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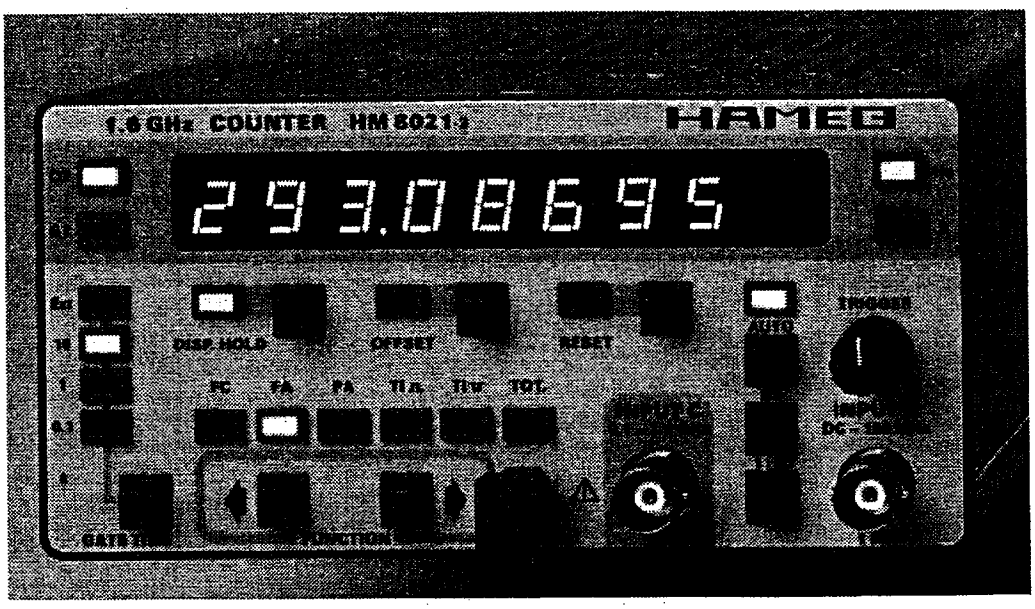
HAMEG®
Instruments

MANUAL

Frequenzzähler HM 8021-3



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CE

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Instruments

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Die HAMEG GmbH / HAMEG S.a.r.l bescheinigt die Konformität für das Produkt
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Bezeichnung / Product name / Designation:	**Universalzähler/Universal Counter/Compteur Universel**
Typ / Type / Type:	**HM8021-3**
mit / with / avec:	**HM8001-2**
Optionen / Options / Options:	**-**

mit den folgenden Bestimmungen / with applicable regulations / avec les directives suivantes

EMV Richtlinie 89/336/EWG ergänzt durch 91/263/EWG, 92/31/EWG
EMC Directive 89/336/EEC amended by 91/263/EWG, 92/31/EEC
Directive EMC 89/336/CEE amendée par 91/263/EWG, 92/31/CEE

Niederspannungsrichtlinie 73/23/EWG ergänzt durch 93/68/EWG
Low-Voltage Equipment Directive 73/23/EEC amended by 93/68/EEC
Directive des equipements basse tension 73/23/CEE amendée par 93/68/CEE

Angewendete harmonisierte Normen / Harmonized standards applied / Normes harmonisées utilisées

Sicherheit / Safety / Sécurité

EN 61010-1: 1993 / IEC (CEI) 1010-1: 1990 A 1: 1992 / VDE 0411: 1994
Überspannungskategorie / Overvoltage category / Catégorie de surtension: II
Verschmutzungsgrad / Degree of pollution / Degré de pollution: 2

Elektromagnetische Verträglichkeit / Electromagnetic compatibility / Compatibilité électromagnétique

EN 50082-2: 1995 / VDE 0839 T82-2
ENV 50140: 1993 / IEC (CEI) 1004-4-3: 1995 / VDE 0847 T3
ENV 50141: 1993 / IEC (CEI) 1000-4-6 / VDE 0843 / 6
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EN 61000-4-4: 1995 / IEC (CEI) 1000-4-4: 1995 / VDE 0847 T4-4: Prüfschärfe / Level / Niveau = 3

EN 50081-1: 1992 / EN 55011: 1991 / CISPR11: 1991 / VDE0875 T11: 1992

Gruppe / group / groupe = 1, Klasse / Class / Classe = B

Datum /Date /Date
14.12.1995

Unterschrift / Signature /Signatur

Dr. J. Herzog
Technical Manager
Directeur Technique

General information regarding the CE marking

HAMEG instruments fulfill the regulations of the EMC directive. The conformity test made by HAMEG is based on the actual generic- and product standards. In cases where different limit values are applicable, HAMEG applies the severer standard. For emission the limits for residential, commercial and light industry are applied. Regarding the immunity (susceptibility) the limits for industrial environment have been used.

The measuring- and data lines of the instrument have much influence on emmission and immunity and therefore on meeting the acceptance limits. For different applications the lines and/or cables used may be different. For measurement operation the following hints and conditions regarding emission and immunity should be observed:

1. Data cables

For the connection between instruments resp. their interfaces and external devices, (computer, printer etc.) sufficiently screened cables must be used. Without a special instruction in the manual for a reduced cable length, the maximum cable length of a dataline must be less than 3 meters long. If an interface has several connectors only one connector must have a connection to a cable.

Basically interconnections must have a double screening. For IEEE-bus purposes the double screened cables HZ72S and HZ72L from HAMEG are suitable.

2. Signal cables

Basically test leads for signal interconnection between test point and instrument should be as short as possible. Without instruction in the manual for a shorter length, signal lines must be less than 3 meters long.

Signal lines must screened (coaxial cable - RG58/U). A proper ground connection is required. In combination with signal generators double screened cables (RG223/U, RG214/U) must be used.

3. Influence on measuring instruments.

Under the presence of strong high frequency electric or magnetic fields, even with careful setup of the measuring equipment an influence of such signals is unavoidable.
This will not cause damage or put the instrument out of operation. Small deviations of the measuring value (reading) exceeding the instruments specifications may result from such conditions in individual cases.

December 1995
HAMEG GmbH

Universal Counter HM8021-3

- **Frequency Range: DC to 1.6GHz**
- **Sensitivity: 20mV**
- **7 Measuring Functions**
- **3 Selectable Gate Times; External Gate**
- **8 Digit LED-Display + Sign + Exponent**
- **Temperature-Compensated Time Base (TCXO) $5x10^{-7}$**
- **Selectable Autotrigger**

With over 15,000 units sold in Europe, the **HM8021-3** brought new dimensions to the price/performance ratio available in universal counters. With this new model, **HAMEG** continues to lead the market in high performance, low price counters. This **microprocessor-based** instrument has built in self-test and auto-calibration features as well as two high sensitivity inputs with an extended frequency input range of **DC** to **1.6GHz**.
The reciprocal frequency measurement technique provides high resolution of low frequency signals with at least **seven significant digits** for a **1s** measurement duration. The **HM8021-3** is equipped with an extremely stable temperature compensated **crystal oscillator** (TCXO) with a stability of 0.5 parts per million over the entire operating temperature range. Readings of frequency, period, time interval and totalized count, up to 99,999,999, combined with the **Display Hold** function and a full range offset makes this instrument ideally suited for a broad range of applications. The **Auto Trigger** function allows for accurate measurements to be made, even on noisy waveforms and those with extremely short duty cycles. The **HM8021-3** provides variable trigger control, offers selectable **20dB** attenuation and AC or DC coupling to simplify measurements on complex signals.
When comparing the **HM8021-3** to other instruments of it's price range you can easily see what makes the **HM8021-3** such an outstanding value.

Specifications
(Reference Temperature: 23°C ±1°C)
Measurement Functions:
Frequency A/C; Period A; Totalize A;
Pulse width ⎍/⎍ (averaged);
Totalize A during Ext. Gate.
Input Characteristics: (Input A)
Frequency range: 0 to 150MHz (DC coupled),
10Hz to 150MHz (AC coupled)
Sensitivity: (normal triggering)
20mV$_{rms}$ (sinewave) DC to 80MHz, 80mV (pulse)
60mV$_{rms}$ (sinewave) 80MHz to 150MHz
50mV$_{rms}$ (sinewave) 20Hz to 80MHz,(autotrigger)
Min. pulse duration: 5ns
Input noise: <100µV, typical
Coupling: AC or DC (switch selectable)
Input impedance: 1MΩ||40pF
Attenuator: x1, x20 (switch selectable)
Max. input voltage:
250V (DC+AC$_{peak}$) from 0 to 440Hz
derated to 8V$_{rms}$ at 1MHz
Input Characteristics: (Input C)
Frequency range: 100MHz to 1.6GHz
Sensitivity: 30mV to 1.3GHz (typ. 20mV)
100mV to 1.6GHz (typ. 80mV)
Input impedance: 50Ω nominal; **Coupling:** AC
Max. input voltage: 5V (DC+AC$_{peak}$)
Input Characteristics: (External Gate)
Input impedance: 4,7kΩ
Max. input voltage: ±30V
High-/Low-Level: >2V/<0,5V
Min. pulse duration: 50ns
Min. eff. gate time: 150µs
Frequency A:
LSD: ($2.5x10^{-7}$s x Freq.) / measuring time
Resolution: ±1 or 2 LSD
Period A:
Range: 10000sec to 66,6ns
LSD: ($2,5x10^{-7}$s x period / measuring time)
Resolution: ±1 or 2 LSD
Totalize A: (manually / gated by external signal)
Range: DC to 20MHz
Min. pulse duration: 25ns
LSD: ±1 Count
Resolution: LSD
Ext. Gate error: (in manual mode only) 100ns
Time Interval:
LSD: 100ns to 10ps (averaged);
Resolution: 1 or 2 LSD
Offset:
Range: same specification as normal measurement
Gate Time:
Range: 100ms to 10s in 3 steps
(cannot be shorter than 1 period)
External gate time: min. 150µs
Timebase:
Frequency: 10MHz clock rate; 10MHz crystal (TCXO)
Accuracy: $±5x10^{-7}$ between 10°C and 40°C
Aging: <2.5ppm / year
General Information:
Display: 8 digit 7 segment LED
7.65mm height. Sign and Exponent.
Power requirements: 7VA, nominal
Ambient temperature: +10°C to +40°C (operation)
Humidity: 10%-90%, no condensation, 5%-95% RH
Dimensions: 135x68x228mm (WxHxD)
Weight: approx. 650g

Values without tolerances are meant to be guidelines
and represent characteristics of the average instrument.

General information

The operator should not neglect to carefully read the following instructions and those of the mainframe HM8001, to avoid any operating errors and to be fully acquainted with the module when later in use.

After unpacking the module, check for any mechanical damage or loose parts inside. Should there be any transportation damage, inform the supplier immediately and do not put the module into operation.

This plug-in module is primarily intented for use in conjunction with the Mainframe HM8001. When incorporating it into other systems, the module should only be operated with the specified supply voltages.

Safety

This instrument has been designed and tested in accordance with **IEC Publication 1010-1, Safety requirements for electrical equipment for measurement, control, and laboratory use**. It corresponds as well to the the CENELEC regulations EN 61010-1. All case and chassis parts are connected to the safety earth conductor. Corresponding to Safety Class 1 regulations (three-conductor AC power cable). Without an isolating transformer, the instruments power cable must be plugged into an approved three-contact electrical outlet, which meets International Electrotechnical Commission (IEC) safety standards.

Warning!
Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective earth terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.

The istrument must be disconnected and secured against unintentional operation if there is any suggestion that safe operation is not possible. This may occur:

- if the instrument has visible damage,
- if the instrument has loose parts.
- if the instrument does not function,
- after long storage under unfavourable circumstances (e.g. outdoors or in moist environments),
- after excessive transportation stress (e.g. in poor packaging).

When removing or replacing the metal case, the instrument must be completely disconnected from the mains supply. If any measurement or calibration procedures are unavoidable on the opened-up instrument, these must only be carried out by qualified personnel acquainted with the danger involved.

Symbols as Marked on Equipment


ATTENTION refer to manual.


DANGER High voltage.


Protective ground (earth) terminal.

Operating conditions

The ambient temperature range during operation should be between +10°C and +40°C and should not exceed –40°C or +70°C during transport or storage. The operational position is optional, however, the ventilation holes on the HM8001 and on the plug-in modules must not be obstructed.

Warranty

Before being shipped, each plug-in module must pass a 24 hour quality control test.
Provided the instrument has not undergone any modifications Hameg warrants that all products of its own manufacture conform to Hameg specifications and are free from defects in material and workmanship when used under normal operating conditions and with the service conditions for wich they were furnished.

The obligation of HAMEG hereunder shall expire two (2) years after delivery and is limited to repairing, or at its option, replacing without charge, any such product which in Hamegs sole opinion proves to be defective with the scope of this warranty.

This is Hamegs sole warranty with respect to the products delivered hereunder. No statement, representation, agreement or understanding, oral or written, made by an agent, distributor, representative or employee of, which is not contained in thiss warranty will be binding upon Hameg, unless made in writing and executed by an authorized Hameg employee. Hameg makes no other warranty of any kind whatsoever, expressed or implied, and all implied warranties of merchantibility and fitness for a particular use which exceed the aforestated obligation are hereby disclaimed by Hameg be liable to buyer, in contract or in tort, for any special, indirect, incidental or consequential damages, espresses, losses or delays however caused.
In case of any complaint, attach a tag to the instrument with a description of the fault observed. Please supply name and department, address and

telephone number to ensure rapid service.

The instrument should be returned in its original packaging for maximum protection. We regret that transportation damage due to poor packaging is not covered by this warranty.

Maintenance

The most important characteristics of the instruments should be periodically checked according th the instructions provided in the sections "Operational check and "Alignment procedcure. To obtain the normal operating temperature, the mainframe with inserted module should be turned on at least 60 minutes before starting the test. The specified alignment procedure should be strictly observed.

When removing the case detach mains/line cord and any other connected cables from case of the mainframe HM8001. Remove both screws on rear panel and, holding case firmly in place, pull chassis forward out of case. When later replacing the case, care should be taken to ensure that it properly fits under the edges of the front and rear frames.

After removal of the two screws at the rear of the module, both chassis covers can be lifted. When reclosing the module, care should be taken that the guides engage correctly with the front chassis.

Operation of the module

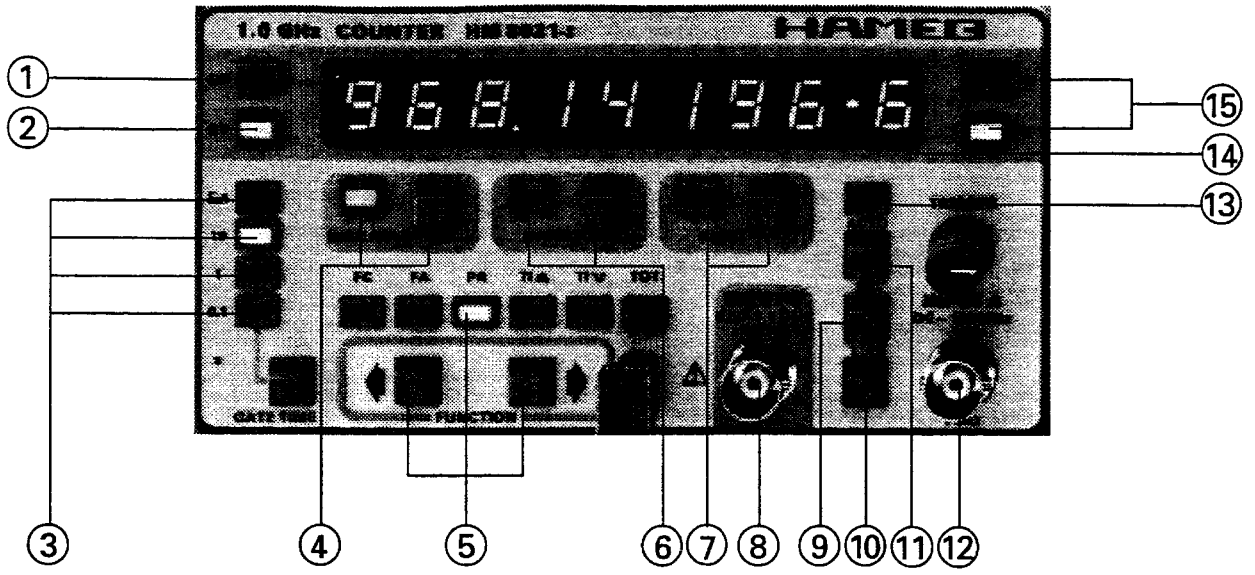
Provided that all hints given in the operating instructions of the HM8001 Mainframe were followed especially for the selection of the correct mains voltage start of operation consists practically of inserting the module into the right or left opening of the mainframe. The following precautions should be observed:

Before exchanging the module, the mainframe must be switched off. A small circle (o) is now revealed on the red power button in the front centre of the mainframe.

If the BNC sockets at the rear panel of the HM8001 unit were in use before, the BNC cables should be disconnected from the basic unit for safety reasons. Slide in the new module until the end position is reached.

Before being iocked in place, the cabinet of the instrument is not connected to the protective earth terminal (banana plug above the mainframe multipoint connector). In this case, no test signal must be applied to the input terminals of the module.

Generally, the HM8001 set must be turned on and in full operating condition, before applying any test signal. If a failure of the measuring equipment is detected, no further measurements should be performed. Before switching off the unit or exchanging a module, the instrument must be disconnected from the test circuit.



(1) OF (LED)
This LED is lit when an overflow occurs. This depends on the selected gate time and on the frequency of the signal applied.
(2) GT (Gate Open; LED)
The gate indicator is lit when the gate is open for measurements. This time equals the preselected gate time and a synchronization time. The gate cannot be open for a time smaller than 1 period of a signal.
(3) Gate Time (Gate time selector; pushbuttons+LEDs)
The gate time is selectable in steps of 0.1s, 1s, 10s.
EXT. (LED)
In the GATE EXTERNAL position, the counter will expect an external control signal, and will not measure until such a signal is supplied.
(4) Display Hold (pushbutton + LED)
Depressing the DISPLAY HOLD pushbutton sets the display time to infinity and freezes the last measurement result. A new measurement can be initiated using the reset pushbutton. Measuring will restart when **Display Hold** is switched off. **Display Hold** starts and stops counting in the TOTALIZE function mode.
(5) Function indicators
LEDs (Refer to "Measuring functions")
Function (pushbuttons)
The "left" and "right" pushbuttons select the desired function. The appropriate LED is lit when a function is selected. The default value when switching power on is Frequency A.
(6) Offset (pushbutton + LED)
The displayed value becomes the reference value. (Not available with the TOTALIZE function).
(7) Reset (pushbutton + LED)
Stops a measurement and clears the display in normal measurement mode. When depressing the button in "Display Hold"-mode the counter performs a single measurement (one shot) on release of the button. When the "Offset"-mode is activated, depressing RESET shows the reference value (which is the actual offset). Reset is active as long as the button is de-pressed.
(8) INPUT C (BNC-connector)
Frequency range: 100MHz to 1.6GHz.
Input impedance 50Ω.
Attention! Do not apply more than 5V (DC+AC peak) to this input terminal.
(9) DC (pushbutton) (DC coupling = button depressed)
Selection of AC or DC coupling of the signal input A. The bandwidth for low frequencies is as low as 10Hz (3dB) when the input is AC coupled. (Input C has a fixed AC coupling).
(10) 1:20 (pushbutton)
Selection of input signal attenuation. **Pressing** this button attenuates the input signal by 26dB before it is applied to the input amplifier.
(14) 8 digit display (7 segment LEDs, 7.65mm high) for the measuring result (8 digit max. + exponent).
(11) Auto Trigger (AC) (pushbutton)
With Auto Trigger active the counter triggers in the middle of the input signal. **Auto Trigger always uses AC-coupling**. (AC = pushbutton depressed).
(12) INPUT A (BNC connector)
Signal input with a sensitivity of 20mV up to 80MHz and 60mV up to 150MHz. The input is protected against overvoltage up to 400V (DC+ACpeak).
Input impedance: 1MΩ||40pF.
(13) TRIGGER LEVEL (adjusting knob)
Continuously adjustment of trigger level.
TRIGGER (LED) 3 State trigger indicator. The LED flashes when triggering is correct. The LED lights when the trigger level is above the input signal level, it is not activated when the trigger level is below the input signal level.
(14) 8 digit display (7 segment LEDs, 7.65mm high) for the measuring result (8 digit max. + exponent).
(15)Hz: (LED) Indicates the measurement of a frequency.
Sec: (LED) Indicates the measurement of time.
(16) External Gate Input (BNC connector)
Allows the measurement of the input signal, controlled by an external source.

Power-on test

A practical test of the correct operation of the HM 8021-3 is run automatically at power on. As soon as power is applied, the display shows type and version of the actual instrument and the GATE indicator appears, LEDs are lit and the Eprom and all functions of the counter are tested. The test runs for about 2 seconds. If an error is detected it is indicated by an "I" at the leading digit and followed by the number of the test that failed.

I 1 microprocessor RAM error
I 2 program ROM error
I 3 counting chain error

When the tests are completed satisfactorily, the counter sets the display to zero and selects the default measuring function A.

Measuring functions

FA/FC: Sets the instrument to measure the frequencyofthesignalconnectedtoinputA/C.

TOT.: The counter will totalize events (pulses or cycles) on input A. Measurement stops and display freezes as soon as the input signal is removed or DISPLAY HOLD is depressed. Depressing RESETcluring totalizing clearsthe display and starts a new measurement when releasing the button. Reset is active as long as the switch **(7)** is depressed. **Totalizing A during External Gate** is performed applying a TTL signal to the Ext. Gate input **(16)**.

PA: Sets the counter to measure the period duration of the signal connected to input A.

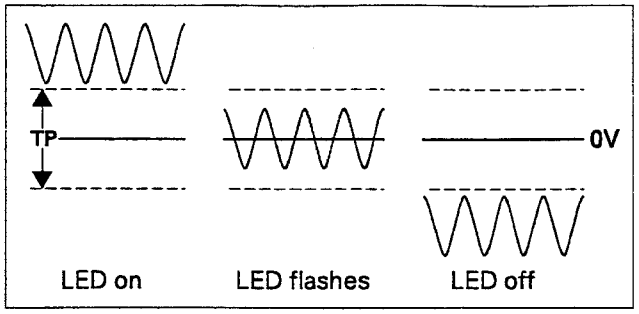
TI⎍/⎍ (AVG): Sets the counter to measure the average pulsewidth between positive slope and the negative slope of an input signal at input A.

Input Triggering

As the input signal can have very different waveforms, it is necessary to shape the signals so that the counting circuits can handle the signals. The HM8021-3 offers a variaty of signal shaping possibilities to improve triggering, such as AC/ DC coupling and two trigger level ranges (-2... 2V, -40...+40V). The trigger level can be set in one of two ways: either by Autotrigger or with the trigger level potentiometer. In Autotrigger mode the counter automatically sets the triggering to the 50% level of the input signal. When this mode is selected AC coupling is necessary. When the trigger level control has been set in the manual trigger mode, the functioning of the trigger circuit can easily be checked on the trigger indicator. The LED shows the state of triggering.

LED on:	the signal is above the trigger level
LED off:	the signal is below the trigger level
LED blinking:	the signal is crossing the hysteresis band, correct triggering.

For reliable triggering the trigger level should, in always most cases, be at 50% of the signal's peak-to-peak voltage.



Selecting the correct attenuation is important to obtain the best results from your instrument. If the attenuation is too high, the measurement will be affected by the noise of the input comparator. This results in an unstable display. With an input signal too great, the input stage may saturate and thus producing overshoots which result in a display which is twice too high e.g. at frequency measurements. Always try to set the control to AC-coupling and use as much attenuation as possible for frequency measurements and DC-coupling with no attenuation for time measurements. In many cases it is vital to have a good impedance matching to avoid reflections which might make the trigger level setting very difficult. Always usea 50Ω termination in 50Ω systems. The C-input facilitates no input conditioning controls and needs no trigger level setting. The input signal is triggered f rom 50 mV up to the maximum input voltage of 5V. The input f requency for the C-input must always be in the range f rom 100MHz to 1000MHz. For frequencies lower than 100MHz the measurement result may be erroneous.

Measuring time and resolution

The measuring time can be varied in 3 steps between 100ms and 10sec. The gate time may be modified during a measurement. In the reciprocal mode (atall frequencies with HM8021-3), the counter totalizes the input cycles until the set measuring time has elapsed and the synchronization conditions are met. Hence, the effective measuring time (also called gate time) is longer than the set measurement time.The measurement in the HM8021-3 is always synchronized to the input signal. This is called the input synchronized or reciprocal method.

In this mode, both the opening and closing of the main gate are synchronized with the input signal, so that only completed input cycles are counted. This means that a ±1 input cycle error is avoided. During the gate time, the counter totalizes the number of clock cycles. When the preselected gate time is over, the counter waits for the next active transition of the input signal to stop counting. If the recurrence of this signal is low, e.g. with long period times, the stop synchronization time may be long compared to the preset gate time. In that case the effective gate time may be very different from the preset value (if the signal was removed during

measurement, this time becomes infinite and the measurement finishes never). The resolution in the input synchronized mode is caused by trunctation of the clock pulses, which results in +1clock pulse error (100ns). The resolution of the measurement thus only depends on the measurement time. For example, the resolution for 1s measuring time is 10^{-7}, independent of input frequency. In conventional counters the gate time is synchronized with the clock signal. The first and last input cycle can therefore be truncated, causing a ±1 cycle error. This resuits in a good resolution for high frequency measurements, but a poor resolution for low frequency measurements (±1 : frequency, for 1sec. measuring time).

Signal inputs

The front panel of the HM8021-3 has two BNC input sockets. One (Input A) with an impedance of 1MΩ II 40pF. As the frequency measuring range of the HM8021-3 unit reaches up to 1GHz, this module offers also an input (C) for frequency measurements from 100MHz up to 1GHz. It is also provided as a BNC socket and has an impedance of 50Ω.

Caution! Particular care should be taken, when applying signal voltages to the 1 GHz input of the HM 8021-3 unit.
A maximum voltage of 5V ($DC+AC_{peak}$) may be applied to the input C (see "Specifications"). Any input voltage exceeding this value will destroy the input stage of the frequency counter!

Frequency measurement

Counters are used for both, frequency and time interval measurements. However, frequency and time interval measurements have contradictory requirements in respect of correct triggering. For frequency measurements, too high a sensitivity means that the counter is too sensitive to noise. Therefore do not use higher sensitivity than needed for correct triggering. Signals which are superimposed on a DC voltage, must be separated via an input coupling capacitor (i.e. AC-coupling, DC pushbutton released). The advantages of AC coupling are: no DC-drift and good protection against DC overload. AC-coupling however, gives a drop in sensitivity for very low frequencies. The signal frequency to be measured is applied to one of the inputs, and the corresponding function is selected. The trigger point is adjusted by use of the TRIGGER knob (9, so that a stable value is displayed. This stability is obtained, when the trigger signal display LED flashes (see "Input triggering"). Now the test frequency can be read on the 8-digit display. The obtained resolution depends on the gate time and can be selected in 3 steps with the GATE TIME pushbutton switch **(3)**. When the measurement range is exceeded, the red OVERFLOW LED **(1)** is light up. A reliable indication is no longer ensured under these circumstances. The maximum resolution of 0.1 Hz is obtained with a gate time of 10sec.

Period measurement

For measurement of the period duration, the reciprocal value of the frequency T=1/f is measured in seconds. The signal is applied as for frequency measurement.

Time interval measurement (Pulsewidth)

In TI ⎍ mode, the time (e.g. number of 100ns clock pulses) is measured between the positive slope and the negative slope of an event at channel A. (Corresponding for negative pulses in TI ⎎ mode). In single source time measurements (e.g.Pulse width) the resolution of the measurement is 1clock pulse (100ns).By using the time interval average technique, which means multiple measurements of a repetitive signal, the measuring accuracy and resolution are greatly im proved.Compared to single time interval measurements, the basic 100ns resolution is improved by a factor of √N, where N is the number of time intervals being averaged during the measuring time. Note that the input signal must be repetitive and must not have a phase relation with the reference frequency. For time interval measurements, too low a sensitivity means that different signal slopes at the positive and negative edge cause different delays between the trigger level crossing and the trigger point, resulting in incorrect measurements. The highest possible sensitivity which does not overload the input stage, is the ideal. DC-coupling, attenuation and a continuously variable setting of the trigger level is necessary for setting the trigger level at any required point of the input signal, independent of waveform and duty factor. Autotriggering requiring AC-coupling is also possible. The display resolution changes with the number of measurements taken from the signal. At single pulse measurements the resolution is 100ns, whereas the resolution may be as small as 10ps, depending directly on the measurement time set with the gate switch **(3)** and the repetition rate of the input signal.

Totallizing (Event counting)

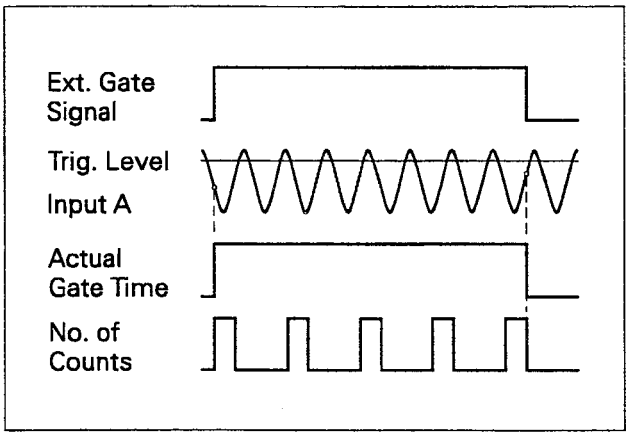
The signal is applied as for frequency measurement.

External gate

The external gate function allows full control of the start and stop of the measurement. When Ext. (gate) is selected **(3)** and the control input signal **(16)** is low, the counter makes all necessary preparations for a measurement. With the high level of the gate signal, measurement starts when the input signal triggers after a synchronization delay. Measurement stops on the first trigger after the gate signal changes from high to low. The external gate overrides the set measurement time. The external gate signal must be in the range

100ns ... 10sec. but the effective gate time will never be smaller than 150µs.

External gate is selected by means of the pushbutton **(3)** and indicated by means of LED. External gate can be used in all functions. Example applications are multiple burst frequencies and masked time intervals. Note that if RF bursts are to be measured using frequency C, the burst should contain at least 128 cycles of the f requency to be measured. External gating is active according to the level applied to the input **(16)** (rear side of mainframe).



Calibration

Caution! The time-base of the HM8021-3 unit should only be re-aligned, if a high-precision frequency standard is available.

Crystal oscillators are subject to natural aging during operation, which leads to deviations from their basic accuracy. Therefore they should be re-aligned at least twice peryear to ensure the accuracy indicated in the specification.

If recallibration is necessary it is carried out as follows:

1) Select function FA (Frequ.A), OFFSET and DISPLAY HOLD should be in OFF position.

2) Apply a frequency standard of 1,5 or 10MHz to input A and adjust channel A trigger setting for a stable reading.

3) Depress RESET **(7)** and then GATE TIME **(3)** for approx. 5secs.

4) The display shows "A...O" during the push buttons are depressed.

5) When the switches are released the display shows the date of the last recalibration (DD-MM-YY or 00-00-00).

6) You may leave calibration mode by depressing RESET T. In this case no changes are made and the unit is working in normal mode.

7) If you want to change the date of the last calibration youshouidproceedfromste 5: Using the key ← or → (left or right function shift keys) you can choose the digit that has to be changed (not flashing). The different digits are changed by pushing down the GATE TIME **(3)** key several times. When the last digit is corrected (now the last digit should light brightly e.g. 20-02-89) you can leave the calibration procedure (continue with step 7a) or frequency calibration can be performed (continue with step 7b).

7a) If you only want to store the date of the last calibration without changing the timebase calibration, there should **not be any** signal at the input A during the following steps. After depressing the right function key "A..." will be indicated in the display after a few seconds. If you now depress the reset button you are again in the normal mode.

7b) If there is a standard frequencyof 1, 5 or 10MHz at the input A, depress the right function shift key. A few seconds later the display shows following informations:

A... if the standard frequency applied is not accepted

A... $1x10^6$ if the counter has recognized a 1 MHz standard

A... $5x10^6$ if the counter has recognized a 5MHz standard

A... $10x10^6$ if the counter has recognized a 10MHz standard

During the following 45 seconds the signal is measured and the HM8021-3 is recalibrated. Finally the new calibrated unit automatically switches back to normal mode.