HM8123
HM8123-X
3 GHz Programmable Counter
User Manual

海洋儀器
致力于电子测试、维护领域!

HAMEG Instruments
A Rohde&Schwarz Company

5800438602

Test & Measurement

Benutzerhandbuch / User Manual

Version 03

ROHDE&SCHWARZ

Content

1 Important hints

(1) (2) (3)

1.1 Symbols

Symbol 1: Attention, please consult manual
Symbol 2: Danger! High voltage!
Symbol 3: Ground connection

1.2 Unpacking

Please check for completeness of parts while unpacking. Also check for any mechanical damage or loose parts, due to transportation. In case of transport damage inform the supplier immediately and do not operate the instrument.

1.3 Positioning

Two positions are possible: According to Fig. 1 the front feet are folded down and are used to lift the instrument so its front points slightly upward (approx. 10 degrees).

If the feet are not used (Fig. 2) the instrument can be stakked safely with many other HAMEG instruments.

In case several instruments are stacked (Fig. 3) the feet rest in the recesses of the instrument below so the instruments can not be inadvertently moved..

Fig. 1

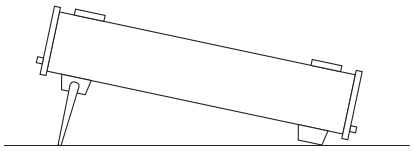


Fig. 2

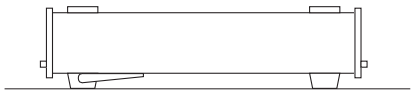
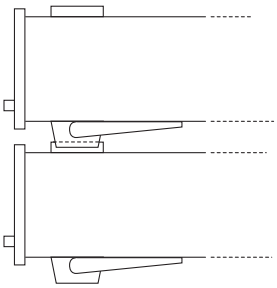


Fig. 3



Please do not stack more than 3 instruments. A higher stack will become unstable, also heat dissipation may be impaired.

1.4 Transport and Storage

Please keep the shipping carton in case the instrument may require later shipment for repair. Losses and damages during transport as a result of improper packaging are excluded from warranty!

Dry indoors storage is required. After exposure to extreme temperatures 2h for accomodation to ambient temperature before turning the instrument on.

1.5 Safety instructions

The instrument conforms to VDE 0411/1 safety standards applicable to measuring instruments and left the factory in proper condition according to this standard. Hence it conforms also to the European standard EN 61010-1 resp. to the international standard IEC 61010-1. Please observe all warnings in this manual in order to preserve safety and guarantee operation without any danger to the operator. According to safety class 1 requirements all parts of the housing and the chassis are connected to the safety ground terminal of the power connector.

For safety reasons the instrument must only be operated from 3 terminal power connectors or via isolation transformers.

Do not disconnect the safety ground either inside or outside of the instrument!

In case of doubt the power connector should be checked according to DIN VDE 0100/610:

- The line voltage of the instrument as shown on the type label must correspond to the line voltage used.
- Only qualified personnel may open the instrument
- Prior to opening the instrument must be disconnected from the line and all other inputs/outputs.

In any of the following cases the instrument must be taken out of service and locked away from unauthorized use:

- Visible damages
- Damage to the power cord
- Damage to the fuse holder
- Loose parts
- No operation
- After longterm storage in an inappropriate environment, e.g. open air or high humidity.
- Excessive transport stress

1.6 Proper operating conditions

Operation in the following environments: industry, business and living quarters, small industry. The instruments are intended for operation in dry, clean environments. They must not be operated in the presence of excessive dust, humidity, nor chemical vapours in case of danger of explosion.

The maximum permissible ambient temperature during operation is +5 °C to +40 °C. In storage or during transport

the temperature limits are: –20 °C to +70 °C. In case of exposure to low temperature or if condensation is suspected, the instrument must be left to stabilize for at least 2 hrs prior to operation.

In principle the instrument may be used in any position, however sufficient ventilation must be ensured. Operation for extended periods of time requires the horizontal or tilted (handle) position. Nominal specifications are valid after 30 minutes warm-up at 23 °C. Specifications without tolerances are typical values taken of average production units.

1.7 Warranty and Repair

Our instruments are subject to strict quality controls. Prior to leaving the manufacturing site, each instrument undergoes a 10-hour burn-in test. This is followed by extensive functional quality testing to examine all operating modes and to guarantee compliance with the specified technical data. The testing is performed with testing equipment that is calibrated to national standards. The statutory warranty provisions shall be governed by the laws of the country in which the product was purchased. In case of any complaints, please contact your supplier.

The product may only be opened by authorized and qualified personnel. Prior to working on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

Any adjustments, replacements of parts, maintenance and repair may be carried out only by authorized technical personnel. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

1.8 Maintenance

Clean the outer case using a dust brush or a soft, lint-free dust cloth at regular intervals.

The display can be cleaned using water or a glass cleaner (but not with alcohol or other cleaning agents). Thereafter wipe the surfaces with a dry cloth. No fluid may enter the instrument. Do not use other cleaning agents as they may adversely affect the labels, plastic or lacquered surfaces.

Before cleaning please make sure the instrument is switched off and disconnected from all power supplies.

No part of the instrument should be cleaned by the use of cleaning agents (as f.e. alcohol) as they may adversely affect the labeling, the plastic or lacquered surfaces.

1.9 Line fuse

The instrument has 2 internal line fuses: T 0.8 A. In case of a blown fuse the instrument has to be sent in for repair. A change of the line fuse by the customer is not permitted.

1.10 Power switch

The instrument has a wide range power supply from 105 to 253 V, 50 or 60 Hz ±10 %. There is hence no line voltage selector.

2 Controls and display

Front panel

[1] POWER (Pushbutton)
Power switch, mains input connector on rear panel

[2] GATE (LED)
The GATE LED will be on for the duration of the gate time and synchronisation time, i.e. for the duration of one complete measurement.

[3] REMOTE (LED and pushbutton)
The REMOTE LED will be on if the instrument is under control via the interface. By pushing the REMOTE button operation will be returned to manual.

[4] Display (LCD)
Display of measurement results and additional information

[5] ESC (pushbutton)
Escape pushbutton (menu)

[6] ENTER (pushbutton)
Enter pushbutton (menu)

[7] SELECT (pushbutton)
Selects a menu or part thereof.

[8] ▲▼◀▶ pushbuttons
These arrow pushbuttons are used to control the menu and the parameters.

[9] Rotating knob
Knob for entering parameters

[10] GATE TIME (pushbutton)
Setting of gate time

[11] LEVEL B (pushbutton)
Setting of channel B trigger level

[12] LEVEL A (pushbutton)
Setting of channel A trigger level

[13] [16] 1 : 10 pushbutton
Input attenuator, total attenuation 100 times.

[14] DC (pushbutton)
Selects the coupling of the corresponding channel.
Button DC lit = DC coupling
Button DC dark = AC coupling

[15] SLOPE (pushbutton)
This pushbutton selects the trigger slope. A lighted pushbutton indicates triggering on the negative slope, an unlighted pushbutton indicates triggering on the positive slope.

[17] 50 Ω (pushbutton)
This pushbutton connects an internal 50 Ω resistor to the input in order to allow operation in 50 Ω systems.

[18] LP 50 kHz (pushbutton)
This pusbuttons inserts a low pass filter in order to suppress hf signals from interfering with triggering from low frequency signals.

[19] [23] TRIG (LED)
Indicate triggered operation

[20] [22] INPUT A, INPUT B (BNC connectors)
Input connectors for measuring signals DC to 200 MHz

[21] AUTO TRIG (pushbutton)
Selects automatic triggering operation indicated by the pushbutton lighting up.

[24] INPUT C (SMA connector)
Input for measuring signals 100 MHz to 3 GHz

[25] RESET / V (pushbutton)
Button with two functions:
1 Pressing this button will stop any measurement, erase the display and start a new measurement.
2 Setting the trigger level with the numerical keys, the entered value will be accepted with the unit Volts (V).

[26] TRIG / GHz/s (pushbutton)
Button with two functions:
1 Pressing this button will start a measurement in ARMED mode.
2 Setting the gate time with the numerical keys, the entered value will be accepted with the unit seconds (s).

[27] HOLD / mV (pushbutton)
Button with two functions:

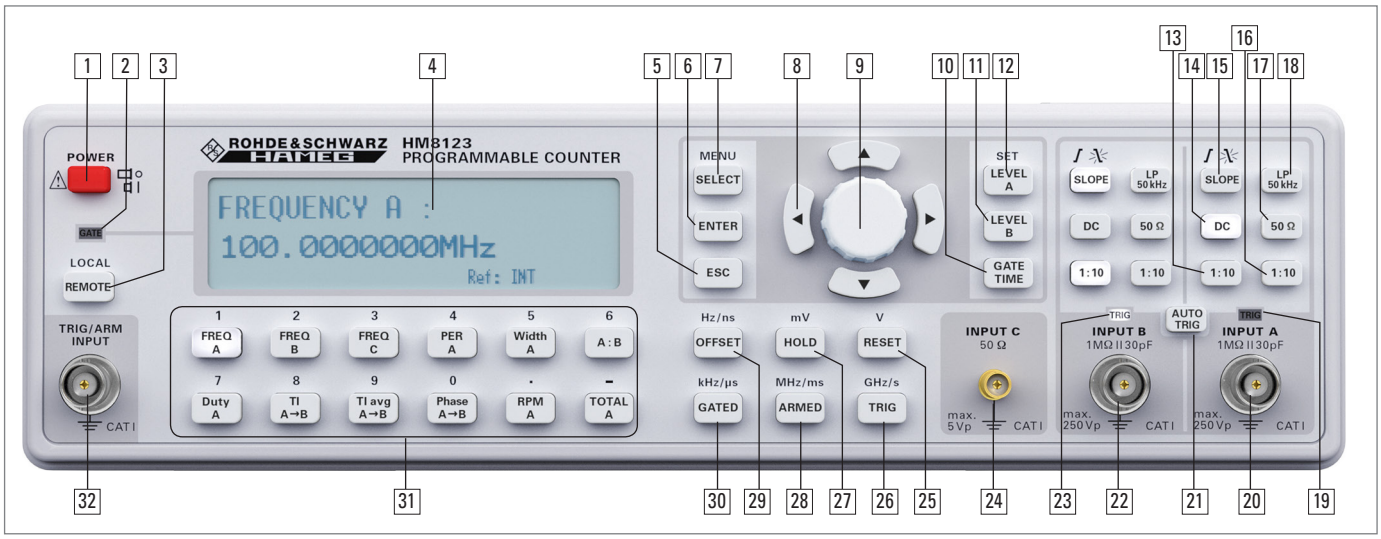


Fig. 2.1: Frontpanel of the HM8123

1 Pressing this button will freeze the display.
2 Setting the trigger level with the numerical keys, the entered value will be accepted with the unit millivolts (mV).

28 ARMED / MHz (pushbutton)
Button with two functions:
1 Pressing this button will select the ARMED mode.
2 Setting the gate time with the numerical keys 31, the entered value will be accepted with the unit milliseconds (ms).

29 OFFSET / Hz/ns (pushbutton)
Pressing this button will activate the OFFSET function.

30 GATED / kHz/us (pushbutton)
Pressing this button will activate the GATED mode.

31 Function pushbuttons A to M
These buttons have two functions:
1 The measurements function are called by operating these buttons. The corresponding button will light up.
2 Setting the trigger level or the gate time, the desired value can be entered with this buttons and the unit buttons (mV 27, V 25 and ms 28, s 28). Also refer to chap. Gate time and Triggering. None of these button lits.

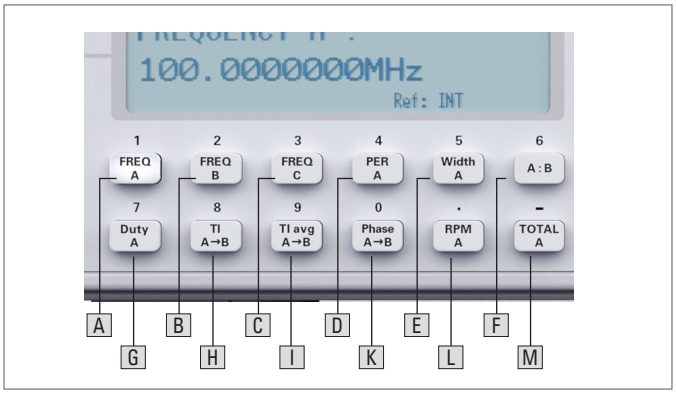


Fig. 2.3: Function keys and their meaning

A	FREQ A	Frequency channel A
B	FREQ B	Frequency channel B
C	FREQ C	Frequency measurement channel C
D	PER A	Period channel A
E	Width A	Pulse width channel A
F	A : B	Frequency ratio of channels A : B
G	Duty A	Duty cycle channel A
H	TI A→B	Time interval A-B
I	TI avg A→B	Time interval A-B averaged
K	Phase A→B	Phase difference A-B (only square-wave signals)
L	RPM A	Rpm measurement channel A
M	TOTAL A	Event counting channel A

32 TRIG/ARM INPUT (BNC connector)
External gate control input

Rear Panel

32 Interface
USB/RS-232 interface (HO820);
Option: IEEE-488 GPIB (HO880)

34 A (BNC connector)
Trigger signal channel A output (e.g. for display on a scope). Signal level 0 to +5 V (TTL level)

35 B (BNC connector)
Trigger signal channel B output (e.g. for display on a scope). Signal level 0 to + 5 V (TTL level)

36 GATE (BNC connector)
Gate view output. This output will be high as long as the gate is open during a measurement.

37 10 MHz Ref. (BNC connector)
External reference input (10 MHz)

38 RESET (BNC connector)
External reset signal input (TTL level). The function is identical to that of the RESET pushbutton 25.

39 Mains input connector

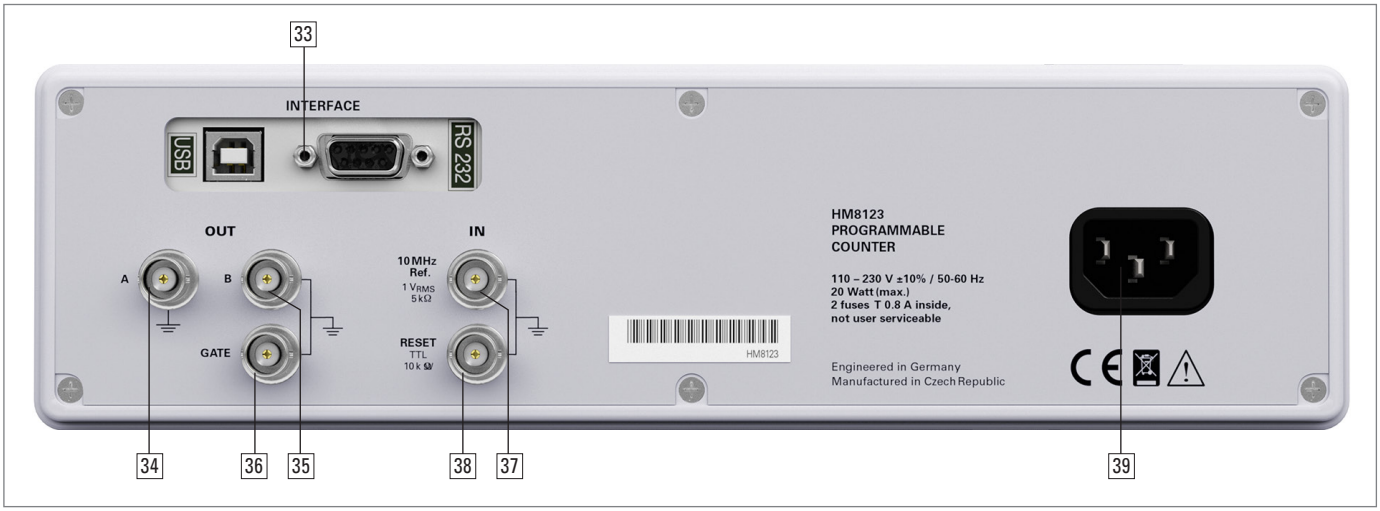


Fig. 2.2: Rear panel of the HM8123

3 Operation of the HM8123

3.1 First time operation

Please note the following hints during first time operation:

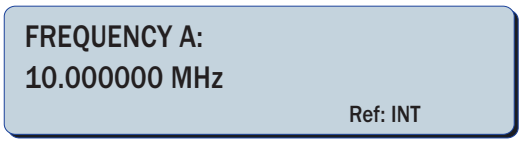
- This instrument has a wide-range power supply designed for 115 to 230 V, 50/60 Hz ±10 %, i.e. it will operate from 105 to 254 V.
- This instrument may only be connected to a wall outlet with a three-conductor safety ground terminal or to an isolation transformer of safety class 2.
- There are two fuses inside of the instrument which are not serviceable by the customer.
- There are no visible damages to the instrument.
- There are no loose parts floating around inside.

3.2 Switch-on

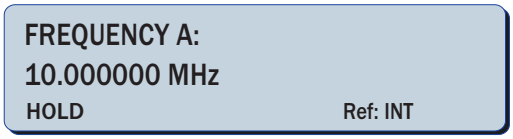
After pressing the red POWER pushbutton 1 the display will show „3 GHz counter Hameg HM8123“ and the current software version installed, e.g. 1.03. During initialization the HM8123 will automatically load the configuration stored in memory 0.

3.3 Display

The display will show the actual measurement function, the result and the reference source (internal or external).



Pressing the HOLD 27 button will activate the Hold function, the pushbutton will light up. The present result will be frozen. The Hold function will be deactivated by pressing the button again or by selecting another function. The pushbutton light will be off.



By pressing the pushbutton OFFSET 29 the Offset function will be activated, the pushbutton OFFSET 29 will light up. In this mode the present result will be taken as the reference value and indicated in the display (e.g. REF: 100.000000 MHz). For all subsequent measurements this value will subtracted from the result, the difference will be displayed.
The following picture shows the display for a reference frequency of 100 MHz.

3.4 Measurement functions

All measurement function are called by the function keys A to M. The selected function key will light up. The function selected will also be shown in the first line of the display.

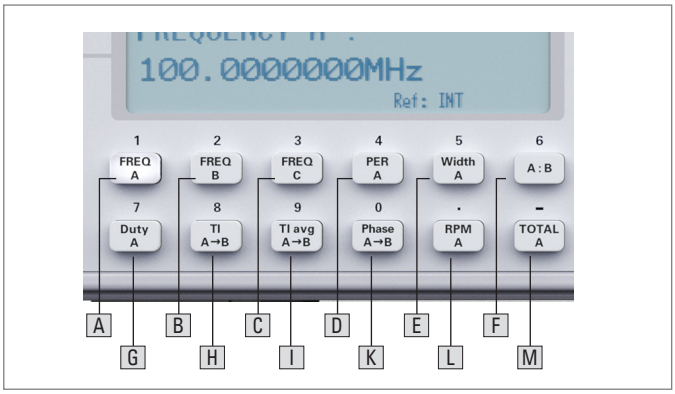


Fig. 3.1: The function keys and their meaning

A FREQ A, B FREQ B, C FREQ C
Frequency measurement of the signal connected to the channel selected. The frequency range of channels A 20 and B 22 is DC to 200 MHz and of channel C is 100 MHz to 3 GHz.

A high input sensitivity is not always desirable for frequency measurements, as the counter will become increasingly sensitive to noise on the signal. Hence frequency measurements should be made using as much attenuation as possible 13 and 16. Any dc content of a signal should be blocked by turning the DC pushbutton 14 light off. DC coupling, however, is necessary at frequencies below approx. 10 Hz (DC Pushbutton lighted). In case a low frequency signal is superimposed by high frequency noise select the low pass filter LP 50 kHz 18.

D **PER A :** Period measurement of the channel A signal.

E **WIDTH A :** Measurement of the pulse width of the channel A signal. Accuracy: 0.4% at squarewave (1 MHz)

F **A:B :** Measurement of the frequency ratio of signals connected to channels A 20 and B 22. A ratio measurement is useful, for instance, for calibration of oscillators with odd frequency. The higher frequency should be applied to INPUT A 20 to achieve the highest resolution possible.

G **DUTY A :** Measurement of the duty cycle of the channel A signal. Accuracy: 0.4% at squarewave (1 MHz)

H **TI A→B :** I In this mode Time Interval the time difference between a signal on channel A 20 (start pulse) and a signal on channel B 22 (stop pulse) will be measured.

I **TI avg A→B :** Measurement of the average of the time interval A→B.

K **Phase A→B :** Measurement of the phase difference between signals A and B (only with square-wave signals possible).

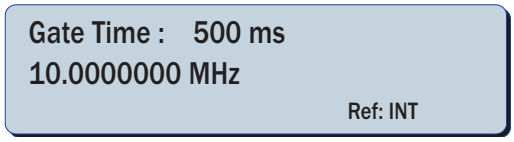
L **RPM A :** Measurement of the rpm (revolutions per minute) of a signal on channel A 20 (e.g.rpm measurement using an optical sensor.) The number of pulses per revolution has to be selected in the menu (1 to 65535 available).

M **TOTAL A :** Event (pulses, periods) measurement of the channel A signal. If the input signal disappears or if the pushbutton HOLD 27 is depressed the measurement will be stopped and the result frozen. By pressing the RESET pushbutton 25 or by a high level on the RESET connector 38 the display will be reset. A new measurement will be started after the RESET pusbutton 25 was released or after the RESET signal switched to low.

3.5 Gate time

The counter HM8123 totalizes the input cycles until the gate time set has eclapsed and the trigger conditions selected are fulfilled. Thus the effective measuring time can be longer than the gate time set. The measuring time cannot be smaller than one period of the signal.

The gate time can be varied between 1 ms and 65.5 s. Operate pushbutton GATE TIME 10 and enter the desired gate time by using the 4 arrow keys ▲▼◄► 8 and the knob 9 or with the numerical keys 31 and the unit buttons (ms 28, s 26). During a measurement the GATE LED 2 is lit. If a short gate time is selected, the HM8123 inserts a wait time between the measurements to simplify the reading of the display. In this case a complete measuring cycle will take at least 180 ms. The wait time can be deactivated by sending WT0 via the interface. To activate the wait time WT1 has to be sent.



3.6 Triggering

When using the channels A 20 or B 22 manual or automatic triggering may be selected. The triggering of channel C 24 signals is not selectable, signals between 50 mV and a maximum of 5 V will be automatically triggered.

Automatic triggering

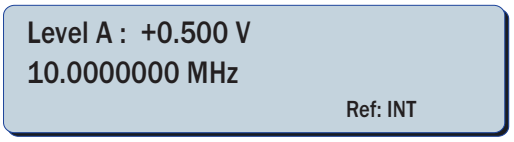
Pressing the AUTO TRIG pushbutton 21 will activate automatic triggering, the pushbutton will light up. Please note that AC coupling is mandatory, the pushbutton DC 14 have to be dark. In this mode the amplitude of the signal is measured, and the trigger level is set to 50 % of it.

Manual Triggering

If the AUTO TRIG pushbutton 21 is dark, manual triggering is active. The trigger level has now to be selected manually. Operate pushbutton LEVEL A 12 or LEVEL B 11 and enter the desired trigger level by using the 4 arrow keys ▲▼◄► 8 and the knob 9 or with the numerical keys 31 and the unit buttons (mV 27, V 25).

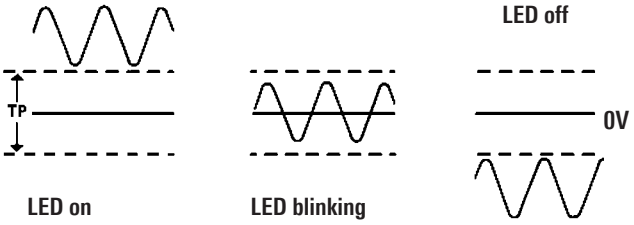
The trigger level may be selected in 3 ranges:

Pushbutton 1:10 13	**Pushbutton 1:10** 16	**Triggerlevel**
off	off	–2,000 V …. + 2,000 V
on	off	–20,00 V …. + 20,00 V
off	on	–20,00 V …. + 20,00 V
on	on	–200,0 V …. + 200,0 V



Optimum triggering is obtained by setting the trigger level to about 50 % of the peak-to-peak amplitude of the input signal. In manual mode proper triggering can be checked by the trigger indicators 19 and 23 control of channels A 20 and B 22 as follows:

LED on continuously:	Input signal above the trigger level selected.
LED off continuously:	Input signal below the trigger level selected.
LED blinking:	Correct setting.



Suitable setting of the attenuators 13 and 18 is a prerequisite for correct measurements. With too much attenuation the residual noise of the input signal comparator will affect the result. With too little attenuation or if the input signal is too large the input stage may be overdriven which lead to erroneous measurements.

With all frequency measurements AC coupling should be used (below approx. 10 Hz DC coupling will be necessary) together with as much attenuation as possible. Period measurements should use DC coupling (pushbutton DC 14 lighted) if at all possible.

If the input signal comes from a 50 Ω system the input impedance of the HM8123 have to be set to 50 Ω (pusbutton 50 Ω 17 lighted).

4 Menu

The menu is called by pressing the pushbutton SELECT [7]. Submenus are called from the main menu by using the rotating knob [9] or the 2 arrow keys ▲▼ [8]. The submenu selected will be identified by an arrow >. The submenu selected will be opened by pressing ENTER [6]. Parameters are changed by using the 4 arrow keys ▲▼◀▶ [8] or the knob [9]. Pressing ENTER [6] will enter the value. Pressing ESC [5] will return the control to the main menu. The main menu will be left by pressing SELECT.

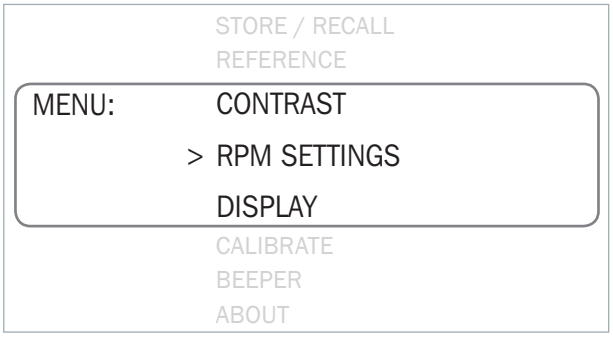


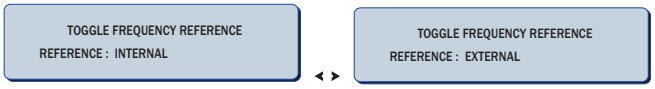
Fig. 4.1: Display of the submenues

4.1 Store/Recall

This function allows storing or recalling of an instrument configuration. The HM8123 is able to store 10 configurations (0 to 9). Use the keyboard 0 – 9 [31] to select. After turn-on the configuration stored in memory 0 will be recalled automatically.

4.2 Reference

In this submenu the internal or an external reference may be selected. If an external reference was chosen the HM8123 will check the signal at the BNC connector 10 MHz [37]. If this frequency is not accurate enough or if there is no signal, in both cases the error message „External Reference Test failed" will be displayed. In this case the instrument will continue to use its own reference. The error message will also be shown and return to the internal standard performed if an external reference frequency deviates more than 2 Hz.

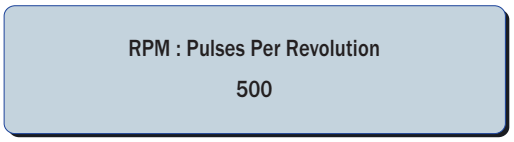


4.3 Contrast

In this submenu the contrast of the LCD display may be set using the arrow keys ▲▼ [8] or the knob [9]. If the contrast adjusted is confirmed by pressing pushbutton ENTER [6] this setting will be stored in a non-volatile memory. If the menu is left without confirmation the setting of the contrast with ENTER [6], this setting will be lost afetr power-off. After turn-on the HM8123 will recall the value stored in the non-volatile memory.

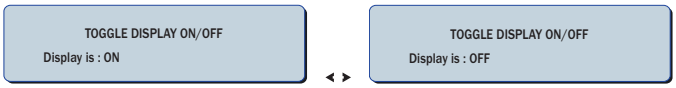
4.4 RPM settings

This menu item allows to select the number of pulses per revolution. This parameter is required for rpm measurements and may be selected from 1 to 65,535 using the knob [9] or the 4 arrow keys ▲▼◀▶ [8].



4.5 Display

In this submenu the display may be turned off or on.



4.6 Calibrate

We recommend that recalibrations should only be performed by Hameg Instruments GmbH or an authorized calibration lab. After receiving the calibration procedure the warranty with respect to the specifications will be voided.

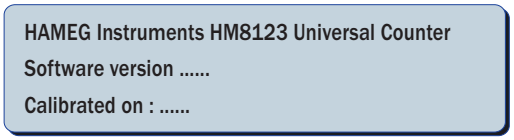
It is possible to recalibrate the reference frequency (Frequency) and the trigger levels of channels A (LEVEL A) and B (LEVEL B). For this purpose the calibration procedure can be ordered at Hameg Instruments GmbH (Phone: +49 6182 - 800 500 or E-Mail: service@hameg.de – serial number required).

4.7 Beeper

In this submenu the beeper can be activated/deactivated. If the instrument configuration is stored using the Store function (see chapter Store/Recall), the setting of the beeper is also stored.

4.8 About

After selection of this submenu the type of instrument and the software version will be displayed.

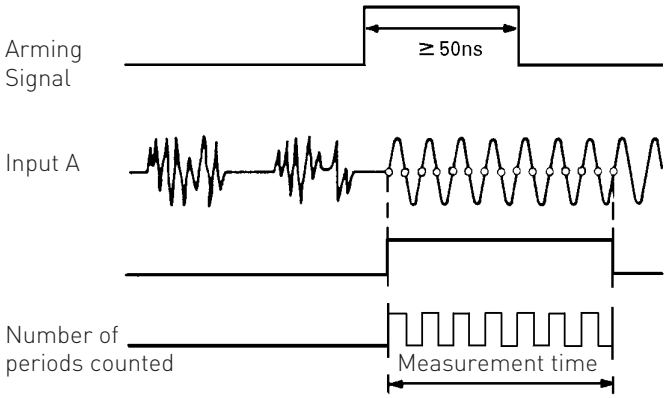


5 Additional inputs and outputs

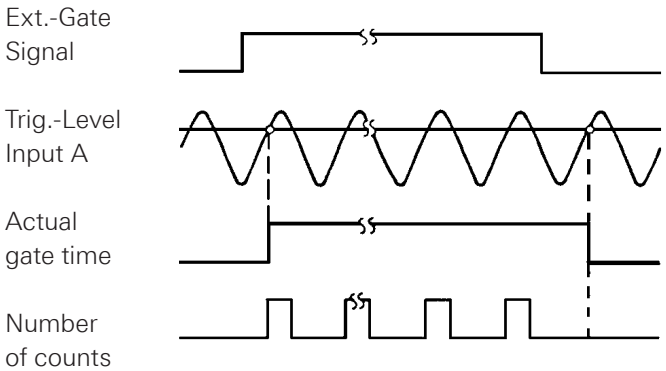
5.1 External Arming

External arming prevents triggering of a measurement by undesired signals. The ARMED mode is selected by pressing ARMED [28], the pushbutton will light up. A measurement can be started either manually by pressing TRIG [26] or by a signal at the TRIG/ARM input [32].

The TRIG/ARM input connector [32] is located on the front panel. As long as there is a low level input signal the counter will not start a new measurement. A measurement will be started if the following conditions are all met: the signal at the input switches from low to high, the trigger conditions selected are fulfilled. The delay time caused by the arming signal is 50 ns. The measurement will be performed according to the HM8123 settings. During a measurement any signals at the TRIG/ARM input [32] will be ignored. A new measurement will be started after the measurement time set has elapsed with the next positive slope at the TRIG/ARM input [32].



5.2 External Gate



A measurement may be started and stopped by a signal at the gate input TRIG/ARM [32]. This input is located on the front panel. The gated mode is entered by pressing GATED [30], the pushbutton will light up. As long as there is a low level at this input no measurement will be started. A measurement is started by a low to high transition at the TRIG/ARM input [32] and if the trigger conditions are met. The measurement will be stopped by a high to low transition at the input. This signal is of higher priority than the gate time selected. The signal at the TRIG/ARM input [32] have to be within the range of 50 ns to 10 s. The effective gate time can not be shorter than 20 µs.

5.3 External Reset

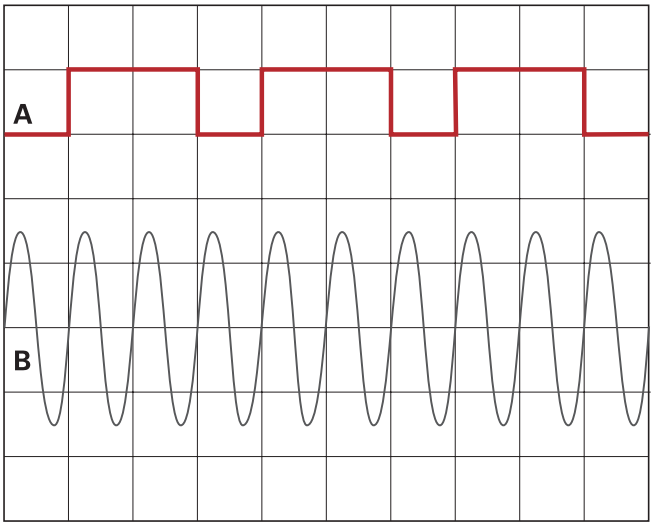
The RESET BNC connector [38] is located on the rear panel. A high level at this input is identical to pressing the RESET pushbutton [25]: the current measurement will be halted, the result reset. A new measurement is started when the signal switches from high to low.

5.4 External Reference

The external reference 10 MHz BNC connector [37] is located on the rear panel. An external 10 MHz reference may be conected to this input. The external refrence has to be selected in the menu (refer to paragraph 4: Menu). This reference signal must have an accuracy of at least ±20 ppm and an amplitude of 2 V_{pp}.

5.5 Gate View

The BNC connector GATE [32] is located on the rear panel. The gate open signal is available here e.g. for scope display. Due to the start sync time this signal will be longer than the measurement time selected.



A: Gate View; B: input signal (10 Hz); Gate time: 200 ms

6 Remote control

6.1 Interfaces

The HM8123 comes with a USB/RS-232 interface, as an option the IEEE-488 GPIB interface is available. We recommend the installation ex factory.

RS-232 Interface parameters:
9600 baud, no paritybit, 8 data bits, 1 stop bit
The interface parameters are fixed and cannot be changed.

USB interface
You do not have to change the configuration. If required, the baud rate can be changed. Connect the HM8123 with your PC using a USB cable and install the USB drivers like described in the manual of the USB interface HO820.

GPIB interface
Connect the HM8123 with your PC using a GPIB cable. It is necessary to set the GPIB adress of the HM8123 to the desired value. The adress is changed at the interface on the rear panel. Do this settings only before starting the instrument. It is not possible when the instrument is running.

6.2 Setup of the commands

A message to the HM8123 may consist of several commands. The commands have to be separated by semicolon (;). After receiving a CR (0x0D) the HM8123 will start to work on the commands received. The commands my contain upper and lower case characters. The commands will be executed in the order they were received. Any commands which can not be executed in the mode selected presently will be ignored (e.g. the command „Set measurement time“ (SMTxxxxx) would be ignored if the event counting mode was selected.)

6.3 Listing of commands

6.3.1 Functions

With these commands the measurement functions are selected.

FRA	Frequency channel A (FREQ A)
FRB	Frequency channel B (FREQ B)
FRC	Frequency channel C (FREQ C)
PRA	Period channel A (PER A)
WDA	Pulse width channel A (Width A)
RAB	Frequency ratio A/B (A:B)
DTA	Duty cycle channel A
TI1	Time interval A to B (TI A to B)
TIA	Time interval A to B averaged (TIavg A to B)
PHA	Phase A to B (Phase A to B)
RPM	rpm measurement channel A (RPM A)
TOT	Event counting channel A (TOTAL A)

6.3.2 Control of measurements

With these commands parameters may be changed.

Attenuators
Activates/deactivates the attenuators, corresponds to pushbuttons 1 : 10 [13] and [16]

AA0	Attenuator channel A off
AA1	Attenuator channel A 1 : 10
AA2	Attenuator channel A 1 : 100
AB0	Attenuator channel B off
AB1	Attenuator channel B 1 : 10
AB2	Attenuator channel B 1 : 100

Slope
Selection of trigger slope, corresponds to pushbutton SLOPE [15].

SA0	Positive slope channel A
SA1	Negative Slope channel A
SB0	Positive slope channel B
SB1	Negative slope channel B

Low pass filter 50 kHz
Activates/deactivates the low pass filer, corresponds to pushbutton LP 50 kHz [18].

FA0	Low pass filter 50 kHz channel A off
FA1	Low pass filter 50 kHz channel A on
FB0	Low pass filter 50 kHz channel B off
Fb1	Low pass filter 50 kHz channel B on

Coupling
Selection of coupling, corresponds to pushbutton DC [14]

ACA	AC coupling channel A
DCA	DC coupling channel A
ACB	AC coupling channel B
DCB	DC coupling channel B

50 Ω
Selection of input impedance, corresponds to pushbutton 50 Ω [17].

OAH	Input impedance channel A 1 MΩ
OAL	Input impedance channel A 50 Ω
OBH	Input impedance channel B 1 MΩ
OBL	Input impedance channel B 50 Ω

Trigger level
Selection of trigger level, corresponds to pushbuttons LEVEL A [12] and LEVEL B [11].

LVAxxxx	Setting of channel A trigger level (xxxx: ±0.001 to ±200.0 V)
LVBxxxx	Setting of channel B trigger level (xxxx: ±0.001 to ±200.0 V)

Gate time
Setting of gate time, corresponds to pushbutton GATE TIME [10].
SMTxxxx Setting of gate time in ms (xxxx: 1 .... 65,535 ms)

Wait time
Activating/Deactivating of the wait time between measurements

WT0	Wait time off
WT1	Wait time on

ARMED
Activating/Deactivating of ARMED function, corresponds to pushbutton ARMED 28.
AR0 ARMED function off
AR1 ARMED function on

GATED
Activating/deactivating of GATED function, corresponds to pushbutton GATED 30.
GT0 GATED function off
GT1 GATED function on

OFFSET
Activating/deactivating of OFFSET function, corresponds to pushbutton OFFSET 29.
OF0 OFFSET function off
OF1 OFFSET function on

HOLD
Activating/deactivating of HOLD function, corresponds to pushbutton HOLD 27.
DH0 Display hold off
DH1 Display hold on

Display
Activating/deactivating the display, corresponds to menu item Display.
DS0 Display off
DS1 Display on

Miscellaneous parameters
NPCxxxx Setting of pulses per revolution for rpm measurement (xxxx: 1 ..65,535)
TRG Trigger
RES Reset
STR Starting event counting
STP Stop of event counting

Requests of parameters:
These commands allow to request parameters and the actual results from the instrument.
VER Request for software version number of the HM8123 (e.g. 1.00)
IDN Identification string (HAMEG HM8123)
FN? Measurement function (e.g. FRA)
SMT? Gate time in ms (e.g. 400ms)
LVA? Trigger level in V of channel A (e.g. +0.100)
LVB? Trigger level in V of channel B (e.g. -1.000)
XMT Request of results, format: value, unit
MA? Settings of channel A Example:
MB? Settings of channel B

Example: Z:50 CPL:AC FL:ON ATT:1 SLP+
Explanation: Z:50 = Input impedance 50 Ω
CPL:AC = AC coupling
FL:ON = Low pass filter on
ATT:1 = Attenuator off
SLP+ = Positive slope

7 Technical Data

3 GHz Programmable Counter HM8123

All data valid at 23 °C after 30 minutes warm-up.

Input characteristics (Input A and B)			
Connection	BNC socket		
Frequency range			
0 to 200 MHz	DC coupled		
10 Hz to 200 MHz	1 MΩ, AC coupled		
500 kHz to 200 MHz	50 Ω, AC coupled		
Input impedance	1 MΩ II 30 pF or 50 Ω (switchable)		
Attenuation	1:1, 1:10, 1:100 (selectable)		
Sensitivity (normal triggering)			
0 to 80 MHz	25 mV_{rms} (sine wave), 80 mV_{SS} (pulse)		
80 to 200 MHz	65 mV_{rms} (sine wave)		
20 Hz to 80 MHz	50 mV_{rms} (sine wave, auto trigger)		
Trigger (programmable via encoder or software			
Attenuation:	Trigger level	Resolution	
1:1	0 to ±2 V	1 mV	
1:10	0 to ±20 V	10 mV	
1:100	0 to ±200 V	100 mV	
Max. input voltage			
Input 1 MΩ	250 V (DC + ACpeak) from 0 to 440 Hz decreasing to 8 V_{rms} at 1 MHz		
Input 50 Ω	5 V_{rms}		
Minimum pulse duration	<5 ns for single pulse		
Input noise	(typ.) 100 µV		
Auto trigger (AC coupling)	trigger point: 50 % of peak-to-peak value		
Trigger slope	Rising or falling		
Filter	50 kHz low-pass filter (selectable)		
Input characteristics (Input C)			
Connection	SMA socket		
Frequency range:	100 MHz to 3 GHz		
Input sensitivity	to 1 GHz: 30 mV_{rms} (typ. 20 mV_{rms}) 1 to 3 GHz: 100 mV_{rms} (typ. 80 mV_{rms})		
Input impedance	50 Ω nominal		
Max. Input voltage	5 V (DC + AC_{peak})		
Input characteristics			
	External Reset	Reference	Gate/ Arming
Input impedance	5 kΩ	500 Ω	5 kΩ
Max. Input voltage	±30 V	±20 V	±30 V
Input sensitivity	-	typ. 2 V_{pp}	-
High level	>2 V	-	>2 V
Low level	<0,5 V	-	<0,5 V
Min. pulse duration	200 ns	-	50 ns
Input frequency	-	10 MHz	-
Min. eff. gate time	-	-	20 µs
Measurement functions			
Frequency A/B/C; period duration A; width A; totalize A; RPM A; frequency ratio A:B; time interval A:B; time interval A:B (average); phase A to B; Duty cycle A; burst measurements			
Frequency measurement (Inputs A, B, C)			
Frequency range	0 to 200 MHz (3 GHz)		
LSD	(1,25 x 10^{-8} s x frequency) / measurement time		
Resolution	1 LSD		
Accuracy	±(resolution/frequency ±time inaccuracy ±trigger error[2] / measurement time)		
Period duration measurement			
Range	5 ns to 10.000 s		
LSD	(1,25 x 10^{-8} s x period) / measurement time		
Resolution	1 LSD		
Accuracy	±resolution / period ±(trigger error[2] / measurement time)		
Totalization A			
	manual control	external control	
Range	0 to 200 MHz	0 to 200 MHz	
Min. pulse duration	10 ns	10 ns	
LSD	1 count	±1 count	
Resolution	LSD	LSD	
Accuracy	(resolution ±ext. gate time error x frequency A) / total		
Pulse resolution	10 ns	10 ns	
Ext. gate error	-	100 ns	
Time interval/Average time interval			
(Input A = start; Input B = stop)			
LSD	10 ns (0,1 ps to 10 ns im 'average' mode)		
Resolution	1 LSD		
Accuracy	±(resolution + trigger error[2] +system error) / time interval ±time base uncertainty (system error: ≤4 ns)		
Number of average	N = 1 to 25 N = 26 to 2.500 N = 2.501 to 250.000 N = 250.001 to 25.000.000 N = >25.000.000	LSD = 10 ns LSD = 1 ns LSD = 100 ps LSD = 10 ps LSD = 0,1 ps	
Drehzahlmessung			
NPR[1] presetting	1 to 65,535 pulses per revolution		
Gate time	330 ms fixed		
LSD	7,5 x 10^{-8} x revolution speed		
Resolution	1 LSD		
Accuracy	±(trigger error[2] / 0.33) ±time base error		
Offset			
Range	Covers the entire measurement range		
Resolution	Same resolution as in normal measurement. If the gate time is changed in the offset mode, the offset resolution is the reference value resolution or the current reading resolution (whichever is less precise).		
Gate time			
Range	1 ms to 65 s		
Resolution	1 ms		
External gate time	min. 20 µs		
Time base			
Frequency	400 MHz clock rate; 10 MHz Quarz		
Temperature stability (0 to 50 °C)	TCXO (standard): ±0,5 x 10^{-6} OCXO (HO85): ±1,0 x 10^{-8}		
Alterung TCXO	<0.27 ppm per month, 0.05 ppm per day		
OCXO	≤ ±1 x 10^{-9}/day		
External Reference	10 MHz ±20 ppm		
Miscellaneous			
Interface	Dual-Interface USB/RS-232 (HO820), IEEE-488 (GPIB) (optional)		
Safety class	Safety class I (EN61010-1)		
Display	LCD display (83 x 21 mm)		
Netzanschluss	115 to 230 V ±10 %, 45 to 60 Hz, CAT II		

Power consumption	approx. 20 W
Operating temperature	+5 to +40 °C
Storage temperature	-20 to +70 °C
Rel. humidity	5 to 80 % (without condensation)
Dimensions (W x H x D)	285 x 75 x 365 mm
Weight	approx. 4 kg

1) NPR=number of pulses per revolution
2) Trigger error= ±noise input (V_{pp})/slew rate of the input signal

Accessories supplied:
Line cord, Operating manual, CD

Recommended accessories:

HO85	OCXO, temperature stability ±1 x 10^{-8} (Installation only ex factory)
HO880	Interface IEEE-488 (GPIB), galvanically isolated
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4mm banana
HZ24	Attenuators 50 Ω (3/6/10/20 dB)
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1.0 m
HZ42	19“ Rackmount kit 2RU
HZ72	GPIB-Cable 2 m