the voltage at the LF output. The maximally possible DEViation depends on `SOURce:FREQuency` (cf. data sheet).

Example: `:SOUR:FM1:DEV 5kHz` *RST value is 10 kHz

[:SOURce]:FM1|2:EXTernal 2

The commands to set the external FM input are under this node. The settings under EXTernal for modulations AM, FM and PM are independent of each other. The settings are always related to the socket which is determined by the numeric suffix after EXTernal. The suffix after FM is ignored then. With the following commands, e.g., the settings are both related to EXT2 input:

`:SOUR:FM1:EXT2:COUP AC`

`:SOUR:FM2:EXT2:COUP AC`

A command without suffix is interpreted like a command with suffix 1.

[:SOURce]:FM1|2:EXTernal1|2:COUPling AC | DC

The command selects the type of coupling for the external FM input.

AC The d.c. voltage content is separated from the modulation signal.

DC The modulation signal is not altered. *RST value is AC

Example: `:SOUR:FM:EXT:COUP AC`

[:SOURce]:FM1|2:INTernal

The settings for the internal FM generators are effected under this node. For FM1, this is always LF generator 1, for FM2, always LF generator 2. Here the same hardware is set for FM1, PM1, AM:INT1 as well as SOURce0, just like for FM2, PM2 and AM:INT2 as well as SOURce2. This means that, e.g., the following commands are coupled with each other and have the same effect:

```
SOUR:AM:INT2:FREQ
SOUR:FM2:INT:FREQ
SOUR:PM2:INT:FREQ
SOUR2:FREQ:CW
```

[:SOURce]:FM1|2:INTernal:FREQuency 400 Hz | 1 kHz | 3 kHz | 15 kHz or 0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz

The command sets the modulation frequency. There are different specified ranges depending on the equipment of the instrument:

If neither SM-B2 nor SM-B6 are fitted, only FM 1 is permissible and values 400 Hz, 1 kHz, 3 kHz and 15 kHz are valid. With option SM-B2, the specified range from 0.1 Hz to 500 kHz is valid, with SM-B6, from 0.1 Hz to 1 MHz. *RST value is 1 kHz

Example: `:SOUR:FM:INT:FREQ 10kHz`

[:SOURce]:FM1|2:PREemphasis 0 | 50us | 75us

The command selects the preemphasis.

0	No preemphasis
50 us	50 µs, European standard
75 us	75 µs, American standard

*RST value is 0

Example: `:SOUR:FM:PRE 50us`

[:SOURce]:FM1|2:SOURce INTernal | EXTernal1 | EXTernal2

The command selects the modulation source. A command without suffix is interpreted like a command with suffix 1. LF generator 1 is INT for FM1, LF generator2 for FM2 (option SM-B5). Several modulation sources can be active at the same time (cf. example)

*RST value for FM1: INT
for FM2:EXT2

Example: `:SOUR:FM:SOUR INT1, EXT2`

[:SOURce]:FM1|2:STATe ON | OFF

The command switches the frequency modulation on or off. *RST value is OFF.

Example: `SOUR:FM:STAT OFF`

3.6.11.7 SOURce:FREQuency Subsystem

This subsystem contains the commands for the frequency settings of the RF source including the sweeps.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:FREQuency			SME03/06:
:CENTer	5 kHz to 1.5 GHz	Hz	5 kHz to 3/6 GHz
[:CW|:FIXed]	5 kHz to 1.5 GHz	Hz	5 kHz to 3/6 GHz
:RCL	INCLude | EXCLude		
:MANual	5 kHz to 1.5 GHz	Hz	5 kHz to 3/6 GHz
:MODE	CW | FIXed | SWEep | LIST		
:OFFSet	-50 to +50 GHz	Hz	
:SPAN	0 to 1.5 GHz	Hz	0 to 3/6 GHz
:STARt	5 kHz to 1.5 GHz	Hz	5 kHz to 3/6 GHz
:STOP	5 kHz to 1.5 GHz		5 kHz to 3/6 GHz
:STEP		Hz	
[:INCRement]	0 to 1 GHz		

[:SOURce]:FREQuency:CENTer 5 kHz to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

The command sets the sweep range by means of the center frequency. This command is coupled to commands `:SOURce:FREQuency:STARt` and `:SOURce:FREQuency:STOP`.

In this command, value OFFSet is considered as with input value FREQUENCY in the FREQUENCY menu. Thus the specified range indicated is only valid for OFFSet = 0. The specified range with other OFFSet values can be calculated according to the following formula (cf. Chapter 2, Section "Frequency Offset" as well):

5 kHz + OFFSet to 1.5 GHz +OFFSet *RST value is (STARt +STOP)/2

Example: `:SOUR:FREQ:CENT 100kHz`

[:SOURce]:FREQuency[:CW|:FIXed] 5 kHz to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

The command sets the frequency for CW operation. This value is coupled to the current sweep frequency. In addition to a numeric value, UP and DOWN can be indicated. The frequency is increased or reduced by the value set under `:SOURce:FREQuency:STEP`. (As to specified range, cf. `FREQuency:CENTer`).

Example: `:SOUR:FREQ:CW 100kHz` *RST value is 100 MHz

[:SOURce]:FREQuency[:CW|:FIXed]:RCL INCLude | EXCLude

The command determines the effect of the recall function on the frequency. *RST value has no effect to this setting.

INCLude The saved frequency is loaded when instrument settings are loaded with the [RECALL] key or with a memory sequence.

EXCLude The RF frequency is not loaded when instrument settings are loaded, the current settings are maintained.

Example: `:SOUR:FREQ:RCL INCL`

[:SOURce]:FREQuency:MANual 5 kHz to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

The command sets the frequency if `SOURce:SWEep:MODE MANual` and `SOURce:FREQuency:MODE SWEep` are set. Only frequency values between the settings with `:SOURce:FREQuency:STARt` and `:SOURce:FREQuency:STOP` are permitted. (As to specified range, cf. `FREQuency:CENTer`) *RST value is 100 MHz

Example: `:SOUR:FREQ:MAN 500MHz`

[:SOURce]:FREQuency:MODE CW | FIXed | SWEep | LIST

The command specifies the operating mode and hence also specifies which commands check the FREQuency subsystem. The following allocations are valid

CW |FIXed CW and FIXed are synonyms. The output frequency is specified by means of `:SOURce:FREQuency:CW | FIXed`.

SWEep The instrument operates in the SWEep operating mode. The frequency is specified by means of commands `SOURce:FREQuency:STARt; STOP; CENTer; SPAN; MANual`.

LIST The instrument processes a list of frequency and level settings. The settings are effected in the SOURce:LIST subsystem. Setting `SOURce :FREQuency:MODE` LIST automatically sets command `SOURce:POWer :MODE to LIST` as well.

Example: `:SOUR:FREQ:MODE LIST` *RST value is CW.

[:SOURce]:FREQuency:OFFSet -50 to + 50 GHz

The command sets the frequency offset of an instrument which might be series-connected, e.g. a mixer. (cf. Chapter 2, Section "Frequency Offset"). If a frequency offset is entered, the frequency entered using SOURce:FREQuency: to does no longer correspond to the RF output frequency. The following connection is true:

`SOURce:FREQuency:to` = RF output frequency + `SOURce:FREQuency:OFFSet`.

Entering an offset does not alter the RF output frequency but the query value of `SOURce:FREQuency:..`

Example: `:SOUR:FREQ:OFFS 100MHz` *RST value is 0

[:SOURce]:FREQuency:SPAN 0 to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

This command indicates the frequency range for the sweep. This parameter is coupled to the start and stop frequency. Negative values for SPAN are permitted, then STARt > STOP is true. There is the following connection:

STARt = CENTer – SPAN/2

STOP = CENTer + SPAN/2 *RST value is (STOP - STARt)

Example: `:SOUR:FREQ:SPAN 1GHz`

[:SOURce]:FREQuency:STARt 5 kHz to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

This command indicates the starting value of the frequency for the sweep operation. Parameters STARt, STOP, SPAN and CENTer are coupled to each other. STARt may be larger than STOP. (As to specified range, cf. `FREQuency:CENTer`). *RST value is 100MHz

Example: `:SOUR:FREQ:STAR 1MHz`

[:SOURce]:FREQuency:STOP 5 kHz to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

This command indicates the final value of the frequency for the sweep operation (see STARt as well). (As to specified range, cf. `FREQuency:CENTer`). *RST value is 500MHz

Example: `:SOUR:FREQ:STOP 100MHz`

[:SOURce]:FREQuency:STEP

The command to enter the step width for the frequency setting if frequency values UP or DOWN are used is under this node. This command is coupled to the KNOB STEP command in manual control. Only linear step widths can be set.

[:SOURce]:FREQuency:STEP[:INCRement] 0 to 1 GHz

The command sets the step width for the frequency setting.

Example: `:SOUR:FREQ:STEP:INCR 1MHz` *RST value is 1MHz

3.6.11.8 SOURce:ILS Subsystem

This subsystem contains the commands to control the characteristics of the test signals for ILS (Instrument Landing System) (option SM-B6, multifunction generator).

Command	Parameter	Default Unit	Remark
[:SOURce]			
:ILS			Option SM-B6
:STATe	ON | OFF		
:SOURce	INT2 | INT2, EXT		
:TYPE	GS | GSLope | LOCalizer		
[:GS | GSLope]			
:MODE	NORM | ULOBe | LLOBe		
:COMid			
[:STATe]	ON | OFF		
:FREQuency	0.1 to 20 000 Hz	Hz	
:DEPTh	0 to 100 PCT	PCT	
:DDM			
:CURRent	-685 uA to+685uA	A	
[:DEPTh]	-0.8 to +0.8 PCT	PCT	
:DIRection	UP | DOWN		
:LOGarithmic	-999.9 to +999.9		
:LLOBe			
[:FREQuency]	100 to 200 Hz	Hz	
:ULOBe			
[:FREQuency]	60 to 120 Hz	Hz	
:PHASe	0 to 120 deg	rad	
:PRESet			No query
:SODepth	0 to 100 PCT	PCT	
:LOCalizer			
:MODE	NORM | LLOBe | RLOBe		
:COMid			
[:STATe]	ON | OFF		
:FREQuency	0.1 to 20 000 Hz	Hz	
:DEPTh	0 to 100 PCT	PCT	
:DDM			
:CURRent	-387 to +387 uA	A	
[:DEPTh]	-0.4 to +0.4 PCT	PCT	
:DIRection	LEFT | RIGHt		
:LOGarithmic	-999.9 to +999.9		
:LLOBe			
[:FREQuency]	60 to 120 Hz	Hz	
:RLOBe			
[:FREQuency]	100 to 200 Hz	Hz	
:PHASe	0 to 120 deg	rad	
:PRESet			No query
:SODepth	0 to 100 PCT	PCT	

[:SOURce]:ILS:STATe ON | OFF

The command switches the generation of ILS signals on or off. STATe ON is only possible if no amplitude modulation is switched on. Modulation generator 2 must not be switched simultaneously as a source for PM or FM either.

Example: `:SOUR:ILS:STAT ON` *RST value is OFF

[:SOURce]:ILS:SOURce INT2 | INT2, EXT

This command determines the signal sources of the test signal.

INT2 The test signal used for ILS is generated internally by LF generator 2.

INT2 , EXT A signal from input EXT1 is added to the internal signal in addition. Switching off the internal source is not possible.

Example: `:SOUR:ILS:SOUR INT2` *RST value is INT2

[:SOURce]:ILS:TYPE GS|GSLope | LOCalizer

The command switches over between the two components of the ILS method. The configuration of the signals is effected under the respective node GSLope or LOCalizer.

GD|GSLope Vertical component (Glide Slope)

LOCalizer Horizontal component (LOCalizer)

Example: `:SOUR:ILS:TYPE GS` *RST value is GS

[:SOURce]:ILS[:GS|GSLope]

The commands to specify the characteristics of the glide slope signal are under this node. Whether this signal is output, however, is determined by command `SOURce:ILS:TYPE`.

[:SOURce]:ILS[:GS|GSLope]:MODE NORM | ULOBe | LLOBe

The command specifies the type of the ILS-GS signal generated.

NORM ILS-GS signal

ULOBe (Upper LOBe) Amplitude modulation of the output signal using the `SOURce:ILS:GS:ULOBe:FREQuency` signal component (generally 90 Hz) of the ILS-GS signal.

The modulation depth for `SOURce:ILS:GS:DDM :DIR DOWN` results from
AM(90Hz) = 0.5 * (ILS:GS:SODepth + ILS:GS:DDM * 100%)
and for `SOURce:ILS:GS:DDM:DIR UP` from

AM(90Hz) = 0.5 * (ILS:GS:SODepth ILS:GS:DDM * 100%)

LLOBe (Lower LOBe) Amplitude modulation of the output signal using the SOURce:ILS:GS:LLOBe:FREQuency signal component (generally 150 Hz) of the ILS-GS signal. The modulation depth for `SOURce:ILS:GS:DDM :DIR DOWN` results from

AM(150Hz) = 0.5 * (ILS:GS:SODepth + ILS:GS:DDM * 100%)

and for `SOURce:ILS:GS:DDM:DIR UP` from

AM(150Hz) = 0.5 * (ILS:GS:SODepth ILS:GS:DDM * 100%)

Example: `:SOUR:ILS:GS:MODE ULOB` *RST value is NORM

[:SOURce]:ILS[:GS|GSLope]:COMid

The commands to set the ComId content (communication/identification signal) of the ILS-GS signal are under this node.

[:SOURce]:ILS[:GS|GSLope]:COMid[:STATe] ON | OFF

The command activates or deactivates the ComId signal. *RST value is OFF

Example: `:SOUR:ILS:GS:COM:STAT ON`

[:SOURce]:ILS[:GS|GSLope]:COMid:FREQuency 0.1 to 20 000 Hz

The command sets the frequency of the ComId signal. *RST value is 1020 Hz

Example: `:SOUR:ILS:GS:COM:FREQ 1020`

[:SOURce]:ILS[:GS|GSLope]:COMid:DEPTh 0 to 100 PCT

The command sets the AM modulation depth of the ComId signal.

Example: `:SOUR:ILS:GS:COM:DEPT 10 PCT` *RST value is 10 PCT

[:SOURce]:ILS[:GS|GSLope]:DDM

(Difference in Depth of Modulation) The commands to set the modulation depth difference between the signal of the upper lobe (90 Hz) and the lower lobe (150 Hz) are under this node.)

[:SOURce]:ILS[:GS|GSLope]:DDM:CURRent - 685 uA to + 685 uA

The command enters the DDM value alternatively as a current by means of the ILS indicating instrument. This parameter is coupled with `SOURce:ILS:GS:DDM:DEPTh` and `:LOGarithmic`.

Example: `:SOUR:ILS:GS:DDM:CURR 0` *RST value is 0 A

[:SOURce]:ILS[:GS|GSLope]:DDM[:DEPTh] - 0.8 to + 0.8 PCT

The command sets the difference of the modulation depth. This parameter is coupled with `SOURce:ILS:GS:DDM:CURRent`.

The following is true for `SOURce:ILS:GS:DDM:DIRection DOWN`

ILS:GS:DDM:DEPTh = (AM(90Hz) - AM(150Hz))/100%

and for `SOURce:ILS:GS:DDM:DIRection UP`

ILS:GS:DDM:DEPTh = (AM(150Hz) - AM(90Hz))/100%

Example: `:SOUR:ILS:GS:DDM:DEPT 0PCT` *RST value is 0PCT

[:SOURce]:ILS[:GS|GSLope]:DDM:DIRection UP | DOWN

The command indicates the direction in which the pilot has to correct the course. By calculation, this setting has the same effect as a reverse of the sign of the `SOURce:ILS:GS:DDM:DEPTh`-value.

UP The airplane is too low, it must climb.

DOWN The airplane is too high, it must descend.

Example: `:SOUR:ILS:GS:DDM:DIR DOWN` *RST value is UP

[:SOURce]:ILS[:GS|GSLope]:DDM:LOGarithmic - 999.9 dB to + 999.9 dB

The command enters the DDM value in dB. This parameter is coupled with `SOURce:ILS:GS:DDM:DEPTh` and `:CURRent`. *RST value is 0.0 dB

Example: `:SOUR:ILS:GS:DDM:LOG 0`

[:SOURce]:ILS[:GS|GSLope]:LLOBe

The commands to configure the signal of the lower ILS-GS antenna lobe are under this node (Lower LOBe).

[:SOURce]:ILS[:GS|GSLope]:LLOBe[:FREQuency] 100 to 200 Hz

The command sets the frequency. Normally, it is 150 Hz. This parameter is coupled with `SOURce:ILS:GS:ULOBe:FREQuency`. As the ratio of `ULOBe:FREQuency` and `LLOBe:FREQuency` must always be 3/5, `ULOBe:FREQuency` is readjusted accordingly.

Example: `:SOUR:ILS:GS:LLOB:FREQ 150` *RST value is 150 Hz

[:SOURce]:ILS[:GS|GSLope]:ULOBe

The commands to configure the signal of the upper ILS-GS antenna lobe (Upper LOBe) are under this node.

[:SOURce]:ILS[:GS|GSLope]:ULOBe[:FREQuency] 60 to 120 Hz

The command sets the frequency. Normally, it is 90 Hz. This parameter is coupled with `SOURce:ILS:GS:LLOBe:FREQuency`. As the ratio of `ULOBe:FREQuency` and `LLOBe:FREQuency` must always be 3/5, `LLOBe: FREQuency` is readjusted accordingly.

Example: `:SOUR:ILS:GS:ULOB:FREQ 90` *RST value is 90 Hz

[:SOURce]:ILS[:GS|GSLOpe]:PHASe 0 to 120 deg

The command sets the phase between the modulation signals of the upper and the lower antenna lobe. The zero crossing of the signal of the lower lobe serves as a reference. The angle is related to the period of the signal of the lower antenna lobe. *RST value is 0

Example: `:SOUR:ILS:GS:PHAS 0deg`

[:SOURce]:ILS[:GS|GSLope]:SODepth 0 to 100 PCT

The command indicates the sum of the modulation depths of the signals of the lower lobe (90 Hz) and the upper lobe (150 Hz). *RST value is 80PCT

Example: `:SOUR:ILS:GS:SOB 80PCT`

[:SOURce]:ILS[:GS|GSLOpe:PRESet

This command is equivalent to the following GS defaultcommand sequence:

```
:ILS:STAT ON
:ILS:TYPE GS
:ILS:SOUR INT2
:ILS:GS:MODE NORM
:ILS:GS:COM OFF
:ILS:GS:COM:FREQ 1020Hz
:ILS:GS:COM:DEPT 10PCT
:ILS:GS:DDM 0.0
:ILS:GS:DDM:DIR UP
:ILS:GS:SOD 80PCT
:ILS:GS:ULOB 90Hz
:ILS:GS:LLOB 150Hz
:ILS:GS:PHAS 0
```

The values set correspond to the state after `SYSTem:PRESet` or *RST. The command neither has a query form nor an *RST value.

Example: `:SOUR:ILS:GS:PRES`

[:SOURce]:ILS:LOCalizer

The commands to specify the characteristics of the LOCalizer localizer modulation signal are under this node. Whether this signal is output, however, is determined by command `SOURce:ILS:TYPE`.

[:SOURce]:ILS:LOCalizer:MODE NORM | LLOBe | RLOBe

The command specifies the type of the ILS-LOC signal generated.

NORM ILS-LOC-Signal

LLOBe (Left LOBe) Amplitude modulation of the output signal using the `SOURce:ILS:LOC:LLOBe:FREQuency` signal component (generally 90 Hz) of the ILS-LOC signal. The modulation depth

AM(90Hz) = 0.5 * (ILS:LOC:SODepth + ILS:LOC:DDM * 100%)

and for `SOURce:ILS:GS:DDM:DIR LEFT` from

AM(90Hz) = 0.5 * (ILS:LOC:SODepth ILS:LOC:DDM * 100%)

RLOBe RLOBe (Right LOBe) Amplitude modulation of the output signal using the `SOURce:ILS:LOC:RLOBe:FREQ` signal component (generally 150 Hz) of the ILS-LOC signal. The modulation depth for ILS:LOC:DDM:DIR RIGHt results from
AM(150Hz) = 0.5 * (ILS:LOC:SODepth + ILS:LOC:DDM * 100%)
and for `ILS:LOC:DDM:DIR LEFT` from
AM(150Hz) = 0.5 * (ILS:LOC:SODepth ILS:LOC:DDM * 100%)

Example: `:SOUR:ILS:LOC:MODE LLOB` *RST value is NORM

[:SOURce]:ILS:LOCalizer:COMid

The commands to set the ComId content (communication/identification signal) of the ILS-LOC signal are under this node.

[:SOURce]:ILS:LOCalizer:COMid[:STATe] ON | OFF

The command activates or deactivates the ComId signal. *RST value is OFF

Example: `:SOUR:ILS:LOC:COM:STAT ON`

[:SOURce]:ILS:LOCalizer:COMid:FREQuency 0.1 to 20 000 Hz

The command sets the frequency of the ComId signal. *RST value is 1020 Hz

Example: `:SOUR:ILS:LOC:COM:FREQ 1020`

[:SOURce]:ILS:LOCalizer:COMid:DEPTh 0 to 100 PCT

The command sets the AM modulation depth of the ComId signal.

Example: `:SOUR:ILS:LOC:COM:DEPT 10PCT` *RST value is 10 PCT

[:SOURce]:ILS:LOCalizer:DDM

(Difference in Depth of Modulation) The commands to set the modulation depth difference between the signal of the left lobe (90 Hz) and the right lobe (150 Hz) are under this node.

[:SOURce]:ILS:LOCalizer:DDM:CURRENT -387 to +387 uA

The command altematively enters the DDM value as a current by means of the ILS indicating instrument. This parameter is coupled with `SOURce:ILS:LOC:DDM: DEPTh`.

Example: `:SOUR:ILS:LOC:DDM:CURR 0` *RST value is 0 A

[:SOURce]:ILS:LOCalizer:DDM[:DEPTh] -0.4 to +0.4 PCT

The command sets the difference of the modulation depth. This parameter is coupled with SOURce:ILS:LOC:DDM:CURRent. The following is true:

for `SOURce:ILS:LOC:DDM:DIRection RIGHt`

ILS:LOC:DDM:DEPTh = (AM(90Hz) - AM(150Hz))/100%

and for `SOURce:ILS:LOC:DDM:DIRection LEFT`

ILS:LOC:DDM:DEPTh = (AM(150Hz) AM(90Hz))/100%

Example: `:SOUR:ILS:LOC:DDM:DEPT 0PCT` *RST value is 0PCT

[:SOURce]:ILS:LOCalizer:DDM:DIRection LEFT | RIGHT

The command enters the DDM value in dB. This parameter is coupled with `SOURce:ILS:LOC:DDM :DEPTh`.

LEFT The airplane is too much to the right, it must turn to the left.

RIGHt The airplane is too much to the left, it must turn to the right.

Example: `:SOUR:ILS:LOC:DDM:DIR LEFT` *RST value is LEFT

[:SOURce]:ILS:LOCalizer:DDM:LOGarithmic -999.9 dB to +999.9 dB

The command enters the DDM value in dB. This parameter is coupled with `SOURce:ILS:LOC:DDM :DEPTh` and `:CURRent`.

Example: `:SOUR:ILS:LOC:DDM:LOG 0` *RST value is 0.0 dB

[:SOURce]:ILS:LOCalizer:LLOBe

The commands to configure the signals of the left ILS-LOC antenna lobe (Left LOBe) are under this node.

[:SOURce]:ILS:LOCalizer:LLOBe[:FREQuency] 60 to 120 Hz

The command sets the frequency. Normally, it is 90 Hz. This parameter is coupled with `SOURce:ILS:LOC:RLOBe:FREQuency`. As the ratio of `LLOBe:FREQuency` and `RLOBe:FREQuency` must always be 3/5, `RLOBe: FREQuency` is readjusted accordingly.

Example: `:SOUR:ILS:LOC:LLOB:FREQ 90` *RST value is 90 Hz

[:SOURce]:ILS:LOCalizer:RLOBe

The commands to configure the signal of the right ILS-LOC antenna lobe (Right LOBe) are under this node.

[:SOURce]:ILS:LOCalizer:RLOBe[:FREQuency] 100 to 200 Hz

The command sets the frequency. Normally, it is 150 Hz. This parameter is coupled with `SOURce:ILS:LOC:LLOBe:FREQuency`. As the ratio of `LLOBe:FREQuency` and `RLOBe:FREQuency` must always be 3/5, `LLOBe: FREQuency` is readjusted accordingly.

Example: `:SOUR:ILS:LOC:RLOB:FREQ 150` *RST value is 150 Hz

[:SOURce]:ILS:LOCalizer:PHASe 0 to 120 deg

The command sets the phase between the modulation signals of the left and the right antenna lobe. The zero crossing of the signal of the right lobe serves as a reference. The angle refers to the period of the signal of the right antenna lobe. *RST value is 0

Example: `:SOUR:ILS:LOC:PHAS 0deg`

[:SOURce]:ILS:LOCalizer:PRESet

This command is equivalent to the following LOC defaultcommand sequence:

```
:ILS:SOUR INT2
:ILS:STAT ON
:ILS:TYPE LOC
:ILS:LOC:MODE NORM
:ILS:LOC:COM OFF
:ILS:LOC:COM:FREQ 1020Hz
:ILS:LOC:COM:DEPT 10PCT
:ILS:LOC:DDM 0.0
:ILS:LOC:DDM:DIR LEFT
:ILS:LOC:SOD 40PCT
:ILS:LOC:LLOB 90Hz
:ILS:LOC:RLOB 150Hz
:ILS:LOC:PHAS 0
```

The values set correspond to the state after SYSTEM:PRESET or *RST. The command neither has a query form nor an *RST value.

Example: `:SOUR:ILS:LOC:PRES`

[:SOURce]:ILS:LOCalizer:SODepth 0 to 100 PCT

The command indicates the sum of modulation depths of the signals of the left lobe (90 Hz) and the right lobe (150 Hz).

Example: `:SOUR:ILS:LOC:SOB 40PCT` *RST value is 40 PCT

3.6.11.9 SOURce:LIST Subsystem

This subsystem contains the commands for the LIST operating mode of the RF generator. Processing the lists is controlled by the `TRIGger:LIST` subsystem. Each list consists of a FREQuency, POWer and DWELl content. The list contents must all be of the same length except for contents of length 1. This is interpreted as if the content_had the same length as the other contents and all values were equal to the first value. After a list has been created and changed, command `:LIST:LEARn` has to be entered to have the settings transferred to the hardware.
The LIST mode is activated by command `SOURce:FREQuency:MODE LIST`.

Note: *SCPI designates the individual lists as segments.*

Command	Parameter	Default Unit	Remark
[:SOURce]			
:LIST			
:CATalog?			Query only
:DELete	"Name of list"		
:ALL			
:DWELl	1ms to1 s {,1 ms to 1 s}	s	
:POINts?			Query only
:FREE?			
:FREQuency	5kHz to 1.5GHz {, 5kHz to 1.5GHz}|block data	Hz	5kHz to 3/6 GHz(SME03/06)
:POINts?			Query only
:LEARn			No query
:MODE	AUTO | STEP		
:POWer	-144 to 16 dBm {, -144 to 16 dBm}|block data		
:POINts?			Query only
:SELect	"Name of list"		

[:SOURce]:LIST:CATalog?

The command requests a list of the lists available separated by commas. The command is a query and hence has no *RST value.

Example: `:SOUR:LIST:CAT?` Answer: `"MYLIST", "LIST1", "LIST2"`

[:SOURce]:LIST:DELete "Name of list"

The command deletes the list indicated. *RST has no influence on data lists.

Example: `:SOUR:LIST:DEL "LIST2"`

[:SOURce]:LIST:DELete:ALL

The command deletes all lists. As a possibly selected list is deleted as well, the LIST mode must be switched off (`SOURce:FREQuency:MODE CW` or `SWEep`). *RST has no influence on data lists.

Example: `:SOUR:LIST:DEL:ALL`

[:SOURce]:LIST:DWELl 1 ms to 1 s {, 1 ms to 1 s}

For every item of the FREQuency or POWer/VOLTage list contents, the command contains the time the instrument "dwells" at this item.

Note: *The RF generator is not in a position to allocate different times to the individual items of the FREQuency and POWer list contents. Thus the DWELl part of the list should have length 1; the value is then valid for all items. If a list containing more than one element is indicated, all values must be equal.*

Example: `:SOUR:LIST:DWEL 0.15`

[:SOURce]:LIST:DWELl:POINts?

The command queries the length (in items) of the DWELl-part of the list. The command is a query and thus has no *RST value.

Example: `:SOUR:LIST:DWEL:POIN?` Answer: `1`

[:SOURce]:LIST:FREE?

The command queries two values. The first one indicates the space still vacant for lists (in items), the second one the space already occupied, also in items. The command is a query and thus has no *RST value.

Example: `:SOUR:LIST:FREE?` Answer: `2400, 200`

[:SOURce]:LIST:FREQuency 5 kHz to 1.5 GHz {, 5 kHz to 1.5 GHz}| block data
(SME03/06: 5 kHz to 3/6 GHz)

The command fills the FREQuency part of the list selected with data. The data can either be indicated as a list of numbers (separated by commas) of arbitrary length or as binary block data. In the case of block data transmission, always 8 (4) bytes are interpreted as a floating-point number of double accuracy (cf. command `FORMat :DATA`). *RST does not influence data lists.

Example: `:SOUR:LIST:FREQ 1.4GHz, 1.3GHz, 1.2GHz,...`

[:SOURce]:LIST:FREQuency:POINts?

The command queries the length (in items) of the FREQuency part of the list presently selected. The command is a query and thus has no *RST value.

Example: `:SOUR:LIST:FREQ:POIN?` Answer: `327`

[:SOURce]:LIST:LEARn

The command learns the list selected. I.e., it determines the hardware setting for the entire list. The data thus determined are stored together with the list. The command triggers an event and thus has no *RST value.

Example: `:SOUR:LIST:LEAR`

Caution: *This command has to be given after every creating and changing of a list.*

[:SOURce]:LIST:MODE AUTO | STEP

The command indicates the mode in which the list is to be processed (by analogy with `SOURce:SWEep:MODE`).

AUTO Each trigger event triggers a complete list run.

STEP Each trigger event triggers only one step in processing the list.

Example: `:SOUR:LIST:MODE STEP` *RST value is AUTO

[:SOURce]:LIST:POWer -144 to 16 dBm {, -144 to 16 dBm} | block data

The command fills the LEVel part of the RF list selected with data. The data can either be indicated as a list of numbers (separated by commas) of arbitrary length or as binary block data. As to the format of the data, cf. command `:SOURce:LIST:FREQ`. *RST does not influence data lists.

Example: `:SOUR:LIST:POW 0dBm, -2dBm, -2dBm, -3dBm,...`

[:SOURce]:LIST:POWer:POINts?

The command queries the length (in items) of the LEVel part of the list presently selected. The command is a query and thus has no *RST value

Example: `:SOUR:LIST:POW:POIN?` Answer: `32`

[:SOURce]:LIST:SELect "Name of list"

The command selects the list indicated. If there is no list of this name, a new list is created. The name may contain up to 7 letters. The command triggers an event and thus has no *RST value

Example: `:SOUR:LIST:SEL "LIST1"`

3.6.11.10 SOURce:MARKer Subsystem

This subsystem contains the commands to check the marker generation with sweeps. The SME has three markers each for frequency and level sweeps which are differentiated by a numeric suffix after MARKer. The settings for frequency sweep and level sweep marker are independent of each other.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:MARKer1|2|3			
[:FSWeep]			
:AMPLitude	ON | OFF		
:AOFF			No query
:FREQuency	5 kHz to 1.5 GHz	Hz	**SME03/06:** 5 kHz to 3/6 GHz
[:STATe]	ON | OFF		
:PSWeep			
:AOFF			No query
:POWer	-144 to+16 dBm	dBm	
[:STATe]	ON | OFF		
:POLarity	NORMal | INVerted		

[:SOURce]:MARKer1|2|3[:FSWeep]

The commands for the markers with frequency sweep are under this node. Keyword :FSWeep can be omitted, then the command conforms to SCPI regulations.

[:SOURce]:MARKer1|2|3[:FSWeep]:AMPLitude ON | OFF

The command specifies whether the marker influences the signal level.

ON The output level is reduced by a constant value when the marker frequency is executed.

OFF The output level remains unchanged. *RST value is OFF

Example: `:SOUR:MARK1:FSW:AMP ON`

[:SOURce]:MARKer1|2|3[:FSWeep]:AOFF

Command (All markers off) switches off all frequency markers. This command triggers an event, thus it has no *RST value and no query form.

Example: `:SOUR:MARK:FSW:AOFF`

[:SOURce]:MARKer1|2|3[:FSWeep]:FREQuency 5 kHz to 1.5 GHz (SME03/06: 5 kHz to 3/6 GHz)

The command sets the marker selected by the numeric suffix with MARKer to the frequency indicated.

In this command, the OFFSet value of the subsystem (menu) FREQuency is considered as with input value MARKER in the SWEEP-FREQ menu. Thus the specified range indicated is only valid for `SOURce:FREQuency:OFFSet` = 0. The specified range with other OFFSet values can be calculated according to the following formula (cf. Chapter 2, Section "Frequency Offset", as well):

5 kHz - OFFSet to 1.5 GHz - OFFSet

*RST value for MARK1: 100 MHz
MARK2: 200 MHz
MARK3: 300 MHz

Example: `:SOUR:MARK1:FSW:FREQ 30MHz`

[:SOURce]:MARKer1|2|3[:FSWeep][:STATe] ON | OFF

The command switches the marker selected by the numeric suffix with MARKer on or off.

Example: `:SOUR:MARK1:FSW:STAT ON` *RST value is OFF

[:SOURce]:MARKer1|2|3:PSWeep

The commands for the markers with level sweep are under this node (Power sweep). The three markers are differentiated by a numeric suffix after MARKer.

[:SOURce]:MARKer1|2|3:PSWeep:AOFF

The command switches all level markers off. This command is an event and thus has no *RST value and no query form.

Example: `:SOUR:MARK:PSW:AOFF`

[:SOURce]:MARKer1|2|3:PSWeep:POWer -144 dBm to +16 dBm

The command sets the marker selected by the numeric suffix with MARKer to the level indicated.

In this command, the OFFSet value of subsystem (menu) POWER (LEVEL) is considered in correspondence with input value MARKER in the SWEEP LEVEL menu. Thus the specified range indicated is only valid for `SOURce:POWer:OFFSet = 0`. The specified range with other OFFSet values can be calculated according to the following formula (cf. Chapter 2, Section "Level Offset" as well):

-144 dBm OFFSet to 16 dBm OFFSet *RST value for MARK1: 1 dBm
MARK2: 2 dBm
MARK3: 3 dBm

Example: `:SOUR:MARK1:PSW:POW -2dBm`

[:SOURce]:MARKer1|2|3:PSWeep[:STATe] ON | OFF

The command switches the marker selected by the numeric suffix with MARKer on or off.

Example: `:SOUR:MARK1:PSW:STAT ON` *RST value is OFF

[:SOURce]:MARKer1|2|3:POLarity NORMal | INVerted

The command specifies the polarity of the marker signal.

NORMal When running through the marker condition, TTL level is applied at the marker output, otherwise 0 V.

INVerted When running through the marker condition, 0 V is applied at the marker output, otherwise TTL level. *RST value is NORM

Example: `:SOUR:MARK:POL INV`

3.6.11.11 SOURce:MBEacon Subsystem

This subsystem contains the commands to control the characteristics of the marker signals (Marker BEacon) as they are used to mark the distance in the approach range of airports (option SM-B6, multifunction generator).

Command	Parameter	Default Unit	Remark
[:SOURce]			
:MBEacon			Option SM-B6
:STATe	ON | OFF		
[:MARKer]			
:FREQuency	400 Hz | 1300 Hz | 3000 Hz	Hz	
:DEPTh	0 to 100 PCT	PCT	
:COMid			
[:STATe]	ON | OFF		
:FREQuency	0.1 to 20 000 Hz	Hz	
:DEPTh	0 to 100 PCT	PCT	

[:SOURce]:MBEacon:STATe ON | OFF

The command switches on or off the generation of marker beacon signals. STATe ON is only possible if no amplitude modulation is switched on. Modulation generator 2 must not be inserted simultaneously as a source for PM or FM either.

Example: `:SOUR:MBE:STAT ON` *RST value is OFF

[:SOURce]:MBEacon[:MARKer]:FREQuency 400 Hz | 1300 Hz | 3000 Hz

The command selects the frequency of the marker signal. *RST value is 400 Hz

Example: `:SOUR:MBE:MARK:FREQ 400`

[:SOURce]:MBEacon[:MARKer]:DEPTh 0 to 100 PCT

The command selects the frequency of the marker signal. *RST value is 95 PCT

Example: `:SOUR:MBE:MARK:DEPT 95PCT`

[:SOURce]:MBEacon:COMid[:STATe] ON | OFF

The command activates or deactivates the ComId signal. *RST value is OFF

Example: `:SOUR:MBE:COM:STAT ON`

[:SOURce]:MBEacon:COMid:FREQuency 0.1 to 20 000 Hz

The command sets the frequency of the ComId signal. *RST value is 1020 Hz

Example: `:SOUR:MBE:COM:FREQ 1020`

[:SOURce]:MBEacon:COMid:DEPTh 0 to 100 PCT

The command sets the AM modulation depth of the ComId signal *RST value is 5 PCT

Example: `:SOUR:MBE:COM:DEPT 5PCT`

3.6.11.12 SOURce:PHASe Subsystem

Command	Parameter	Default Unit	Remark
[:SOURce]			
:PHASe			
[:ADJust]	-360 deg to +360 deg	rad	
:REFerence			No query

[:SOURce]:PHASe[:ADJust] -360 deg to +360 deg

The command indicates the phase between output signal and reference oscillator signal. This setting is only accepted using `SOURce:PHASe:REFerence` (cf. below). An indication in RADian is possible.

Example: `:SOUR:PHAS:ADJ 2DEG`
`:SOUR:PHAS:ADJ 0.1RAD` *RST value is 0.0 DEG

[:SOURce]:PHASe:REFerence

The command accepts the phase set using `SOURce:PHASe:ADJust` as a new reference phase. The command has no *RST value.

Example: `:SOUR:PHAS:REF`

3.6.11.13 SOURce:PM Subsystem

This subsystem contains the commands to check the phase modulation and to set the parameters of the modulation signal. The SME can be equipped with two independent phase modulators, PM1 and PM2 (option SM-B5). They are differentiated by a suffix after PM.

SOURce:PM1
SOURce:PM2

Command	Parameter	Default Unit	Remark
[:SOURce]			
:PM1|2			Option SM-B5
[:DEViation]	-360 deg to +360 deg	rad	
:EXTernal1|2			
:COUPling	AC | DC		
:INTernal			
:FREQuency	400 kHz | 1 kHz | 3 kHz | 15 kHz or	Hz	
	0.1Hz to 500 kHz or 0.1Hz to 1 MHz		Option SM-B2 or -B6
:SOURce	INT | EXT1 | EXT2		
:STATe	ON | OFF		

[:SOURce]:PM1|2[:DEViation] -360 to +360 deg

The command sets the modulation depth in Radian. DEGree are accepted.

*RST value is 1 rad

Example: `SOUR:PM:DEV 20DEGR`

[:SOURce]:PM1|2:EXTernal1|2

The commands to check the external input of the PM modulators are under this node. The settings under EXTernal for modulations AM, FM and PM are independent of each other. The settings are always related to the socket determined by the suffix after EXTernal. The suffix after PM is ignored then. With the following commands, e.g., the settings are both related to socket EXT2:

```
:SOUR:PM1:EXT2:COUP AC
:SOUR:PM2:EXT2:COUP AC
```

A command without suffix is interpreted like a command with suffix 1.

[:SOURce]:PM1|2:EXTernal1|2:COUPling AC | DC

The command selects the type of coupling for the external PM input.

AC The d.c. voltage content is separated from the modulation signal.

DC The modulation signal is not changed. *RST value is AC

Example: `:SOUR:PM:COUP DC`

[:SOURce]:PM1|2:INTernal

The settings for the internal PM generators are effected under this node. For PM1, this is always LF generator 1, for PM2, always LF generator 2. Here the same hardware is set for FM1, PM1, AM::INT1 as well as SOURce0, for FM2, PM2 and AM:INT2 and SOURce2 as well. This means that, e.g., the following commands are coupled with each other and have the same effect:

```
SOUR:AM:INT2:FREQ
SOUR:FM2:INT:FREQ
SOUR:PM2:INT:FREQ
SOUR2:FREQ:CW
```

[:SOURce]:PM1|2:INTernal:FREQuency 400 kHz | 1 kHz | 3 kHz | 15 kHz or 0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz

The command sets the modulation frequency. There are different specified ranges depending on the equipment of the instrument:

If neither SM-B2 nor SM-B6 are fitted, only INT1 is permissible and values 400 Hz, 1 kHz, 3 kHz and 15 kHz are valid. With option SM-B2, the specified range from 0.1 Hz to 500 kHz is valid, with SM-B6 from 0.1 to 1 MHz: *RST value is 1 kHz

Example: `:SOUR:PM:INT:FREQ 10kHz`

[:SOURce]:PM1|2:SOURce INTernal | EXTernal1 | EXTernal2

The command selects the modulation source. A command without suffix is interpreted like a command with suffix 1. LF generator 1 is INTernal for PM1, LF generator2 for PM2 (option SM-B5). Several modulation sources can be active at the same time (see example)

*RST value for PM1: INT

Example: `:SOUR:PM:SOUR INT, EXT2` for PM2:EXT2

[:SOURce]:PM1|2:STATe ON | OFF

The command switches the phase modulation selected by the numeric suffix with PM on or off.

Example: `:SOUR:PM1:STAT OFF` *RST value is OFF

3.6.11.14 SOURce:POCSag Subsystem

POCSAG is a standard which in its various implementations (e.g. CITYRUF, SCALL) allows convenient paging. When equipped with the SME-B42 (POCSAG), SME-B11 (DM coder) and SME B12 (DM memory extension) options, the SME generates call signals complying to the POCSAG standard. All essential parameters and the message to be transmitted are freely selectable.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:POCSag			
:STATe	ON | OFF		
:MODulation	FSK | FFSK		
:BRATe	512bps | 1200bps | 2400bps		
:DEViation	1.5 | 2.0 | 3.0 | 3.5 | 4.0 | 4.5 kHz	Hz	
:ERRor			
:MASK	0 to 4294967295		
:WORD	0 to 16		
:LBATches	0 to 100		
:MESSage			
:ADDRess	0 to 2097151		
:CATegory	NUMeric | TONE | ALPHanumeric		
:SWORd	POCSag | INForuf		
:TONE	A | B | C | D		
:NUMeric	"string"		
:ALPHanumeric			
[:SELect]	"FOX" | "ALPHA" | "USER1 to 4"		
:CATalog?			Query only
:DATA	"alphanumeric data"		
:POLarity	NORMal | INVerted		
:TSLice	2 to 120 sec	s	
:TACTion	MESSage | STARt		

[:SOURce]:POCSag:STATe ON| OFF

The command switches all of the other active DM modulation settings off. In contrast to ERMES, the RF frequency is not changed. Each time OFF is switched to ON, the data for the memory expansion are recalculated and written into the "XMEM" list. The data must be recalculated whenever any POCSAG parameter other than POCSag:DEViation is changed. This means that STATe OFF should be briefly activated after every change.

Example: `:SOUR:POCS:STAT ON` *RST value is OFF

[:SOURce]:POCSag:MODulation FSK | FFSK

The command selects the desired modulation.

Two types are available for POCSAG, FSK und FFSK.

FSK The RF is directly modulated with the data signal.

FFSK An LF is first modulated, which is then used as the modulation signal for the RF.

Example: `:SOUR:POCS:MOD FSK` *RST value is FSK

[:SOURce]:POCSag:DEViation 1.5 | 2.0 | 3.0 | 3.5 | 4.0 | 4.5 kHz

The command enters the input value of the frequency deviation for the set modulation.

For FSK 4.0 kHz and 4.5 kHz are possible, for FFSK 1.5 kHz, 2.0 kHz, 3.0 kHz, 3.5 kHz, 4.0 kHz and 4.5 kHz. The instrument stores two independent deviation values (one for each type of modulation). The value which is displayed and used depends on the modulation setting.

Example: `:SOUR:POCS:DEV 4.5kHz` *RST value is 4kHz

[:SOURce]:POCSag:BRATe 512bps | 1200bps | 2400bps

The command selects the bitrate, at which the data should be outputted. Possible values are: 512, 1200, and 2400 baud.

Example: `:SOUR:POCS:BRAT 512bps` *RST value is 512bps

[:SOURce]:POCSag:ERRor:MASK 0 to 4294967295

The command determines the erroneous bits in a 32-bit field. The transmitted decimal number (0...4294967295) is converted internally into a 32-bit binary number and thus defines the 32 bits. These bits are XORed with the word of the message which is to be falsified and thus determine which bits of this word are to be transmitted correctly or incorrectly.

Example: `:SOUR:POCS:ERRor:MASK 0` *RST value is 0.

[:SOURce]:POCSag:ERRor:WORD 0 to 16

The command determines the position of the word to be falsified in the batch. Value 0 denotes the synchronization word.

Example: `:SOUR:POCS:ERRor:WORD 0` *RST value is 0.

[:SOURce]:POCSag:LBATches 0 to 100

The command sets the number of filler batches which are transmitted before the message (Leading BATches). *RST value : 0

Example: `:SOUR:POCS:LBAT 0`

[:SOURce]:POCSag:MESSage

The parameters of this section are used for setting the destination address as well as the useful data of the message.

[:SOURce]:POCSag:MESSage:ADDRess 0 to 2097151

The command sets the address of the pager to be called. The specified range is 0 to 2097151.

Example: `:SOUR:POCS:MESS:ADDR 1` *RST value is 1

[:SOURce]:POCSag:MESSage:CATegory NUMeric | TONE | ALPHanumeric

The command selects the category of the transmitted message.

TONE Tone-only message

NUMeric Numeric message,

ALPHanumeric Alphanumeric message. *RST value is TONE

Example: `:SOUR:POCS:MESS:CAT TONE`

[:SOURce]:POCSag:MESSage:SWORd POCSag | INForuf

The command selects the contents of the sync word. This word distinguishes between the various types of paging services.

POCSAG 0x7CD215D8; also used for CITYRUF

INFORUF 0x7CD21436. *RST value is POCSag

Example: `:SOUR:POCS:MESS:SWOR POCS`

[:SOURce]:POCSag:MESSage:TONE A | B | C | D

The command selects the tone which is transmitted during category TONE. Four tones are available (A, B, C, D).

Note: *Only true tone-only receivers can process all four possible values.*
Numerical and alphanumerical receivers react to tone-only pages only when tone number is B or C.

Example: `:SOUR:POCS:MESS:TONE B` *RST value is TONE

[:SOURce]:POCSag:MESSage:NUMeric "String"

The command determines the type of character string the numeric message may consist of. SME allows a maximum of 41 characters. In addition to the 10 figures "0" to "9" other characters such as square brackets right and left "[", "]", upper case letter "U", hyphen "-" and blank space " " can be used.

Example: `:SOUR:POCS:MESS:NUM "12-17"` *RST value is 0123456789 U-[]

[:SOURce]:POCSag:MESSage:ALPHanumeric

This node contains commands for the determination of the contents of the alphanumeric messages. There is one common character set for FLEX and POGSAG. These commands can only be activated if `POCS:MESSage:CATegory ALPHanumeric` is selected.

[:SOURce]:POCSag:MESSage:ALPHanumeric[:SELect] "FOX" | "ALPHA" | "USER 1" | "USER2" | "USER3" | "USER4"

The command selects the alphanumeric message. The following selection can be made:

"FOX" The quick brown fox jumps over the lazy dog

"ALPHA" ABCD to (complete POGSAG character set)

"USER1 to 4" 4 messages that can be freely edited by command `ALPHanumeric:DATA`.

Example: `:SOUR:POCS:MESS:ALPH:SEL "FOX"` *RST value is USER3

[:SOURce]:POCSag:MESSage:ALPHanumeric:CATalog?

The command queries the alphanumeric messages available. It causes a list to be returned on which the entries are separated by commas. The command is a query command and thus has no *RST value.

Example: `:SOUR:POCS:MESS:ALPH:CAT?` Answer: `FOX, ALPHA, USER1`

[:SOURce]:POCSag:MESSage:ALPHanumeric:DATA "String"

The command allows any character string to be entered into one of the alphanumeric messages USER 1 to 4. This message has to be selected first with the command `ALPHanumeric:SELect`. *RST value is "" (eg, empty message)

Example: `:SOUR:POCS:MESS:ALPH:DATA "Hello"`

[:SOURce]:POCSag:POLarity NORMal | INVerted

The command sets the polarity of the modulation.

NORMal The polarity of the modulation is set according to standard POCSAG.

INVerted The polarity of the modulation is inverted.

Example : `:SOUR:POCS:POL NORM` *RST value is NORM

[:SOURce]:POCSag:TSLice 2 to 120 sec

The command determines the length of the time slice. Possible values are: 2 to 120 sec. A preamble of 576 bits is sent at the beginning of every time slice, followed by the number of filler batches set with command *POCS:LBAT*. Each batch has the length of 544 bits.

Depending on the settings under commands *POCS:TACT* and *TRIG:DM*, zero, one or two message batches follow. Then an unmodulated signal is sent up to the end of the time slice.

Due to the fact that only complete code word groups are sent, it is possible that, depending on the set bit rate, the length of the actual time slice slightly differs from the set value of time slice length.

Example: `:SOUR:POCS:TSL 10` *RST value is 10

[:SOURce]:POCSag:TACTion MESSage | STARt

This command (Trigger ACTion) determines the action which is activated by a trigger event. The valid trigger events are specified by command `TRIGger:DM:SOURce`. This command also defines the allocation between manual and remote-control operations.

MESSage A trigger event switches from filler data output to useful data output for the duration of a time slice. The filler data are then output again.

STARt Digital modulation is started by a trigger event. Useful data are then continuously output according to the settings.
This setting is suitable, for example, for a synchronous start of several units.

Example: `SOUR:POCS:TACT MESS` *RST value is MESSage

3.6.11.15 SOURce:POWer Subsystem

This subsystem contains the commands to set the output level, the level control and the level correction of the RF signal. Other units can be used instead of dBm:

- by indication directly after the numeric value (Example `:POW 0.5V`),
- by altering the DEFault unit in the UNIT system (see Command `:UNIT:POWER`)

Command	Parameter	Default Unit	Remark
[:SOURce]			
:POWer			
:ALC			
:BANDwidth | BWIDth	100 Hz | 500 kHz	Hz	
:AUTO	ON | OFF | ONCE		
[:STATe]	ON | OFF		
[:LEVel]			
[:IMMediate]			
[AMPLitude]	-144 to +16 dBm	dBm	
:OFFSet	-100 to +100 dB	dB	
:RCL	INCLude | EXCLude		
:LIMit			
[:AMPLitude]	-144 to +16 dBm	dBm	
:MANual	-144 to +16 dBm	dBm	
:MODE	FIXed | SWEep | LIST		
:STARt	-144 to +16 dBm	dBm	
:STOP	-144 to +16 dBm	dBm	
:STEP			
[:INCRement]	0.1 to 10 dB	dB	

[:SOURce]:POWer:ALC

The commands checking the automatic level control are under this node.

[:SOURce]:POWer:ALC:BANDwidth|BWIDth 100 Hz | 500 kHz

The command sets the bandwidth of the level control. *RST value is 100 kHz

Example: `:SOUR:POW:ALC:BAND 100kHz`

[:SOURce]:POWer:ALC:BANDwidth | BWIDth:AUTO ON | OFF | ONCE

The command determines the mode in adapting the bandwidth.

ON The bandwidth is automatically adapted.

OFF No bandwidth adaptation.

ONCE The bandwidth is adapted once, then AUTO is automatically set to OFF.

Example: `:SOUR:POW:ALC:BAND:AUTO ON` *RST value is ON

[:SOURce]:POWer:ALC[:STATe] ON | OFF

The command switches level control on or off.

ON Level control is permanently switched on.

OFF Level control is switched on for a short period of time if the level changes.

Example: `:SOUR:POW :ALC:STAT ON` *RST value is ON

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] -144 to +16 dBm

The command sets the RF output level in operating mode CW. UP and DOWN can be indicated in addition to numeric values. Then the level is increased or reduced by the value indicated under `:SOURce:POWer:STEP`.

In this command, the OFFSet value is considered as with input value AMPLITUDE in the LEVEL-LEVEL menu. Thus the specified range indicated is only valid for `:POWer:OFFSet = 0`. The specified range with other OFFSet values can be calculated according to the following formula (cf. Chapter 2, Section "Level Offset" as well):

-144dBm+ OFFSet to +16dBm +OFFSet

The keywords of this command are optional to a large extent, thus the long as well as the short form of the command is shown in the example. *RST value is -30 dBm

Example: `:SOUR:POW:LEV:IMM:AMPL 15` or
`:POW 15`

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]:OFFSet -100 to +100 dB

The command enters the constant level offset of a series-connected attenuator/ amplifier (cf. Chapter 2, Section "Level Offset"). If a level offset is entered, the level entered using :POWer:AMPLitude does no longer conform to the RF output level. The following connection is true:

`:POWer` = RF output level + `POWer:OFFSet`.

Entering a level offset does not change the RF output level but only the query value of `:POWer:AMPLitude`.

Only dB is permissible as a unit here, linear units (V, W etc.) are not permitted.

Caution*: The level offset is also valid in the case of level sweeps!*

Example: `:SOUR:POW:LEV:IMM:AMPL:OFFS 0` oder *RST value is 0
`:POW:OFFS 0`

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]:RCL INCLude | EXCLude

The command determines the effect of the recall function on the RF level.*RST value has no effect to this setting.

INCLude The saved RF level is loaded when instrument settings are loaded with the [RECALL] key or with a memory sequence.

EXCLude The RF level is not loaded when instrument settings are loaded, the current settings are maintained.

Example: `:SOUR:POW:RCL INCL`

[:SOURce]:POWer:LIMit[:AMPLitude] -144 to + 16 dBm

The command limits the maximum Rf output level in operating mode CW and SWEEP. It does not influence the display LEVEL and the answer to query `POW?`.

Example: `:SOUR:POW:LIM:AMPL 15` *RST value is +16 dBm

[:SOURce]:POWer:MANual -144 to +16 dBm

The command sets the level if `SOURce:POWer:MODE` is set to SWEep and `SOURce:SWEep:MODE` to MANual. Only level values between START and STOP are permissible. (As to specified range, cf. `:POWer`). *RST value is -30 dBm

Example: `:SOUR:POW:MAN 1dBm`

[:SOURce]:POWer:MODE FIXed | SWEep | LIST

The command specifies the operating mode and thus also by means of which commands the level setting is checked.

FIXed The output level is specified by means of commands under `:SOURce:POWer:LEVel`.

SWEep The instrument operates in the SWEep mode. The level is specified by means of `:SOURce:POWer;STARt; STOP; CENTer; SPAN` and `MANual`.

LIST The instrument processes a list of frequency and level settings. The settings are effected in the `SOURce:LIST` subsystem.

Setting `:SOURce:POWer:MODE LIST` automatically sets command `:SOURce :FREQuency :MODE to LIST` as well. *RST value is FIXed

Example: `:SOUR:POW:MODE FIX`

[:SOURce]:POWer:STARt -144 to +16 dBm

The command sets the starting value for a level sweep. STARt may be larger than STOP, then the sweep runs from the high to the low level (As to specified range, cf. `:POWer:AMPLitude`).

Example: `:SOUR:POW:STAR -20` *RST value is -30dBm

[:SOURce]:POWer:STOP -144 to +16 dBm

The command sets the final value for a level sweep. STOP may be smaller than STARt. (As to specified range, cf. `:POWer:AMPLitude`). *RST value is -10dBm

Example: `:SOUR:POW:STOP 3`

[:SOURce]:POWer:STEP[:INCRement] 0.1 to 10 dB

The command sets the step width with the level setting if UP and DOWN are used as level values. The command is coupled with KNOB STEP in the manual control, i.e., it also specifies the step width of the shaft encoder.

Only dB is permissible as a unit here, the linear units (V, W etc.) are not permitted.

Example: `:SOUR:POW:STEP:INCR 2` *RST value is 1dB

3.6.11.16 SOURce:PULM Subsystem

This subsystem contains the commands to check the pulse modulation and to set the parameters of the modulation signal. The internal pulse generator (option SM-B4) is set in the SOURce:PULSe subsystem.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:PULM			Option SM-B3, SM-B4, SM-B8, and SM-B9
EXTernal			
:IMPedance	50 Ohm| 10 kOhm	Ohm	
:INTernal			
:FREQuency	0.01176 Hz to 10 MHz	Hz	
:POLarity	NORMal | INVerted		
:SOURce	INTernal | EXTernal		
:STATe	ON | OFF		

[:SOURce]:PULM:EXTernal:IMPedance 50 Ohm | 10 kOhm

The command sets the impedance of the input socket for the external pulse generator. The pulse generator has an own input socket, hence this setting is independent of the corresponding settings under PM and FM. *RST value is 10 kOhm

Example: `:SOUR:PULM:EXT:IMP 10E3`

[:SOURce]:PULM:INTernal:FREQuency 0.01176 Hz to 10 MHz

The command sets the frequency of the pulse generator. This parameter is coupled with `SOURce:PULSe:PERiod`. *RST value is 100 kHz

Example: `:SOUR:PULM:INT:FREQ 1MHz`

[:SOURce]:PULM:POLarity NORMal | INVerted

The command specifies the polarity between modulating and modulated signal.

NORMal The RF signal is suppressed during the interpulse period.

INVerted The RF signal is suppressed during the pulse.

Example: `:SOUR:PULM:POL INV` *RST value is NORMal

[:SOURce]:PULM:SOURce EXTernal | INTernal

The command selects the source of the modulating signal.

INTernal Internal pulse generator (option SM-B4).

EXTernal Signal fed externally *RST value is INTernal

Example: `:SOUR:PULM:SOUR INT`

[:SOURce]:PULM:STATe ON | OFF

The command switches on or off the pulse modulation. *RST value is OFF

Example: `:SOUR:PULM:STAT ON`

3.6.11.17 SOURce:PULSe Subsystem

This subsystem contains the commands to set the pulse generator (option SM-B4). The pulse generation is triggered on principle, with the trigger certainly being able to be set to "free run" using `TRIGger:PULSe:SOURce AUTO` as well. The pulse modulation (option SM-B3) is set in the SOURce:PULM subsystem.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:PULSe			Option SM-B4
:DELay	40 ns to 1 s	s	
:DOUBle			
:DELay	60 ns to 1 s	s	
[:STATe]	ON | OFF		
:PERiod	100 ns to 85 s	s	
:WIDTh	20 ns to 1 s	s	

[:SOURce]:PULSe:DELay 40 ns to 1 s

The command specifies the time from the start of the period to the first edge of the pulse. Due to the construction of the instrument, this parameter is set to 0 if `:SOURce:PULSe:DOUBle:STATe` is set to `ON`. The old value is activated again as soon as the double pulse has been switched off.

Example: `:SOUR:PULS:DEL 10us` *RST value is 1 us

[:SOURce]:PULSe:DOUBle

The commands to check the second pulse are under this node. If `:SOURce:PULSe:DOUBle:STATe` is set to ON, a second pulse whose width is identical to the first pulse is generated in every period.

[:SOURce]:PULSe:DOUBle:DELay 60 ns to 1 s

The command sets the time from the start of the pulse period to the first edge of the second pulse. *RST value is 1 us

Example: `:SOUR:PULS:DOUB:DEL 10us`

[:SOURce]:PULSe:DOUBle[:STATe] ON | OFF

The command switches the second pulse on or off.

ON The second pulse is switched on. Parameter `:SOURce:PULSe:DELay` is set to 0 and cannot be changed. `WIDTh > (PULSe:PERiod - PULSe:DOUBle:DELay)/2` results in error message -221, "Settings conflict".

OFF The second pulse is switched off. *RST value is OFF

Example: `:SOUR:PULS:DOUB:STAT OFF`

[:SOURce]:PULSe:PERiod 100 ns to 85 s

The command sets the pulse period.
The pulse period is the reciprocal value of the pulse frequency, thus this command is coupled to command `:SOURce:PULM:INTernal:FREQuency` *RST value is 10 us

Example: `:SOUR:PULS:PER 2s`

[:SOURce]:PULSe:WIDTh 20 ns to 1s

The command sets the pulse width. *RST value is 1 us

Example: `:SOUR:PULS:WIDT 0.1s`

3.6.11.18 SOURce:ROSCillator Subsystem

This subsystem contains the commands to set the external and internal reference oscillator.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:ROSCillator			
:EXTernal			
:FREQuency	1 to 16 MHz	Hz	
[:INTernal]			
:ADJust			
[:STATe]	ON | OFF		
:VALue	0 to 4095		
:SOURce	INTernal | EXTernal		

[:SOURce]:ROSCillator:EXTernal

The commands to set the external reference oscillator are under this node.

[:SOURce]:ROSCillator:EXTernal:FREQuency 1 to 16 MHz

The command informs the instrument about at which frequency the external reference oscillator oscillates.

Example: `:SOUR:ROSC:FREQ 5MHz` *RST value is 10 MHz

[:SOURce]:ROSCillator[:INTernal]:ADJust

The commands for frequency correction (fine adjustment of the frequency) are under this node.

[:SOURce]:ROSCillator[:INTernal]:ADJust[:STATe] ON | OFF

The command switches the fine adjustment of the frequency on or off.

Example: `:SOUR:ROSC:INT:ADJ:STAT ON` *RST value is OFF

[:SOURce]:ROSCillator[:INTernal]:ADJust:VALue 0 to 4095

The command indicates the frequency correction value (tuning value). For a detailed definition, cf. Chapter 2,Section Reference Frequency Internal/External.

Example: `:SOUR:ROSC:INT:ADJ:VAL 2048` *RST value is 2048

[:SOURce]:ROSCillator:SOURce INTernal | EXTernal

The command selects the reference source.

INTernal The internal oscillator is used.

EXTernal The reference signal is fed externally. *RST value is INTernal

Example: `:SOUR:ROSC:SOUR EXT`

3.6.11.19 SOURce:STEReo Subsystem

This subsystem contains the commands to generate FM stereo multiplex signals conforming to standards according to the pilot-tone method (options SM-B5 and SM-B6). The modulation signal is output in addition at the LF output socket (cf. Section "OUTPut2 system" as well).

Command	Parameter	Default Unit	Remark
[:SOURce]			
:STEReo			Option SM-B6 and SM-B5
:STATe	ON | OFF		
[:DEViation]	0 Hz to 100 kHz	Hz	
:SIGNal	AUDio | ARI		
:AUDio			
[:FREQuency]	0.1 Hz to 15 kHz	Hz	
:PREemphasis	OFF | 50 us | 75 us		
:MODE	RIGHt | LEFT | RELeft | REMLeft		
:PILot			
:STATe	ON | OFF		
[:DEViation]	0 Hz to 10 kHz	Hz	
:PHASe	0 to 360 deg	rad	
:ARI			
[:DEViation]	0 Hz to 10 kHz		
:TYPE	BK | DK | OFF	Hz	
:BK			
[:CODE]	A | B | C | D | E | F		

[:SOURce]:STEReo:STATe ON | OFF

The command switches on or off the stereo signal. *RST value is OFF

Example: `:SOUR:STER:STAT ON`

[:SOURce]:STEReo[:DEViation] 0 Hz to 100 kHz

The command sets the frequency deviation of the FM stereo multiplex signal without considering the pilot-tone content.

Example: `:SOUR:STER:DEV 40kHz` *RST value is 40 kHz

[:SOURce]:STEReo:SIGNal AUDio | ARI

The command selects which signals are generated, simulated audio signals or ARI traffic channel signals with a 19-kHz pilot tone.

AUDio Audio signals are generated, ARI is switched off.

ARI ARI signals are generated.

Example: `:SOUR:STER:SIGN AUD` *RST value is AUDio

[:SOURce]:STEReo:AUDio

The commands to set the characteristics of the audio signals generated by the SME are under this node.

[:SOURce]:STEReo:AUDio[:FREQuency] 0.1 Hz to 15 kHz

The command sets the frequency of the audio signal. The frequency applies to both channels at the same time.

Example: `:SOUR:STER:AUD 1kHz` *RST value is 1 kHz

[:SOURce]:STEReo:AUDio:PREemphasis OFF | 50 us | 75 us

The command selects the preemphasis of the audio signal.

OFF	Preemphasis is switched off.
50 us	0 µs preemphasis
75 us	75 µs preemphasis

*RST value is OFF

Example: `:SOUR:STER:AUD:PRE 50us`

[:SOURce]:STEReo:AUDio:MODE RIGHt | LEFT | RELeft | REMLeft

The command selects the operating mode in which the two channels operate.

RIGHt	Audio signal only in the right channel
LEFT	Audio signal only in the left channel
RELeft	(Right Equals Left) Audio signals of same frequency and phase in both channels
REMLeft	(Right Equals Minus Left) Audio signals of same frequency but opposite phase in both channels.

Example: `:SOUR:STER:AUD:MODE RIGH` *RST value is RELeft

[:SOURce]:STEReo:PILot

The commands to set the characteristics of the 19-kHz pilot-tone signal are under this node.

[:SOURce]:STEReo:PILot:STATe ON | OFF

The command activates or deactivates the pilot tone. The pilot tone can be activated or deactivated independently of the setting of `SOURce:STEReo:SIGNal`.

Example: `:SOUR:STER:PIL:STAT ON` *RST value is OFF

[:SOURce]:STEReo:PILot[:DEViation] 0 Hz to 10 kHz

The command sets the frequency deviation of the pilot tone. *RST value is 6,72 kHz

Example: `:SOUR:STER:PIL:DEV 6720`

[:SOURce]:STEReo:PILot:PHASe 0 to 360 deg

The command sets the phase of the pilot tone. The zero crossing of the suppressed 38-kHz auxiliary carrier of the stereo multiplex signal serves as a phase reference.

Example: `:SOUR:STER:PIL:PHAS 10deg` *RST value is 0 deg

[:SOURce]:STEReo:ARI

The commands to specify the characteristics of the ARI traffic channel signal are under this node.

[:SOURce]:STEReo:ARI[:DEViation] 0 Hz to 10 kHz

The command sets the deviation content of the unmodulated 57-kHz ARI auxiliary carrier.

Example: `:SOUR:STER:ARI:DEV 4kHz` *RST value is 4 kHz

[:SOURce]:STEReo:ARI:TYPE BK | DK | OFF

The command specifies which identification is generated.

BK	Area code. The AM modulation depth of the area code on the ARI auxiliary carrier, which has been selected under `SOURce: STEReo:ARI:BK:CODE` is m = 0.6.
DK	Broadcasting code. The AM modulation depth of the broadcasting code (125 Hz) on the ARI auxiliary carrier is m = 0.3.
OFF	Area and broadcasting code are deactivated. *RST value is DK

Example: `:SOUR:STER:ARI:TYPE BK`

[:SOURce]:STEReo:ARI:BK

The commands to specify the characteristics of the BK signal are under this node.

[:SOURce]:STEReo:ARI:BK[:CODE] A | B | C | D | E | F

The command specifies the area code.

A	Traffic area code A 23,7500 Hz
B	Traffic area code B 28,2738 Hz
C	Traffic area code C 34,9265 Hz
D	Traffic area code D 39,5833 Hz
E	Traffic area code E 45,6731 Hz
F	Traffic area code F 53,9773 Hz *RST value is A

Example: `:SOUR:STER:ARI:BK A`

3.6.11.20 SOURce:SWEep Subsystem

This subsystem contains the commands to check the RF sweep, i.e., sweeps of the RF generators. Sweeps are triggered on principle. The frequency sweep is activated by command `SOURce:FREQuency:MODE SWEep`, the level sweep by command `SOURce:POWer:MODE SWEep`.

Command	Parameter	Default Unit	Remark
[:SOURce]			
:SWEep			
:BTIMe	NORMal | LONG		
[:FREQuency]			
:DWELl	10 ms to 5 s	s	
:MODE	AUTO | MANual | STEP		
:POINts	Number		
:SPACing	LINear | LOGarithmic		
:STEP			
[:LINear]	0 to 1 GHz	Hz	
:LOGarithmic	0.01 to 50 PCT	PCT	
:POWer			
:DWELl	10 ms to 5 s	s	
:MODE	AUTO | MANual | STEP		
:POINts	Number		
:SPACing	LOGarithmic		
:STEP			
:LOGarithmic	0 to 10 dB	dB	

[:SOURce]:SWEep:BTIMe NORMal | LONG

The command sets the blank time (Blank TIMe) of the sweep. The setting is valid for all sweeps, i.e., also for LF sweeps.

NORMal Blank time as short as possible.

LONG Blank time long enough to permit an XY recorder to return to 0.

Example: `:SOUR:SWE:BTIM LONG` *RST value is NORM

[:SOURce]:SWEep[:FREQuency]

The commands to set the frequency sweeps are under this node. Keyword `[:FREQuency]` can be omitted (cf. examples). The commands are SCPI compatible then unless stated otherwise.

[:SOURce]:SWEep[:FREQuency]:DWELl 10 ms to 5 s

The command sets the dwell time per frequency step.

Example: `:SOUR:SWE:DWEL 12ms` *RST value is 15 ms

[:SOURce]:SWEep[:FREQuency]:MODE AUTO | MANual | STEP

The command specifies the run of the sweep.

AUTO Each trigger triggers exactly one entire sweep cycle.

MANual Each frequency step of the sweep is triggered by means of manual control or a `SOURce:FREQuency:MANual` command, the trigger system is not active. The frequency increases or decreases (depending on the direction of the shaft encoder) by the value indicated under `[:SOURce]:FREQuency:STEP:INCRement`.

STEP Each trigger triggers only one sweep step (single-step mode). The frequency increases by the value indicated under `[:SOURce]:SWEep:STEP:LOGarithmic`.

Example: `:SOUR:SWE:MODE AUTO` *RST value is AUTO

[:SOURce]:SWEep[:FREQuency]:POINts Number

The command determines the number of steps in a sweep.

Instead of this command, commands `SOURce:SWEep:FREQuency:STEP:LINear` and `SOURce:SWEep:FREQuency:STEP:LOGarithmic` should be used, as `SOURce:SWEep :FREQuency:POINts` has been adapted to the instrument characteristics in comparison to the SCPI command.

The value of POINts depends on SPAN and STEP according to the following formulas..

The following is true for linear sweeps : POINts = SPAN / STEP:LIN + 1

The following is true for logarithmic sweeps and STARt < STOP:

POINts = ((log STOP - log STARt) / log (1+ STEP:LOG))

Two independent POINts values are used for SPACing LOG and SPACing LIN. I.e., before POINts is changed, SPACing must be set correctly. A change of POINts results in an adaptation of STEP, but not of STARt, STOP and SPAN.

Example: `:SOUR:SWE:POIN 100`

[:SOURce]:SWEep[:FREQuency]:SPACing LINear | LOGarithmic

The command selects whether the steps have linear or logarithmic spacings.

Example: `:SOUR:SWE:SPAC LIN` *RST value is LINear

[:SOURce]:SWEep[:FREQuency]:STEP[:LINear] 0 to 1 GHz

The command sets the step width with the linear sweep. If STEP[:LINear] is changed, the value of POINts valid for SPACing:LINear also changes according to the formula stated under POINts. A change of SPAN does not result in a change of STEP[:LINear]. Keyword [:LINear] can be omitted, then the command conforms to SCPI regulations (see example).

Example: `:SOUR:SWE:STEP 1MHz` *RST value is 1 MHz

[:SOURce]:SWEep[:FREQuency]:STEP:LOGarithmic 0.01 to 50 PCT

The command indicates the step width factor for logarithmic sweeps. The next frequency value of a sweep is calculated according to

new frequency = prior frequency + STEP:LOG x prior frequency (if STARt < STOP)

STEP:LOG indicates the fraction of the prior frequency by which this is increased for the next sweep step. Usually STEP:LOG is indicated in percent, with the suffix PCT having to be used explicitly. If STEP:LOG is changed, the value of POINts valid for SPAC:LOG also changes according to the formula stated under POINts. A change of STARt or STOP does not result in a change of STEP:LOG.

Example: `:SOUR:SWE:STEP:LOG 10PCT` *RST value is 1 PCT

[:SOURce]:SWEep:POWer:DWELl 10 ms to 5 s

The command sets the dwell time per level step.

Example: `:SOUR:SWE:POW:DWEL 12ms` *RST value is 15 ms

[:SOURce]:SWEep:POWer:MODE AUTO | MANual | STEP

The command specifies the run of the sweep.

AUTO Each trigger triggers exactly one entire sweep cycle.

MANual Each level step of the sweep is triggered by means of manual control or a `SOURce:POWer:MANual` command, the trigger system is not active. The level increases or decreases (depending on the direction of the shaft encoder) by the value stated under `:SOURce:POWer:STEP: INCRement.`

STEP Each trigger triggers only one sweep step (single-step mode). The level increases by the value indicated under :SOURce:POWer:STEP: INCRement.

Example: `:SOUR:SWE:POW:MODE AUTO` *RST value is AUTO

[:SOURce]:SWEep:POWer:POINts Number

The command determines the number of steps in a sweep. Instead of this command, command SOURce:SWEep:POWer:STEP:LOGarithmic should be used, as POINts has been adapted to the instrument characteristics in comparison to the SCPI command.

The value of :POINts depends on .SPAN and :STEP according to the following formulas:

POINts = ((log STOP - log STARt) / log STEP:LOG) + 1

A change of POINts results in an adaptation of STEP but not of STARt, STOP and SPAN.

Example: `:SOUR:SWE:POW:POIN 100`

[:SOURce]:SWEep:POWer:SPACing LOGarithmic

The command specifies that the steps have logarithmic spacings. It permits the query of SPACing. *RST value is LOGarithmic

Example: `:SOUR:SWE:POW:SPAC LOG`

[:SOURce]:SWEep:POWer:STEP:LOGarithmic 0 to 10 dB

The command indicates the step width factor for logarithmic sweeps. The next level value of a sweep is calculated according to

new level = prior level + STEP:LOG × prior level

STEP:LOG indicates the fraction of the prior level by which this is increased for the next sweep step. Usually STEP:LOG is indicated in dB, with suffix dB having to be used explicitly. If STEP:LOG is changed, the value of POINts also changes according to the formula indicated under POINts. A change of STARt or STOP does not result in a change of STEP:LOG. Keyword :LOG can be omitted, then the command conforms to SCPI regulation (see example).

Example: `:SOUR:SWE:STEP 10dB` *RST value is 1dB

3.6.11.21 SOURce:VOR Subsystem

This subsystem contains the commands to control the characteristics of the test signals for VOR (VHF Omnidirectional Range) (option SM-B6, multifunction generator).

Command	Parameter	Default Unit	Remark
[:SOURce]			
:VOR			Option SM-B6
:STATe	ON | OFF		
:SOURce	INT2 | INT2, EXT		
:MODE	NORM | VAR | SUBCarrier | FMSubcarrier		
[:BANGle]	0 to 360 deg	rad	
:DIRection	FROM | TO		
:VAR			
[:DEPTh]	0 to 100 PCT	PCT	
:FREQuency	20 to 40 Hz	Hz	
:SUBCarrier			
:DEPTh	0 to 100 PCT	PCT	
[:FREQuency]	5 to 15 kHz	Hz	
:REFerence			
[:DEViation]	0 to 960 Hz	Hz	
:PRESet			No query
:COMid			
[:STATe]	ON | OFF		
:FREQuency	0.1 to 20 000 Hz	Hz	
:DEPTh	0 to 100 PCT	PCT	

[:SOURce]:VOR:STATe ON | OFF

The command switches on or off the generation of VOR signals. STATe ON is only possible if no amplitude modulation is switched on. Modulation generator 2 must not be switched simultaneously as a source for PM or FM either. *RST value is OFF

Example: `:SOUR:VOR:STAT ON`

[:SOURce]:VOR:SOURce INT2 | INT2, EXT

This command determines the signal sources of the test signal.

INT2 — The test signal used for VOR is generated internally by LF generator 2 (SOURce INT2).

INT2 , EXT — A signal from input EXT1 is added to the internal signal in addition. Switching off the internal source is not possible. *RST value is INT2

Example: `:SOUR:VOR:SOUR INT2`

[:SOURce]:VOR:MODE NORM | VAR | SUBCarier

The command specifies the type of VOR signal generated.

NORM VOR signal

VAR Amplitude modulation of the output signal with the `SOURce:VOR:VAR:FREQuency` signal component (usually 30 Hz) of the VOR signal. The modulation depth is set under `SOURce:VOR:VAR:DEPTh`.

SUBCarrier Amplitude modulation of the output signal with the unmodulated `SOURce:VOR:SUBCarrier:FREQuency-FM carrier` (usually 9960 Hz) of the VOR signal. The modulation depth is set under `SOURce:VOR:SUBCarrier:DEPTh`.

FMSubcarrier (FM-modulated subcarrier) Amplitude modulation of the output signal with the frequency-modulated `SOURce:VOR:SUBCarrier:FREQuency` FM carrier (usually 9960 Hz) of the VOR signal. The frequency deviation is set under `SOURce:VOR:REFerence:DEViation`, the modulation depth under `SOURce:VOR:SUBCarrier:DEPTh`. *RST value is NORM

Example: `:SOUR:VOR:MODE VAR`

[:SOURce]:VOR[:BANGle] 0 to 360 deg

The command sets the Bearing ANGle between the VAR signal and the reference signal. The orientation of the angle depends on the setting under `SOURce:VOR :BANGle:DIRection`.

Example: `:SOUR:VOR:BANG 0deg` *RST value is 0 Grad

[:SOURce]:VOR[:BANGle]:DIRection FROM | TO

The command determines the orientation of the bearing angle.

FROM The bearing angle is measured between the geographic north and the connection line from beacon to airplane.

TO The bearing angle is measured between the geographic north and the connection line from airplane to beacon.

Example: `:SOUR:VOR:BANG:DIR TO` *RST value is FROM

[:SOURce]:VOR:VAR[:DEPTh] 0 to 100 PCT

The command sets the AM modulation depth of the VAR signal.

Example: `:SOUR:VOR:VAR:DEPT 30PCT` *RST value is 30PCT

[:SOURce]:VOR:VAR:FREQuency 20 to 40 Hz

The command sets the frequency of the VAR signal. As VAR and reference signal must always have the same frequency, this setting is also valid for the reference signal.

Example: `:SOUR:VOR:VAR:FREQ 30` *RST value is 30 Hz

[:SOURce]:VOR:SUBCarrier:DEPTh 0 to 100 PCT

The command sets the AM modulation depth of the FM carrier. *RST value is 30PCT

Example: `:SOUR:VOR:SUBC:DEPT 30PCT`

[:SOURce]:VOR:SUBCarrier[:FREQuency] 5 to 15 kHz

The command sets the frequency of the FM carrier. *RST value is 9960 Hz

Example: `:SOUR:VOR:SUBC:FREQ 9960`

[:SOURce]:VOR:REFerence[:DEViation] 0 to 960 Hz

The command sets the frequency deviation of the reference signal on the FM carrier.

Example: `:SOUR:VOR:REF:DEV 480` *RST value is 480 Hz

[:SOURce]:VOR:PRESet

The command sets the frequency deviation of the reference signal on the FM carrier.

```
:VOR:MODE NORM
:VOR:SOUR INT2
:VOR 0deg
:VOR:DIRection FROM
:VOR:VAR:FREQ 30Hz
:VOR:VAR 30PCT
:VOR:SUBC 9960Hz
:VOR:SUBC:DEPTh 30PCT
:VOR:REF:DEV 480Hz
:VOR:COM OFF
:VOR:COM:FREQ 1020Hz
:VOR:COM:DEPTh 10PCT
```

The values set correspond to the state after SYSTEM:PRESET or *RST. The command neither has a query form nor an *RST value.

Example: `:SOUR:VOR:PRES`

[:SOURce]:VOR:COMid[:STATe] ON | OFF

The command activates or deactivates the ComId signal. *RST value is OFF

Example: `:SOUR:VOR:COM:STAT ON`

[:SOURce]:VOR:COMid:FREQuency 0.1 to 20 000 Hz

The command sets the frequency of the ComId signal. *RST value is 1020 Hz

Example: `:SOUR:VOR:COM:FREQ 1020`

[:SOURce]:VOR:COMid:DEPTh 0 to 100 PCT

The command sets the AM modulation depth of the ComId signal.

Example: `:SOUR:VOR:COM:DEPT 10PCT` *RST value is 10 PCT

3.6.12 SOURce0|2 System

The SOURce0|2 system contains the commands to configure the LF signal sources. The following allocation is valid:

SOURce0: Standard generator.
Designated as INT1 if used as a modulation source (cf. command SOURce:AM:SOURce INT1, e.g.). The numbering as SOURce0 is different from the manual control.
Second optional LF generator (option SM-B2).
Replaces the standard generator which is cut out by this option. Is designated as INT1 if it is used as a modulation source; if it is used as an LF generator, it is designated as SOURce0 differently from the numbering of the manual control.

SOURce2: First optional LF or modulation generator (option SM-B2 or SM-B6).
Is designated as INT2 if it is used as a modulation source; if it is used as an LF generator, it is designated as SOURce2.

The commands to set the output voltage of the LF generators are in the OUTPut2 system (see Section 3.6.10)

Subsystems	Settings
:SOURce0 | 2	
:FREQuency	Frequency with CW and sweep operation.
:FUNCtion	Waveform of the output signal
:MARKer	Marker for LF sweeps (only possible using SOURce2)
:SWEep	LF sweep (only possible using SOURce2)

3.6.12.1 SOURce0|2:FREQuency Subsystem

This subsystem contains the commands for the frequency settings in operating modes CW and SWEep. Only command `SOURce0:FREQuency:CW|FIXed` is effective for the standard LF generator (SOURce0). For LF generator2 (SOURce2), sweep commands are effective as well.

Command	Parameter	Default Unit	Remark
:SOURce0 | 2			
:FREQuency			
[:CW|:FIXed]	400 Hz | 1 kHz | 3 kHz | 15 kHz or	Hz	
	0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz		Option SM-B2 or B6
:MANual	0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz	Hz	Option SM-B2 or B6
:MODE	CW|FIXed | SWEep		Option SM-B2 or B6
:STARt	0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz	Hz	Option SM-B2 or B6
:STOP	0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz	Hz	Option SM-B2 or B6

:SOURce0|2:FREQuency[:CW | :FIXed] 400 Hz | 1 kHz | 3 kHz | 15 kHz or 0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz

The command sets the frequency for the CW mode.

If neither SM-B2 nor SM-B6 are fitted, the values 400 Hz, 1 kHz, 3 kHz and 15 kHz are permissible for SOURce0. With option SM-B2, values from 0.1 Hz to 500 kHz are permissible, with SM-B6 from 0.1 Hz to 1 MHz. RST-Wert is 1 kHz

Example: `:SOUR2:FREQ:CW 1kHz`

SOURce0|2:FREQuency:MANual 0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz

The command sets the frequency if `SOURce2:SWEep:MODe MANual` and `SOURce2:FREQuency: MODe SWEep` are set. In this case, only frequency values between the settings `SOURce2: FREQuency:STARt` and to `:STOP` are allowed.

Example: `:SOUR2:FREQ:MAN 1kHz` *RST value is 1kHz

SOURce0|2:FREQuency:MODE CW|FIXed | SWEep

The command specifies the operating mode and hence by means of which commands the FREQuency subsystem is checked. The following allocations are valid:

CW |FIXed CW and FIXed are synonyms. The output frequency is specified by means of `SOURce0|2:FREQuency:CW |FIXed`.

SWEep The generator operates in the SWEep mode. The frequency is specified by means of commands `SOURce2:FREQuency:STARt; STOP; MANual`. The SWEep setting is only possible for SOURce2-

Example: `:SOUR2:FREQ:MODE CW` *RST value is CW

SOURce0|2:FREQuency:STARt 0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz

This command indicates the starting value of the frequency for the sweep.

Example: `:SOUR2:FREQ:STAR 100kHz` *RST value is 1kHz

SOURce0|2:FREQuency:STOP 0.1 Hz to 500 kHz or 0.1 Hz to 1 MHz

This command indicates the end value of the frequency for the sweep.

Example: `:SOUR2:FREQ:STOP 200kHz` *RST value is 100 kHz

3.6.12.2 SOURce 0|2:FUNCtion-Subsystem

This subsystem contains the commands specifying the waveform of the output signal.

Command	Parameter	Default Unit	Remark
:SOURce0|2 :FUNCtion [:SHAPe]	SINusoid | SQUare | TRIangle | PRNoise | SAWTooth		Option SM-B2 / B6 Option SM-B6

:SOURce0|2:FUNCtion[:SHAPe] SINusoid | SQUare | TRIangle | PRNoise | SAWTooth

The command specifies the waveform of the output signal. In the case of the standard generator, the waveform is specified to be sine. Option SM-B2, LF generator can be converted to the signal forms sine, square, triangle and periodic noise, option SM-B6, multifunction generator to all signal forms. If two options SM-B2 are installed, SOURce0 can be set to the signal forms of option SM-B2 as well.

SINusoid	Sine
SQUare	Square
TRIangle	Triangle
PRNoise	Periodic noise
SAWtooth	Sawtooth

*RST value is SIN

Example: `:SOUR2:FUNC:SHAP SQU`

3.6.12.3 SOURce2:MARKer-Subsystem

This subsystem contains the commands to check the marker generation in the case of LF sweeps. Operating mode SWEep is only possible for SOURce2. The three markers existing are differentiated by a numeric suffix after marker.

Command	Parameter	Default Unit	Remark
:SOURce2			Option SM-B2/B6
:MARKer 1 | 2 | 3			
[:FSWeep]			
:AOFF			No query
:FREQuency	0.1 Hz to 500 kHz	Hz	
[:STATe]	ON | OFF		
:POLarity	NORMal | INVerted		

:SOURce2:MARKer 1 | 2 | 3[:FSWeep]

The commands for the markers with the LF frequency sweep (Frequency SWeep) are under this node. Keyword [:FSWeep] can also be omitted, then the command conforms to SCPI regulation (see examples).

:SOURce2:MARKer1|2|3[:FSWeep]:AOFF

The command switches off all LF frequency markers. This command triggers an event, thus is has no *RST value and no query form.

Example: `:SOUR2:MARK:AOFF`

:SOURce2:MARKer1|2|3[:FSWeep]:FREQuency 0.1 Hz to 500 kHz

The command sets the marker selected by the numeric suffix at MARKer to the frequency indicated.

*RST value for MARK1: 100kHz
MARK2: 10kHz
MARK3: 1kHz

Example: `:SOUR2:MARK1:FREQ 9000`

:SOURce2:MARKer1|2|3[:FSWeep][:STATe] ON | OFF

The command switches on or off the marker selected by the numeric suffix at MARKer.

Example: `:SOUR2:MARK1:STAT ON` *RST value is OFF

:SOURce2:MARKer1|2|3:POLarity NORMal | INVerted

The command specifies the polarity of the marker signal as follows:

NORMal When running through the marker condition, TTL level is applied at the marker output, otherwise 0 V.

INVers When running through the marker condition, 0 V is applied at the marker output, otherwise TTL level. *RST value is NORM

Example: `:SOUR2:MARK1:POL INV`

3.6.12.4 SOURce2:SWEep-Subsystem

This subsystem contains the commands to check the LF sweep of SOURce2. Sweeps are triggered on principle.

Command	Parameter	Default Unit	Remark
:SOURce2			Option SM-B2
:SWEep			
:BTIMe	NORMal | LONG		
[:FREQuency]			
:DWELl	1 ms to 1 s	s	
:MODE	AUTO | MANual | STEP		
:POINts	Number		
:SPACing	LINear | LOGarithmic		
:STEP			
[:LINear]	0 to 500 kHz	Hz	
:LOGarithmic	0.01 PCT to 50 PCT	PCT	

:SOURce2:SWEep:BTIMe NORMal | LONG

The command sets the blank time (Blank TIMe) of the sweep. The setting is valid for all sweeps, i.e., also for RF sweeps

NORMal Blank time as short as possible.

LONG Blank time long enough to permit an X/Y recorder to return to 0.

Example: `:SOUR2:SWE:BTIM LONG` *RST value is NORM

:SOURce2:SWEep

The commands to set the frequency sweeps are under this node. Keyword [:FREQuency] can be omitted. Then the commands are SCPI-compatible unless stated otherwise (see examples).

:SOURce2:SWEep[:FREQuency]:DWELl 1 ms to 1 s

The command sets the time per frequency step (dwell).

Example: `:SOUR2:SWE:DWEL 20ms` *RST value is 15 ms

:SOURce2:SWEep[:FREQuency]:MODE AUTO | MANual | STEP

The command specifies the run of the sweep.

AUTO Each trigger triggers exactly one entire sweep cycle.

STEP Each trigger triggers only one sweep step (single-step mode). The frequency increases by the value indicated under `:SOURce2:SWEep`

Example: `:SOUR2:SWE:MODE AUTO` *RST value is AUTO

:SOURce2:SWEep[:FREQuency]:POINts Number

The command determines the number of steps in a sweep. Instead of this command, commands `:SOURce2:FREQuency:STEP:LINear` and `:SOURce2 :FREQuency:STEP:LOGarithmic` should be used, as `:SOURce2:SWEep:FREQuency: POINts` has been adapted to the instrument characteristics in comparison to the SCPI command. The value of POINts depends on SPAN and STEP according to the following formulas.

The following is true of linear sweeps : POINts = SPAN / STEP:LIN + 1

The following is true of logarithmic sweeps and STARt < STOP:

POINts = ((log STOP log STARt) / log STEP:LOG) + 1

Two independent POINts values are used for SPACing LOG and SPACing LIN. That is to say, before POINts is changed, SPACing must be set correctly. A change of POINts causes an adaption of STEP, but not of STARt, STOP and SPAN.

Example: `:SOUR2:SWE:POIN 50`

:SOURce2:SWEep[:FREQuency]:SPACing LINear | LOGarithmic

The command selects whether the steps have linear or logarithmic spacings.

Example: `:SOUR2:SWE:SPAC LOG` *RST value is LINear

:SOURce2:SWEep[:FREQuency]:STEP

The commands to set the step width with linear and logarithmic sweeps are under this node. The settings of STEP:LIN and STEP:LOG are independent of each other.

:SOURce2:SWEep[:FREQuency]:STEP[:LINear] 0 to 500 kHz

The command sets the step width with the linear sweep. If STEP:LINear is changed, the value of POINts valid for SPACing:LINear also changes according to the formula indicated under POINts. A change of SPAN does not cause a change of STEP:LINear. Keyword [:LINear] can be omitted, then the command conforms to SCPI regulation (see example)

Example: `:SOUR2:SWE:STEP 10kHz` *RST value is 1 kHz

:SOURce2:SWEep[:FREQuency]:STEP:LOGarithmic 0.01 to 50PCT

The command indicates the step width factor for logarithmic sweeps. The next frequency value of a sweep is calculated according to (if STARt < STOP) :

new frequency = prior frequency + STEP:LOG x prior frequency

Thus STEP:LOG indicates the fraction of the prior frequency by which this is increased for the next sweep step. Usually STEP:LOG is indicated in percent, with the suffix PCT having to be used explicitly. If STEP:LOG is changed, the value of POINts valid for SPACing:LOGarithmic also changes according to the formula stated unde

Example: `:SOUR2:SWE:STEP:LOG 5PCT` *RST value is 1 PCT

3.6.13 STATus-System

This system contains the commands for the status reporting system (c.f. Section "Status Reporting System"). *RST has no influence on the status registers.

Command	Parameter	Default Unit	Remark
:STATus			
:OPERation			
[:EVENt]?			Query only
:CONDition?			Query only
:PTRansition	0 to 32767		
:NTRansition	0 to 32767		
:ENABle	0 to 32767		
:PRESet			No query
:QUEStionable			
[:EVENt]?			Query only
:CONDition?			Query only
:PTRansition	0 to 32767		
:NTRansition	0 to 32767		
:ENABle	0 to 32767		
:QUEue			
[:NEXT]?			Query only

:STATus:OPERation

The commands for the STATus:OPERation register are under this node.

:STATus:OPERation[:EVENt]?

The command queries the content of the EVENt part of the STATus:OPERation register. In reading out, the content of the EVENt part is deleted.

Example: `:STAT:OPER:EVEN?` Response: `17`

:STATus:OPERation:CONDition?

The command queries the content of the CONDition part of the STATus:OPERation register. In reading out, the content of the CONDition part is not deleted. The value returned directly reflects the current hardware state.

Example: `:STAT:OPER:COND?` Response: `1`

:STATus:OPERation:PTRansition 0 to 32767

The command (Positive TRansition) sets the edge detectors of all bits of the STATus:OPERation register from 0 to1 for the transitions of the CONDition bits.

Example: `:STAT:OPER:PTR 32767`

:STATus:OPERation:NTRansition 0 to 32767

The command (Negative TRansition) sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Example: `:STAT:OPER:NTR 0`

:STATus:OPERation:ENABle 0 to 32767

The command sets the bits of the ENABle register. This register selectively enables the individual events of the appropriate status event register for the sum bit in the status byte.

Example: `:STAT:OPER:ENAB 1`

:STATus:PRESet

The command resets the edge detectors and ENABle parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e., all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e., a transition from 1 to 0 in a CONDition bit is not detected. The ENABle parts of STATus:OPERation and STATus:QUEStionable are set to 0, i.e., all events in these registers are not passed on.

Example: `:STAT:PRES`

:STATus:QUEStionable

The commands for the STATus:QUEStionable register are under this node.

:STATus:QUEStionable[:EVENt]?

The command queries the content of the EVENt part of the STATus:QUEStionable register. In reading out, the content of the EVENt part is deleted.

Example: `:STAT:QUES:EVEN?` Response: `1`

:STATus:QUEStionable:CONDition?

The command queries the content of the CONDition part of the STATus:QUEStionable register. In reading out, the content of the CONDition part is not deleted.

Example: `:STAT:QUES:COND?` Response: `2`

:STATus:QUEStionable:PTRansition 0 to 32767STATus:QUEStionable:PTRansitionß to

The command (Positive TRansition) sets the edge detectors of all bits of the STATus:QUEStionable register from 0 to 1 for transitions of the CONDition bit.

Example: `:STAT:QUES:PTR 32767`

:STATus:QUEStionable:NTRansition 0 to 32767

The command (Negative TRansition) sets the edge detectors of all bits of the STATus:QUEStionable register from 1 to 0 for transitions of the CONDition bit.

Example: `:STAT:QUES:NTR 0`

:STATus:QUEStionable:ENABle 0 to 32767

The command sets the bits of the ENABle part of the STATus:QUEStionable register. This part selectively enables the individual events of the appropriate EVENt part for the sum bit in the status byte

Example: `:STAT:QUES:ENAB 1`

:STATus:QUEue [:NEXT]?

The command queries the entry that has been in the error queue for the longest time and thus deletes it. Positive error numbers denote errors specific of the instrument, negative error numbers error messages specified by SCPI (see annex B). If the error queue is empty, 0, "No error", is returned. The command is identical to SYSTem :ERRor?

Example: `STATus:QUEue:NEXT?` Response: `-221, "Settings conflict"`

3.6.14 SYSTem-System

In this system, a number of commands for general functions which are not immediately related to signal generation, are combined.

Command	Parameter	Default Unit	Remark
:SYSTem			
:BEEPer			
:STATe	ON | OFF		
:COMMunicate			
:GPIB			
[:SELF]			
:ADDRess	0 to 30		
:SERial			
:CONTrol			
:RTS	ON | IBFull | RFR		
:BAUD	1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200		
:PACE	XON | NONE		
:ERRor?			Query only
:KLOCk	ON | OFF		
:MODE	FIXed | MSEQuence		
:MSEQuence			
:CATalog?			Query only
:DELete	"Name of sequence"		
:ALL			
:DWELl	50 ms to 60 s {,50 ms to 60 s}	s	
:FREE?			
:MODE	AUTO | STEP		
[:RCL]	1 to 50 {,1 to 50}		
:POINts?			Query only
:SELect	"Name of sequence"		
:PRESet			No query
:PROTect			
[:STATe]	ON | OFF , password		
:SECurity			
[:STATe]	ON | OFF		
:SERRor?			Query only
:VERSion?			Query only

:SYSTem:BEEPer:STATe ON | OFF

This node contains the commands to set the beeper fitted. *RST value is OFF

Example: `:SYST:BEEP:STAT OFF`

:SYSTem:COMMunicate

The commands to set the remote control interfaces are under this node.

:SYSTem:COMMunicate:GPIB

The commands to check the IEC bus are under this node (GPIB = General Purpose Interface Bus)

:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess 1 to 30

The command sets the IEC bus instrument address. *RST value is 28

Example: `:SYST:COMM:GPIB:ADDR 1`

:SYSTem:COMMunicate:SERial

The command to set the serial interface are under this node. The data format is fixedly set to 8 data bits, no parity and 1 stop bit. These values cannot be changed. The device represents a DTE (Data Terminal Equipment) in relation to the serial interface. Therefore the the controller must be connected via a 0-modem.

:SYSTem:COMMunicate:SERial:BAUD 1200| 2400| 4800| 9600| 19200| 38400| 57600| 115200

The commands sets the baud rate for both the transmit and the receive direction. *RST has no influence on this parameter.

Example: `:SYST:COMM:SER:BAUD 1200` *RST value is 9600

:SYSTem:COMMunicate:SERial:CONTrol:RTS ON | IBFull | RFR

he commands sets the hardware handshake. *RST has no influence on this parameter.

ON Interface line RTS is always active.

IBFull | RFR Input Buffer Full | Ready For Receiving.
Interface line RTS remains active as long as the instrument is ready to receive data

Example: `:SYST:COMM:SER:CONT:RTS ON` *RST value is RFR

:SYSTem:COMMunicate:SERial:PACE XON | NONE

The command sets the software handshake. *RST has no influence on this parameter.

XON Software handshake using the ASCII codes 11h (XON) and 13h (XOFF).

Note: *This mode is not recommended for binary data and for baud rates above 9600 bauds.*

NONE No software handshake.

Example: `:SYST:COMM:SER:PACE NONE` *RST value is NONE

:SYSTem:ERRor?

The command queries the entry that has been in the error queue for the longest time. Positive error numbers denote errors specific of the instrument, negative error numbers denote error messages specified by SCPI (see annex B). If the error queue is empty, 0, "No error", is returned. The command is identical to `STATus:QUEue:NEXT?`

Example: `:SYST:ERR?` Response: `-221, "Settings conflict"`

:SYSTem:KLOCk ON | OFF

The command (Keyboard LOCk) disables the keyboard of the SME including the [LOCAL] key or enables it again (OFF).

Caution: *If :SYSTem:SECurity is ON, the keyboard cannot be enabled, i.e., :SYSTem:KLOCk OFF is not accepted. If the disabling of the command is released by switching over to :SYSTem:SECurity OFF, data will be lost.*

Example: `:SYST:KLOC ON` *RST value is OFF

:SYSTem:MODE FIXed | MSEQence

The command sets the operating mode of the instrument.

FIXed The overall instrument state can only be switched over using *RCL.

MSEQuence The instrument successively sets the instrument states indicated under `:SYSTem:MSEQuence:RCL`. *RST value is FIXed

Example: `:SYST:MODE FIX`

:SYSTem:MSEQuence

This node follows the SOURce:LIST system. It can manage several memory sequences which each consist of a list of instrument state numbers and a time list. If `:SYSTem:MODE` is switched to MSEQuence, the instrument states stated in the list selected are set successively for the time stated in the time list in each case.

:SYSTem:MSEQuence:CATalog?

The command queries the memory sequences available. It returns a list, the entries are separated by means of commas.

Example: `:SYST:MSEQ:CAT?` Response: `"SEQ1", "DEMO", "SEQA"`

:SYSTem:MSEQuence:DELete "Name of sequence"

The command deletes the memory sequence indicated.

Example: `:SYST:MSEQ:DEL "SEQ1"`

:SYSTem:MSEQuence:DELete:ALL

The command deletes all memory sequences. The memory-sequence mode must be switched off as a selected sequence cannot be deleted (`SYSTem:MODE FIXed`).

Example: `:SYST:MSEQ:DEL:ALL`

:SYSTem:MSEQuence:DWELl 50 ms to 60 s{,50 ms to 60 s}

For the memory sequence which has currently been selected, the command transmits a list indicating the time for which an instrument setting is "held" in each case before the instrument proceeds to the next setting. If DWELl indicates only one parameter, every item of the instrument state list is set for the same, indicated time. Lists are not influenced by *RST.

Example: `:SYST:MSEQ:DWEL 1s`

:SYSTem:MSEQuence:FREE?

The command queries the space available for memory sequences. It returns two values. The first value indicates the space still vacant, the second the space already occupied.

Example: `:SYST:MSEQ:FREE?` Response: `20, 236`

:SYSTem:MSEQuence:MODE AUTO | STEP

The command indicates in which way the memory sequence is to be processed (by analogy with `:SOURce:SWEep:MODE`).

AUTO Each trigger event triggers a complete cycle of the memory sequence selected.

STEP Each trigger event only triggers one step in processing the memory sequence.

Example: `:SYST:MSEQ:MODE AUTO` *RST value is AUTO

:SYSTem:MSEQuence[:RCL] 1 to 50 {,1 to 50}

The command transmits the list of the instrument states to be assumed successively. The list contains integers denoting the states stored by means of *SAV. These instrument states are set successively using a simulated *RCL (thus the name of the list). The length of the list is not limited. The values of the list are between 1 and 50 (number of memory locations to be called). Lists are not influenced by *RST.

Example: `:SYST:MSEQ:RCL 30, 31, 32 ,32 ,32 , 33`

:SYSTem:MSEQuence[:RCL]:POINts?

The command queries the length of the RCL list selected. The RCL list is user-defined and of variable length. The maximal length of the list can be queried by means of `:SYSTem:MSEQence:FREE?` (addition of the two values)..

Example: `:SYST:MSEQ:RCL:POIN?` Response: `17`

:SYSTem:MSEQuence:SELect "Name of sequence"

The command selects a memory sequence. The name of the sequence may be an arbitrary character string of up to 7 letters. If there is no memory sequence of the name indicated, the command creates it, i.e., this command can be used to generate new lists.

Example: `:SYST:MSEQ:SEL "SEQA"`

:SYSTem:PRESet

The command triggers an instrument reset. It has the same effect as the RESET key of the manual control or as command *RST. This command triggers an event and hence has no *RST value.

Example: `:SYST:PRES`

:SYSTem:PROTect1|2|3

The commands to disable certain instrument functions are under this node. A list of the functions concerned can be found in the manual control (Section Password Input With Protected Functions). There are three protection levels which are differentiated by means of a suffix after PROTect. *RST has no effects on the disabling/enabling of the instrument functions.

:SYSTem:PROTect1|2|3 [:STATe] ON | OFF, password

The command switches a protection level on or off. The passwords are 6-digit numbers. They are fixedly stored in the firmware. The password for the first level is 123456.

ON — disables the functions belonging to this protection level. A password need not be indicated.

OFF — deactivates the disabling again if the correct password is indicated. Otherwise an error -224, "Illegal parameter value" is generated and STATe remains ON.

Example: `:SYST:PROT1:STAT OFF, 123456`

:SYSTem:SECurity

The commands setting the security characteristics of the instrument are under this node.

:SYSTem:SECurity[:STATe] ON | OFF

The command switches the security state on or off. The command is not influenced by *RST and *RCL.

ON — The following commands cannot be executed:
```
:DISPlay:ANNotation:ALL ON
:DISPlay:ANNotation:FREQ ON
:DISPlay:ANNotation:AMPLitude ON
:SYSTem:KLOCk OFF
```

OFF — In the transition from ON to OFF all data existing in the instrument except for the calibrating data are deleted, especially all status registers, all instrument states and all lists.

Example: `:SYST:SEC:STAT ON`

:SYSTem:SECurity:SERRor?

This command returns a list of all errors existing at the point of time of the query. This list corresponds to the indication on the ERROR page with manual control (cf. Section Error Messages).

Example: `:SYST:SERR?`
Response: `-221, "Settings conflict", 153, "Input voltage out of range"`

:SYSTem:SECurity:VERSion?

The command returns the SCPI version number the instrument acts in accordance with. This command is a query and thus has no *RST value.

Example: `:SYST:VERS?` Response: `1994.0`

3.6.15 TEST-System

This system contains the commands to execute the selftest routines (RAM?, ROM? and BATTery?) as well as to directly manipulate the hardware modules (:TEST:DIRect). The selftests return a "0" if the test has been executed successfully, otherwise a value unequal to "0". All commands of this system do not have an *RST value.

Caution: *The commands under node :TEST:DIRect directly act on the respective hardware module circumventing any security mechanisms. They are provided for service purposes and should not be used by the user. Improper use of the commands may damage the module.*

Command	Parameter	Default Unit	Remark
:TEST			
:DIRect			
:ATTC	Subaddress, hex data string		
:DCOD	Subaddress, hex data string		
:DSYN0MUX	Subaddress, hex data string		
:DSYN1MUX	Subaddress, hex data string		
:FMOD	Subaddress, hex data string		
:LFGENA	Subaddress, hex data string		
:LFGENB	Subaddress, hex data string		
:MGEN	Subaddress, hex data string		
:OPU1M	Subaddress, hex data string		
:OPU3M	Subaddress, hex data string		
:OPU6M	Subaddress, hex data string		
:PUM	Subaddress, hex data string		
:REFSS	Subaddress, hex data string		
:ROSC	Subaddress, hex data string		
:SUM	Subaddress, hex data string		
:RAM?			Query only
:ROM?			Query only
:BATTery[:RAM]?			Query only
:BATTery :XMEM?			Query only

:TEST:DIRect

This node contains the commands directly acting on the respective hardware module circumventing any security mechanisms. The commands under this node have no short form.

:TEST:DIRect:SUM Subaddress, hex data string

The command directly acts on module SUM. A subaddress (0 or 1) must be indicated as a parameter. The data are indicated as a <string> (i.e., an ASCII character string enclosed in quotation marks) representing hexadecimal numbers. Thus characters 0 to 9 A to F may occur in the character string.

Example: `:TEST:DIR:SUM 0, "0010AF1F"`

Query: `:TEST:DIR:SUM? 0`

:TEST:DIRect:ATTC Subaddress, hex data string

The command acts on module ATTC. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:DCOD Subaddress, hex data string

The command acts on module DCOD. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:DSYN0MUX Subaddress, hex data string

The command acts on module DSYN. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:DSYN1MUX Subaddress, hex data string

The command acts on module DSYN. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:FMOD Subaddress, hex data string

The command acts on module FMOD. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:LFGENA Subaddress, hex data string

The command acts on module LFGENA. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:LFGENB Subaddress, hex data string

The command acts on module LFGENB. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:MGEN Subaddress, hex data string

The command acts on module MGEN. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:OPU1M Subaddress, hex data string

The command acts on module OPU1. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:OPU3M Subaddress, hex data string

The command acts on module OPU3. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:OPU6M Subaddress, hex data string

The command acts on module OPU6. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:PUM Subaddress, hex data string

The command acts on module PUM. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:REFSS Subaddress, hex data string

The command acts on module REFSS. (cf. `:TEST:DIR:SUM`)

:TEST:DIRect:ROSC Subaddress, hex data string

The command acts on module ROSC. (cf. `:TEST:DIR:SUM`)

:TEST:RAM?

The command triggers a test of the EPROMS.

:TEST:ROM?

The command triggers a test of the main memory.

:TEST:BATTery[:RAM]?

The command triggers a test of the RAM battery voltage. The voltage should be at least 2.1 V.

:TEST:BATTery:XMEM?

The command triggers a test of the XMEM battery voltage. The voltage should be at least 2.1 V.

3.6.16 TRIGger-System

The TRIGger system contains the commands to select the trigger source and to configure the external trigger socket. The suffix is only important for the SWEEP subsystem and conforms to the numbering of the SOURce system:
TRIGger1 = RF generator
TRIGger2 = LFGEN2

The trigger system of the SME is a simplified implementation of the SCPI trigger system. Compared to SCPI, the TRIGger system shows the following differences:

- No INITiate command, the instrument behaves as if `INITiate:CONTinuous ON` was set.
- There are several subsystems denoting the different parts of the instrument under TRIGger (SWEep, LIST, PULSe, MSEQuence, DM).

Further commands as to the trigger system of the SME can be found in the ABORt system.

Command	Parameter	Default Unit	Remark
:TRIGger1|2			
[:SWEep]			
[:IMMediate]			No query
:SOURce	SINGle | EXTernal | AUTO		
:DM			Option SME-B11
[:IMMediate]			No query
:SOURce	SINGle | EXTernal | AUTO		
:LIS			
[:IMMediate]			No query
:SOURce	SINGle | EXTernal | AUTO		
:MSEQuence			
[:IMMediate]			No query
:SOURce	SINGle | EXTernal | AUTO		
:PULSe			
:SOURce	EXTernal | AUTO		
:SLOPe	POSitive | NEGative		
:SLOPe	POSitive | NEGative		

:TRIGger1|2[:SWEep]

All commands to trigger a sweep are under this node. The settings here act on level and frequency sweeps for RF generator (TRIG1) and LF generator (TRIG2).

:TRIGger1|2[:SWEep][:IMMediate]

The command immediately starts a sweep. Which sweep is executed depends on the respective MODE setting, e.g. `:SOURce:FREQuency:MODE SWEep`. The command corresponds to manual-control command EXECUTE SINGLE SWEEP. This command triggers an event and thus has no *RST value.

Example: `:TRIG:SWE:IMM`

:TRIGger1|2[:SWEep]:SOURce AUTO | SINGle | EXTernal

The command specifies the trigger source. The naming of the parameters directly corresponds to the different settings with manual control. SCPI uses other designations for the parameters the instrument accepts as well. These designations are to be preferred if compatibility is important. The following table provides an overview.

SME designation	SCPI designation	Command with manual control
AUTO	IMMediate	MODE AUTO
SINGle	BUS	MODE SINGLE or STEP
EXTernal	EXTernal	MODE EXT TRIG SINGLE or EXT TRIG STEP

AUTO The trigger is free-running, i.e., the trigger requirement is permanently met. As soon as a sweep has been terminated, the next one is started.

SINGle Triggering is effected by means of IEC-bus commands `:TRIGger:SWEep:IMMediate` or `*TRG`. If `:SOURce:SWEep:MODE` is set to `STEP`, a step, in the case of the `AUTO` setting a complete sweep, is executed.

EXTernal Triggering is effected from outside via the EXT.TRIG. socket or by the GET command via IEC/IEEE-bus (see annex A). The action triggered depends on the setting of the sweep mode as in the case of SINGle.

Example: `:TRIG:SWE:SOUR AUTO` *RST value is SINGle

:TRIGger:DM

The commands for the autorun control of digital modulations are under this is node.

These commands are only valid for TRIGger1.

:TRIGger:DM[:IMMediate]

In case of basic digital modulations, this command immediately starts the processing of the data list of the DM data generator. The command acts on the type of modulation presently set using `SOURce:DM:TYPE`.

In case of complex digital modulations (FLEX, ERMes, POCSag), the command immediately triggers the action set using TACTion (Trigger ACTion, in the subsystem of the corresponding modulation).

It corresponds to the EXECUTE SINGLE command of the manual control in the associated DIGITAL MOD menu. This command is an event and thus has no *RST value.

Example: `:TRIG:DM:IMM`

:TRIGger:DM:SOURce AUTO | SINGle | EXTernal

The command specifies the valid trigger events. See following table for effect on complex modulations

AUTO — The trigger condition is always fulfilled. In case of basic digital modulations, the list is processed repeatedly, the RF signal is continuously DM-modulated.

SINGle — The trigger condition can be fulfilled by manual control or by using the commands `TRIG:DM:IMM` or `*TRG`. The list is processed only once. DM is subsequently inactive.

EXTernal — This setting has no effect on the basic digital modulations.

Effect of `TRIGger:DM:SOURce` and `SOURce:ERMes|FLEX|POCSag:TACtion` on the sequence of complex digital modulations.

	:SOURce:ERMes:TACTion MESSage	:SOURce:ERMes:TACTion STARt
TRIGger:DM:SOURce AUTO	MODE ALWAYS Useful and filler data are continuously repeated in the set sequence; the setting under ERMes/FLEX/POCsag:TACTion is irrelevant	
TRIGger:DM:SOURce SINGle	MODE SINGLE A trigger event (key; IEC/IEEE-bus-command) switches once from filler data output to useful data output.	–
TRIGger:DM:SOURce EXTernal	MODE EXT-SINGLE An external trigger event (signal edge at the trigger connector) switches once from filler data output to useful data output.	MODE EXTTRIG-SINGLE An external trigger event starts digital modulation. Subsequently, the useful and filler data are continuously repeated in the set sequence.

Example: `:TRIG:DM:SOUR AUTO` *RST value is AUTO

:TRIGger:LIST

This node contains all commands to trigger a list in the LIST mode.

The commands are only valid for TRIGger1.

:TRIGger:LIST[:IMMediate]

The command immediately starts the processing of a list of the LIST mode. It corresponds to command EXECUTE SINGLE MODE of the manual control in the LIST menu. This command is an event and thus has no *RST value.

Example: `:TRIG:LIS:IMM`

:TRIGger1|2:LIST:SOURce AUTO | SINGle | EXTernal

The command specifies the trigger source. The naming of the parameters corresponds to the one with sweep mode. SCPI uses other designations for the parameters the instrument accepts as well. These designations are to be preferred if compatibility is important. The following table provides an overview:

SME designation	SCPI designation	Command with manual control
AUTO	IMMediate	MODE AUTO
SINGle	BUS	MODE SINGLE or STEP
EXTernal	EXTernal	MODE EXT TRIG SINGLE or EXT TRIG STEP

AUTO — The trigger is free-running, i.e., the trigger condition is permanently fulfilled. As soon as the list selected has been finished in the LIST mode, it is started anew.

SINGle — Triggering is executed by means of IEC-bus command :TRIGger:LIST :IMM. The list is executed once.

EXTernal — Triggering is carried out from outside via the EXT.TRIG. socket or by the GET command via IEC/IEEE-bus (see annex A). The list is executed once

Example: `:TRIG:LIS:SOUR AUTO` *RST value is SINGle

:TRIGger:MSEQuence

This node contains all commands to trigger a memory sequence. The commands are only valid for TRIGger1.

:TRIGger:MSEQuence[:IMMediate]

The command immediately starts a memory sequence. It corresponds to the EXECUTE SINGLE MODE command of the manual control in the MEMORY SEQUENCE menu. This command is an event and thus has no *RST value.

Example: `:TRIG:MSEQ:IMM`

:TRIGger:MSEQuence:SOURce AUTO | SINGle | EXTernal

The command specifies the trigger source (cf. `:TRIGger:SWEep:SOURce`)

Example: `:TRIG:MSEQ:SOUR AUTO` *RST value is SINGle

:TRIGger:PULSe

This node contains all commands to trigger the pulse generator (option SM-B4). The commands are only valid for TRIGger1.

:TRIGger:PULSe:SOURce EXTernal | AUTO

The command specifies the trigger source.

EXTernal	Triggering is effected from outside via the PULSE socket.	
AUTO	Trigger is free-running (see above)	*RST value is AUTO
Example:	`:TRIG:PULS:SOUR AUTO`	

:TRIGger:PULSe:SLOPe POSitive | NEGative

The command indicates whether the action triggered is triggered at the positive or the negative edge of the trigger signal. *RST value is POSitiv

Example: `:TRIG:PULS:SLOP NEG`

:TRIGger:SLOPe POSitive | NEGative

The command indicates whether the external trigger input only responds to the positive, the negative or to both edges of the trigger signal. The command acts on TRIGger:SWEep, TRIGger:LIST and TRIGger:MSEQuence. The pulse generator has an own trigger input and thus also an own SLOPe command. *RST value is POSitiv

Example: `:TRIG:SLOP NEG`

3.6.17 UNIT-System

This system contains the commands specifying which units are valid if no unit is indicated in a command. These settings are valid for the entire instrument.

Command	Parameter	Default Unit	Remark
:UNIT			
:ANGLe	DEGRee| DEGree | RADian		
:POWer	DBM | DBW | DBMW | DBUW | DBV | DBMV | DBUV | V		

:UNIT:ANGLe DEGRee | DEGree | RADian

The command indicates the unit for angles. *RST value is RADian

Example: `:UNIT:ANGL DEGR`

:UNIT:POWer DBM | DBW | DBMW | DBUW | DBV | DBMV | DBUV | V

The command indicates the unit for power. *RST value is DBM

Example: `:UNIT:POW V`

3.7 Instrument Model and Command Processing

The instrument model shown in Fig. 3-2 has been made viewed from the standpoint of the servicing of IEC-bus commands. The individual components work independently of each other and simultaneously. They communicate by means of so-called "messages".

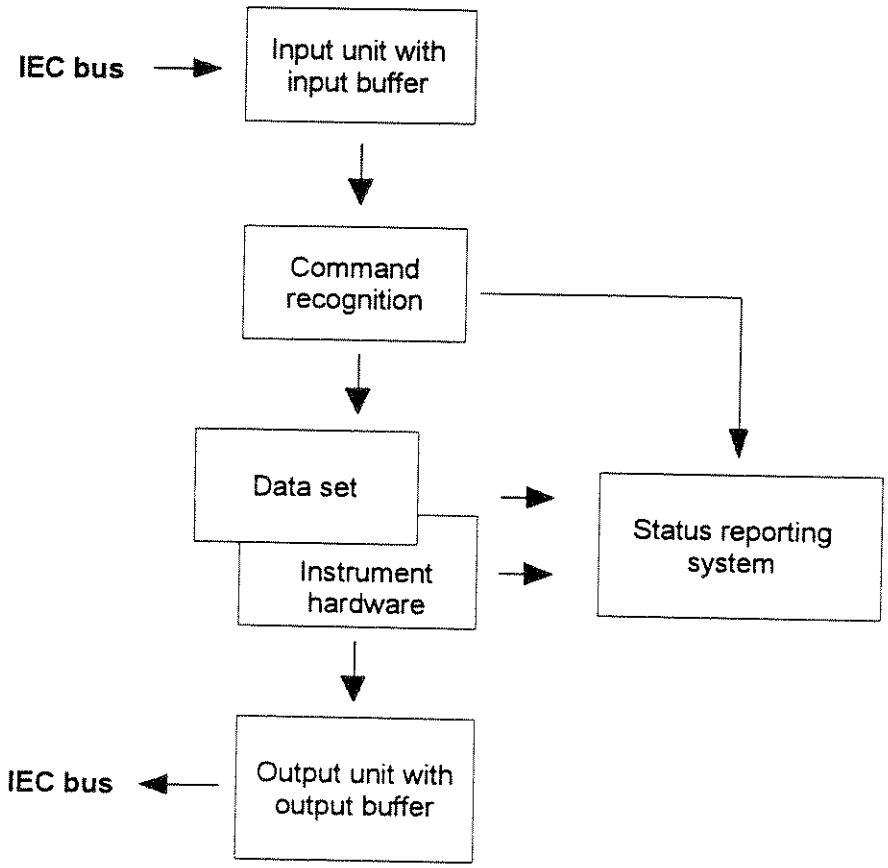


Fig. 3-2 Instrument model in the case of remote control by means of the IEC bus

3.7.1 Input Unit

The input unit receives commands character by character from the IEC bus and collects them in the input buffer. The input buffer has a size of 1024 characters. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.

If the input buffer is full, the IEC-bus traffic is stopped and the data received up to then are processed. Subsequently the IEC-bus traffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The receipt of a DCL clears the input buffer and immediately initiates a message to the command recognition.

3.7.2 Command Recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only a DCL is serviced with priority, a GET (Group Execute Trigger), e.g., is only executed after the commands received before as well. Each recognized command is immediately transferred to the data set but without being executed there at once.
Syntactical errors in the command are recognized here and supplied to the status reporting system. The rest of a command line after a syntax error is analyzed further if possible and serviced.
If the command recognition recognizes a delimiter or a DCL, it requests the data set to set the commands in the instrument hardware as well now. Subsequently it is immediately prepared to process commands again. This means for the command servicing that further commands can already be serviced while the hardware is still being set ("overlapping execution").

3.7.3 Data Set and Instrument Hardware

Here the expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation, measurement etc. The controller is not included.

The data set is a detailed reproduction of the instrument hardware in the software.

IEC-bus setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. As this is always only effected at the end of a command line, the order of the setting commands in the command line is not relevant.

The data are only checked for their compatibility among each other and with the instrument hardware immediately before they are transmitted to the instrument hardware. If the detection is made that an execution is not possible, an "execution error" is signaled to the status reporting system. All alterations of the data set are canceled, the instrument hardware is not reset. Due to the delayed checking and hardware setting, however, it is permissible to set impermissible instrument states within one command line for a short period of time without this leading to an error message (example: simultaneous activation of FM and PM). At the end of the command line, however, a permissible instrument state must have been reached again.

Before passing on the data to the hardware, the settling bit in the STATus:OPERation register is set (cf. Section 3.8.3.4). The hardware executes the settings and resets the bit again as soon as the new state has settled. This fact can be used to synchronize command servicing.

IEC-bus queries induce the data set management to send the desired data to the output unit.

3.7.4 Status Reporting System

The status reporting system collects information on the instrument state and makes it available to the output unit on request. The exact structure and function are described in Section 3.8.

3.7.5 Output Unit

The output unit collects the information requested by the controller, which it receives from the data set management. It processes it according to the SCPI rules and makes it available in the output buffer. The output buffer has a size of 1024 characters. If the information requested is longer, it is made available "in portions" without this being recognized by the controller.
If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data set management, the output unit sends error message "Query UNTERMINATED" to the status reporting system. No data are sent on the IEC bus, the controller waits until it has reached its time limit. This behavior is specified by SCPI.

3.7.6 Command Sequence and Command Synchronization

What has been said above makes clear that all commands can potentially be carried out overlapping. Equally, setting commands within one command line are not absolutely serviced in the order in which they have been received.

In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line, that is to say, with a separate IBWRT()-call.
In order to prevent an overlapping execution of commands, one of commands *OPC, *OPC? or *WAI must be used. All three commands cause a certain action only to be carried out after the hardware has been set and has settled. By a suitable programming, the controller can be forced to wait for the respective action to occur (cf. table 3-3).

Table 3-3 Synchronization with *OPC, *OPC? and *WAI

Com-mand	Action after the hardware has settled	Programming the controller
*OPC	Setting the operation-complete bit in the ESR	- Setting bit 0 in the ESE - Setting bit 5 in the SRE - Waiting for service request (SRQ)
*OPC?	Writing a "1" into the output buffer	Addressing the instrument as a talker
*WAI	Executing the next command Note: The IEC-bus handshake is not stopped	Sending the next command

An example as to command synchronization can be found in annex D "Program Examples".

3.8 Status Reporting System

The status reporting system (cf. Fig. 3-4) stores all information on the present operating state of the instrument, e.g. that the instrument presently carries out an AUTORANGE and on errors which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via IEC bus.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUEStionable which are defined by SCPI and contain detailed information on the instrument.

The IST flag ("Individual STatus") and the parallel poll enable register (PPE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills an analog function for the IST flag as the SRE for the service request.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB and thus is represented in Fig. 3-4.

3.8.1 Structure of an SCPI Status Register

Each SCPI register consists of 5 parts which each have a width of 16 bits and have different functions (cf. Fig. 3-3). The individual bits are independent of each other, i.e. each hardware status is assigned a bit number which is valid for all five parts. For example, bit 3 of the STATus:OPERation register is assigned to the hardware status "wait for trigger" in all five parts. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integer.

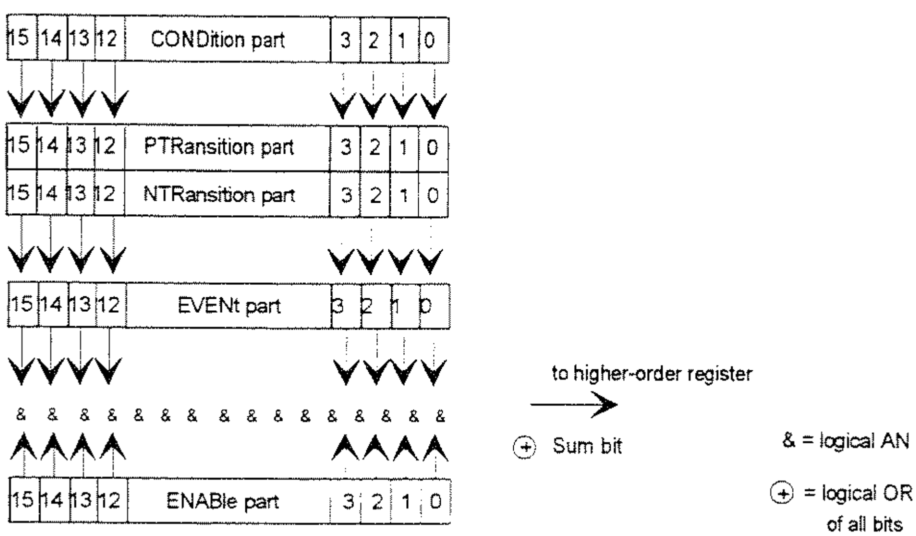


Fig. 3-3 The status -register model

CONDition part The CONDition part is directly written into by the hardware or the sum bit of the next lower register. Its contents reflects the current instrument status. This register part can only be read, but not written into or cleared. Its contents is not affected by reading.

PTRansition part The Positive-TRansition part acts as an edge detector. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENt bit is set to 1.
PTR bit =1: the EVENt bit is set.
PTR bit =0: the EVENt bit is not set.
This part can be written into and read at will. Its contents is not affected by reading.

NTRansition part The Negative-TRansition part also acts as an edge detector. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENt bit is set to 1.
NTR bit =1: the EVENt bit is set.
NTR bit =0: the EVENt bit is not set.
This part can be written into and read at will. Its contents is not affected by reading.
With these two edge register parts the user can define which state transition of the condition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENt part.

EVENt part The EVENt part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the edge filters. It is permanently updated by the instrument. This part can only be read by the user. During reading, its contents is set to zero. In linguistic usage this part is often equated with the entire register.

ENABle part The ENABle part determines whether the associated EVENt bit contributes to the sum bit (cf. below). Each bit of the EVENt part is ANDed with the associated ENABle bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an OR function (symbol '+').
ENAB bit =0: the associated EVENt bit does not contribute to the sum bit
ENAB bit =1: if the associated EVENT bit is "1", the sum bit is set to "1" as well.
This part can be written into and read by the user at will. Its contents is not affected by reading.

Sum bit As indicated above, the sum bit is obtained from the EVENt and ENABle part for each register. The result is then entered into a bit of the CONDition part of the higher-order register.
The instrument automatically generates the sum bit for each register. Thus an event, e.g. a PLL that has not locked, can lead to a service request throughout all levels of the hierarchy.

Note: *The service request enable register SRE defined in IEEE 488.2 can be taken as ENABle part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABle part of the ESR.*

3.8.2 Overview of the Status Registers

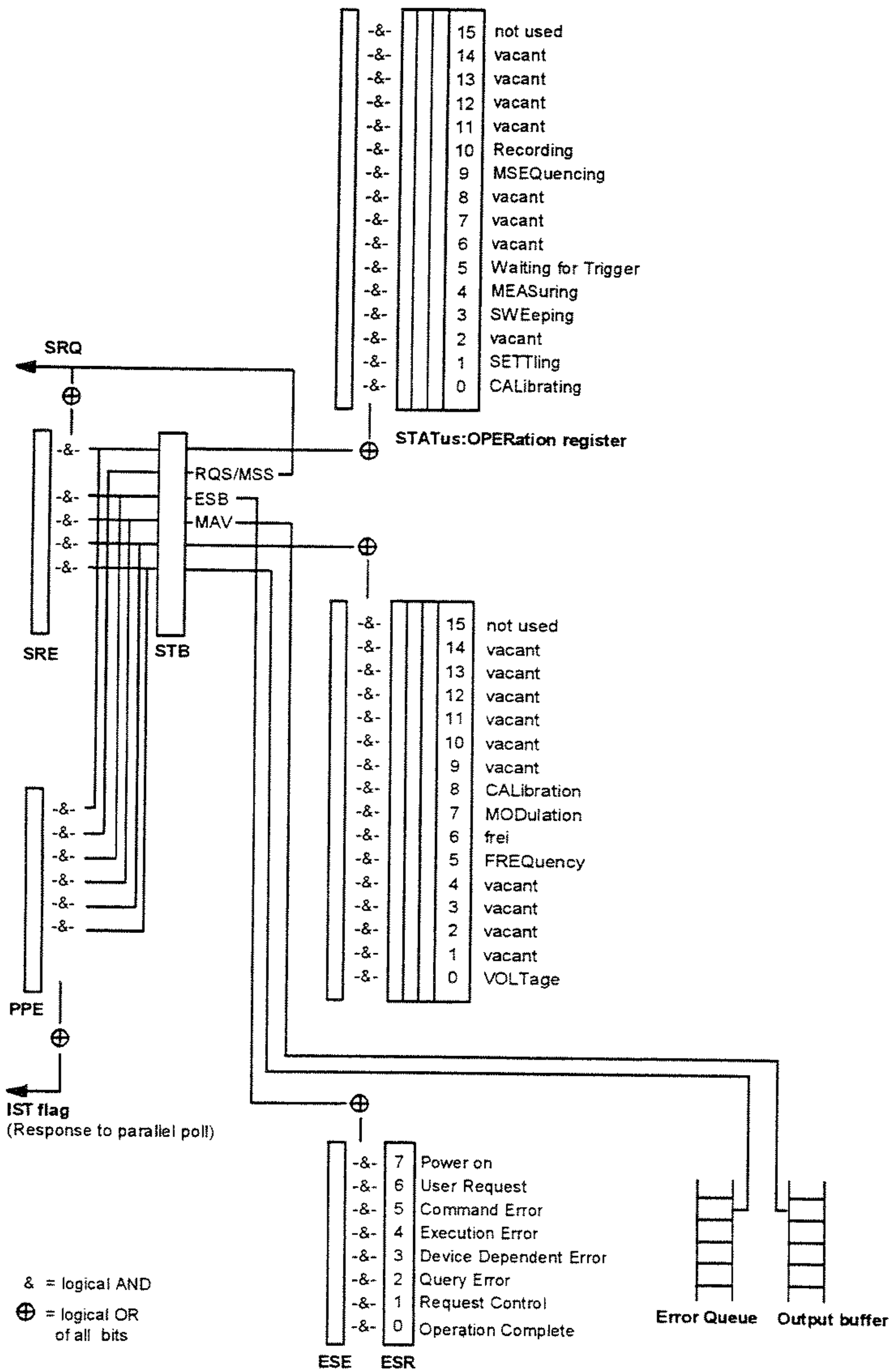


Fig. 3-4 Overview of the status register

3.8.3 Description of the Status Registers

3.8.3.1 Status Byte (STB) and Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDition part of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.
The STATUS BYTE is read out using the command "*STB?" or a serial poll.

The STB implies the SRE. It corresponds to the ENABle part of the SCPI registers as to its function. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a Service Request (SRQ) is generated on the IEC bus, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there.
The SRE can be set using command "*SRE" and read using "*SRE?".

Table 3-4 Meaning of the bits used in the status byte

Bit no.	Meaning
2	**Error Queue not empty** The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a Service Request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with IEC-bus control.
3	**QUEStionable status sum bit** The bit is set if an EVENt bit is set in the QUEStionable status register and the associated ENABle bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUEStionable status register
4	**MAV-Bit** (Message AVailable) The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller (cf. annex D, program examples).
5	**ESB bit** Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit implies a serious error which can be specified in greater detail by polling the event status register.
6	**MSS-Bit** (Master Status Summary bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this register is set together with its mask bit in the service request enable register SRE.
7	**OPERation status register sum bit** The bit is set if an EVENt bit is set in the OPERation status register and the associated ENABle bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the OPERation status register.

3.8.3.2 IST Flag and Parallel Poll Enable Register (PPE)

By analogy with the SRQ, the IST flag combines the entire status information in a single bit. It can be queried by means of a parallel poll (cf. Section 3.8.4.3) or using command "*IST?".

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are ANDed with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The Ist flag results from the ORing of all results. The PPE can be set using commands "*PRE" and read using command "*PRE?".

3.8.3.3 Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is already defined in IEEE 488.2. It can be compared with the EVENt part of an SCPI register. The event status register can be read out using command "*ESR?".
The ESE is the associated ENABle part. It can be set using command "*ESE" and read using command "*ESE?".

Table 3-5 Meaning of the bits used in the event status register

Bit No.	Meaning
0	**Operation Complete** This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
2	**Query Error** This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	**Device-dependent Error** This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue (cf. annex B, Error Messages).
4	**Execution Error** This bit is set if a received command is syntactically correct, however, cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue (cf. annex B, Error Messages).
5	**Command Error** This bit is set if a command which is undefined or syntactically incorrect is received. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue (cf. annex B, Error Messages).
6	**User Request** This bit is set on pressing the LOCAL key, i.e., when the instrument is switched over to manual control.
7	**Power On** (supply voltage on) This bit is set on switching on the instrument.

3.8.3.4 STATus:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last reading. It can be read using commands `"STATus:OPERation:CONDition?"` or `"STATus:OPERation [:EVENt]?"`..

Table 3-6 Meaning of the bits used in the STATus:OPERation register

Bit-No.	Meaning
0	**CALibrating** This bit is set as long as the instrument is performing a calibration.
1	**SETTling** This bit is set as long as the new status is settling after a setting command. It is only set if the settling time is longer than the command processing time.
3	**SWEeping** This bit is set while the instrument is performing a sweep.
4	**MEASuring** This bit is set while the instrument is performing a measurement.
5	**WAIT for TRIGGER** This bit is set as long as the instrument is waiting for a trigger event.
8	**LEARning** This bit is set while the instrument is "learning" a list.
9	**MSEQuencing** This bit is set while the instrument is performing a memory sequence.
10	**RECording** This bit is set while the instrument is recording external data via the DATA input.

3.8.3.5 STATus:QUEStionable Register

This register contains information on questionable instrument states. They can occur, e.g. if the instrument is operated out of its specifications. It can be queried using commands `"STATus :QUEStionable:CONDition?"` or `"STATus:QUEStionable[:EVENt]?"`.

Table 3-7 Meaning of the bits used in the STATus:QUEStionable register

Bit-No.	Meaning
0	**VOLTage** This bit is set if the voltage at an output connector is not correct, if the voltage is above or below the specified limit values, if the level limit has responded, if the overvoltage protection has responded.
5	**FREQuency** The bit is set if a frequency at the RF output is not correct or if it is lower or higher than the specified values
7	**MODulation** The bit is set if a modulation is not correct or is operated outside the specifications.
8	**CALibration** The bit is set if a calibration is not performed properly.

3.8.4 Application of the Status Reporting Systems

In order to be able to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed there. There are several methods which are represented in the following. Detailed program examples are to be found in annex D, Program Examples.

3.8.4.1 Service Request, Making Use of the Hierarchy Structure

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react with corresponding actions. As evident from Fig. 3.4 (Section 3.8.2), an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The corresponding setting of the ENABle parts of the status registers can achieve that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request, all bits should be set to "1" in enable registers SRE and ESE.

Examples (cf. Fig. 3.4, Section 3.8.2 and Program Examples, annex D as well):

Use of command "`*OPC`" to generate an SRQ

- Set bit 0 in the ESE (Operation Complete)
- Set bit 5 in the SRE (ESB)

After its settings have been completed, the instrument generates an SRQ.

Indication of the end of a sweep by means of an SRQ with the controller

- Set bit 7 in the SRE (sum bit of the STATus:OPERation register)
- Set bit 3 (sweeping)in the STATus:OPERation:ENABle.
- Set bit 3 in the STATus:OPERation:NTRansition so as to make sure that the transition of sweeping bit 3 from 1 to 0 (sweep end) is recorded in the EVENt part.

After a sweep has been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument such that a service request is initiated in the case of malfunction. The program should react appropriately to the service request. A detailed example for a service request routine is to be found in annex D , Program Examples.

3.8.4.2 Serial Poll

In a serial poll, just as with command "`*STB`", the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works with instruments which do not adhere to SCPI or IEEE 488.2.

The quick-BASIC command for executing a serial poll is "`IBRSP()`". Serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the IEC bus.

3.8.4.3 Parallel Poll

In a parallel poll, up to eight instruments are simultaneously requested by the controller by means of a single command to transmit 1 bit of information each on the data lines, i.e., to set the data line allocated to each instrument to logically "0" or "1". By analogy to the SRE register which determines under which conditions an SRQ is generated, there is a parallel poll enable register (PPE) which is ANDed with the STB bit by bit as well considering bit 6. The results are ORed, the result is then sent (possibly inverted) as a response in the parallel poll of the controller. The result can also be queried without parallel poll by means of command "`*IST`".

The instrument first has to be set for the parallel poll using quick-BASIC command "`IBPPC()`". This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using "`IBRPP()`".

The parallel-poll method is mainly used in order to quickly find out after an SRQ which instrument has sent the service request if there are many instruments connected to the IEC bus. To this effect, SRE and PPE must be set to the same value. A detailed example as to the parallel poll is to be found in annex D, Program Examples.

3.8.4.4 Query by Means of Commands

Each part of every status register can be read by means of queries. The individual commands are indicated in the detailed description of the registers in Section 3.8.3. What is returned is always a number which represents the bit pattern of the register queried. Evaluating this number is effected by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

3.8.4.5 Error Queue Query

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages which can be looked at in the ERROR menu via manual control or queried via the IEC bus using command "`SYSTem:ERRor?`". Each call of "`SYSTem:ERRor?`" provides <u>one</u> entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error"

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

3.8.5 Resetting Values of the Status Reporting Systems

Table 3-8 comprises the different commands and events causing the status reporting system to be reset. None of the commands, except for *RST and SYSTem:PRESet influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 3-8 Resetting instrument functions

Event / Effect	Switching on supply voltage Power-On-Status-Clear 0	 1	DCL,SDC (Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Clear STB,ESR	—	yes	—	—	—	yes
Clear SRE,ESE	—	yes	—	—	—	—
Clear PPE	—	yes	—	—	—	—
Clear EVENt parts of the registers	—	yes	—	—	—	yes
Clear ENABle parts of all OPERation-and QUESTionable registers, Fill ENABle parts of all other registers with "1".	—	yes	—	—	yes	—
Fill PTRansition parts with „1" Clear NTRansition parts	—	yes	—	—	yes	—
Clear error queue	yes	yes	—	—	—	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	—	—	—

1) Every command being the first in a command line, i.e. immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

Contents

1 Preparation for Use

2 Manual Operation

3 Remote Control

4 Maintenance and Troubleshooting

5 Performance Test

Annex A – Interfaces

Annex B – List of Error Messages

Annex C – Alphabetical List of Commands

Annex D – Programming Example

Tables

Figures

ROHDE&SCHWARZ
EC Certificate of Conformity

CE

Certificate No.: 9502004

This is to certify that:

Equipment type	Order No.	Designation
SME02/03/06	1038.6002.02/03/06	Signal Generator
SME42	1038.6002.42	"
SME22/23/24	1038.6002.22/23/24	Power Signal Generator
SME-B11	1036.8720.02/22	DM Coder
SME-B12	1039.4090.02	8MB Memory Extension

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (73/23/EEC revised by 93/68/EEC)

- relating to electromagnetic compatibility (89/336/EEC revised by 91/263/EEC, 92/31/EEC)

Conformity is proven by compliance with the following standards:

EN61010-1 : 1991
EN50081-1 : 1992
EN50082-1 : 1992

Affixing the EC conformity mark as from 1995

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 21.11.95

Central Quality Management FS-QZ / Becker

ROHDE&SCHWARZ
EC Certificate of Conformity

CE

Certificate No.: 9502055

This is to certify that:

Equipment type	Order No.	Designation
SM-B1	1036.7599.02	Reference Oszillator
SM-B2	1036.7947.02/08	LF Generator
SM-B3	1036.6340.02	Pulse Modulator
SM-B4	1036.9310.02	Pulse Generator
SM-B5	1036.8489.02	FM/PHIM Modulator
SM-B6	1036.7760.02/08	Multifunction Generator
SM-B8	1036.6805.02	Pulse Modulator
SM-B9	1039.5100.02	Pulse Modulator

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electromagnetic compatibility (89/336/EEC revised by 91/263/EEC, 92/31/EEC)

Conformity is proven by compliance with the following standards:

EN50081-1 : 1992
EN50082-1 : 1992

Affixing the EC conformity mark as from 1995

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 21.11.95

Central Quality Management FS-QZ / Becker