SPECIFICATIONS

Measuring Functions

Frequency A or B

Range,

Freq A: 0.1 Hz to 160 MHz

Freq B: 70 MHz to 1.3 GHz (option PM 9608B)

Mode: Reciprocal frequency counting.

LSD unit displayed: $\frac{2.5 * 10^{-7} * FREQ}{Measuring\ time}$

Frequency A/A_0

A Frequency A measurement is performed. The measured frequency is divided by the constant A_0 before display. The resolution of the displayed ratio is determined by the FREQ A measurement. At power on A_0 is set to 1 (default).

Frequency A-A_0

A Frequency A measurement is performed. The value of the constant A_0 is substracted from the measured frequency before display. The resolution of the displayed difference is determined by the FREQ A measurement. At power on A_0 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 to $720 * 10^6$ RPM

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: $100\ ns\ (TIME < 100s)$

$\frac{5 * PERIOD}{10^9\ s}\ (TIME > 100s)$

Period average measurement: $\frac{2.5 * 10^{-7} * PERIOD}{Measuring\ time}$

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 to $1 * 10^{15}$ with indication of k or M (Kilo-pulses or Megapulses). The result is truncated if out of display range.

Frequency Range:

Sine-Wave: 0 Hz to 16 MHz

Pulse: 0 Hz to 16 MHz

Pulse Pair Resolution: 8 ns

LSD displayed: 1 unit count (counts < 10^9)
$5 * counts/10^9$ (counts ≥ 10^9)

Width A

A positive Pulse Width measurement is performed. Measuring time selection is not valid (always SINGLE measurement).

Range: $100\ ns\ to\ 2 * 10^8\ s$

LSD Displayed: $100\ ns\ (Time < 100\ s)$

$$\frac{5 * WIDTH}{10^{9}\ s}\ (Time > 100\ s)$$

NOTE: Triggering on 50% of amplitude will occur only if the duty factor of the signal is 0.5.

Definitions

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, and Period A: Resolution can be 1 LSD unit or 2 LSD units.

If; $\frac{LSD * Measuringtime}{FREQ\ or\ PERIOD} < 10^{-7}$

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:

$\frac{Resolution}{FREQ, PERIOD, or\ WIDTH}$

± relative trigger error

± relative time base error

Relative trigger error, Freq A, Period A:

$$\pm \frac{noise\ voltage\ A\ (V_{pp})}{signal\ slope A\ (V/s) * meas\ time}$$

Relative time base error: $\pm \frac{deviation\ from\ 10\ MHz}{10\ MHz}$

Input specifications

Input-A

Frequency Range: 0 Hz to 160 MHz

Sensitivity,

Sine: 10 mV_{RMS} 10 Hz to 120 MHz
30 mV_{RMS} typically 120 MHz to 160 MHz

Pulse: 30 mV_{RMS} 0.1 Hz to 120 MHz

Coupling: AC

Impedance: 1 MΩ // 30 pF

Attenuation: Continously variable in two ranges between x1 and x400.

Filter: Switchable 50 kHz low pass noise filter, on Input-A, with a suppression of 20 dB at 200 kHz.

Trigger Levels: Three different levels for triggering on signals with various duty factors, and AUTO.

⎍ symmetrical input signals, should be selected forinput signals with a duty factor of 0.25 to 0.75%.

⎍ positive pulses, for input signals with duty factor <25%.

⎍ negative pulses, for input signals with duty factor >75%.

AUTO Trigger Levels: The counter will make test settings and automatically selects the best trig level setting. AUTO requires repetetive signals with a repetition rate >100 Hz. AUTO is not active in TOTALIZE A measurements.

Trigger Slopes via GPIB Only: Positive or negative.

Maximum Voltage: 350 V (DC + AC_{peak}) between 0 and 440 Hz, falling to 11 V_{RMS} at 1 MHz.

Input-B

(option PM 9608B)

Frequency 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}, 900 MHz 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.

Ext Reference Input

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. 300Ω at 10 MHz

Max Input Voltage: 15 V_{RMS}

General Information

Power Requirements

Line Voltage: 115 or 230 V_{RMS} 15%;
46 to 440 Hz, (<20 VA incl. all options).

Safety: in accordance with IEC publication 1010-1, and CSA 22.2 No.231.

Line Interference: below VDE 0871 B and MIL STD 461.

Battery Unit: See PM 9605 option.

Dimensions and Weight

Width: 186 mm

Height: 88 mm

Depth: 270 mm

Weight, net: 2.1 kg, shipping:3.0 kg

Cabinet: The counter is housed in a metal cabinet, to minimize electro-magnetic 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/m^2)

Storing: 15000 m (15.2 kN/m^2)

Humidity,

Operating: 10% to 90% RH, no condensation

Storing: 5% to 95% RH

Vibration Test: According to IEC 68Fc

Bump Test: According to IEC 68Eb

Handling Test: According to IEC 68Ec

Display

Read Out: 9 digit LCD display with unit indication.

Unit Indication: MHz, kHz, Hz, mHz, ks, s, ms, µs, ns, M, k, m, µ,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.

Time Base (Crystal Oscillator)

Choice of:

– Uncompensated crystal oscillator (order no PM 6669/.1.)

– MTCXO, i.e. Mathematically Temperature Compensated Crystal Oscillator (order no PM 6669/.3.). The MTCXO can be ordered separately for later upgrading of the counter (option PM 9607).

MTCXO Working Principle: 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 mathe-

matically corrected for the time-base frequency temperature error, before being displayed.

Oscillator Version:

	Uncompensated	MTCXO
Stability against:		
Ageing per month	$< 5 * 10^{-7}$	$< 1 * 10^{-7}$
per year	$< 5 * 10^{-6}$	$< 5 * 10^{-7}$
Temperature changes 0 to 50°C	$< 1 * 10^{-5}$	$< 2 * 10^{-7}$
Line voltage changes 10%	$< 1 * 10^{-8}$	$< 1 * 10^{-9}$

Auxiliary Functions

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 or B manual mode.

Measuring-Time

A measuring-time of 0.2 s, 1 s, 10 s or SINGLE can be selected.

NOTE: 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 A_0

The DISPL HOLD/STORE A_0 button has two functions:

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

STORE A_0 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 A_0, which is used for the calculation of frequency difference ($A-A_0$) and ratio (A/A_0).

Blank Digits

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

Optional Accessories

GPIB-Interface, PM 9604

Mounting: Inside counter cabinet.

Interface Functions: SH1, AH1, T5, L4, SR1, RL1, DC1, DT1, E2

Address Setting: Switch selectable at rear panel between 0 and 30. Factory preset at 10.

Programmable Device Functions:
Measuring functions
Measuring-time
Trigger slope
Manual Totalize gate control
Output separator selection
Device clear
Device trigger
High-speed dump
MTCXO on/off
Short output format
Free run/Triggered measurements
Set SRQ-mask
Program data out queries
Device identity query

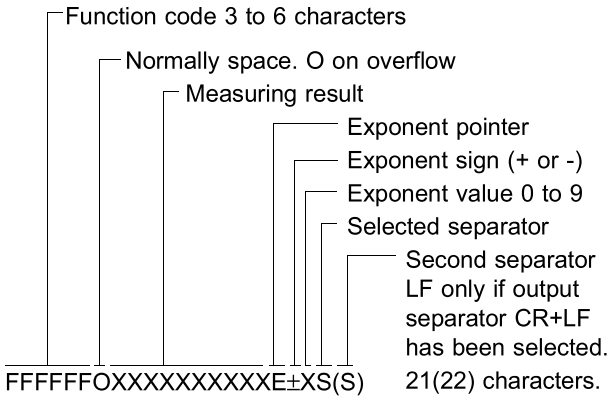
Programming Code Format: 7-bit ISO code (ASCII) characters. Both upper and lower case characters are accepted.

Input Separator: The counter accepts the following characters as separators:
ETX, ETB, CR, LF, ' '(space) ','(comma), ':'(colon) ';'(semicolon).

Output Data Separator: Default separator at power-on is LF. The separator can be programmed to be any non printable ASCII-code with decimal equivalent 0-31, except 27 (ESC).

In addition the combination 13+10 (CR+LF) can be programmed. The EOI-line can be programmed to be active together with the last output byte sent.

Output Format:
Measuring result is sent as:



When you select 'Short output format' FFFFFF and leading zeroes are omitted.

High-Speed Dump
The contents of the counting registers are transferred to the controller, without being processed by the counter. The processing must be done in the controller instead. Max output rate is approximately 100 readings/s.

The output format is FMXXXXXXXXXXXXS(S) where F is calculation formula, M is multiplier, X..X = 12 hex-digits representing the register contents, and S(S) is the set output separator.

Ranges: Same as for normal operation, with the following exceptions:

Frequency; Max measuring time: 1 s

Period, Average; Max measuring time: 1.4 s

Time Interval, Average; 0 ns to 1.6 s
Max measuring time: 4 s

Ratio A/B: 0 and $6*10^{-7}$ to $1.6*10^{8}$

Ratio B/A: 0 and $6*10^{-8}$ to $1.6*10^{7}$

Ratio C/A, C/B: 8 to $4*10^{9}$

Max Data Output Rate: Normal mode gives >5 readings/s. High-speed dump gives >100 readings/second.
The highest output rate is obtained at SINGLE Measuring-time.

Output Time for Measuring Data;

Normal operation: Approx. 10 ms (21 bytes)

High-speed dump: Approx. 4 ms (15 bytes)

Response time for addressing: Approx. 5 µs

Response Time for Trigger Command (GET):

Normal Operation: Approx. 10 ms

High-Speed Dump: Approx. 2 ms

Response Time for Serial Poll: Approx. 1.5 ms

Input Buffer Size: 28 bytes

Typical Read Time for Programming Data: Approx. 1 ms/byte (unless input buffer is full)

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: 3 hours of continuous 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 to +40°C

Storage: –40 to +50°C

Weight: 0.8 kg

Rack Mounting Adapter, PM 9606/01

The PM 9606/01 is a 19" wide Rack Mounting Adapter. It can host one PM 6662, PM 6665, PM 6666 or PM 6669 Counter only.

Rack Mounting Adapter, PM 9606/02

The PM 9606/02 is a 19" wide Rack Mounting Adapter. It can host one PM 6662, PM 6665, PM 6666 or PM 6669 Counter together with a second instrument.

That second instrument can be a Philips PM 2534 to 35 or a FLUKE 8840 Digital Multimeter, or another PM 666X counter.

High Stability Time-Base PM 9607

See specifications for optional MTCXO time-base.

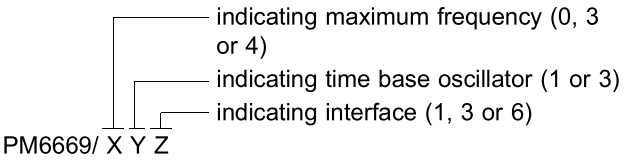
HF-Input PM 9608B

See specifications for optional Input-C.

Ordering Information

Versions

The PM 6669 ordering number consists of the basic type number and a 3 digit XYZ suffix, specifying the re-quired con-figuration.



Type No.	Description
PM 6669/011	Frequency counter, 160 MHz frequency range, uncompensated oscillator $5*10^{-7}$/month, incl. operators manual.
PM 6669/4..	As above, but including 1.3 GHz HF-input PM 9608B.
PM 6669/.3.	As above, but including crystal oscillator PM 9607 (MTCXO).
PM 6669/..3	As above, but including battery unit PM 9605.
PM 6669/..6	As above, but including GPIB interface PM 9604.

Example: PM 6669/416 means a PM 6669 frequency counter, including both an 160 MHz and an 1.3 GHz input channel, an uncompensated oscillator and a GPIB interface.

Options and Accessories

PM 9604	GPIB-interface
PM 9605	Battery unit
PM 9606	Rack-mount kit
PM 9607	MTCXO time-base
PM 9608B	1.3 GHz HF-input
PM 9609	Carrying case
PM 2296/50	IEEE to IEC adapter
PM 2295/05	IEEE cable, 0.5 m
PM 2295/10	IEEE cable, 1 m
PM 2295/20	IEEE cable, 2 m
PM 8911	1.5 GHz, 500Ω probe set, 1:10
PM 8922	120 MHz, 1 MΩ probe set, 1:1 and 1:10
PM 8943	650 MHz, 1 MΩ FET probe set
PM 9581	50Ω termination, 3 W
PM 9585	50Ω termination, 1 W

All options mentioned above can be installed by the cus-tomer.

NOTE: The GPIB interface PM 9604 and the battery unit PM 9605 can not be installed together in a PM 6669 counter.

Manuals

4822 872 20021	Operators Manual
4822 872 20022	Operators Manual (German)
4822 872 20023	Operators Manual (French)
4822 872 25006	Service Manual
4822 872 20016	GPIB Pocket Guide