

UNIVERSAL COUNTER

HIOKI

Universal counter

3601

Multi-Function Universal Counter Covering 1mHz to 160MHz



Easy-to-Use Multi-Function Counter

○ Frequency

FREQ. [A pre.] 2MHz~160MHz
 " [A] 10MHz~20MHz
 " [B (A)] 1mHz~20MHz

○ Period: 50ms~1000s

○ Frequency ratio: $10^{-4} \sim 10^8$

○ Time interval: 100ms~1000s

○ Pulse width: 100ms~1000s

○ Duty cycle: 0~100%

○ Totalize: 0~ 10^8

○ Rpm: 0.06~ 6×10^7 rpm

○ GP-IB (-01 specifications)

The 3601 Universal Counter provides a broad range of time-measurement functions in a single compact, easy-to-use counter.

Frequency counting is performed using three techniques—direct, prescaled and reciprocal, enabling coverage of 1mHz to 160MHz.

In addition, the 3601 provides a versatile range of other functions, including period, frequency ratio, time interval, pulse width, duty cycle, totalize and even rpm.

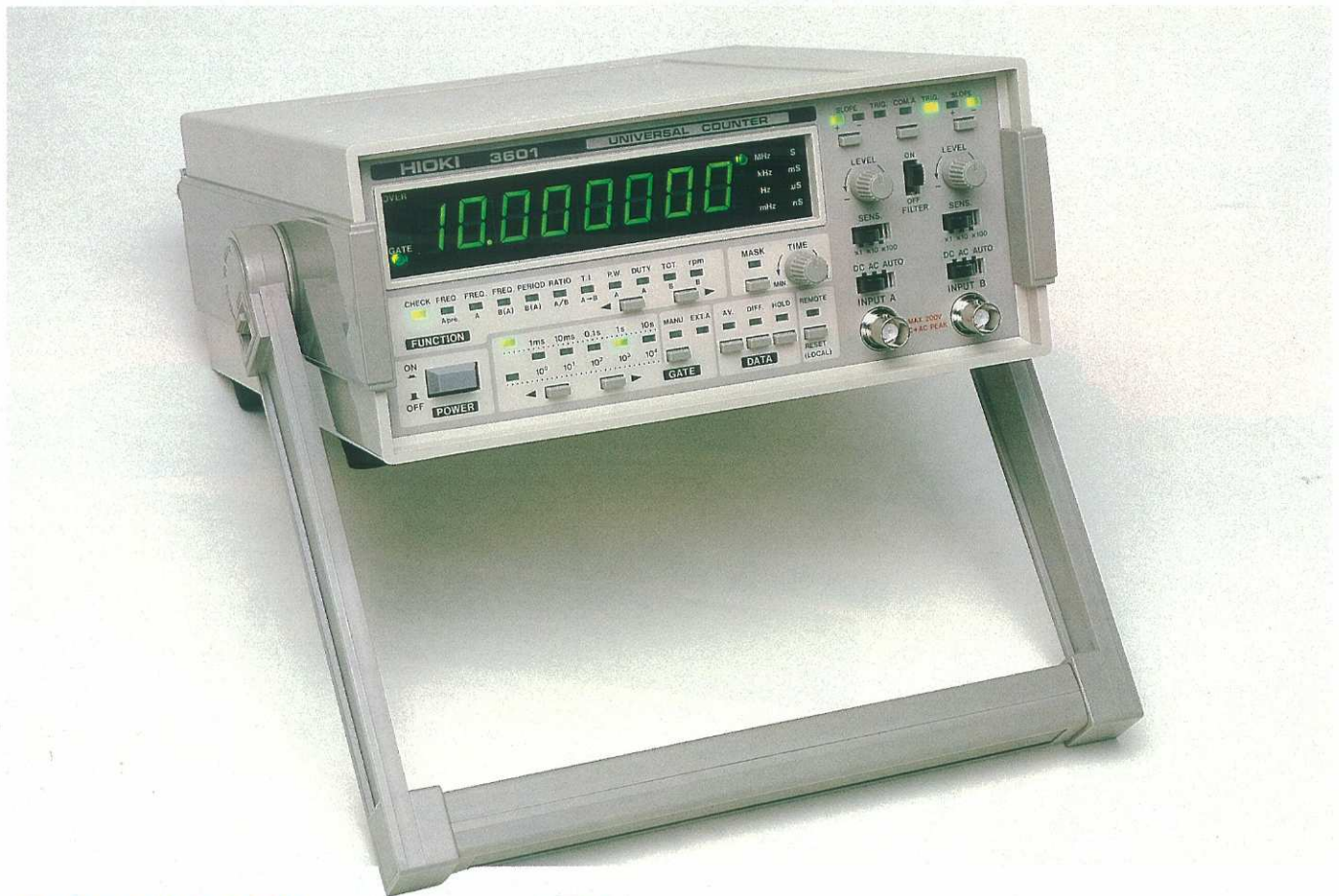
Data processing functions include averaging and difference measurements and masking has been provided to eliminate the influence of noise on measurements and ensure accurate

measurements for a wide variety of signal conditions.

The COM. A switch enables the A input to be used in making period and reciprocal method frequency measurements normally made using the B input. For pulse width and duty cycle measurements, COM. A and the trigger slope are set automatically.

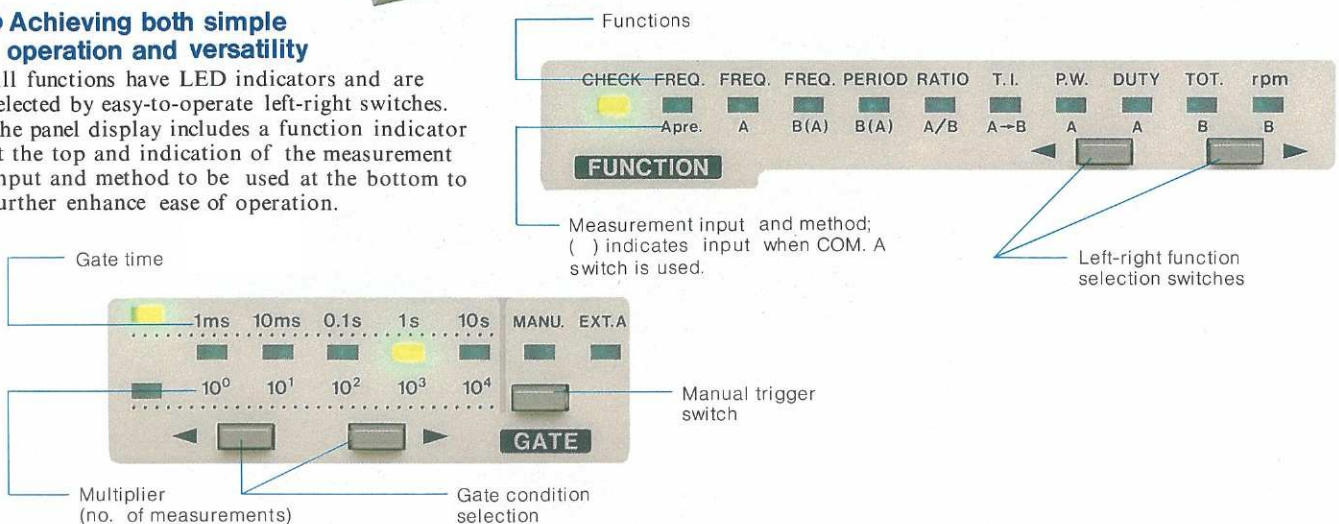
The 3601 operates in either 100V or 200V line power environments without switching and has a host of other features that make it the easy-to-use universal counter.

Add the optional GP-IB capability and the 3601 can easily become part of an automatic measurement system.



● Achieving both simple operation and versatility

All functions have LED indicators and are selected by easy-to-operate left-right switches. The panel display includes a function indicator at the top and indication of the measurement input and method to be used at the bottom to further enhance ease of operation.



3601 Universal Counter

● Frequency Measurement

One of the following three measurement methods is selected, depending upon the frequency to be measured and the required measurement accuracy.

(1) FREQ. [A pre.]: Prescaled counting method

Measurement range: 2MHz~160MHz
This measurement method is suitable for measuring frequencies above 10MHz. The input signal is 1/10 divided and then counted directly.

(2) FREQ. [A]: Direct counting method

Measurement range: 10Hz~20MHz
After converting the input signal to a pulse signal, the number of cycles during a given time interval (gate) is counted in this, the most basic, counting method. While the resolution increases with frequency, there is a limit on the frequency that can be counted using this method.

(3) FREQ. [B(A)]: Reciprocal counting method

Measurement range: 1mHz~20MHz
Since the gate time determines the number of significant digits, this method provides high resolution for even low frequencies. Using the fact that the frequency is the reciprocal of the period, this method consists of first measuring the period of the input signal and then calculating the reciprocal of this value to obtain the frequency.

Since this method is inherently one of measuring period, it normally uses the B input. The COM, A switch can be used, however, to perform this type of measurement using the A input as well.

● Duty Cycle [DUTY] Measurement

A unique measurement method has been used for this function which enables the duty cycle to be measured during a single cycle. This enables measurements of signals whose duty cycle varies randomly and of single pulses. By virtue of this method, in which the input connection is switched when the function is selected, the measurement is possible using only the A input.

● Pulse Width [P.W.] Measurement

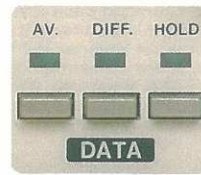
Whereas this measurement function has traditionally been performed by applying the time interval function, the 3601 provides it as an independent measurement function.

The measurement is completed in just one cycle of the input signal and is performed by connecting the input signal to the A input using this unique measurement method.

● Data Processing Functions

(1) Average Value [AV] calculation

This function measures the input signal a number of times under the set conditions and displays the average of these measurements.



The average value function may be used with the period, frequency ratio, time interval, pulse width and duty cycle measurement functions.

Using this function, if the gate time is set to a value greater than 10^2 (e.g., 10^3 for a setting of 1s), the measurement is repeated until the gate time has elapsed (for period and frequency ratio). For time interval, pulse width and duty cycle measurements, single measurements are repeated for 0.1s, 1s or 10s and the resolution determined by statistical processing.

(2) Difference [DIFE] display

The measured value at the instant the DIFE switch is set to ON is taken as the reference value which is subtracted from all subsequent measured values before being displayed.

This function is useful in measuring frequency difference and variations from a reference value.

● COM.A Switch

The usual universal counter has an A and a B input, the uses of which are predetermined.

In the 3601, for period and reciprocal-type frequency measurements [FREQ B(A)], the input signal is applied at the B input. The COM. A switch can be used, however, to implement internal connection switching, enabling these measurements to be made using the A input when the COM. A switch is ON. For pulse width and duty cycle measurements, the COM. A function is set, enabling these measurements to be made from the A input also.

● Wide Line Voltage Range

The power supply of the 3601 was designed to enable operation over the entire range of 85~250V without the necessity of switching.

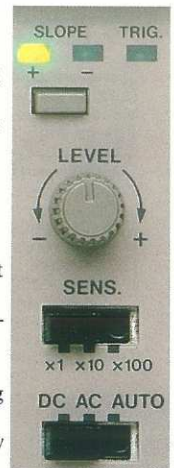
● GP-IB Capability (-01 Specifications)

The 3601 can be connected to the GP-IB, a standard measurement interface bus. This enables computer control and data acquisition, making possible automatic measurements and the easy adaptation of the 3601 into an automated measurement system.

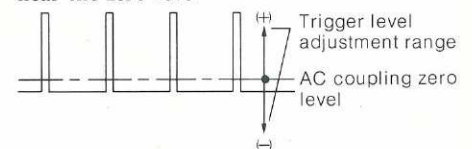
● Automatic Trigger Level Setting

In addition to the conventional AC and DC input signal coupling modes, the 3601 features an AUTO coupling mode which automatically sets the trigger level.

This coupling mode provides AC coupling but differs from the normal AC coupling mode in that it automatically sets the trigger level to approximately 1/2 of the peak-to-peak amplitude of the input signal. When using AC coupling with an input signal having a low duty cycle, since the zero level is set low, as shown in Fig. 1-(1), trigger level setting and adjustment are difficult. The AUTO coupling mode solves this problem by setting the trigger level near the center of the peak-to-peak amplitude as shown, ensuring stable triggering. (Fig. 1-(2))



(1) AC coupling with trigger level set near the zero level



(2) AUTO coupling with trigger level set automatically to 1/2 the input signal amplitude



Fig. 1. Trigger level adjustment

● Masking Function

In making period and time interval measurements, the effects of noise or chattering superimposed on the input signal can be eliminated using the masking function.

As shown in Fig. 2, a given time interval after the counting start trigger is set up as the mask time, during which generation of the counting stop trigger is inhibited.

Using this function, false counting stop triggers caused by such phenomena as noise are prevented, ensuring measurement with the proper triggering.

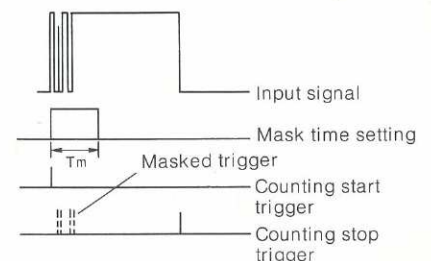


Fig. 2. Masking function

● SPECIFICATIONS

1. Electrical Specifications

Frequency measurement (FREQ A pre)
Prescaled
Input terminal: INPUT A
Measurement range: 2MHz~160MHz
Gate time: 1ms, 10ms, 0.1s, 1s, 10s,
Units: MHz
Measurement accuracy: ± 1 count \pm timebase accuracy

Frequency measurement (FREQ A)
Input terminal: INPUT A
Measurement range: 10Hz~20MHz
Gate time: 1ms, 10ms, 0.1s, 1s, 10s
Units: Hz, kHz, MHz
Measurement accuracy: ± 1 count \pm timebase accuracy

Frequency measurement (FREQ B(A))
Input Terminal: INPUT B(A)
Measurement range: 1mHz~20MHz
Gate time:
1ms \geq 100Hz; 1ms~10ms
< 100Hz; One input signal period Display
4 digits or more
10ms \geq 10Hz; 10ms~100ms
< 10Hz; One input signal period Display
5 digits or more
0.1s \geq 1Hz; 0.1s~1s
< 1Hz; One input signal period Display
6 digits or more
1s \geq 0.1Hz; 1s~10s
< 0.1Hz; One input signal period Display
7 digits or more
10s \geq 10mHz; 10s~100s
< 10mHz; One input signal period
Units: mHz, Hz, kHz, MHz
Measurement accuracy: \pm (Trigger error/
measured frequency.gate time)+1 count+
timebase accuracy

Period measurement (PERIOD B(A))
Input terminal: INPUT B(A)
Measurement range: 50ns~999,99999s
Multiplier: 10^0 , 10^1 , 10^2 , 10^3 , 10^4
Timebase: 100ns
Units: ns, μ s, ms, s
Measurement accuracy: \pm (Trigger error/
multiplier) \pm 1 count \pm timebase accuracy

Frequency ratio measurement (RATIO A/B)
Input terminal: INPUT A, B
Measurement range: DC~20MHz
Multiplier:
 10^0 (1~99999999 display)
 10^1 (0.1~99999999 display)
 10^2 (0.01~99999999 display)
 10^3 (0.001~9999999.9 display)
 10^4 (0.0001~999999.99 display)
Measurement accuracy: $\pm B$ Input trigger
error/multiplier ± 1 count $\pm A$ Input accuracy

Time interval measurement (T.I. A→B)
Input terminal: INPUT A, B
Measurement range: 100ns~999,99999s
Multiplier: 10^0 , 10^1 , 10^2 , 10^3 , 10^4
Timebase: 100ns
Units: μ s, ms, s
Measurement accuracy: \pm Trigger error/N ± 1
count \pm timebase accuracy
Note N is the square root of the multiplier and
is 1 for an extremely stable signal which is
synced to the timebase.

Pulse width measurement (P.W. A)
Input terminal: INPUT A
Measurement range: 100ns~999,99999s
Multiplier: 10^0 , 10^1 , 10^2 , 10^3 , 10^4
Timebase: 100ns
Units: μ s, ms, s
Measurement accuracy: \pm Trigger error/N ± 1
count \pm timebase accuracy
Note N is the square root of the multiplier and
is 1 for an extremely stable signal which is
synced to the timebase.

Duty cycle measurement (DUTY A)
Input terminal: INPUT A
Measurement range: 1mHz~1MHz
Multiplier: 10^0 , 10^1 , 10^2 , 10^3 , 10^4
Timebase: 100ns
Units: None (the value displayed is in %)

Measurement accuracy: \pm Trigger error/N ± 1
count \pm timebase accuracy
Note N is the square root of the multiplier and
is 1 for an extremely stable signal which is
synced to the timebase. The calculation
error is + 1 count.

Totalize (TOT. B)

Input terminal: INPUT B
Counting range: DC~20MHz
Counting capacity: 0~99999999
Rpm measurement (rpm B)
Input terminal: INPUT B
Measurement range: 0.06~60000000rpm
Gate time: 1ms, 10ms, 0.1s, 10s (time until
next signal is input)

2. Input Specifications

INPUT A, B
Input sensitivity:
25mVrms DC~20MHz
10MHz~150MHz (prescaled)
50mVrms 2MHz~10MHz
150MHz~160MHz (prescaled)
Sensitivity switching: $\times 1$, $\times 10$, $\times 100$
Input voltage: 25mVrms~1Vrms
Input withstanding voltage: 200V (DC + AC
peak)
Input coupling modes: DC, AC, Auto (AC)
Input impedance: Approx. 1M Ω , 30pF
Trigger level:
DC, AC Approx. -1V~+1V, continuously
adjustable
Auto Automatically adjusted to
approximately 1/2 the input signal
amplitude.

Trigger slope: +, - (switchable)
Masking: Approx. 100 μ s~100ms (INPUT B)
Setting value (mask time) can be monitored
using the Check function.

Noise rejection: Approx. 100kHz lowpass
filter

Timebase

Internal timebase: 10MHz
Temperature coefficient: $\pm 3 \times 10^{-6}$ / $^{\circ}$ C
(0 $^{\circ}$ C~50 $^{\circ}$ C)

Aging rate: $\pm 1 \times 10^{-8}$ /year
Internal timebase voltage output: Approx.
2Vp-p (Output impedance: approx. 100 Ω)

Timebase frequency input
Input frequency: 10MHz
Input voltage: 1~10Vp-p
Input resistance: Approx. 1k Ω

3. General Specifications

No. of display digits: 8
Display type: 7-segment LED (storage type)
Calculation functions DIFF (difference):
A switch is used to set any displayed value
as the reference value with respect to which
differences are displayed thereafter.
(Display=Measured value-reference value)
AV (average): For the gate multipliers 10^2 ,
 10^3 and 10^4 , averaging is performed for
0.1s, 1s and 10s, respectively (frequency
and period measurements)
The 10^0 gate multiplier value is averaged
for 0.1s, 1s or 10s and displayed (time
interval, pulse width and duty cycle
measurements)

Hold: A switch operation holds the next sampled
value.

Sampling rate: 40ms or less (or hold)
Operating temperature and humidity: 0~40 $^{\circ}$ C
85% RH max. (with no condensation)

Storage temperature and humidity: -20~
+70 $^{\circ}$ C, 90% RH max. (with no condensation)

AC line voltage: 85~250V, switching not
required

Line frequency: 47~66Hz
Power consumption: 25VA max.
Dimensions: Approx. 92H \times 217W \times 255D mm
(not including handle and knobs)

Weight: Approx. 2.2kg

Accessories:
Power cable
Input cables (2)
Fuse
Instruction manual

● GP-IB (-01 Specifications)

(1) Applicable standard: IEEE 488-1978

(2) Interface functions

SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0.

(3) Talker functions (→ mark are spaces)

Data format:

AAA O DDDDDDDDDDD EEE XX
① ② ③ ④ ⑤

① Header CKF: Frequency check
CKM: Mask time check
FAP: Frequency A prescaled
measurement
FA→: Frequency A measurement
FB→: Frequency B measurement
PRD: Period measurement
TI →: Time interval measurement
PWH: High-level time measurement
PWL: Low-level time measurement
FR→: Frequency ratio
DRH: High-level duty cycle
measurement
DRL: Low-level duty cycle
measurement

TCM: Totalize (manual control)
TCA: Totalize (A input control)
RPM: Rpm measurement

② Over O : Over
→ : Normal

③ Measured value

The measured value consists of the sign (+ or
space), value and decimal point. If this requires
fewer than 10 digits, spaces are padded to make
up the 10 digits.

④ Exponent

E-9~E+6 in 10^3 multiples

⑤ Delimiter DIP switch settable

(4) Listener functions

○ Function (F0~F9, F'), gate (G0~G6), trigger
(T0~T5), averaging (A0, A1), difference (D0,
D1), hold (H0, H1), masking (M0, M1), manual
gate (O0, O1), service request (S0, S1),
header (HD0, HD1), delimiter (DL0~DL3)
○ Initialize (C), measurement start (E)

Standard packing (doublecarton box)

Sets	N.W.kg	G.W.kg	M ³
3	9	11	0.10m ³

HIOKI E.E. CORPORATION

DISTRIBUTED BY

HEAD OFFICE: P.O. Box 1, Sakaki, Nagano, 389-06 Japan.

Tlx: 3327508 HIOKI J / Cable: HEWLOV, Ueda

Telephone: (0268) 82-3030

TOKYO OFFICE: 2-23-24 Shiba Nakata, Kawaguchi, Saitama 333.

Telephone: (0482) 61-2401

HIOKI-RCC, INC.: 198 Route 206 South Somerville, N.J. 08876 U.S.A.

Telephone: (201) 874-6484