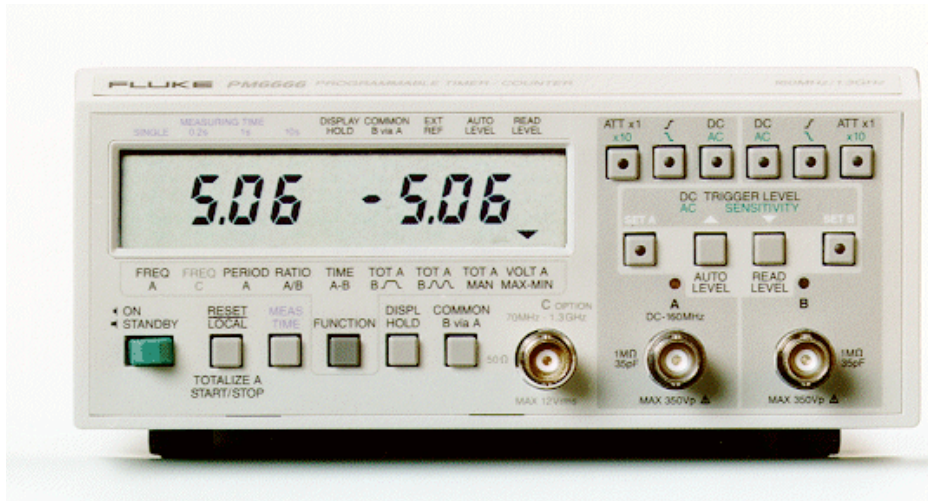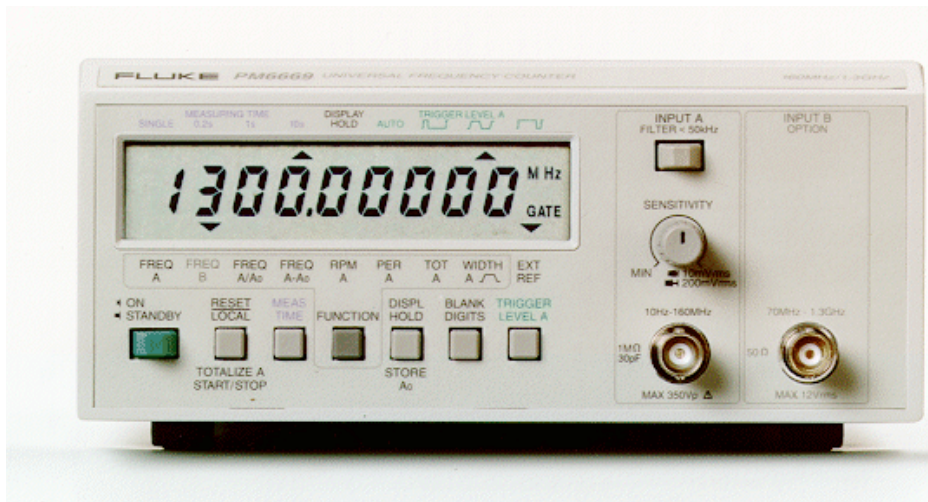# PM 6666
Programmable Timer / Counter

Technical Data

PM 6669 Frequency Counter

- Unrivaled price/performance
- 160 MHz / 1.3 GHz option
- Reciprocal counting, 7 digits per second
- High stability MTCXO: 2×10^{-7} over 0°C to 50°C with push–button calibration
- Error–free triggering–, high noise immunity input circuitry
- PM 6666: Full GPIB/IEEE 488 programmability, Auto trigger, Voltage measurements
- PM 6669 Ease of operation, auto triggering, auto range and auto display
- Rugged, no compromise quality, MTBF 50.000h & 70.000h
- Excellent suppression of RF interference through all–metal cabinet
- Optional battery for field use

The PM6666 and PM6669 are economical, easy-to-use counters that meet the demands for high-precision measurements, reliability and durability. The units use reciprocal frequency counting, which yields high resolution measuring results under all conditions, even on low frequency measurements. The high performance counter front-ends, providing variable sensitivity and noise immunity increase measuring accuracy. Accuracy can be further improved with the optional high stability MTCXO TimeBase, that offers a stability of 2×10^{-7} (0°C to 50°C), comparable to that of an oven stabilized oscillator. The counters have high input protection, allowing it to withstand inputs of 12V rms on the optional 50Ω RF input and 350V (dc+ac peak) on the 1 MΩ LF input.

PM 6669 Frequency Counter

The multi-function PM 6669 offers next to frequency measurements also period, count totalization, ratios, pulsewidth and frequency difference measurements, functions normally found only in more expensive timer / counters. This counter can be used on the test bench or for field service. It has a full 9-digit display, to allow complete presentation of measuring results. When less accurate measurements are made, blanking of irrelevant display digits makes it easy to read results.

PM 6666 Programmable Timer/ Counter

The PM 6666 is a low cost timer/counter with high accuracy frequency, time and voltage measurements that also offers 100% programmability including trigger level and sensitivity settings. A bus learn mode is provided to speed and simplify programming. The PM 6666 is also a bench-top use; with 9 front panel selectable measuring functions including voltage max. /min. measurements.

Error-Free Triggering

Triggering is error-free on the PM 6666 for all waveforms.

Trigger level setting can be automatic on all input signals over 100 Hz. Resolution is 20/200 mV, over a very wide range (-50V to +50V) that allows measurements to be accurate even on high voltage events. The trigger level can be displayed immediately with one keystroke; and inputs can be instantly checked for triggering with the Tri-state LED trigger indicators. To give the various noise immunity settings, input sensitivity has six steps, from 20 mV to 1V rms.

V pp measurements up to 50 MHz

The PM 6666 has Volt peak measurements up to 50 MHz. When displaying Vmax. / min. measurements, positive and negative signal peaks of the input signal are shown simultaneously with a resolution of 20 or 200 mV.

High Resolution

The PM 6666 can measure low frequency signals to high resolution with synchronized multiple period measurements and computing the reciprocal values. Resolution is at least 7 digits on a 1s measuring time, because the traditional ± 1 input cycle error is eliminated. Time interval measurements are high resolution

Selection Table	PM 6666 timer/counter	PM 6669 frequency counter
Freq. A	0.1 Hz to 160 MHz	10 Hz to 160 MHz
Freq. B via GPIB	0.1 Hz to 16 MHz	
RF Freq. option	70 MHz to 1.3 GHz (Chan. C)	70 MHz to 1.3 GHz (Chan B)
Measuring Modes	Freq. A, B, C (RF)	Freq. A, B (RF)
	Time Interval A–B, Period A Ratio A/B, Ratio B/A, C/A, C/B (GPIB) Totalize A Volt max. /min. A	Pulse width A, Period A, RPM A Freq. A/AO, Freq. A–AO Totalize A
Resolution	7 digits/s (frequency) 100 ns (time interval single, period), $\geq$ 30 ps time interval averaged	7 digits/s (frequency)
Measuring times	0.2, 1, 10s and SINGLE	0.2, 1, 10s and SINGLE
Sensitivity LF, RF	20, 10 mV	10, 10 mV
Sensitivity setting, range	6 steps, x1 ... x50	x1 to x400, cont. variable
Trigger level	AUTO, Manual, GPIB	AUTO, Manually set (+, 0, –)
Input attenuation	x1 x10 AUTO	
GPIB interface	Full programmable	All front panel settings
External Reference input	10 MHz	10 MHz
Noise suppression filter	–	50 kHz low pass
Other facilities	–	Display hold, Reset, Digit blanking
Options	MTCXO time base, 1.3 GHz RF input, GPIB interface, Rack mount, Battery pack, Carrying case	

as well as high accuracy, due to the time interval averaging technique. The 100 ns resolution is improved by a factor $\sqrt{N}$ (N = number of time intervals averaged) when compared with single time interval measurements.

MTCXO Time Base

(Mathematically Temperature Compensated Crystal Oscillator) Counter stability and precision is ultimately determined by the time–base oscillator. This can be further improved with the optional high stability MTCXO time–base that offers a stability, comparable to that of an oven stabilized oscillator, but at much lower cost. The temperature dependency curve for each individual crystal oscillator is factory-measured, and the frequency deviations (Δf) across the temperature range are stored in a non–volatile memory. During operation, the Δf value for the operating temperature is referenced in memory and used to compensate the measuring result before it is displayed. This automatic temperature compensation also results in highly accurate measurements instantly, without long warm–up times. The unique MTCXO principle gives a residual temperature stability of 2×10^{-7} over the temperature range 0 °C to 50°C.

Specifications PM6666

Measuring Modes

Freq. A, Freq. B, Freq. C, Period A, Ratio A/B, (Ratio B/A & C/A & C/B via GPIB), Totalize A, Time Interval A-B, Volt Max./Min. A.

Frequency A or C

(Frequency B via GPIB only)
Freq. A: 0.1 Hz to 160 MHz (120 MHz to 160 MHz with limited temperature range; typ. +23 °C $\pm$ 5°C)
Freq. B: 0.1 Hz to 16 MHz (only via GPIB)
Freq. C: 70 MHz to 1.3 GHz (option)

Mode: Reciprocal freq. counting.
LSD displayed:
2.5×10^{-7} x FREQ / Measuring time

Period A
Range: 8 ns to 2×10^8 s
Mode: Single period measurement (SINGLE) or period average measurement
(at 0.2, 1 or 10 s measuring-times).
LSD displayed:
SINGLE period measurement:
- (TIME < 100 s): 100 ns
- (TIME > 100 s): 5 x PERIOD / 10^9 s
Period average measurement:
- 2.5×10^{-7} x PERIOD / meas. time

Ratio A/B
(Ratio B/A, C/A or C/B via GPIB only)
Range:
0 and 1×10^{-7} to 2×10^9 (A/B)
0 and 1×10^{-8} to 2×10^8 (B/A)
0 to 1×10^{15} (A/B SINGLE and B/A SINGLE), 8 to 6×10^{10} (C/B) (C/A)
Frequency range:
Input A: 0.1 Hz to 160 MHz (A/B) (120 MHz to 160 MHz with limited temperature range; typ. +23 °C $\pm$ 5 °C)
0 Hz to 16 MHz (B/A, C/A, A/B SINGLE)
Input B: 0 Hz to 16 MHz
Input C: 70 MHz to 1.3 GHz (option PM 9608B)

LSD displayed (Ratio A/B):
25 / meas. time x FREQ B
(0.2, 1 or 10 s Measuring times)

LSD displayed (Ratio B/A):
2.5 / meas. time x FREQ A)
(0.2, 1 or 10 s Measuring times)

LSD displayed (A/B SINGLE, B/A SINGLE):
(RATIO < 10^9): 1
(RATIO > 10^9): 5 x RATIO / 10^9

LSD displayed (Ratio C/A or C/B):
640 / meas. time x FREQ A or B

Time interval A-B
(Time interval B-A via GPIB only)
Range:
100 ns to 2×10^8 s (SINGLE)

0 ns to 20 s (average)
Mode: Single time interval (SINGLE) for time interval average measurements (at 0.2, 1 or 10 s measuring-times).
LSD displayed:
SINGLE Time interval measurement:
(TIME < 100 s): 100 ns
(TIME > 100 s): 5 x TIME / 10^9 s
Time interval average measurement:
2.5×10^{-7} s / N
Number of Intervals averaged N:
Measuring time / pulse repetition rate.
Min dead time from stop to start: 250 ns
Timing difference A-B channels:
4 ns max.
Note: Input signals must be repetitive and asynchronous with respect to the time base.

Totalize A
(Totalize B via GPIB only)
Range:
0 to 1×10^{15} with indication of k or M (kilo–pulses or Mega–pulses) the result is truncated if out of display range.
Frequency range: 0 Hz to 16 MHz
Pulse pair resolution: 80 ns
LSD displayed:
1 unit count (counts < 10^9)
5 x counts / 10^9
(counts > 10^9)
Gated by B (A) mode: Event counting on input A (B) during the duration of a pulse on input B (A).
Start/stop by B (A) mode: Event counting on input A (B) between two consecutive pulses on input B (A).
Manual mode: Event counting is controlled by the START/STOP button. Sequential start–stop counts are accumulated. RESET closes the gate and resets the Timer/Counter to zero.

Volt Max/Min A
(Volt Max/Min B via GPIB only)
Range: –51 V to +51 V
Frequency range:
DC and 100 Hz to 50 MHz

(Input A)
DC and 100 Hz to 5 MHz (Input B)
Resolution:
Input signals within ± 5 V:
20 mV
Input signals outside ± 5 V:
200 mV

Inaccuracy DC and 100 Hz to 16 MHz(A) or to 1 MHz(B):
Input signals within ± 5 V: 30 mV
±1 % of reading ±3 %
of Vpp
Input signals outside ± 5 V:
300 mV ±3 % of reading
±3 % of Vpp

Inaccuracy 16 MHz to 50 MHz(A) or 1 MHz to 5 MHz(B):
Input signals within ± 5 V: 30 mV
± 10 % of reading ± 10 % of Vpp
Input signals outside ± 5 V:
300 mV ± 10 % of reading
± 10 % of Vpp

Definitions PM6666

LSD displayed
LSD = Unit value of the least significant digit displayed. All calculated LSD's (see section Measuring functions) should be rounded to the nearest decade (e.g. 0.3 Hz is rounded to 0.1 Hz and 5 Hz to 10 Hz) and cannot exceed the 9th digit.

Resolution
Resolution = smallest increment between two measuring results on the display, due to the 1 count error.
Freq. A, C, Period A and Ratio A/B:
Resolution can be 1 LSD unit or 2 LSD units if:
– LSD x Measuring time / FREQ or PERIOD < 10^{-7} the resolution is 2 LSD units
(30 % probability).
– Otherwise resolution is 1 LSD unit (70 % probability).
Ratio A/B:
Resolution can be 1 LSD unit or 2 LSD units if:
– LSD x Measuring time / RATIO < 10 / FREQ A the resolution is 2 LSD units (30 % probability).
– Otherwise resolution is 1 LSD unit (70 % probability).
SINGLE Period A and SINGLE

Ratio A/B:
Resolution equals 1 LSD unit.
Time A-B: Resolution
(95 % confidence level) equals 1 LSD unit or 100 ns/N, whichever is greatest.

Inaccuracy
Inaccuracy, i.e. the relative error, depends on the following factors:
± Resolution / FREQ, PERIOD, RATIO, or TIME
± relative trigger error
± relative time base error
± relative systematic error

Relative trigger error:
Freq. A, Period A:
± noise voltage A [Vpp] / signal slope A [V/s] x meas. time
Ratio A/B:
± noise voltage B [Vpp] / signal slope B [V/s] x meas. time
Totalize A, gated or start stop by B:
± noise voltage B [Vpp] / signal slope B [V/s] x gate time B
Time A-B:
± noise voltage A [Vpp] / signal slope A [V/s] x TIME x Sqrt N
± noise voltage A [Vpp] / signal slope A [V/s] x meas. time
Relative time base error:
± deviation from 10 MHz / 10 MHz
Relative Time A-B systematic error:
Inaccuracy caused by timing difference between A and B channels < ± 4 ns / TIME.

Input specification PM6666

Input A and Input B
Frequency range:
DC Coupled: DC to 160 MHz*
AC Coupled: 20 Hz to 160 MHz*
*(120 MHz to 160 MHz with limited temperature range; typ. +23 °C ± 5 °C)

Sensitivity, DC coupled
Sine:
20 mV rms, 0 Hz to 30 MHz
40 mV rms, 30 MHz to 120 MHz
60 mV rms typ. 120 MHz to 160 MHz

Pulse:
60 mV pp, 0 Hz to 30 MHz
110 pp, 30 MHz to 120 MHz

Sensitivity AC coupled
20 mV rms, 0 Hz to 30 MHz
40 mV rms, 30 MHz to 120 MHz
Sensitivity is selectable in 6 steps; 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V rms (sine); nominal. Sensitivity decreases to 60 mV rms typical at 160 MHz (at room temp.)
Coupling: AC or DC coupled, switch selectable.
Impedance: 1 MΩ //35 pF, independent of "COM B via A" switch setting.
Attenuation: x1 or x10, switch selectable or AUTO.
Channel input: Separate A and B. or A and B common via input–A.
Maximum voltage: 350 V (DC+AC Peak) between 0 and 440 Hz, falling to 8 V rms at 1 MHz.

Triggering
Trigger level range
DC coupled: +51 V to −51 V, adjustable via up/down control.
AC Coupled: 0 V fixed or AUTO level.
Trigger level resolution:
signals within ± 5 V: 20 mV
signals outside ± 5 V: 200 mV
Trigger level setting accuracy:
± 10 mV 1 % of setting
AUTO trigger level: Trigger level on input A (and B when required) is automatically set to 50 % of input signal amplitude. Frequency range: 100 Hz to 160 MHz (120 MHz to 160 MHz with limited temperature range; typ. +23 °C ± 5 °C)
Trigger indicators: Tri state LED-indicators;
On: Signal above set trigger level.
Off: Signal below set trigger level.
Blinking: Triggering occurs.
Trigger slopes: Positive or negative.

Auxiliary functions PM6666

Power on/off:
Switches counter power on/off. At power up a self test is performed

and the counter is set to default settings.

Default settings
Function: FREQ A
Measuring time: 0.2 s
Coupling Input A: AC
Coupling input B: DC
AUTO trigger level: On
Trigger Slope A & B: Positive

Reset:
The RESET-button has three functions:
RESET: Starts a new measurement. The settings are not changed.
LOCAL: Makes the counter go to LOCAL operation, when in remote operation (unless Local Lock-Out is programmed).
START/STOP: Opens/closes the gate in TOTALIZE A or B manual mode.

Measuring-time
A Measuring-time of 0.2 s, 1 s, 10 s or SINGLE can be selected. (When SINGLE is selected together with PERIOD, RATIO or TIME, the result is a single cycle measurement, but SINGLE together with FREQUENCY results in a fixed 3 ms measuring-time.

Measuring rate:
Approx. 5 measurements/s. Approx. 2 measurements/s when AUTO trigger level is switched on.

Display time:
Normally the display time equals the set Measuring-time. When SINGLE is selected, a display time of 0.1 seconds is used.

Display hold:
The result of the current measurement will be frozen on the display. A new measurement starts when RESET button is pressed.

SPECIFICATIONS PM6669

Measuring Modes
Freq. A, Freq. B, Period A, RPM A, Totalize A. Freq. A/Ao, Freq. A–Ao, Pulse Width A.

Frequency A or B (optional)
Frequency Range:
Freq. A: 0.1 Hz...160 MHz
Freq. B: 70 MHz...1.3 GHz (option PM 9608B)
Mode: Reciprocal frequency counting.
LSD displayed: $2.5 \times 10^{-7} \times$ FREQ / Measuring-time

Frequency A/Ao
A Frequency-A measurement is performed. The measured frequency is divided by the constant Ao before display. The resolution of the displayed ratio is determined by the FREQ A measurement. At power-on Ao is set to 1 (default).

Frequency A-Ao
A Frequency-A measurement is performed. The value of constant Ao is subtracted from the measured frequency before display. The resolution of the displayed difference is determined by the FREQ A measurement. At power-on Ao is set to 0 (default).

RPM A
A Frequency – A measurement is done. The measured frequency is multiplied with 60, and shown on the display as revolutions per minute (RPM).
Range: 6 RPM...720×10^6 RPM

Period A
Range: 8 ns...2×10^8s
Mode: Single period measurement (SINGLE) or period average measurement (at 0.2, 1 or 10 s measuring-times).
LSD displayed:
- SINGLE period measurement:
  (TIME < 100 s): 100 ns
  (TIME > 100 s): $5 \times$ PERIOD / 10^9s
- Period Average measurement:
  $2.5 \times 10^{-7} \times$ PERIOD / Measuring time

Totalize A
Event counting is controlled by the START/STOP button. Sequential start-stop counts are accumulated. RESET closes the gate and resets the Frequency Counter to zero.
Range: 0... 1×10^{15} with

indication of k or M (kilo–pulses or Mega–pulses). The result is truncated if out of display range.
Frequency range:
Sine-wave: 10 Hz...16 MHz
Pulse: 0 Hz...16 MHz
Pulse pair resolution: 80 ns
LSD displayed:
1 unit count (counts < 10^9)
$5 \times$ counts/109 (counts $\geq 10^9$)

Width A
A positive Pulse Width measurement is performed. Measuring time selection is not valid (always SINGLE measurements).
Range: 100ns...2×10^8s
LSD displayed:
(TIME < 100s): 100ns
(TIME $\geq$ 100s): $5 \times$ WIDTH / 10^9s
(Triggering on 50% of amplitude will occur only if the duty factor of the signal is 0.5)

Definitions PM6669

LSD displayed
LSD = Unit value of the least significant digit displayed. All calculated LSD's (see section Measuring functions) should be rounded to the nearest decade (e.g. 0.3 Hz is rounded to 0.1 Hz and 5 Hz to 10 Hz) and cannot exceed the 9th digit.

Resolution
Resolution = smallest increment between two measuring results on the display, due to the 1 count error.
Freq. A, B, Period:
Resolution can be 1 LSD unit or 2 LSD units if:
- LSD x Measuring time / FREQ or PERIOD < 10^{-7} the resolution is 2 LSD units (30% probability).
- Otherwise resolution is 1 LSD unit (70% probability).
SINGLE Period A and Width A:
Resolution equals 1 LSD unit.

Inaccuracy
Inaccuracy, i.e. the relative error, depends on the following factors:
$\pm$ Resolution / FREQ, PERIOD or

WIDTH
± relative trigger error
± relative time base error
Relative trigger error
Freq. A, Period A:
± noise voltage A (Vpp) / signal
slope A (V/s) x meas. time
Relative time base error:
± deviation from 10 MHz / 10 MHz

Input specification PM6669

Input-A
Frequency range:
10 Hz...160 MHz (120 MHz to
160 MHz with limited temperature
range; typ.
+23 °C ± 5 °C)
Sensitivity,
Sine: 10 mVrms, 10 Hz to
120 MHz
30 mV rms typically, 120 to
160 MHz at room temperature
Pulse: 30 mV rms,
0.1 Hz...120 MHz
Coupling: AC
Impedance: 1 MΩ // 30 pF
Attenuation: Continuously
variable in two ranges between
x1 and x400
Filter: Switchable 50 kHz low
pass noise filter with a
suppression of 20 dB at
200 kHz.
Maximum voltage: 350 V (DC +
AC peak) between 0 and 440 Hz,
falling to 11 Vrms at 1 MHz.

Triggering
Trigger levels:
3 different levels for triggering on
signals with various duty factors,
and AUTO.
– Symmetrical input signals,
should be selected for input
signals with a duty factor of
0.25...0.75.
– Positive pulses, for input signals
with duty factor <0.25.
– Negative pulses, for input signals
with duty factor >0.75.
AUTO trigger level:
The counter will make test
settings and automatically select
the best trig level setting. AUTO
requires repetitive signals with a
repetition rate > 100 Hz. AUTO is
not active in TOTALIZE–A
measurements.

Trigger slopes (via GPIB only):
Positive or negative.

Auxiliary functions PM6669

Power on/off:
Switches counter power on/off. At
power up a self-test is made and
the counter is set to default
settings.
Default settings
Function: FREQ A
Measuring time: 0.2 s
Trigger level Offset: AUTO

Reset:
The RESET-button has three
functions:
RESET Starts a new
measurement. The settings are not
changed.

LOCAL Makes the counter go to
LOCAL operation, when in remote
operation (unless Local Lock–Out is
programmed).
START/STOP, Opens/closes the
gate in TOTALIZE A.

Measuring-time
A Measuring–time of 0.2 s, 1 s,
10 s or SINGLE can be selected.
(When SINGLE is selected
together with PERIOD or WIDTH,
the result is a single cycle
measurement, but SINGLE
together with FREQUENCY or RPM
results in a fixed 3 ms Measuring–
time.)

Measuring rate:
Approx. 5 measurements/s.
Display time:
Normally the display time equals
the set Measuring–time. When
SINGLE Is selected, a display time
of 0.1 seconds is used.

Displ. Hold/Store Ao:
The DISPL HOLD/STORE AO
button has two functions
DISPL HOLD: The current
measurement result is frozen on
the display. A new measurement
starts when RESET button is
pressed.
STORE AO: This function is active
in FREQ A measurements only.
When the button is pressed for >

1 s, the result on the display is
stored as the constant AO, which
is used for the calculation of
Frequency difference (A–AO) and
ratio (A/AO).

Blank digits
This function blanks any number
of least significant digits on the
display, in order to hide unstable
digits on the display.

General Specification PM6666 & PM6669

RF Input 1.3 GHz
(Option PM 9608B)
PM6666 Input C
PM6669 Input B
Freq. range: 70 MHz to
1.3 GHz
Coupling: AC
Operating input voltage range:
10 mV rms to 12 V rms,
70 MHz to 900 MHz
15 mV rms to 12 V rms, 0.9 to 1.1
GHz
40 mV rms to 12 V rms,
1.1 to 1.3 GHz
AM tolerance: 98 %, minimum
signal must exceed minimum
operating input voltage
requirement
Impedance: 50Ω nominal, VSWR
<2:1
Maximum voltage without damage:
12 V rms, overload protection with
PIN diodes.

External reference input D
The input automatically detects
when a suitable external
reference signal is connected. The
use of an external reference signal
is indicated on the display.
Input frequency: 10 MHz ±
0.1 MHz
Coupling: AC
Sensitivity: 500 mV rms
Input impedance:
approx. 300 Ω at 10 MHz
Max input voltage: 15 V rms

Power requirements
Line voltage:
115 or 230 V rms ±15 %; 46 to
440 Hz, (<24 VA incl. all options).

Safety:
According to CE publication 73/23 EN10101, CAT II, Polution Degree 2;
CSA 22.2 No.231.
Line interference: According to CE regulation 89/336: Emission according to EN 50081-1, EN 55011. Immunity according to EN 50082-1, inclusive IEC 801-2,-3,-4
Battery unit: See PM 9605 option.

Dimensions and weight
Dimensions: Width: 186 mm
Height: 88 mm Depth: 270 mm
Weight:
PM 6666 Net: 2.4 kg, Shipping: 3.2 kg
PM 6669 Net: 2.1 kg, Shipping: 3.0 kg
Cabinet:
The counter is housed in a metal cabinet, to minimize electromagnetic interference and achieve good mechanical stability

Environmental conditions
Temperature:
Operating: 0 °C to +50 °C
Storing: –40 °C to +70 °C
Altitude:
Operating: 5000 m
(53.3 kN/m2)
Storing: 15000 m (15.2 kN/m2)
Humidity:
Operating: 10 % to 90 % RH, no condensation
Storing: 5 % to 95 % RH

Display
Read out: 9 digit LCD display with unit indication.
Unit indication: MHz, kHz, Hz, mHz, ks, s, ms, s, ns, M, k, m, m and n.
GATE indicator: Indicates that the counter is busy measuring.
REMOTE indicator: indicates when control over the counter is taken over by an installed GPIB interface PM 9604.
Cursor: Indicates selected measuring function, selected Measuring-time, input triggering, display hold and whether an external reference frequency is in use.

TimeBase Crystal Oscillators

Standard Crystal Oscillator
(order no PM 666-/-1-)
Uncertainty due to:
Calibration adjustment tolerance, at +23°C ± 3°C
$< 1 \times 10^{-6}$
Aging
- per 24 hr. N/A.
- per month: $< 5 \times 10^{-7}$ (5 Hz)
- per year: $< 5 \times 10^{-6}$ (50 Hz)
Temperature variation :
- 0 to 50°C: $< 1 \times 10^{-5}$ (100 Hz)
- 20 °C – 26 °C $< 3 \times 10^{-6}$ (typical value)
Power voltage variation 10 %: $< 1 \times 10^{-8}$ (0.1 Hz),
Power-on stability:
- Deviation versus final value after 24hr on time, N/A.
- after a warm-up time of: 30 min
Total uncertainty, for operating temperature 0°C to 50 °C, at 2σ (95 %) confidence interval:
- 1 year after calibration
  $< 1.2 \times 10^{-5}$
- 2 year after calibration
  $< 1.5 \times 10^{-5}$
Typical total uncertainty, for operating temperature 20°C to 26°C, at 2σ (95 %) confidence interval:
- 1 year after calibration
  $< 7 \times 10^{-6}$
- 2 years after calibration
  $< 1.2 \times 10^{-5}$

MTCXO :
Mathematically **T**emperature **C**ompensated **C**rystal **O**scillator (order no PM 666x/_3_)
Uncertainty due to:
Calibration adjustment tolerance, at +23°C ± 3°C
$< 1 \times 10^{-7}$
Aging
- per 24 hr. N/A.
- per month: $< 1 \times 10^{-7}$ (5 Hz)
- per year: $< 5 \times 10^{-7}$ (50 Hz)
Temperature variation :
- 0 to 50°C: $< 2 \times 10^{-7}$ (100 Hz)
- 20 °C – 26 °C $< 5 \times 10^{-8}$ (typical value)
Power voltage variation 10 %:
$< 1 \times 10^{-9}$ (0.1 Hz),

Power-on stability:
- Deviation versus final value after 24hr on time, N/A.
- after a warm-up time of: 30 min
Total uncertainty, for operating temperature 0°C to 50 °C, at 2s (95 %) confidence interval:
- 1 year after calibration
  $< 6 \times 10^{-7}$
- 2 year after calibration
  $< 1 \times 10^{-6}$
Typical total uncertainty, for operating temperature 20°C to 26°C, at 2s (95 %) confidence interval:
- 1 year after calibration
  $< 6 \times 10^{-7}$
- 2 years after calibration
  $< 1 \times 10^{-6}$
The MTCXO can be ordered separately for later upgrading of the counter (option PM 9607).

MTCXO working principle:
(Mathematically Temperature Compensated Crystal Oscillator) The temperature of the crystal is measured. The built in microprocessor calculates the frequency deviation for that particular temperature from a stored table. The measuring result is mathematically corrected for the time-base frequency temperature error, before being displayed. The correction is switched off when SINGLE is selected to increase the number of measurements/second. This may introduce an additional time base error of $< 1 \times 10^{-5}$.

Explanation:
Calibration Adjustment Tolerance:
Is the maximal tolerated deviation from the true 10MHz frequency after a calibration. When the reference frequency does not exceed the tolerance limits at the moment of calibration, an adjustment is not needed.

Total uncertainty:
Is the total possible deviation from the true 10MHz value under influence from frequency drift due to aging and ambient temperature variations versus the reference temperature. The operating

temperature range and the calibration interval are part of this specification.

GPIB Interface

Option PM 9604
Mounting: Inside counter cabinet.
Interface functions: SH1, AH1, T5, L4, SRI, RL1, DC1, DT1, E2
Address setting:
Switch selectable at rear panel between 0 and 30. Factory Preset at 10.
Programmable device Functions for:
PM 6666 Full GPIB programmability, Auto trigger, Voltage Measurements.
PM 6669 All front panel settings except Power On/Standby, Sensitivity and Filter On/Off; plus trigger Slope (Pos/Neg)

Max Data Output Rate
Normal Mode: Approx. 5 readings/s
High-Speed Dump: Approx. 100 readings/s.
The highest output rate is obtained for **PM6666** at SINGLE measuring time. The content of the counting registers are transferred to the controller, without being processed by the counter. The processing must be done in the controller instead.

Output Time for measuring Data
Normal Mode:
Approx. 10 ms (21 bytes)
High-Speed Mode:
Approx. 4 ms (15 bytes)
Response time for Addressing:
Approx. 5 µs
Response Time for Trigger Command (GET):
Approx. 10 ms
Typical Read Time for Programming Data:
Approx. 1 ms/byte

Battery unit PM 9605
The PM 9605 is a rechargeable battery unit for mounting inside the counter. The unit contains a standard 6 V sealed lead-acid battery and an automatic battery charger.
Battery capacity (20 °C):

Approx. 15 Wh
Operating time when battery powered for:
PM 6666 2 hours of cont. operation.
PM 6669 3 hours of cont. operation.
Recharging time: 7 hours to approx. 75 % of full capacity.
Battery protection: Overcharge protection and auto-shut-off total discharge protection.
Temperature:
Operating: 0 ...+ 40 °C
Storage: –40 ... + 50 °C
Weight: 0.8 kg

Carrying Case PM9609
The PM9609 is a leather like carrying case, for protection of the counter during transportation

Ordering Information

Basic Models
PM 6666/011 Timer/Counter
PM 6669/011 Frequency Counter

Included with Instrument
One-year product warranty, line cord, operator manual, and Certificate of Calibration Practices.

Optional Configurations
When ordering, select basic "PM" Model desired from above, plus construct a 3-digit/suffix by selecting 1-digit in each suffix column to identify Input Frequency, Reference Oscillator, and Interface.

RF Input Frequency Option
/0– – Standard 160 MHz
/4– – 1.3 GHz (PM 9608/201)

Reference Oscillator Option
/–1 – Standard
/–3 – MTCXO (PM 9607/00)

Interface Option
/– –1 Standard line voltage, non GPIB/IEEE-488
/– –3 Battery (PM 9605/00)
/– –6 GPIB/IEEE-488 (PM 9604/00)

Options & Accessories
PM 9581/011 50Ω Termination, 3W

PM 9585/011 50Ω Termination, 1W
PM 9604/001 * GPIB Interface
PM 9605/001 * Battery Unit
PM 9606/021 Rack kit for PM 666x and 8840A/42A
PM 9606/011 Rack Kit for PM 666x
PM 9607/001 MTCXO Time Base
PM 9608/201 1.3 GHz RF-Input
PM 9609/001 Carrying Case
All options can be field installed by the user.
* Note: Options PM 9604 and PM 9605 cannot be installed together in a PM 666x Counter.

Manuals
PM 6666 Operator**
PM 6669 Operator**
PM 6669 Service
PM 6666 Service
**No charge with purchase of unit

Factory Warranty
One-year product warranty.