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1 General Information

1.1 ⚠ Safety Instructions

☞ **Note** **Wherever you see this sign ⚠ you will find information on potential hazards. Please read these sections with particular care!**

⚠ **Warning!** Before opening the AFG 100 disconnect the mains plug!

⚠ **Attention!** Our instrument fuses are dimensioned in such a way that optimum protection is guaranteed for the AFG 100 and the user.
If the fuse has to be changed, use only G fuse-link 5 × 20 according to IEC 127 (see 4.1)!

⚠ **Attention!** The T250 replacement fuses contained in the accessories are intended for a mains voltage of 115 V and must not be used at a mains voltage of 230 V!

1.2 Switching the Operating Voltage 230 V~/115 V~

⚠ **Attention!** Your AFG 100 left the factory set to 230 V. Switching to 115 V requires the AFG 100 to be opened, which should only be done by trained personnel.

Setting the operating voltage 115 V~

1. Disconnect the AFG 100 from the mains.
2. Remove upper caps and loosen the screws below.
3. Identify the mains voltage switch by means of the following illustration.
4. Switch the mains voltage switch (slide switch) located under the power switch to the indication “115”.
5. Remove safety cover at the mains plug and replace the fuse with the fuse for 115 V supplied with the instrument.
6. Fasten upper caps and put the sticker supplied with the instrument for marking the switch-over to 115 V on to the type label.

Mains voltage switch

115 V position

230 V position

1.3 Mains Connection

⚠ **Attention!** The design of the unit meets the requirements of safety class I according to EN 61010-1, i. e. all metal parts accessible from outside and exposed to contact are connected with the protective conductor of the supply network.
Power is supplied via a mains cable with an earthing contact.

1.4 Installing the AFG 100

⚠ **Attention!** The AFG 100 should not be operated close to equipment that develops heat.

1.5 Switching on

☞ **Note** The AFG 100 is switched on using the power switch at the front. The power switch separates the AFG 100 completely from the primary side of the transformer.
The LED *I/O* serves as a status indicator.

1.6 Inspection and Maintenance

⚠ **Attention!** If service is needed, due attention should be paid to the regulations according to VDE 0701. The AFG 100 should only be repaired by trained personnel.

1.7 EMC

Radio interference suppression

The AFG 100 is interference-free according to EN 50081 and EN 50082.

Prerequisite for EMC

In order to fulfil the limit values in line with present standards, it is absolutely essential that only cables which are in perfect condition be connected to the AFG 100. The following information applies here:

- Metallic or metallized socket cases must be used for the serial interface RS-232C. The socket cases and the braided screen of the cables must be connected at the shortest distance possible. The signal earth must not be connected to the braided screen.
- After opening and closing the AFG 100 check that all the fixing elements and contact springs are installed as before and that all the screws have been tightened.

1.8 Warranty

Conditions for warranty

Digimess guarantees the perfect working order of the AFG 100 for 12 months as from delivery.
There is no warranty for faults arising from improper operation or from changes made to the unit or from inappropriate application.

Returning the instrument

If a fault occurs please contact or send your AFG 100 to:

The AFG 100 should be returned in appropriate packing - if possible in the original packing. Please enclose a detailed fault report (functions working incorrectly, deviating specifications and so on) including unit type and serial number.

Identification

Kindly verify warranty cases by enclosing your delivery note. Any repairs carried out without reference to a valid warranty will initially be at the owner's expense.
Should the warranty have expired, we will, of course, be glad to repair your AFG 100 as per our General Terms Of Assembly And Service.

1.9 Accessories Supplied

Contents

1 mains cable	1XK64100
1 coaxial cable	1AK64220
1 fine fuse	T125 L/250 V (230 V)
2 fine fuses	T250 L/250 V (115 V)

1 operating instructions

1 label for indicating the switch-over to 115 V

1 diskette with arbitrary signals and loading program

2 Application

Performance features

The function generator AFG 100, controlled by a microprocessor, is a compact signal source. The AFG 100 uses the DDS (Direct Digital Synthesis) method and generates the following wave forms:

- Sinusoidal and square-wave signals in the frequency range of 0.01 Hz to 12.5 MHz
- Triangular and sawtooth-shaped signals from 0.01 Hz to 100 kHz
- Arbitrary signals with a sample rate up to 33.33 MSa/s and with a vertical resolution of 10 bits

Additional functions

The amplitude and the dc voltage offset of the output signal can be adjusted within a wide range.
The AFG 100 is fitted with a sweep function.
Furthermore, a square-wave signal (sync signal) with a CMOS/TTL level can be picked off.

Operation via keybord

All functions and measuring ranges can be set via menus by means of four buttons and a rotary switch.
The chosen parameters of the output signal are clearly depicted on a two-line alphanumeric LC matrix display.

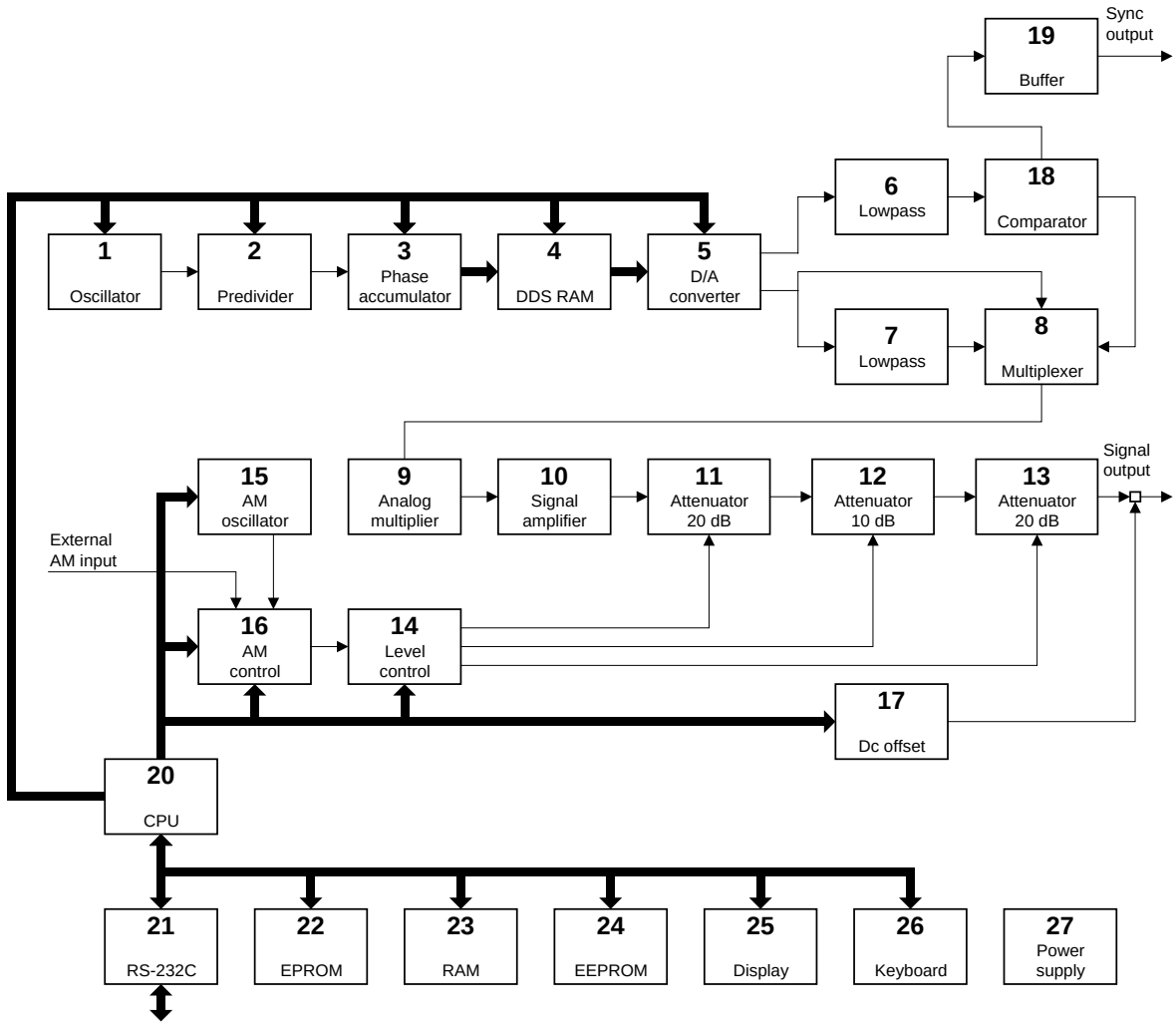
Remote control via RS-232C

The instrument is equipped, as standard, with serial interface RS-232C for communication with a PC.

- All functions and parameters can be set.
- The settings and conditions of the AFG 100 can be transmitted.

3 Configuration and Functional Description

3.1 Block Diagram



(1) Oscillator
(2) Predivider
(3) Phase accumulator
(4) DDS RAM memory
(5) D/A converter for DDS
(6) Lowpass filter
(7) Lowpass filter
(8) Multiplexer
(9) Analog multiplier
(10) Signal amplifier
(11) Output attenuator for 20 DB
(12) Output attenuator for 10 dB
(13) Output attenuator for 20 dB
(14) Level control circuit of the output signal
(15) AM oscillator
(16) Circuit for the control of the amplitude modulation
(17) Dc voltage offset generator
(18) Comparator
(19) Buffer of the output signal and CMOS/TTL converter
(20) Microprocessor
(21) RS-232C interface
(22) Program memory EPROM
(23) Data memory RAM
(24) EEPROM memory for calibrating data
(25) LC display
(26) Keyboard with rotary switch
(27) Power supply

3.2 Description

Internal control unit

The internal operational procedures are controlled by the one-chip microprocessor MCS-51 (20) with the help of additional circuits, e. g. program memory EPROM (22), data memory RAM (23) and memory EEPROM for the calibrating data (24).

Operating the AFG 100

The AFG 100 can be operated locally via the keyboard with the rotary switch (26) and via the LC display (25).
Remote control by a PC takes place via the serial interface RS-232C (21) and is controlled by the microprocessor.

Generation of the required wave form

The microprocessor (20) carries out the configuration and sets the hardware of the AFG 100 after the parameters have been selected.
The corresponding value for the phase accumulator (3) is calculated according to the frequency which has been entered. The phase accumulator works with a clock frequency derived from the frequency of the oscillator (1) and from the dividing ratio of the programmable frequency-predivider (2). According to the phase generated by the phase accumulator, the D/A converter (5) derives information about the amplitude of the signal from the DDS RAM memory (4).
Lowpass filters (6), (7) which reconstruct the required signal, are connected at both outputs of the D/A converter. The corresponding signal is forwarded via the switch logic (8).

Generation of the sync signal

A square-wave signal is formed from a sinusoidal signal with the help of the comparator (18). The square-wave signal is fed through the buffer stage (19) with CMOS logic level to the sync output.

Output level setting

The generated output signal is fed to the analog multiplier (9). The output level is set within the range from 0 to 10 dB by means of this circuit. The signal is also led to the amplifier (10) and to the output attenuators (11), (12), (13) in stages of 0, 10, 20, 30, 40 or 50 dB. According to the required value of the output level, the analog multiplier (9) and subsequently the damping of the output attenuators (11), (12), (13) are set via the level control circuit (14). The attenuated signal is led to the output socket of the AFG 100.

Amplitude modulation of the output signal

The output level of the AFG 100 can be influenced by amplitude modulation. This means that the internal AM oscillator (15) and an external AM signal can be used. The AM control circuit (16) feeds the selected AM signal through and with internal amplitude modulation, sets the required modulation depth of the output signal.

Setting the dc voltage offset

The dc voltage offset generator (17), a programmable current source is also connected to the output socket. The current source is controlled by the microprocessor (20) via the control circuit (14). The offset voltage generator permits setting of the dc voltage part of the output signal within a wide voltage range.

4 Technical Data

4.1 General Data

Operating temperature:	+ 5 ... + 40 °C
Nominal temperature:	+ 23 °C ± 2 °C
Relative humidity:	20 ... 80 %
Atmospheric pressure:	70 ... 106 kPa
Operating position:	horizontal or inclined by ± 15 °
Operating voltage:	sinusoidal alternating voltage 115/230 V (+ 10 %/– 15 %), internally switchable 50 ... 60 Hz (± 5 %) Distortion factor less than 5 %
Power consumption:	max. 27 VA (max. 27 W)
Fuses:	T125 L/250 V (230 V~) T250 L/250 V (115 V~) Dimensions 5 × 20 mm, according to IEC 127
Safety class:	I, according to EN 61010 Part 1
Radio interference suppression:	EN 55011 Class B
Dimensions (L × H × D):	225 mm × 85 mm × 200 mm
Dimensions of packing:	315 mm × 115 mm × 270 mm
Weight of AFG 100: incl. packing and accessories:	 approx. 2.5 kg approx. 3.5 kg

4.2 Specifications

Frequency range:	0.01 Hz ... 12.5 MHz for sinusoidal and square-wave signal 0.01 Hz ... 100 kHz for triangular and sawtooth signal
Frequency setting:	5 places or 4 places + point position
Accuracy of frequency setting (at nominal temperature):	 ± 0.01 % ± 0.002 Hz
Temperature coefficient of frequency:	± 100 ppm in the range of the operating temperature
Warm-up time:	15 min

4.2.1 Signal Output

Output impedance:	50 Ω ± 1.5 %, asymmetrical
Output voltage V_{PP}:	10 mV ... 10 V/50 Ω
Maximum output level incl. offset voltage:	 $V_{PP} + \lvert 2\ V_{Offset} \rvert \leq 10.00$ V
Setting the output voltage:	3 places
Accuracy of output voltage at f = 1 kHz:	 ± (2 % + 20 mV)
Additional frequency error of output voltage:	 ± 1 dB in the range 10 Hz … 1 MHz ± 3 dB in the range 0.01 Hz … 12.5 MHz

Temperature coefficient of output voltage:	$< \pm 5 \times 10^{-3}$/K
Dc voltage offset of signal (V_{Offset}):	± 2.5 V/50 Ω
Setting of dc voltage offset:	in 10 mV steps
Accuracy of setting of dc voltage offset:	± (1 % + 20 mV)
Output signal:	sinusoidal signal square-wave signal triangular signal sawtooth signal (up, down) arbitrary signal
Distortion of sinusoidal signal:	< 0.5 % in the range 10 Hz … 100 kHz
Rise time of square-wave signal:	< 25 ns
Overshooting of square-wave signal:	< 5 % of the output voltage + 30 mV
Nonlinearity of triangular signal (5 ... 95 %):	< 1 %

4.2.2 Arbitrary Signal

Horizontal resolution (length of the signal):	8,192 samples
Vertical resolution of the level:	1,024 level (10 bit)
Sample period:	$30 \text{ ns} \times 2^{N-1}$, N = 1 … 32

4.2.3 Sweep Function

Frequency change at sweep function:	0.01 Hz … 12.5 MHz (100 kHz for triangular and sawtooth signal)
Sweep mode:	linear, logarithmic - discreet
Direction of frequency change:	rising, falling
Repetition period at sweep function:	10 ms … 60 s

4.2.4 Amplitude Modulation

Source of modulation signal:	internal, external
Frequency range of external modulation input:	0 Hz ... 20 kHz
Amplitude of external signal (V_{PP}):	2 V for AM modulation depth m = 100 %
Input impedance of external AM input:	100 kΩ
Frequency range of internal modulation oscillator:	approx. 100 Hz ... 10 kHz, discreet frequency results
Depth of amplitude modulation:	0 ... 100 %, in 1 % steps at internal AM

4.2.5 Square-wave Sync Output

Output impedance:	approx. 50 Ω
Output voltage V_{PP}:	5 V ± 10 % in the idling mode
Maximum output current:	10 mA
Pulse duty ratio	
for periodical signals:	approx. 1:1
at sweep function:	"start" pulse with a breadth of approx. 5 µs

4.3 Display

Set-up and display contents

The AFG 100 is equipped with a 2 × 16-digit alphanumerical LC matrix display with background lighting.
It indicates the set parameters of the output signal or the menu-controlled functions and system messages.

4.4 Remote Control

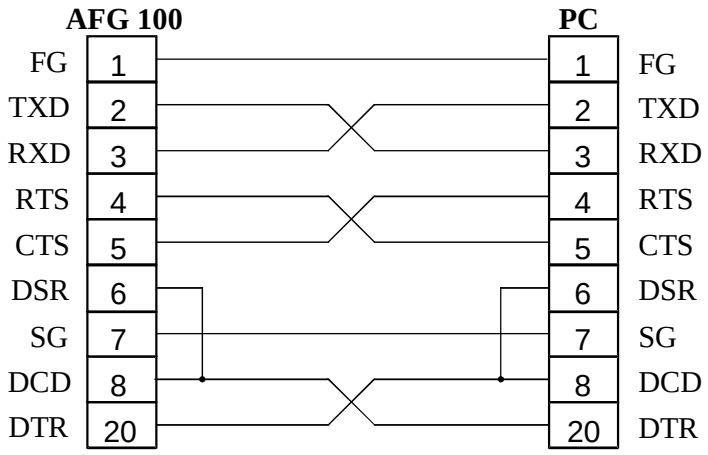
Performance range

The AFG 100 can be fully remote controlled and read via the serial interface RS-232C. Data transfer is based on the ASCII character set.

Data transmission parameters

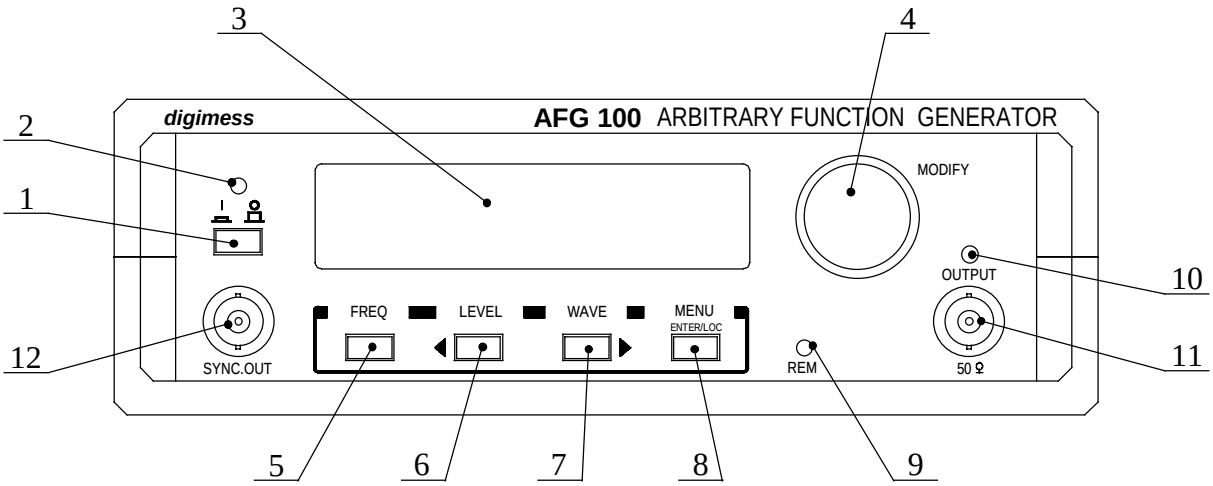
Baud rate in Bd (eligible):	1,200, 2,400, 4,800, 9,600, 19,200
Length of data character:	8 Bit
Number of STOP bits:	1
Parity:	none
Protocol:	RTS/CTS, without (NONE)
Length of input buffer:	64 characters
Length of output buffer:	256 characters
Final character on receiving:	LF (10 dec.)
Final characters on transmission:	CR + LF (13 dec. + 10 dec.)

Plug connections of cable

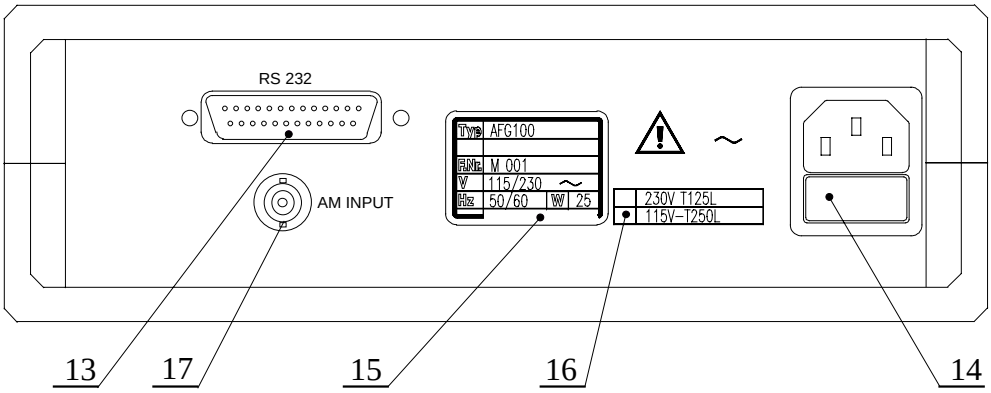


5 Control Elements

Front side of AFG 100



Rear side of AFG 100



[1] Power switch

[2] LED I/O

The LED indicates whether the AFG 100 is ready for operation.

[3] Display

See 4.3.

[4] Rotary switch

The rotary switch makes it possible to adjust the measuring parameters and to scroll the current menu forwards and backwards. The sign ↻ in the display signals the parameter setting with the help of the rotary switch.

[5] Function button F1 (with multiple allocation)

FREQ – The button opens the menu to set the frequency of the output signal.

▲▼ – The button changes between first and second line of the display.

. . . – The button has different meanings in the menu levels.

[6] Function button F2 (with multiple allocation)

LEVEL – The button opens the menu to set the level of the output signal.

◀ – The cursor is moved to the left in the menu.

. . . – The button has different meanings in the menu levels.

[7] Function button F3 (with multiple allocation)

WAVE – The button opens the menu to set the wave form of the output signal.

▶ – The cursor is moved to the right in the menu.

. . . – The button has different meanings in the menu levels.

[8] Function button F4 (with multiple allocation)

MENU – The button opens the menu to set further parameters of the AFG 100.

ENTER – With the help of this button the new parameter setting is confirmed.

LOC – On remote control the AFG 100 changes to local control.

. . . – The button has different meanings in the menu levels.

[9] LED *REM*

The LED lights up if the AFG 100 is being remote controlled via the PC.

[10] LED *OUTPUT*

The LED lights up if the signal output is switched on.

[11] BNC socket of signal output

[12] BNC socket of sync output

[13] Plug of RS-232C interface

[14] Fused plug for non-heating appliances

The AFG 100 is protected by a T125 L/250 V fuse for 230 V~ or T250 L/250 V for 115 V~ net voltage respectively.

[15] Type plate

[16] Operating voltage indication

The operating voltage indication shows which operating voltage is to be used.

[17] BNC input socket for external AM source

6 Operation of the AFG 100

6.1 Introduction

Keyboard

The AFG 100 is operated via function buttons F1 to F4 with multiple functions.
In response to the operational status of the AFG 100 and the menu-driven settings, the function buttons perform different tasks (see 5).

Menu control via display

After activating the function button F4 [8], menus and also menu-points are opened for settings
After opening a menu, the name of the menu is displayed in the top line of the display [3]. Function buttons F1 to F4 have the function as displayed in the bottom line of the display.
The cursor buttons ◂ [6] and ▸ [7] and the rotary switch [4] are used to set the required parameters. A flashing band under the current entry field of the display [3] requests that you enter these parameters. The symbol ↵ which appears on the right-hand side of the display requests that you activate the rotary switch [4].

Parameter entry and measurement

After opening a menu the operating state of the AFG 100 is interrupted until the menu is exited by pressing the F4 button [8]:

- Pressing the F4 button [8] with the meaning ENTER brings about a completion of the menu-driven settings and the AFG 100 reverts to the operating state. The set parameters are activated.
- Pressing the F4 button [8] with the meaning EXIT will cause the AFG 100 to revert to the operating state without changing the parameters.

6.2 Starting

Attention!

When the AFG 100 is operated remotely via PC the connecting cable of the system interface RS-232C must be connected before switching on the operating voltage.

Switching on the AFG 100

1. Connect the AFG 100 [14] to the mains with the mains cable.

2. Press the **power switch** [1].
- The LED *I/O* [2], *REM* [9] and *OUTPUT* [10] light up and the following message appears on the display [3]:

```
GENERATOR AFG100
PowerUp SelfTest
```

Starting the initialization test

An internal initialization test starts up.
The following message appears on the display [3]:

```
Testing: <UNIT>
........ PASSED
```

The variable **<UNIT>** stands for the unit which has just been tested:
- Processor (**CPU**)
- Data bus (**BUS**)
- ROM memory (**ROM**)
- RAM memory (**RAM**)
- EEPROM memory (**EEPROM**)
- Battery (**BATTERY**)
- Display (**DISPLAY**)
- Keyboard (**KEYBOARD**)
- Complete system (**SYSTEM**)

Note

The test routine can be switched off (see 6.5.1).
In this case, the initialization test is started only if a button is pushed while switching the AFG 100 on.

Fault-free test

On error-free conclusion of the test the current software version and the following confirmation appear, e. g.:

```
GENERATOR AFG100
    Ver:2.00
```

and

```
GENERATOR AFG100
     READY
```

Operating state

After fault-free testing the LEDs *REM* [9] and *OUTPUT* [10] go out and the parameters of the AFG 100 correspond to the following presettings:

Frequency of the output signal:	1.000 kHz
Output voltage V_{PP}:	1.00 V
Dc voltage offset of the output:	0.00 V
Output signal:	sinusoidal
Signal output:	switched off

Sync output:	switched off
Sweep function:	switched off
Start frequency:	1.0000 kHz
Stop frequency:	10.000 MHz
Sweep period:	100 ms
Amplitude modulation:	switched off
Modulation depth of internal AM:	100 %
Modulating frequency of internal AM:	approx. 1 kHz
Baud rate:	9,600 Bd
Data transmission protocol:	switched off (NONE)
Initialization test:	switched off

The AFG 100 is ready for operation and the following message appears on the display [3]:

```
FREQ:  1.0000  kHz
WAVE:  SINE
```

☞ **Note**

If you have saved your own instrument settings, these are loaded after the instrument is switched on (see 6.5.4.2). The AFG 100 starts with the last saved or loaded instrument setting.

Faulty test

Should a system error occur during the internal test, the AFG 100 interrupts the test until the error is eliminated. The following message appears on the display [3]:

```
Testing:  <UNIT>
........  ERROR
```

The variable **<UNIT>** stands for the unit which has just been tested (see above).

If errors which have no direct effect on the function of the AFG 100 occur in the component circuits, the test will continue. A warning with corresponding error characterization appears on the display [3], e. g.:

- With incomplete calibrating data:

```
GENERATOR AFG100
Calibration OFF!
```

- With faulty data in the EEPROM memory:

```
GENERATOR AFG100
 Bad EEPROM CRC
```

- With faulty data in the RAM memory (e. g. data of the arbitrary signal):

```
GENERATOR AFG100
 Bad Backup RAM
```

6.3 Operating Parameters

6.3.1 Setting the Frequency (FREQ)

Calling up the menu point

1. Press the **F1 button FREQ** [5] when the AFG 100 is in operation.
- The cursor appears on the display [3] on the smallest decimal position of the frequency value, e. g.:

Changing the parameter

2. With the **cursor buttons** ◂ [6] und ▸ [7], select the decimal position of the parameter to be changed.

3. Change the frequency value with the help of the **rotary switch** ↻ [4] in the following range:
- **0.01 Hz ... 12.5 MHz** - for sinusoidal and square-wave signals
- **0.01 Hz ... 100 kHz** - for triangular and sawtooth signals

---

☞ **Note**

If the cursor is on the smallest decimal position (on the right) and the cursor button ▸ [7] is pressed, the frequency value is reduced by one power place, e. g. **1.0000 kHz → 100.00 Hz**.
If the cursor is on the largest decimal position (on the left) and the cursor button ◂ [6] is pressed, the frequency value is extended by one power place, e. g. **1.0000 kHz → 10.000 kHz**.
If you try to exceed the limit values the following message **L i m i t !** is signalled on the display.

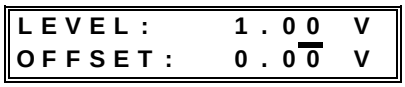
Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The cursor disappears and the last position of the cursor is preserved.
- The AFG 100 returns to the operating state.

6.3.2 Setting the Output Level (LEVEL)

Calling up the menu point

1. Press the **F2 button LEVEL** [6] when the AFG 100 is in operation.
- The last settings of the output voltage and the dc voltage offset appear on the display [3]:



Changing the parameter

2. With the **cursor buttons** ◂ [6] und ▸ [7], select the decimal position of the parameter to be changed.

3. Change the output voltage with the help of the **rotary switch** ↻ [4] in the following range:
- **10 mV ... 10 V**

☞ **Note**

If the cursor is on the smallest decimal position (on the right) and the cursor button ▸ [7] is pressed, the voltage value is reduced by one power place, e. g. **1.00 V → 100 mV**.
If the cursor is on the largest decimal position (on the left) and the cursor button ◂ [6] is pressed, the voltage value is extended by one power place, e. g. **1.00 V → 10 V**.
If you try to exceed the limit values the message **Limit!** is signalled on the display.
It is possible to change between the 1st and 2nd line of the display with the cursor using the **F1 button** ⬍ [5].

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The cursor disappears and the last position of the cursor is preserved.
- The AFG 100 returns to the operating state.

6.3.3 Setting the Dc Voltage Offset (OFFSET)

Calling up the menu point

1. Press the **F2 button LEVEL** [6] when the AFG 100 is in operation.
- The last settings of the output voltage and the dc voltage offset appear on the display [3]:

```
LEVEL:    1.00 V
OFFSET:   0.00 V
```

Changing the parameter

2. Shift from the setting for the output voltage to the setting for the dc voltage offset with the **F1 button** ⬍ [5].

3. With the **cursor buttons** ◂ [6] und ▸ [7], select the decimal position of the parameter to be changed.

4. Change the dc voltage offset with the help of the **rotary switch** ↻ [4] in the following range:
- **± 2.5 V**

☞ **Note**

If you try to exceed the limit values the message **Limit!** is signalled on the display.
It is possible to change between the 1st and 2nd line of the display with the cursor using the **F1 button** ⬍ [5].

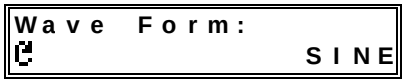
Saving the change

5. Save the new setting with the help of the **F4 button ENTER** [8].
- The cursor disappears and the last position of the cursor is preserved.
- The AFG 100 returns to the operating state.

6.3.4 Selection of the Wave Form (WAVE)

Calling up the menu point

1. Press the **F3 button WAVE** [7] when the AFG 100 is in operation.
– The current setting of the wave form appears on the display [3], e. g.:



Changing the parameter

2. Change the form of the generated output signal with the help of the **rotary switch** [4]:

- **SINE** - sinusoidal signal
- **SQUARE** - square-wave signal
- **TRIANGLE** - triangular signal
- **RAMP UP/RAMP DOWN** - sawtooth signal
- **ARBITRARY** - arbitrary, freely programmable wave form

Saving the change

3. Save the new setting with the help of the **F4 button ENTER** [8].
– The AFG 100 returns to the operating state.

☞ **Note**

Simultaneous activation of the arbitrary signal and the sweep function is not permissible.
The data for the arbitrary signal are prepared externally and loaded into the AFG 100 via the serial interface RS-232C (see 7.3.2.9).

6.3.4.1 Input of the Sample Period at Arbitrary Signals (FREQ)

Prerequisite

1. Select the wave form **ARBITRARY** (see 6.3.4).
– A modified main menu appears on the display [3].

Calling up the menu point

2. Press the **F1 button FREQ** [5] when the AFG 100 is in operation.
– The current setting of the sample period appears on the display [3], e. g.:

Changing the parameter

3. Change the sample period with the help of the **rotary switch** [4] in the following range:

- **30 ns × 2^{N-1}, N = 1 … 32**

☞ **Note**

If you try to exceed the limit values the message **Limit!** is signalled on the display.

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].

6.4 Operating Modes

6.4.1 Activating the Outputs

Calling up the menu

1. Press the **F4 button MENU** [8] when the AFG 100 is in operation.
– The main menu appears on the display [3]:

```
-- Main Menu --
OUT SWP AM NEXT
```

2. Press the **F1 button OUT** [5].
– The menu for setting the signal output and the sync output appears on the display [3]:

```
- Outputs Menu -
SYNC SIGNAL EXIT
```

3. Select the corresponding menu point with the **function buttons F1-F4**:
- **SYNC** [5] - to activate the sync output (see 6.4.1.2)
- **SIGNAL** [6/7] - to activate the signal output (see 6.4.1.1)
- **EXIT** [8] - to leave the menu **without** changing the parameters or adapting the parameters if changes have been made

6.4.1.1 Switching on/off the Signal Output (SIGNAL)

Calling up the menu point

1. Call up the menu for setting the signal output and the sync output with the button sequence: **F4**, **F1** (see 6.4.1).

2. Press the **F2** or **F3 button SIGNAL** [6].
– The current state of the signal output appears on the display [3], e. g.:

```
Signal Output:
                    OFF
```

Changing the parameter

3. Change the state with the help of the **rotary switch** [4]:
- **OFF** - signal output is switched off
- **ON** - signal output is switched on

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
– The AFG 100 returns to the menu for setting the signal output and the sync output.
– The activated signal output is displayed with the LED *OUTPUT* [10].

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - main menu
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

6.4.1.2 Switching on/off the Sync Output (SYNC)

Calling up the menu point

1. Call up the menu for setting the signal output and the sync output with the button sequence: **F4**, **F1** (see 6.4.1).

2. Press the **F1 button SYNC** [5].
– The current state of the sync output appears on the display [3], e. g.:

```
Sync. Output:
                    OFF
```

Changing the parameter

3. Change the state with the help of the **rotary switch** [4]:
- **OFF** - sync output is switched off
- **POSITIVE** - positive square-wave signal at the sync output
- **NEGATIVE** - negative square-wave signal at the sync output

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
– The AFG 100 returns to the menu for setting the signal output and the sync output.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - main menu
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

6.4.2 Activating the Sweep Function

Calling up the menu

1. Press the **F4 button MENU** [8] when the AFG 100 is in operation.
– The main menu appears on the display [3]:

```
-- Main Menu --
OUT SWP AM NEXT
```

2. Press the **F2 button SWP** [6].
– The sweep menu appears on the display [3]:

```
__ Sweep Menu __
MOD FREQ ST EXIT
```

3. Select the corresponding menu point with the **function buttons F1-F4**:
- **MOD** [5] - to activate the sweep function (see 6.4.2.1)
- **FREQ** [6] - to enter the frequency limits (see 6.4.2.2)
- **ST** [7] - to enter the period (see 6.4.2.3)
- **EXIT** [8] - to leave the menu **without** changing the parameters or adapting the parameters if changes have been made

6.4.2.1 Switching on/off the Sweep Function (MOD)

Calling up the menu point

1. Call up the sweep menu with the butten sequence: **F4**, **F2** (see 6.4.2).

2. Press the **F1 button MOD** [5].
- The current state of the sweep function appears on the display [3], e. g.:

```
Sweep Mode:
                      OFF
```

Changing the parameter

3. Change the state with the help of the **rotary switch** [4]:
- **OFF** - sweep function is switched off
- **LINEAR** - linear frequency change
- **LOGARITHMIC** - logarithmic frequency change

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The AFG 100 returns to the sweep menu.

5. Press the **F4 button EXIT** [8].
- The AFG 100 is configured anew and the sweep function is either started or stopped.
- The AFG 100 returns to the main menu.

Changing to the operating state

6. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the main menu
- Press × 2 - operating state of the AFG 100

☞ **Note** Simultaneous activation of the arbitrary signal and the sweep function is not permissible.

6.4.2.2 Input of the Frequency Limits (FREQ)

Calling up the menu point

1. Call up the sweep menu with the butten sequence: **F4**, **F2** (see 6.4.2).

2. Press the **F2 button FREQ** [6].
- The current settings of the frequency limits appear in the display [3], e. g.:

```
Start:  1.0000kHz
Stop:   10.000MHz
```

Changing the parameter

3. Change with the **F1 button** ⇕ [5] between the upper limit (**Start**) and lower limit (**Stop**) of the frequency change.

4. With the **cursor buttons** ◂ [6] und ▸ [7], select the decimal position of the parameter to be changed.

5. Change the upper and lower limit with the help of the **rotary switch** [4].

☞ **Note**

If the cursor is on the smallest decimal position (on the right) and the cursor button ▸ [7] is pressed, the frequency value is reduced by one power place, e. g. **1.0000 kHz → 100.00 Hz**.
If the cursor is on the largest decimal position (on the left) and the cursor button ◂ [6] is pressed, the frequency value is extended by one power place, e. g. **1.0000 kHz → 10.000 kHz**.
If you try to exceed the limit values the message **L i m i t !** is signalled on the display.

Saving the change

6. Save the new setting with the help of the **F4 button ENTER** [8].
- The cursor disappears and the last position of the cursor is preserved.
- The AFG 100 returns to the sweep menu.

7. Press the **F4 button EXIT** [8].
- The AFG 100 is configured anew and the sweep function is either started or stopped.
- The AFG 100 returns to the main menu.

Changing to the operating state

8. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the main menu
- Press × 2 - operating state of the AFG 100

6.4.2.3 Input of the Period (ST)

Calling up the menu point

1. Call up the sweep menu with the butten sequence: **F4**, **F2** (see 6.4.2).

2. Press the **F3 button ST** [7].
- The current setting of the period appears on the display [3], e. g.:

```
Sweep Time:
                100 ms
```

Changing the parameter

3. With the **cursor buttons** ◂ [6] und ▸ [7], select the decimal position of the parameter to be changed.

4. Change the period within the range of **100 ms** to **60 s** with the help of the **rotary switch** [4].

☞ **Note**

If you try to exceed the limit values the message **L i m i t !** is signalled on the display.

Saving the change

5. Save the new setting with the help of the **F4 button ENTER** [8].
- The cursor disappears and the last position of the cursor is preserved.
- The AFG 100 returns to the sweep menu.

6. Press the **F4 button EXIT** [8].
- The AFG 100 is configured anew and the sweep function is either started or stopped.
- The AFG 100 returns to the main menu.

Changing to the operating state

7. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the main menu
- Press × 2 - operating state of the AFG 100

6.4.3 Activating the Amplitude Modulation (AM)

Calling up the menu

1. Press the **F4 button MENU** [8] when the AFG 100 is in operation.
- The main menu appears on the display [3]:

```
-- Main Menu --
OUT SWP  AM NEXT
```

2. Press the **F3 button AM** [7].
- The menu for setting the amplitude modulation appears on the display [3]:

```
--- AM Menu ---
MOD DEPTH F EXIT
```

3. Select the corresponding menu point with the **function buttons F1-F4**:
- **MOD** [5] - to activate the AM (see 6.4.3.1)
- **DEPTH** [6] - to enter the modulating depth (see 6.4.3.2)
- **F** [7] - to enter the modulating frequency (see 6.4.3.3)
- **EXIT** [8] - to leave the menu **without** changing the parameters or adapting the parameters if changes have been made

6.4.3.1 Switching on/off the AM (MOD)

Calling up the menu point

1. Call up the menu for setting the amplitude modulation with the butten sequence: **F4**, **F3** (see 6.4.3).

2. Press the **F1 button MOD** [5].
- The current state of the amplitude modulation appears on the display [3], e. g.:

```
AM Mode:
                  OFF
```

Changing the parameter

3. Change the state with the help of the **rotary switch** [4]:
- **OFF** - amplitude modulation is switched off
- **INTERNAL** - internal amplitude modulation
- **EXTERNAL** - external amplitude modulation

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The AFG 100 returns to the menu for setting the amplitude modulation.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - main menu
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

☞ **Note**

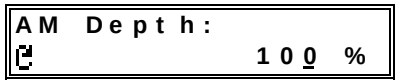
During external amplitude modulation the modulation signal which is supplied via the input **AM INPUT** [17] is used.

6.4.3.2 Input of the Modulation Depth at Internal AM (DEPTH)

Calling up the menu point

1. Call up the menu for setting the amplitude modulation with the butten sequence: **F4**, **F3** (see 6.4.3).

2. Press the **F2 button DEPTH** [6].
- The current setting of the modulation depth appears on the display [3], e. g.:



Changing the parameter

3. With the **cursor buttons** ◂ [6] und ▸ [7], select the decimal position of the parameter to be changed.

4. Change the modulation depth within the range of **0 %** to **100 %** with the help of the **rotary switch** [4].

☞ **Note**

If you try to exceed the limit values the message **Limit!** is signalled on the display.

Saving the change

5. Save the new setting with the help of the **F4 button ENTER** [8].
- The cursor disappears and the last position of the cursor is preserved.
- The AFG 100 returns to the menu for setting the amplitude modulation.

Changing to the operating state

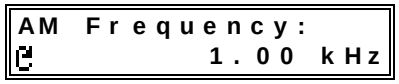
6. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - main menu
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

6.4.3.3 Input of the Modulation Frequency at Internal AM (F)

Calling up the menu point

1. Call up the menu for setting the amplitude modulation with the butten sequence: **F4**, **F3** (see 6.4.3).

2. Press the **F3 button F** [7].
- The current setting of the modulating frequency appears on the display [3], e. g.:



Changing the parameter

3. Change the modulation frequency in discreet frequency values within the range of **100 Hz** to **10 kHz** with the help of the **rotary switch** [4].

☞ **Note**

If you try to exceed the limit values the message **Limit!** is signalled on the display.

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The AFG 100 returns to the menu for setting the amplitude modulation.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - main menu
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

6.5 User Settings of the AFG 100

Calling up the menu

1. Press the **F4 button MENU** [8] when the AFG 100 is in operation.
– The main menu appears on the display [3]:

```
-- Main  Menu --
OUT SWP   AM NEXT
```

2. Press the **F4 button NEXT** [8].
– The 2nd stage of the main menu appears on the display [3]:

```
-- Main  Menu --
INT USR SPC EXIT
```

3. Press the **F2 button USR** [6].
– The menu for the user settings appears on the display [3]:

```
-- User  Menu --
PS TEST LCD NEXT
```

4. Select the corresponding menu point with the **function buttons F1-F4**:
- **PS** [6] - to activate the initialization test (see 6.5.1)
- **TEST** [7] - self-diagnosis of the AFG 100 (see 6.5.2)
- **LCD** [5] - to adjust the display (see 6.5.3)
- **NEXT** [8] - changeover to the 2nd stage of the menu for the user settings (see 6.5.4)

6.5.1 Switching on/off the Initialization Test (PS)

Calling up the menu point

1. Call up the menu for the user settings with the butten sequence: **F4**, **F4**, **F2** (see 6.5).

2. Press the **F1 button PS** [5].
– The current state for the sequence of operations of the initialization test after switching on the AFG 100 appears on the display [3], e. g.:

```
PowerUp SelfTST:
                ON
```

Changing the parameter

3. Change the state with the help of the **rotary switch** [4].
- **ON** - Initialization test is switched on
- **OFF** - Initialization test is switched off

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
– The AFG 100 returns to the menu for the user settings.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the menu for the user settings
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

☞ **Note**

If the initialization test has been deactivated (OFF), it is still possible to activate the test routine when the AFG 100 is switched on. This is done by pressing any button while switching on the instrument.
When the AFG 100 is switched off, the current state for the initialization test is preserved.

6.5.2 Self-Diagnosis of the AFG 100 (TEST)

☞ **Note**

For successful performance of the test, testing equipment is necessary.

Calling up the menu point

1. Call up the menu for the user settings with the butten sequence: **F4**, **F4**, **F2** (see 6.5).

Starting the self-diagnosis

2. Press the **F2 button TEST** [6].
- The internal diagnostic test routines are started.
- After fault-free test the AFG 100 returns to the menu for the user settings.

Changing to the operating state

3. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the menu for the user settings
- Press × 2 - 2nd stage of the main menu
- Press × 3 - operating state of the AFG 100

6.5.3 Display

6.5.3.1 Contrast Setting of the Display (CONT)

Calling up the menu point

1. Call up the menu for the display settings of the with the butten sequence: **F4**, **F4**, **F2, F3** (see 6.5).
- The following message appears on the display [3]:

```
-- LCD Adjust --
CONT BRIGHT EXIT
```

2. Press the **F1 button CONT** [5].
- The current contrast setting appears on the display [3], e. g.:

```
Contrast Adjust:
                75 %
```

Changing the parameter

3. Change the contrast within the range of **0 %** to **100 %** in 5 % steps with the help of the **rotary switch** [4].

☞ **Note**

If you try to exceed the limit values the message **Limit!** is signalled on the display.

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The AFG 100 returns to the menu for the display settings.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - menu for the user settings
- Press × 2 - 2nd stage of the menu for the user settings
- Press × 3 - 2nd stage of the main menu
- Press × 4 - operating state of the AFG 100

☞ **Note** When the AFG 100 is switched off, the last contrast setting is preserved.

6.5.3.2 Brightness Setting of the Display (BRIGHT)

Calling up the menu point

1. Call up the menu for the display settings with the butten sequence: **F4**, **F4**, **F2, F3** (see 6.5).
– The following message appears on the display [3]:

```
-- LCD Adjust --
CONT BRIGHT EXIT
```

2. Press the **F2** or **F3 button BRIGHT** [6, 7].
– The current brightness setting appears on the display [3], e. g.:

```
Bright Adjust:
                75 %
```

Changing the parameter

3. Change the brightness within the range of **0 %** to **100 %** in 5 % steps with the help of the **rotary switch** [4].

☞ **Note** If you try to exceed the limit values the message **Limit!** is signalled on the display.

Saving the change

4. Save the new setting with the help of the **F4 button ENTER** [8].
– The AFG 100 returns to the menu for the display settings.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - menu for the user settings
- Press × 2 - 2nd stage of the menu for the user settings
- Press × 3 - 2nd stage of the main menu
- Press × 4 - operating state of the AFG 100

☞ **Note** When the AFG 100 is switched off, the last contrast setting is preserved.

6.5.4 Instrument Settings

Application

If applications with certain instrument settings are repeated, there is the possibility of saving up to 9 user settings in the AFG 100.
Parallel to the freely configurable user settings there is a set instrument setting default of the manufacturer. If required the desired instrument setting can be loaded.
The AFG 100 starts with the last saved or loaded instrument setting.

☞ **Note**

The settings of the interface and the display as well as the activation of the initialization test are **not** saved. After switching on the AFG 100 the parameters which were up-to-date before switching off are set.

6.5.4.1 Saving the Current Instrument Settings (STO)

Calling up the menu point

1. Calling up the 2nd stage of the menu for the user settings with the butten sequence: **F4**, **F4**, **F2, F4** (see 6.5).
   – The following message appears on the display [3]:

```
-- User Menu 2--
STO RCL       EXIT
```

2. Press the **F1 button STO** [5].
   – The current storage location appears on the display [3]:

```
Memory Store:
                 1
```

Saving the parameters

3. Select the storage location **1** to **9** with the help of the **rotary switch** [4].

4. Press the **F4 button ENTER** [8].
   – If the **storage location is free**, the actual instrument setting is saved. The following message appears on the display [3]:

```
Current Setting:
........  SAVING
```

   The saved instrument setting is loaded in the main memory and continues to be up-to-date. The following message appears on the display [3]:

```
User Setting ...
........ LOADING
```

   The AFG 100 returns to the 2nd stage of the menu for the user settings.

   – If the **storage location is occupied**, the question if the memory content should be replaced appears on the display [3]:

```
 Rewrite Memory
NO            YES
```

5.a) Press the **F4 button YES** [8].

– The current instrument setting is saved. The following message appears on the display [3]:

```
Current Setting:
........  SAVING
```

The saved instrument setting is loaded in the main memory and continues to be up-to-date. The following message appears on the display [3]:

```
User Setting ...
........ LOADING
```

The AFG 100 returns to the 2nd stage of the menu for the user settings.

5.b) Press the **F1 button NO** [5].

– The AFG 100 returns to the 2nd stage of the menu for the user settings **without** saving.

Changing to the operating state

6. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:

- Press × 1 - main menus
- Press × 2 - operating state of the AFG 100

6.5.4.2 Loading the Instrument Settings (RCL)

Calling up the menu point

1. Calling up the 2nd stage of the menu for the user settings with the butten sequence: **F4**, **F4**, **F2, F4** (see 6.5).

– The following message appears on the display [3]:

```
-- User Menu 2--
STO RCL      EXIT
```

2. Press the **F2 button RCL** [6].

– The current storage location appears on the display [3], e. g.:

```
Memory Load:
                1
```

Loading the parameters

3. Select the storage location **0** to **9** with the help of the **rotary switch** [4].

4. Press the **F4 button ENTER** [8].

– If the **storage location 0 is selected**, the instrument setting of the manufacturer is loaded. The following message appears on the display [3]:

```
Default Setting
........ LOADING
```

– If the **storage location 1-9 is occupied**, the current instrument setting is loaded. The following message appears on the display [3]:

```
User Setting
........ LOADING
```

– If the **storage location 1-9 is not occupied**, the current instrument setting is preserved. The following message appears on the display [3]:

```
User Setting ...
 Is Not Defined!
```

– The AFG 100 returns to the 2nd stage of the menu for the user settings.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:

- Press × 1 - main menu
- Press × 2 - operating state of the AFG 100

6.6 The Special Functions of the AFG 100 (SPC)

Calling up the password input

1. Call up the **F4 button MENU** [8] when the AFG 100 is in operation.

– The main menu appears on the display [3]:

```
-- Main Menu --
OUT SWP  AM NEXT
```

2. Press the **F4 button NEXT** [8].

– The 2nd stage of the main menu appears on the display [3]:

```
-- Main Menu --
INT USR SPC EXIT
```

3. Press the **F3 button SPC** [7].

– The field for the input of the password appears on the display [3]:

```
Password:
              00000000
```

Entering the password

4. With the **cursor buttons** ◂ [6] und ▸ [7], select the position of the password to be changed.

5. Enter the right password with the help of the **rotary switch** [4].

6. Press the **F4 button ENTER** [8].

– The special menu is opened to the authorized user (service technicians) for service and calibration work.

Wrong password input

If the wrong password is entered the following message appears on the display [3] and the instrument returns to the main menu:

```
Password:
          INVALID!
```

7. Press the **F4 button ENTER** [8].
- The AFG 100 returns to the operating state.

6.7 Protection of the Signal Output

Operation

The signal output OUTPUT [11] is equipped with a protective circuit (Reverse Power Protection).
If an external voltage V > ± 15 V is connected to the active signal output [11] of the AFG 100, the signal output switches itself off automatically.

Error message

The LED *OUTPUT* [10] at the front of the AFG 100 is cleared when the AFG 100 is switched off and the following error message appears on the display [3]:

```
** Error: 31  **
  RPP Tripped!
```

Only after the error has been removed is the operating state of the signal output automatically restored and the error message disappears.

7 Remote Control by Program

7.1 Preparation of the AFG 100

⚠ **Attention!**	For remote control of the AFG 100 the connecting cable of the serial interface RS-232C has to be connected before switching on the operating voltage.
Prerequisite	Remote control of the AFG 100 with a personal computer (PC) is possible via the serial interface RS-232C. The interface of the personal computer must be configured as described in paragraph 4.4. The connecting cable must not be longer than 15 m.
Connecting the connecting cable	**1.** Connect the connecting cable to the AFG 100 [13] and the PC. **2.** Screw the connections in tight.
Switching on the AFG 100	**3.** Switch on the AFG 100. – After the initialization test the AFG 100 can receive commands.
☞ **Note**	Make sure that the phase of the mains voltage at the AFG 100 and PC is the same, the earth loops has been removed and the ESD regulations are observed.

7.1.1 Selecting the Interface Parameters

Calling up the menu

1. Press the **F4 button MENU** [8] when the AFG 100 is in operation.
– The main menu appears on the display [3]:

```
-- Main  Menu --
OUT SWP   AM NEXT
```

2. Press the **F4 button NEXT** [8].
– The 2nd stage of the main menu appears on the display [3]:

```
-- Main  Menu --
INT USR SPC EXIT
```

3. Press the **F1 button INT** [5].
– The menu for selecting the interface parameters appears on the display [3]:

```
-- RS 232 Set --
BDR PROT     EXIT
```

4. Select the corresponding menu point with the **function buttons F1-F4**:
- **BDR** [5] - to set the baud rate (see 7.1.1.1)
- **PROT** [6] - to set the transmission protocol (see 7.1.1.2)
- **EXIT** [8] - to leave the menu **without** changing the parameters or adapting the parameters if changes have been made

7.1.1.1 Setting the Baud Rate (BDR)

Calling up the menu point

1. Call up the menu for selecting the interface parameters with the butten sequence: **F4**, **F4**, **F1** (see 7.1.1).

2. Press the **F1 button BDR** [5].
- The current baud rate appears on the display [3], e. g.:

Changing the parameter

3. Change the baud rate with the help of the **rotary switch** [4].
- **1200**, **2400**, **4800**, **9600**, **19200** [Bd]

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The AFG 100 changes to the menu for selecting the interface parameters.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the main menu
- Press × 2 - operating state of the AFG 100

☞ **Note**

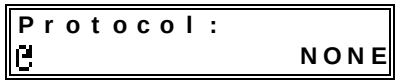
After switching off the AFG 100 the current setting of the baud rate is preserved.

7.1.1.2 Setting the Transmission Protocol (PROT)

Calling up the menu point

1. Call up the menu for selecting the interface parameters with the butten sequence: **F4**, **F4**, **F1** (see 7.1.1).

2. Press the **F4 button PROT** [6].
- The current setting of the transmission protocol appears on the display [3], e. g.:



Changing the parameter

3. Change the setting of the transmission protocol with the help of the **rotary switch** [4].
- **NONE** - communication without transmission protocol
- **RTS/CTS** - communication with RTS/CTS protocol

4. Save the new setting with the help of the **F4 button ENTER** [8].
- The AFG 100 changes to the menu for selecting the interface parameters.

Changing to the operating state

5. Repeated pressing of the **F4-button** [8] allows the user to shift between the different menu levels and/or to the operating state of the AFG 100:
- Press × 1 - 2nd stage of the main menu
- Press × 2 - operating state of the AFG 100

☞ **Note**

After switching off the AFG 100 the current setting of the transmission protocol is preserved.

Communication **with** RTS/CTS protocol

Data received from PC	Signal **RTS=ON** – AFG 100 can receive data. Signal **RTS=OFF** – AFG 100 cannot receive data.
Data transmitted to PC	Signal **CTS=ON** – AFG 100 transmitting data. Signal **CTS=OFF** – AFG 100 not transmitting data.

Communication **without** RTS/CTS protocol

Data received from PC	Signal **RTS=ON** – AFG 100 can always receive data, when the input buffer is overloaded, the error 131 **INP.BUFFER FULL** is reported.
Data transmitted to PC	Signal **CTS=ON** – AFG 100 can always transmit data.

7.1.2 Local Control ⇔ Remote Control

Activating the remote control	Transmit the command **REN** via the PC. – The AFG 100 is in the Remote Control status. This is indicated by the LED *REM* [9]. Afterwards control of the AFG 100 by the local control elements is not possible (except with the F4 button **LOC** [8]).

☞ **Note**	Block the F4 button **LOC** [8] with the help of the command **LLO**. Then all the commands of the PC can be processed completely.

Activating the local control	– There are several ways of switching from remote control to local control: ▪ By transmitting the command **GTL** (Go To Local) from the PC ▪ By pressing the F4 button **LOC** [8] at the AFG 100 if the keyboard has not been locked by the command **LLO** (Local Lock Out) ▪ By switching the **power switch** [1] off and on – The keyboard is ready for use again after the transition to local control. The LED *REM* [9] goes out.
Remote control at local control	– The following commands and instrument messages can also be transmitted by the PC when the AFG 100 is on local control: ▪ ***IDN?, *CLS,* ESR?,* ESE, *ESE?, *STB?, *SRE, *SRE? ,ERR?, DER?**

7.2 Messages of the AFG 100 on Remote Control

7.2.1 Description of the Unit Status

Introduction

The current status of the operating conditions of the AFG 100 can be interrogated at any time via the EVENT STATUS REGISTER and the STATUS BYTE REGISTER.

7.2.1.1 ESR - EVENT STATUS REGISTER

Reading and deleting the register

The contents of the ESER register **<XXX>** are saved in the output buffer and deleted by transmitting the command **∗ESR?**.
The ESR register is set on **Ø** also after the following operations:

- Switching on the AFG 100 (except bit 7)
- Transmitting the command ∗CLS (except bit 4 - MAV)
- Changing the interface parameters

Contents of the ESR register

Bit 7: (PON) Power On
Operating readiness and interface activities are displayed on **1**.

Bit 6: (URQ) User Request
Is not used, is always set on **Ø**.

Bit 5: (CME) Command Error
Is set on **1** at instruction errors.

Bit 4: (EXE) Execution Error
Is set on **1** at query errors and execution errors.

Bit 3: (DDE) Device Dependent Error
Device errors are displayed on **1**.

Bit 2: (QYE) Query Error
Is set on **1** at query errors.

Bit 1: (RQC) Request Control
Is not used, is always set on **Ø**.

Bit 0: (OPC) Operation Complete
Is set on **1** by transmitting the command **∗OPC**.

ESE - EVENT STATUS ENABLE REGISTER

Meaning of the register

Various statuses and settings of the AFG 100 can be checked. For this the contents of the ESR register are called with the help of a mask. The single bits are compared and evaluated by the following logical equation:

- ESB = (ESR7 ∧ ESE7) ∨ (ESR6 ∧ ESE6) ∨ (ESR5 ∧ ESE5) ∨ (ESR4 ∧ ESE4) ∨ (ESR3 ∧ ESE3) ∨ (ESR2 ∧ ESE2) ∨ (ESR1 ∧ ESE1) ∨ (ESR0 ∧ ESE0)

The result ESB (Event Summary Bit) is entered in the STB register.

Describing the register

The command **∗ESE <XXX>** offers the possibility of initializing the ESE register with any mask. The value **<XXX>** has to be within the range of **0** to **255**. Otherwise the error 134 **VAL. OUT OF RANGE** is reported.

Reading and deleting the register

The current contents **<XXX>** are saved in the output buffer by transmitting the command **∗ESE?**.
The ESE register is set on **Ø** after the following operations:

- Switching on the AFG 100
- Transmitting the command ∗ESE 0
- Changing the interface parameters

7.2.1.2 STB - STATUS BYTE REGISTER

Reading and deleting the register

The contents of the STB register **<XXX>** are filed in the output buffer by transmitting the command **∗STB?**.
The STB register is set on **Ø** after the following operations:

- Switching on the AFG 100
- Transmitting the command ∗CLS (except bit 4 - MAV)
- Changing the interface parameters

Contents of the STB register

Bit 7: Is not used, is always set on **Ø**.
Bit 6: (MSS) Master Summary Bit
Result during checkup of the STB register with a mask (SRE register, see below).
Bit 5: (ESB) Event Summary Bit
Result during checkup of the ESR register with a mask (ESE register, see above).
Bit 4: (MAV) Message Available
Is set on **1** if a current message of the AFG 100 is requested at the output buffer.
Bit 3: Is not used, is always set on **Ø**.
Bit 2: Is not used, is always set on **Ø**.
Bit 1: Is not used, is always set on **Ø**.
Bit 0: Is not used, is always set on **Ø**.

SRE - SERVICE REQUEST ENABLE REGISTER

Meaning of the register

Various statuses and settings of the AFG 100 can be checked. For this the contents of the STB register are called with the help of a mask. The single bits (except SRE bit 6, which is always set on **Ø**) are compared and evaluated by the following logical equation:

- MSS = (STB7 ∧ SRE7) ∨ (STB5 ∧ SRE5) ∨ (STB4 ∧ SRE4) ∨ (STB3 ∧ SRE3) ∨ (STB2 ∧ SRE2) ∨ (STB1 ∧ SRE1) ∨ (STB0 ∧ SRE0)

The result MSS (Master Summary Status) is entered in the STB register.

Describing the register

The command **∗SRE <XXX>** offers the possibility of initializing the SRE register with any mask. The value **<XXX>** has to be within the range of **0** to **255**. Otherwise the error 134 **VAL. OUT OF RANGE** is reported.

Reading and deleting the register

The current contents **<XXX>** are saved in the output buffer by transmitting the command ***SRE?**.
The SRE register is set on **Ø** after the following operations:

- Switching on the AFG 100
- Transmitting the command *SRE 0
- Changing the interface parameters

7.2.2 Description of Errors

Contents of the fault register

When errors occur in the remote-controlled settings and queries, they are saved with a code in the error register.

Reading and deleting the register

The contents of the error register can be called and deleted at any time by transmitting the command **ERR?**.
If several errors arise only the error codes of the first and last error are saved. By repeatedly transmitting the command **ERR?** the error codes are filed in the output buffer.
The error register is set on **Ø** after the following operations:

- Repeated use of the command **ERR?** (according to the number of errors)
- Initialization of the status register (***CLS**)

☞ **Note**

Before transmission of the command **ERR?** the interface command **DCL** has to be transmitted.

7.2.2.1 DER - DEVICE ERROR REGISTER

Meaning of the register

The contents of the DER register specify the device error in the error register.

Reading and deleting the register

The contents of the register **<XXX>** within the range of **0** to **255** are filed in the output buffer by transmitting the command **DER?**.
The DER register is set on **Ø** after the following commands:

- Repeated use of the command **ERR?** (according to the number of errors)
- Initializing of status structure (***CLS**)

Contents of the DER register

Bit 7: Is not used, is always set on **Ø**.
Bit 6: Is set on **1**, if the calibration data have been deleted.
Bit 5: Is set on **1**, if the data in the RAM memory have been deleted.
Bit 4: Is set on **1**, if an external voltage of > ± 15 V is connected at the output and the output has been switched off.
Bit 3: Is not used, is always set on **Ø**.
Bit 2: Is not used, is always set on **Ø**.
Bit 1: Is not used, is always set on **Ø**.
Bit 0: Is not used, is always set on **Ø**.

☞ **Note**

When a device error occurs the bit 3 (DDE) of the ESR register is set on **1**.

7.2.2.2 Error Messages

Dependence of the error message

The error messages are dependent on the **operating status** and the **type of error**.

- On local control interface errors are displayed for only a short time. On remote control of the AFG 100 interface errors are displayed until the contents of the error register have been queried or deleted.
- Device errors are displayed during the error status.

List of Error Messages

Error code	**Error mode** Text of messages	**Meaning of text**
0	-	Faultless operation
	DEVICE ERROR	**Device error**
31	RPP TRIPPED	Output overload with external voltage
98	INVALID PASSWORD	Wrong password
	QUERY ERROR	**Query error**
120	BAD USING QUERY	Used query is wrong
	EXECUTION ERROR	**Execution error**
131	NO EXECUTION	Cannot be executed
132	NOT EX. IN LOCAL	Cannot be executed on local control
134	VAL. OUT OF RANGE	Value is out of range
	COMMAND ERROR	**Command error**
151	ILLEGAL COMMAND	Unknown command
	RS 232 ERROR	**Error of the RS-232C interface**
181	INP. BUFFER FULL	Input buffer is full

7.3 List of Commands on Remote Control

7.3.1 General Commands

7.3.1.1 Interface Commands

REN
(Remote)
– Transition from local control to remote control

ASCII	Character (dec.)
HT	9

LLO
(Local Lock Out)
– Locking of the F4 button LOC [8]

ASCII	Character (dec.)
EM	25

GTL
(Go To Local)
– Transition from remote control to local control

ASCII	Character (dec.)
SOH	1

DCL
(Device Clear)
– Initializing the communications protocol of the interface
– Initializing the partial circuit and deleting the buffer

ASCII	Character (dec.)
DC4	20

☞ **Note** The command **DCL** has no influence on the functions of the device. These have to be initialized by the general command ***RST**.

7.3.1.2 Initializing the Instrument Settings

***RST**
(Reset)
– Basic initialization of the AFG 100 as during the starting (see 6.2).

☞ **Note** After switching on the AFG 100 the commands ***RST**, **DCL** and ***CLS** are executed automatically and the contents of the ESE and SRE registers are deleted. Bit 7 (PON) of the ESR register is set on **1**.

7.3.1.3 Self-Diagnosis of the AFG 100

***TST?**
(Test)
– Start of internal test and saving of result
where: **0** - test is successful
1 - test is not successful

7.3.1.4 Identification of the AFG 100

***IDN?** (Identification)	– Identification *digimess*,**AFG 100, <X...X>,<Y...Y>** where: **<X...X>** - production number or 0 **<Y...Y>** - software version or 0

☞ **Note**	The query ***IDN?** should be written at the end of the command line because subsequent data may be lost before transmission. Otherwise the error 120 **BAD USING QUERY** is reported.

7.3.1.5 Initializing the Status Structure

***CLS** (Clear Status Byte)	– Resetting of ESR and STB registers (except bit 4 - MAV) ESE and SRE registers are not deleted. – Initializing of the error structure (see 7.2.2)

7.3.1.6 Sync Commands

***WAI** (Waiting)	– The following commands are executed only after completion of the current operation.
***OPC** (Operation Complete)	– After completion of the current operation bit 0 (OPC) in the ESR register is set on **1**.
***OPC?**	– After completion of the current operation the number 1 is saved in the output buffer.

☞ **Note**	In the AFG 100 all commands are executed sequentially. The execution of the next command starts only when the current operation is ended. While the commands ***OPC** and ***OPC?** are executed immediately, the command ***WAI** does not have any effect.

7.3.1.7 Query of the Instrument Status

ERR? (Error)	– Reading and resetting of the error messages (see 7.2.2)
DER?	– Contents of the DER register are filed in the output buffer.
***ESR?** ***ESE <XXX>** ***ESE?**	– Reading of the ESR register (see 7.2.1.1)
***STB?** ***SRE <XXX>** ***SRE?**	– Reading of the STB register (see 7.2.1.2)

7.3.2 Instrument Settings and Messages

7.3.2.1 Output Frequency

FREQ <X...X> – Frequency setting [Hz] within the range of **0.010** to **1.2500E7** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

FREQ? – The set frequency value [Hz] is filed in the output buffer with the following format:
- **HZ <X.XXXXE+0Y>** or
- **HZ <ZX.XXXE+0Y>** or
- **HZ <ZXX.XXE+0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0**, **3** or **6**

7.3.2.2 Sample Period at Arbitrary Signals

RATE <XX> – Setting the sample rate of the arbitrary signal with the help of the coefficient N within the range of **1** to **32** (in the free format)
The numeric argument is rounded up.
Sample rate = 30 ns ∗ 2^{N-1}, N = 1 to 32

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

RATE? – The set sample rate [s] is filed in the output buffer with the following format:
- **S <Z.XXXXE±0Y>** or
- **S <ZX.XXXE±0Y>** or
- **S <ZXX.XXE±0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0**, **3, 6** or **9**

7.3.2.3 Output Level

LEVEL <X...X> – Level setting [V] within the range of **10.0E-03** to **10.0** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

LEVEL – The set output level [V] is filed in the output buffer with the following format:
- **V <Z.XXE±0Y>** or
- **V <ZX.XE±0Y>** or
- **V <ZXXE±0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0** or **3**

7.3.2.4 Dc Voltage Offset of the Output Signal

OFFSET <X...X> – Setting the dc voltage offset of the output signal [V] within the range of **–2.5** to **+2.5** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

OFFSET – The set dc voltage offset [V] is filed in the output buffer with the following format:
- **V <TZ.XXE+00>**

where: **T** - character (**-**/**blank**)
Z - character from **0** to **2**
X - character from **0** to **9**
E - exponent

7.3.2.5 Wave Form of the Output Signal

W_SINE – The sinusoidal output signal is selected.

W_SQUARE – The square-wave output signal is selected.

W_TRIANGLE – The triangular output signal is selected.

W_RAMPUP – The sawtooth output signal (Ramp Up) is selected.

W_RAMPDN – The sawtooth output signal (Ramp Down) is selected.

W_ARBIT – The saved arbitrary output signal is selected.

WAVE? – The current selection of the wave form at the output of the AFG 100 is filed in the output buffer with the following format:
- **W_SINE**, **W_SQUARE**, **W_TRIANGLE**, **W_RAMPUP**, **W_RAMPDN** or **W_ARBIT**

7.3.2.6 Switching State of the Signal and Sync Outputs

Signal output

OUT_ON – The signal output is switched on.

OUT_OFF – The signal output is switched off.

OUT? – The current state of the signal output is filed in the output buffer:
- **OUT_ON** or **OUT_OFF**

Sync output

SOUT_OFF – The square-wave signal at the sync output is switched off.

SOUT_POS – The positive square-wave signal at the sync output is switched on.

SOUT_NEG – The negative square-wave signal at the sync output is switched on.

SOUT – The current status is filed in the output buffer:
- **SOUT_OFF**, **SOUT_POS** or **SOUT_NEG**

7.3.2.7 Sweep Function

Switching on/off

SWP_OFF – The sweep function is switched off.

SWP_LIN – The linear sweep function is switched on.

SWP_LOG – The logarithmic sweep function is switched on.

SWP – The current state of the sweep function is filed in the output buffer:
- **SWP_OFF**, **SWP_LIN** or **SWP_LOG**

Frequency limits

SWP_START <X...X> – Setting the lower frequency limit [Hz] within the range of **0.010** to **1.250E7** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

SWP_START – The set lower frequency limit [Hz] is filed in the output buffer with the following format:
- **HZ <X.XXXXE+0Y>** or
- **HZ <ZX.XXXE+0Y>** or
- **HZ <ZXX.XXE+0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0**, **3** or **6**

SWP_STOP <X...X> – Setting the upper frequency limit [Hz] within the range of **0.010** to **1.250E7** (in the free format)
The numeric argument is rounded up.

☞ **Note**	If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

SWP_STOP – The set upper frequency limit [Hz] is filed in the output buffer with the following format:
- **HZ <X.XXXXE+0Y>** or
- **HZ <ZX.XXXE+0Y>** or
- **HZ <ZXX.XXE+0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0**, **3** or **6**

Period

SWP_TIME <X...X> – Setting the period [s] within the range of **10E-3** to **60** (in the free format)
The numeric argument is rounded up.

☞ **Note**	If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

SWP_TIME – The set period [s] is filed in the output buffer with the following format:
- **S <ZXE±0Y>** or
- **S <Z.XXE±0Y>** or
- **S <ZX.XE±0Y>** or
- **S <ZXXE±0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0** or **3**

7.3.2.8 Amplitude Modulation

Switching on/off

AM_OFF – The amplitude modulation is switched off.

AM_INT – The amplitude modulation (internal modulation source) is switched on.

AM_EXT – The amplitude modulation (external modulation source) is switched on.

AM – The current state of the amplitude modulation is filed in the output buffer:
- **AM_OFF**, **AM_INT** or **AM_EXT**

Modulation depth at internal AM

AM_DEPTH <X...X> – Setting the modulation depth [%] at internal amplitude modulation within the range of **0** to **100** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

AM_DEPTH – The set modulation depth [%] at internal amplitude modulation is filed in the output buffer with the following format:
- **PCT <X>** or
- **PCT <ZX>** or
- **PCT 100**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**

Modulating frequency at internal AM

AM_FREQ <X...X> – Setting the discreet frequency values of the oscillator at internal amplitude modulation within the range of **1** to **31** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

AM_FREQ – The set frequency value of the internal oscillator at internal amplitude modulation is filed in the output buffer with the following format:
- **HZ <Z.XXE+0Y>** or
- **HZ <ZX.XE+0Y>** or
- **HZ <ZXXE+0Y>**

where: **Z** - character from **1** to **9**
X - character from **0** to **9**
E - exponent
Y - character **0** or **3**

7.3.2.9 Saving the Arbitrary Signals

Memory addressing

ARB_ADR <X...X> – Input of the start address for saving/loading the arbitrary signal within the range of **0** to **8191** (in the free format)
The numeric argument is rounded up.

☞ **Note** If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.

Saving with ASCII font

ARB_DATA <X...X> – Saving a sample of the arbitrary signal within the range of **0** to **65535** (in the free format)
The numeric argument is rounded up.

☞ **Note**

If the value is out of range the error 134 **VAL. OUT OF RANGE** is reported.
The start address is set with the command **ARB_ADR** (see above). The command **ARB_DATA** sets the internal address pointer automatically.

<X...X>
Structure of the saved data

Bit 15: If this bit is set on **1**, a sync marker is generated. This is carried out when the sample is at the output.
Bit 14: If this bit is set on **1 at all samples**, the sync markers are generated according to the setting of bit 15.
Bit 13 ... 10: Is not used, is always set on **Ø**.
Bit 9: MSB of the sample
Bit 8 ... 1: Sample of the wave form
Bit 0: LSB of the sample

☞ **Note**

If bits 14 and 15 are set on **Ø**, internal sync markers are generated automatically.

Bit 9 ... 0
Contents of the sample

When setting the output level V_{pp} = 1 V and when using the internal sync markers the output level corresponds to the following numeric argument (in the free format):

- **- 0.5 V ...** corresponds to **0 ...**
- **... + 0.5 V** corresponds to **... 1023**

ARB_DATA – A saved sample of the arbitrary signal is filed in the output buffer with the following format:
- **0 ... 65535**

☞ **Note**

The command **ARB_DATA** sets the internal address pointer automatically.

Saving with binary data blocks

ARB <ABPD> – Fast saving of a whole data block of the arbitrary signal (Arbitrary Block Program Data) in the following format:

- **#<NZD><D><DB>**

  where: **#** - Start signal of the data block
  <NZD> - ASCII number (no 0) within the range of **49** to **57** (dec.) which defines the number of the following ASCII numbers
  <D> - ASCII number within the range of **48** to **57** (dec.) which defines the number of the following binary data blocks
  <DB> - binary data within the range of **0** to **255** (dec.), which are transmitted in the following order:
  1. High byte of the data word
  2. Low byte of the data word

  Example: #500004<DB><DB><DB><DB>

<DB>
Structure of the data word

High byte of the data word:

Bit 7: If this bit is set on **1**, a sync marker is generated. This is carried out when the sample is at the output.
Bit 6: If this bit is set on **1 at all samples**, the sync markers are generated according to the setting of bit 7 (High byte).
Bit 5 ... 2: Is not used, is always set on **Ø**.
Bit 1: MSB of the sample
Bit 0: Sample of the wave form

Low byte of the data word:

Bit 7 ... 1: Sample of the wave form
Bit 0: LSB of the sample

Bit 1 ... 0 (H byte)**, Bit 7 ... 1** (L byte) Contents of the samples

When setting the output level V_{pp} = 1 V and when using the internal sync markers the output level corresponds to the following numeric argument:

- **- 0.5 V ...** corresponds to H byte **0 dec.** and L byte **0 dec.**
- **... + 0.5 V** corresponds to H byte **3 dec.** and L byte **255 dec.**

7.3.2.10 Password Input

PASSWORD <X...X> – Input the 8-digit password **<XXXXXXXX>** for access to the service menu

☞ **Note** If the password is wrong, the error 98 **INVALID PASSWORD** is reported.

7.4 Programming Notes

Command line

Single commands can be written consecutively in one command line, the length of which must not exceed 64 characters. In case errors occur, the command sequence is ignored and error 181 **INP. BUFFER FULL** is indicated.

Separation characters

Commands and device messages have to be separated by a semicolon:

ASCII	Character (dec.)
;	59

Final characters

A final character is at the end of every command line.

- During transmission of commands to the AFG 100:

ASCII	Character (dec.)
LF	10

- During reception of commands from the AFG 100:

ASCII	Character (dec.)
CR + LF	13 + 10

Parameter separators

Certain commands or messages can contain parameters or results which are separated from the command by a parameter separator.

- During transmission of commands to the AFG 100:

ASCII	Character (dec.)
SP	32
NUL	0
STX to BS	2 to 8
VT to DC3	11 to 19
NAK to CAN	21 to 24
SUB to US	26 to 31

- During reception of commands from the AFG 100:

ASCII	Character (dec.)
SP	32

7.5 Program Example for Square-wave Signal (Q Basic)

```
100 '*********************************************************
*
110 '              The Example in Microsoft Q Basic
120 '         of using the AFG 100 with RS-232C interface
130 '           Serial port is com1 and Bd rate is 9600
140 '            Settings - output frequency: 1.234 kHz
150 '                     - output level: 2 V
160 '                     - wave form: square-wave
170 '*********************************************************
*
180
190 CLS
200
210 '**** Activating interface ****
220   IDCL$ = CHR$(20): IREN$ = CHR$(9): ILLO$ = CHR$(25):
230   IGTL$ = CHR$(1)
240
250 '**** Set up device and status reporting ****
260 OPEN  "COM1:9600,n,8,1,CS30000,LF" FOR RANDOM AS #1
270
280 '**** Set up AFG 100 and status reporting ****
290 PRINT #1, IDCL$; IREN$; ILLO$; "*RST;*CLS"
300
310 '**** Frequency setting ****
320 PRINT #1, "FREQ 1.2345E+3"
330
340 '**** Output wave form setting ****
350 PRINT #1, "W_SQUARE"
360
370 '**** Output level setting ****
380 PRINT #1, "LEVEL 2"
390
400 '**** Signal output setting ****
410 PRINT #1, "OUT_ON"
420
430 '**** Set local mode ****
440 PRINT #1, "*OPC?"
450 INPUT #1, A$
460 PRINT #1, IGTL$
470
480 '**** Close statement ****
490 CLOSE #1
500
510 END
```

8 Loading External Arbitrary Signals

Introduction

Each arbitrary signal which is to be used within the AFG 100 must be generated externally. The data which have been generated (samples) must have a defined format and can be loaded into the AFG 100 as a TXT file or a BIN file via interface RS-232C.
Several options are available for data transmission with a PC (e. g. MS-DOS, Special Program).
After activating ARBITRARY mode, the transmitted arbitrary signal is loaded into the main memory (DDS RAM) and is available as a wave form.

8.1 File Creation

8.1.1 Structure of a TXT File (ASCII)

Instructions

The file should have the following structure:

1. Command **REN**
   - Activating the remote control
2. Command **ARB_ADR 0**
   - Input of the start address when saving the arbitrary signal (see 7.3.2.9)
3. 8192 × command **ARB_DATA <X...X>**
   - Saving the 8,192 samples of an arbitrary signal (see 7.3.2.9)

Simple ASCII TXT file with arbitrary signal

```
Ø9H
ARB_ADR 0
ARB_DATA <Value_1>
ARB_DATA <Value_2>
ARB_DATA <Value_3>
...
ARB_DATA <Value_8192>
```

☞ **Note**

Each instruction can be found on one line of the file, i. e. it is concluded with the final characters CR (13 dec.) and LF (10 dec.).

8.1.2 Structure of a BIN File (HEX)

Instructions

The file should have the following structure:

1. Command **REN**
   - Activating the remote control
2. Command **ARB #516384**
   - The instruction leads the block of the binary data which characterizes the arbitrary signal with a length of 16,384 bytes.
3. 8,192 × byte Arbitrary dat **<XX>**
   - Saving the 8,192 samples of an arbitrary signal (see 7.3.2.9)

Simple binary file with arbitrary signal

```
Ø9H
ARB #516384<H_byte-Value_1><L_byte-
Value_1> ... ... <H_byte-Value_8129><L_byte-
Value_8129>
```

8.2 Data Transmission

8.2.1 Transmission of a TXT file

8.2.1.1 Transmission via MS DOS

Instructions

1. Make the connection between AFG 100 and PC (see 7.1).

2. Set the following interface parameters in the AFG 100:
- Baud rate: max. 4,800 Bd (see 7.1.1.1)
- Transmission protocol: switched off (see 7.1.1.2)

3. Configure the PC with the following command:
- **MODE COMz:4800,N,8,1**
  where: **z** - number of the serial port

4. Transmit the TXT file from the PC to the AFG 100 with the following command:
- **COPY x.y COMz: /B /V**
  where: **x.y** - file name of the TXT file
  z - number of the serial port of the PC

☞ **Note** The transmission time is approx. 4 minutes. After fault-free completion of the transmission confirmation appears at the screen.

8.2.1.2 Transmission via Windows with the Help of the TERMINAL Program

Instructions

1. Make the connection between AFG 100 and PC (see 7.1).

2. Set the following interface parameters in the AFG 100:
- Baud rate: max. 4,800 Bd (see 7.1.1.1)
- Transmission protocol: switched off (see 7.1.1.2)

3. Configure the serial interface in the program TERMINAL via the menu: Settings\Communication.
- Baud rate: max. 4,800 Bd
- Data bits: 8
- Stop bits: 1
- Parity: without
- Control of the data flow: none
- Parity check: none
- Detecting of the disk: none
- Serial port: COM 1/2

4. Set the control of the data flow in the program TERMINAL via the menu: Settings\Transmitting Of The Text.
- Standard control of the data flow

5. Activate the data transmission in the program TERMINAL via the menu: Transmission\Send Text File
- Select the corresponding file with arbitrary signals
- Set the option “after the CR sign without changes” (neither add nor leave out the sign LF)
- Transmit the TXT file from the PC to the AFG 100

☞ **Note** The transmission time is approx. 4 minutes. After fault-free completion of the transmission confirmation appears at the screen.

8.2.2 Transmission of a BIN File

8.2.2.1 Transmission via MS DOS

Instructions

1. Make the connection between AFG 100 and PC (see 7.1).

2. Set the following interface parameters in the AFG 100:
- Baud rate: max. 19,200 Bd (see 7.1.1.1)
- Transmission protocol: switched off (see 7.1.1.2)

3. Configure the PC with the following command:
- **MODE COMz:19200,N,8,1**
  where: **z** - number of the serial port

4. Transmit the BIN file from the PC to the AFG 100 with the following command:
- **COPY x.y COMz: /B /V**
  where: **x.y** - file name of the BIN file
  z - number of the serial port of the PC

☞ **Note** The transmission time is approx. 8 seconds. After fault-free completion of the transmission confirmation appears at the screen.

8.2.2.2 Transmission via Windows with the Help of the TERMINAL Program

Instructions

1. Make the connection between AFG 100 and PC (see 7.1).
2. Set the following interface parameters in the AFG 100:
   - Baud rate: max. 19,200 Bd (see 7.1.1.1)
   - Transmission protocol: switched off (see 7.1.1.2)
3. Configure the serial interface in the program TERMINAL via the menu: Settings\Communication.
   - Baud rate: max. 19,200 Bd
   - Data bits: 8
   - Stop bits: 1
   - Parity: without
   - Control of the data flow: none
   - Parity check: none
   - Detecting of the disk: none
   - Serial port: COM 1/2
4. Set the control of the data flow in the program TERMINAL via the menu: Settings\Transmitting Of The Text.
   - Standard control of the data flow
5. Activate the data transmission in the program TERMINAL via the menu: Transmission\Send Text File
   - Select the corresponding file with arbitrary signals
   - Set the option “after the CR sign without changes” (neither add nor leave out the sign LF)
   - Transmit the TXT file from the PC to the AFG 100

☞ **Note** The transmission time is approx. 8 seconds. After fault-free completion of the transmission confirmation appears at the screen.

8.2.3 Transmission with Special Program

Instructions

1. Make the connection between AFG 100 and PC (see 7.1).
2. Set the following interface parameters in the AFG 100:
   - Baud rate: max. 19,200 Bd (see 7.1.1.1)
   - Transmission protocol: switched off (see 7.1.1.2)
3. Start the special program **ARB_AFG.EXE** and set the following parameters:
   - Number of the serial port of the PC: COM 1/2
   - Baud rate: according to AFG 100
   - Name of the TXT file or BIN file
4. Transmit the TXT file or BIN file from the PC to the AFG100.

☞ **Note** The program makes possible the conversion of a TXT file to a BIN file simultaneously.

8.3 Activating the Arbitrary Signal

Instructions

1. Press the **F4 button LOC** [8] of the AFG 100 after transmission of the TXT file or BIN file.
   – The AFG 100 changes from remote control to local control.
2. Set the wave form **ARBITRARY** at the AFG 100 (see 6.3.4).
   – The transferred arbitrary signal is loaded in the main memory (DDS RAM) and is available as wave form.

8.4 Contents of Enclosed Diskette

Contents of the diskette

There are the following files on the diskette:

- **READ_ME.DOC** - Description "loading of external arbitrary signals" (see 8)
- **ARB_AFG.EXE** - Special program for data transmission
- **ARB_FCE.TXT** - TXT file for an arbitrary signal

Text file ARB_FCE.TXT

The generated arbitrary signal is described with the following equation:

$$f(x) = INT\left(\frac{2^{10}}{2} * \sin\left(\frac{16 * x}{8192} * 2\pi\right) * \exp^{-\frac{4*x}{8192}} + \frac{2^{10}}{2}\right)$$

The TXT file can be loaded in the AFG 100 with the above-mentioned possibilities of data transmission.

9 Care and Maintenance

⚠ **Warning!**	The AFG 100 must be separated from all power sources before maintenance work is carried out and before parts or fuses are repaired or replaced.
Care	Only use a soft wet rag with some soap suds or a soft rinse liquid for cleaning. Avoid acrid cleanser and solvents.
Maintenance	The AFG 100 does not require special maintenance if it is used and handled correctly. Service work should only be done by trained personnel. In case of repairs it is vital to ensure that the design features of the AFG 100 are not changed, resulting in a reduction in operational safety, and that replacement parts match the original ones and are installed properly (original state).

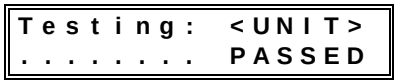
10 Appendix

10.1 List of Operating Functions

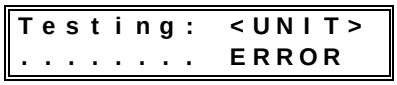
Operating function		Butten sequence in the operating state
Operating parameters:		
Input of the output frequency	(**FREQ**)	**F1: F2-F3** [◄ ►], ↻ [Frequency], **F4**
Input of the output level	(**LEVEL**)	**F2: F2-F3** [◄ ►], ↻ [Level], **F4**
Input of the dc voltage offset	(**OFFSET**)	**F2: F1** [▲▼], **F2-F3** [◄ ►], ↻ [Offset], **F4**
Selecting the wave form	(**WAVE**)	**F3:** ↻ [Wave form], **F4**
Input of the sample period at arbitrary signals	(**FREQ**)	**F1:** ↻ [Sample period], **F4**
Operating modes:		
Activating the outputs:		
Switching on/off the signal output	(**SIGNAL**)	**F4, F1, F2/F3:** ↻ [ON/OFF], **F4, ...**
Switching on/off the sync output	(**SYNC**)	**F4, F1, F1:** ↻ [POS/NEG/OFF], **F4, ...**
Activating the sweep function:		
Switching on/off the sweep function	(**MOD**)	**F4, F2, F1:** ↻ [LIN/LOG/OFF], **F4, ...**
Input of the frequency limits	(**FREQ**)	**F4, F2, F2: F2-F3** [◄ ►], ↻ [START], **F1** [▲▼], **F2-F3** [◄ ►], ↻ [STOP], **F4, ...**
Input of the period	(**ST**)	**F4, F2, F3: F2-F3** [◄ ►], ↻ [Period], **F4, ...**
Activating the amplitude modulation:		
Switching on/off the amplitude modulation	(**MOD**)	**F4, F3, F1:** ↻ [INT/EXT/OFF], **F4, ...**
Input of the modulation depth at internal AM	(**DEPTH**)	**F4, F3, F2: F2-F3** [◄ ►], ↻ [AM depth], **F4, ...**
Input of the frequency at internal AM	(**F**)	**F4, F3, F3:** ↻ [AM Freq.], **F4, ...**
User settings:		
Switching on/off the initialization test	(**PS**)	**F4, F4, F2, F1:** ↻ [ON/OFF], **F4, ...**
Self-diagnosis	(**TEST**)	**F4, F4, F2, F2:** [Result], **F4, ...**
Adapting the display:		
Contrast setting	(**CONT**)	**F4, F4, F2, F3, F1:** ↻ [0-100 %], **F4, ...**
Brightness setting	(**BRIGHT**)	**F4, F4, F2, F3, F2/F3:** ↻ [0-100 %], **F4, ...**
instrument settings:		
Saving the instrument settings	(**STO**)	**F4, F4, F2, F4, F1:** ↻ [Memory 1-9], **F4, ...**
Loading the instrument settings	(**RCL**)	**F4, F4, F2, F4, F2:** ↻ [Memory 0-9], **F4, ...**
Configuring the interface:		
Baud rate	(**BDR**)	**F4, F4, F1, F1:** ↻ [Bd rate], **F4, ...**
Transmission protocol	(**PROT**)	**F4, F4, F1, F2:** ↻ [Protocol], **F4, ...**
Special functions:		
Password input	(**SPC**)	**F4, F4, F3: F2-F3** [◄ ►], ↻ [Password], **F4, ...**

10.2 List of Instrument Messages

– Internal test starts (see 6.2)



– Faultless test, **<UNIT>** stands for the unit which has just been tested (see 6.2)



– Error during test, **<UNIT>** stands for the unit which has just been tested (see 6.2)

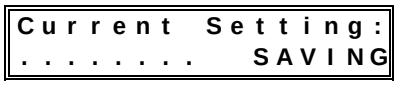
– Warning with error characteristics (see 6.2)

– Error description (see 6.2)

– Error description (see 6.2)

– Version of the firmware (see 6.2)

– Operational readiness of the AFG 100 (see 6.2)

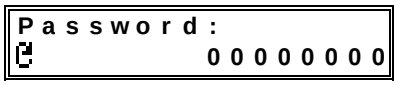


– Saving the current instrument settings (see 6.5.4.1)

– Loading the manufacture's instrument settings (see 6.5.4.2)

– Loading of the saved user settings (see 6.5.4.2)

– No settings are saved (see 6.5.4.2)



– Password input (see 6.6)

– Invalid password (see 6.6)

– Signal output of external source is overloaded (see 6.7)