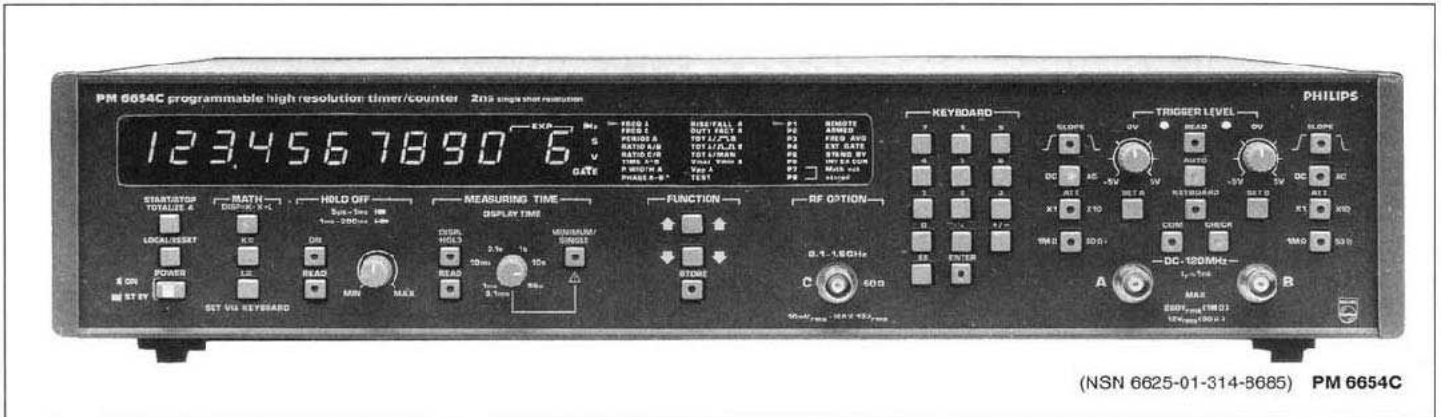


# System Timer/Counters

## PM 6654C & PM 6652C



(NSN 6625-01-314-8685) PM 6654C

### PM 6654C & PM 6652C System Timer/Counters

- High accuracy FREQUENCY and PERIOD measurements of 9 digits in one second
- High sensitivity 1.5 or 2.3 GHz inputs with wide 10 mV rms to 12V rms dynamic range
- TIME-INTERVAL resolution down to 0.5 ps averaged and 2 ns single shot
- Measuring modes incl.: Phase, Rise/Fall Time, Duty Factor, V max/min/p-p of input
- 8 pre-programmable front panel menus: digital readout of trigger levels
- Mathematical functions
- Trigger facilities include Arming, Hold-Off, External Gating and Auto Triggering Level

### Introduction

PM 6652C and PM 6654C high performance, fully programmable timer/counters satisfy virtually all frequency and time measurement requirements, especially in R & D laboratories and automatic test systems applications.

The measuring functions and appearance of both instruments are the same. The difference is found in resolution, accuracy and measuring speed. The PM 6652C has a 10 MHz (100 ns) clock frequency, whereas the extra high resolution PM 6654C features a 500 MHz (2 ns) realtime clock resolution. Thanks to its short measuring cycle times, the extra high resolution PM 6654C is particularly well suited to high speed automatic test systems. Both the PM 6652C & 6654C timer/counters offer 14 frequency, time and voltage measuring modes, 100% GPIB/IEEE-488\* bus programmability, over 400 readings/second bus speed, 2 ns single shot resolution and 2.3 GHz frequency range.

### High Time Interval Measuring Accuracy

A unique combination of high resolution, high trigger accuracy and special trigger control facilities puts these instruments among the most powerful timers on the market.

The high technology PM 6654C with its 2 ns single shot resolution allows time interval measurements to be made to an accuracy and resolution well beyond those of normal timer/counters.

Repetitive signals allow significantly improved resolution by averaging of measuring results. Time intervals, pulse widths, rise and fall times can be measured this way down to sub-pico-second resolution with the PM 6654C and down to 10 ps resolution with the PM 6652C.

### Powerful FREQUENCY Measuring Capabilities

High accuracy FREQUENCY and PERIOD measurements can be made in a one second measuring time with resolution of 9 digits in the PM 6654C and 7 digits in the economy version PM 6652C. Both models perform advanced frequency measurements, including externally gated frequency measurements, burst frequency and multiple burst frequency average measurements on down to 200 ns narrow bursts (500 ns for PM 6652C).

Trigger HOLD-OFF, when activated in the FREQUENCY and PERIOD modes, acts as a digital low-pass filter to ignore noise and interference, thereby preventing erroneous measurements.

### Complete Triggering Capability

Ultimately, no timer measures more accurately than its trigger accuracy. The PM 6652C's and PM 6654C's inputs therefore features very fast 1 ns rise time and 20 mV rms, sensitivity over a -5V to +5V dynamic range, Trigger level accuracy is assured by digital setting and display with 10 mV resolution.

The trigger level may be set by knob controls, keyboard entry, or automatically. In the AUTO mode the counters automatically set A and B trigger levels to 50% of input signal amplitude or 10% and 90% for rise/fall time measurements.

Automatic hysteresis compensation ensures that the actual triggering occurs at the set trigger level and is not delayed by the input hysteresis. Arming and trigger hold-off enable unwanted signals to be ignored.

### Mathematics

The MATH (mathematics) facility allows scaling and/or off-setting of measured results before display. This significantly extends the range of application by enabling calibration or unit conversion.

### Powerful IEEE-488 Bus Capabilities

Both the PM 6652C and PM 6654C are fully programmable, including all front-end controls and trigger level voltages. Advanced software features are available, including bus learn mode and programmable delimiters. In addition, the high-speed dump mode allows the user to fully exploit the high resolution/high-measuring speed of the PM 6654C, allowing up to 400-500 measurements per second. Pre-set limit monitoring is another useful feature, allowing the counter to send an SRQ when low or high limits are exceeded.

\* The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.

# System Timer/Counters

## PM 6654C & PM 6652C

### Specifications

#### Measuring Functions

##### Frequency A

Range  
**PM 6652C:** 0.1 Hz to 120 MHz  
**PM 6654C:** 0.01 Hz to 120 MHz

##### Frequency C Optional

Range: 100 MHz to 1.5 GHz (Option PM 9610)  
 Range: 100 MHz to 2.3 GHz (Option PM 9619)

##### Period A

Range  
**PM 6652C:** 100 ns to 10<sup>10</sup>s, resolution 100 ns  
**PM 6654C:** 8 ns to 10<sup>10</sup>s, resolution 2 ns

##### Time Interval A to B, Pulse Width A, Rise/Fall A; Single

Range  
**PM 6652C:** 100 ns to 10<sup>10</sup>s, resolution 100 ns  
**PM 6654C:** 8 ns to 10<sup>10</sup>s, resolution 2 ns

##### Time Interval A to B, Pulse Width A, Rise/Fall A; Averaged

Range  
 Time Interval: 0 ns to 100s  
 Pulse Width: 4 ns to 100s  
 Rise/Fall Time: 8 ns to 100s

Resolution  
**PM 6652C:** (100 ns)/√N  
**PM 6654C:** (10 ns)/√N

##### Duty Factor A

Range: 0 to (1 - 250 ns x Pulse rep. rate)  
 Frequency Range: 0.03 Hz to 2 MHz

##### Totalize A

Range: 1 to 10<sup>10</sup>  
 Frequency Range: 0 to 120 MHz  
 Mode: Manual or external

##### Ratio A/B

Range: 10<sup>-9</sup> to 10<sup>10</sup>  
 Frequency Range: 0.1 Hz to 120 MHz/0.01 Hz to 10 MHz

##### Ratio C/B

Range: 10 to 10<sup>11</sup>  
 Frequency Range: Input C range/0.01 Hz to 10 MHz

##### Phase A-B

Range: 0° to 360° / (1 - 250 ns x FREQ)  
 Frequency Range: 0.03 Hz to 2 MHz

##### V Max, V Min, V p-p

Range: -50V to +50V  
 Frequency Range: DC, 100 Hz to 120 MHz

### Input and Output Specifications

#### Inputs A and B

**Frequency Range:** DC-coupled: 0 to 120 MHz; AC-coupled: 20 Hz to 120 MHz  
**Rise Time:** Approx 1 ns  
**Sensitivity:** 20 mV rms sinewave or 60 mV p-p (0 to 60 MHz); 30 mV rms sinewave or 90 mV p-p (60 MHz to 120 MHz)  
**Min. Pulse Duration:** 4 ns  
**Attenuation:** x 1, x 10 (fixed)  
**Hysteresis Band:** Approx. 40 mV p-p  
 Hysteresis compensation is automatically performed in TIME A-B, P Width A, RISE/FALL a, PHASE A-B and DUTY FACTOR measuring modes; resulting in a residual hysteresis band which is virtually 10 mV p-p.  
**Dynamic Input Voltage Range:** 60 mV p-p within ±5V p-p±5V dc (x 1); 600 mV p-p within ±50V p-p 50V dc (x 10)

**Trigger Level Selection:** Manually via keyboard (10 MV steps); Manually via potentiometers; Auto trigger

**Trigger Level Range:** -5V to +5V (x 1); -50V to +50V (x 10)

**Trigger Slopes:** Positive or negative

**Trigger Level Readout:** Set trigger levels for channel A and B are displayed with a resolution of 10 mV (x 1) or 100 mV (x 10)

**Trigger indicators:** Tri-state LED indication

**AUTO Trigger:** The AUTO trigger will automatically set A and B trigger levels to 50% of input signal amplitude (10% and 90% for rise/fall time measurements).

**Min. Amplitude:** 120 mV p-p

**Frequency range:** 100 Hz to 120 MHz

**Coupling:** DC/AC

**Channel Input:** Separate A and B or common via A

#### Impedance

**Separate A and B:** 1 MΩ/35 pF or 50Ω nominal (A and B);

#### Crystal Oscillator Summary

PM 66..J to Version Including Time Base Option	/1. Standard Version	/2. Version PM 9678B	/4. Version PM 9690	/5. Version PM 9691
Stability Against	Standard	TCXO	Oven	Oven
Aging: /24h /Month /Year	N/A <5 x 10 <sup>-7</sup> <5 x 10 <sup>-6</sup>	N/A <1 x 10 <sup>-7</sup> <5 x 10 <sup>-7</sup>	<1.5 x 10 <sup>-9*</sup> <3 x 10 <sup>-8</sup> <1.5 x 10 <sup>-7</sup>	<5 x 10 <sup>-10*</sup> <1 x 10 <sup>-8</sup> <7.5 x 10 <sup>-8</sup>
Temperature: 0°C to 50°C Ref. to +23°C	<1 x 10 <sup>-5</sup>	<1 x 10 <sup>-6</sup>	<3 x 10 <sup>-8</sup>	<5 x 10 <sup>-9</sup>
Change in supply mode: line/nt battery/ext DC 12V to 28V	<3 x 10 <sup>-7</sup>	<5 x 10 <sup>-8</sup>	<3 x 10 <sup>-9</sup>	<3 x 10 <sup>-9</sup>
Line Voltage: ±10%	<1 x 10 <sup>-8</sup>	<1 x 10 <sup>-9</sup>	<5 x 10 <sup>-10</sup>	<5 x 10 <sup>-10</sup>
Warm-up time to reach 10 <sup>-7</sup> of final value	N/A	N/A	<15 min	<15 min

\*After 48 hours of continuous operation

**Common A:** 0.5 MΩ/70 pF nominal or 50Ω nominal (A). Open input (B).

#### Input C (Option/PM 9610)

**Frequency:** 100 MHz to 1.5 GHz  
**Operating Input Voltage Range:** [10 mV rms to 12 mV rms (100 MHz to 1 GHz); [30 mV rms to 12 mV rms (1 to 1.5 GHz)

**Coupling:** AC

**Impedance:** 50Ω nominal; VSWR ≤2

**AM Tolerance:** 98%; minimum signal must exceed minimum operating input voltage

**Max Voltage Without Damage:** 12V rms; overload protection with PIN diodes

#### Input C (Option PM 9619)

**Frequency Range:** 0.1 to 2.3 GHz

**Coupling:** AC

**Operating Input Voltage Range:**

20 mV rms to 12V rms; 100 to 300 MHz  
 10 mV rms to 12V rms; 0.3 to 2 GHz  
 15 mV rms to 12V rms; 2 to 2.1 GHz  
 25 mV rms to 12V rms; 2.1 to 2.3 GHz\*

**AM Tolerance:** 94% at max 100 kHz modulation frequency. Minimum signal must exceed minimum operating input voltage requirement.

**Input Impedance:** 50Ω nominal

**VSWR:** <2.0:1; 50 to 1500 MHz

<2.5:1; 1.5 to 2 GHz

<3.5:1; >2 GHz

**Max Voltage Without Damage:** 12V rms; overload protection with pin diodes Rear Panel Inputs and Outputs

#### Rear Panel Inputs and Outputs

**Input D:** 100 kHz to 10 MHz external reference frequency

**Input E:** External reset

**Input F:** External arming, external gate or average

**Output G:** 10 MHz internal reference frequency

**Output H:** Gate open/closed output signal

**Output I and J:** Channels A and B trigger levels

# System Timer/Counters

## PM 6654C & PM 6652C

### GPIB/IEEE-488 Bus

All front panel accessible functions are programmable through the option PM 9696B.

**Date Output Rate:** 30 to 50 readings/s in normal mode, approx. 420 readings/s in high speed dump mode.

### General Specifications

**Measuring Time:** 0.1 ms to 96s, down to approx. 2  $\mu$ s for single events measurements or external gate

**Display hold:** Freezes measuring result

**Trigger Hold Off Range:** 5  $\mu$ s to 200 ms (manual setting)

**Time Interval Delay:** 100  $\mu$ s to 99s; bus programmable Hold-off active in single-shot Time Interval, Pulse width or Rise/Fall Time measurement.

**Mathematics:** Mathematics makes it possible to offset a measuring value or to change scale factor as follows: KX+L.

**Check:** Applies 10 MHz Time Base Frequency to the measuring logic

**Reset:** Manual via push-button or electrical via input E

**Power On/Stand By:** In "ST BY" position, power is available to maintain an ovenized crystal oscillator

**Test Function:** Performs internal self test

**Program Memory:** 8 complete instrument settings can be saved and recalled from internal non-volatile memory

**Display:** 10 digits LED display, sign and exponent

**Unit Indicators:** 3 LEDs indicating Hz, s or V

**Operating Temperature:** -5° C to 50° C

**Power Requirements:** 115/230V  $\pm$  15%, 45 to 440 Hz; 60 VA. The PM 6652C and PM 6654C can also be powered by an external dc voltage; 17V to 29V.

**Size:** 440 mm W x 89 mm H x 440 mm L (17.3 in W x 3.5 in H x 17.3 in L)

**Weight:** Net, 8 kg (17.5 lb); shipping, 10 kg (22 lb)

## Ordering Information

### Models

**PM 6652C** 120 MHz, 100 ns Timer/Counter  
**PM 6654C** Plus 2 ns resolution

### Included with Instrument

One-year product warranty, line cord, rack mounting brackets, Operating 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.

### Input Frequency Option

/0-- Standard 120 MHz

/5-- 1.5 GHz (PM 9610/01)

/6-- 2.3 GHz (PM 9619)

### Reference Oscillator Option

/-1- Standard Crystal

/-2- TCXO (PM 9678B/01)

/-4- Very High Stability Ovenized Crystal (PM 9690/01)

/-5- Ultra High Stability Ovenized Crystal (PM 9691/01)

/-8- Standard Crystal plus Externally Referenced Frequency Multiplier (PM 9697/00)

### Interface Option

/--1 Standard Front Panel Control

/--2 Blind Panel Version with GPIB IEEE-488 I/F (PM 9696B/00)

/--5 Standard Front Panel with Analog Recorder Output (PM 9695/00)

/--6 Standard Front Panel with GPIB IEEE-488 I/F (PM 9696B/00)

### Example, Ordering Configuration

To order the 120 MHz, 100 ns resolution version with TCXO oscillator and standard front panel with GPIB IEEE-488 I/F, select:

Configuration	Model
Option Suffix -	PM 6652C
Input	/0--
Oscillator	/-2-
Interface	/--6
Yields Complete Model Number	PM 6652C/026

### Options and Accessories

**PM 9585/01** 50 $\Omega$  Feedthrough Termination; 1W

**PM 9610/01** 1.5 GHz Option (input C)

**PM 9611/01** Built-in Rear Panel Input

Wiring Option

**PM 9612/01** Fan

**PM 9613/01** Rack Mount Slide Kit

**PM 9619** 2.3 GHz Option (input C)

**PM 9665B/01** 50 kHz Low Pass Filter

**PM 9666/01** Trigger Level Output Cable

**PM 9678B/01** TCXO Time Base Oscillator (version/.2.)

**PM 9690/01** Ovenized Time Base Oscillator (version/.4.)

**PM 9691/01** Ovenized Time Base Oscillator (version/.5.)

**PM 9695/00** Analog Recorder Output

**PM 9696B/00** IEEE-488 Bus Interface

**PM 9697/00** External Reference Frequency Multiplier

*The time base oscillators PM 9678 to PM 9691 can also be ordered separately for later upgrading of the counters.*

*The PM 9611 option is not customer retrofittable, but must be ordered factory installed. The PM 9697 multiplier can be installed only in the /-1- versions.*

*Older versions of bus interface, PM 9696 without "RTL-update," cannot be used in a PM 6652C or PM 6654C.*

### Manuals

**PM 6652/54** Pocket Guide

**PM 6652/54** Operator\*

**PM 6652/54C** Service

\*No charge with purchase of unit

### Customer Support Services

Also see Section 20.

### Factory Warranty

One-year product warranty.