

Fluke PM6652/016

Programmable High Resolution Timer/Counter



\$1995.00

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IEEE 488

IEC 625

**PM 6652 PROGRAMMABLE
PM 6654 TIMER/COUNTERS**

Pocket guide

831015

9499 460 1111

BUS INTERFACE CHARACTERISTICS

Description	Code	Capability
Source handshake	SH1	Complete
Acceptor handshake	AH1	Complete
Control function	C0	No controller
Talker function	T5	Complete
Listener function	L4	Complete (except listen only)
Service request	SR1	Complete
Remote/local function	RL1	Complete
Parallel poll	PP0	No parallel poll
Device clear function	DC1	Complete
Device trig. function	DT1	Complete

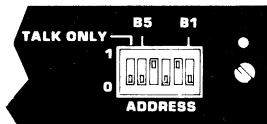


**Test & Measuring
Instruments**

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SETTINGS



Address selection switches

The counter address is selectable by the B5 . . . B1 switches at rear panel address selector. All addresses except 31 (= 11111_{binary}) are allowed. At delivery the selected address is 10 (01010_{binary}).

Talk only switch

1 = Talk only mode ON
0 = Talk only mode OFF

INPUT DELIMITERS ACCEPTED ARE:

LF	(Line feed)
CR	(Carriage return)
ETX	(End of text)
ETB	(End of transmission block)
,	(Comma)
;	(Semicolon)

OUTPUT DATA FORMAT

NORMAL OUTPUT FORMAT

FF SP X X X X X X X X X X E ± X D (D)

- Bytes 1,2 FF = Function code, see table.
 Byte 3 Normally a space character. On overflow, 0 is sent.
 Bytes 4..14 XXXXXXXXXXXX; 11 characters are digits; one is a floating decimal point.
 Byte 15 E is an exponent pointer.
 Byte 16 Exponent sign is + or - .
 Byte 17 Exponent value X is either 0 or multiples of ±3.
 Byte 18 Delimiter CR, LF, ETX or ETB.
 Byte 19 Second delimiter LF (only if delimiter combination is CR + LF).

FUNCTION CODES

Codes	Functions
DF	Duty Factor A
FA	Frequency A
FC	Frequency C
HT	Hold-off Time
MT	Measuring Time
PA	Period A
PH	Phase A-B
PW	Pulse Width A
RA	Ratio A/B
RC	Ratio C/B
RT	Rise/Fall Time A
TG	Tot A gated by B
TI	Time Interval A-B
TL	Trigger Levels A, B
TM	Tot A, Manual
TS	Tot A, Start/Stop by B
VM	V _{max} , V _{min} A
VP	V _{peak-peak} A

PROGRAMMING CODES

PROGRAMMING CODES

PROGRAMMING CODES

PM 6654 programmable high resolution timer/counter 2ns single shot resolution

EXP

HZ

FREQ A

PERIOD A

RATIO A/B

TIME A-B

DWIDTH A

PHASE A-B

DISP/FALL A

DUTY FACT A

TOT A/F/L/B

TOT A/J/L/B

Vmax Vmin

Vpp A

TEST

P1

P2

P3

P4

P5

P6

P7

P8

REMOTE ARMED

FREQ AVG

EXT GATE

STAND BY

MATH NOT STORED

START/STOP TOTALIZE A

TO1

TO0

RESET

X

POWER

ON

ST BY

MATH DISP-K-X+L

ME1

ME0

K=

SK...

L=

SL...

HOLD OFF

5µs-1ms

1ms-200ms

ON

HE1

HE0

READ

RH1

RH0

MIN

MAX

MEASURING TIME

DISPLAY TIME

DISPL HOLD

TE1

TE0

10ns

1ms

96s

SM...

MINIMUM/SINGLE

SS1

SS0

RM1

RM0

FUNCTION

▲

▼

STORE

F1...F15

TS1...TS6

LP1...LP8

SP1...SP8

RF OPTION

0.1-1.5GHz

C

50Ω

10mVrms-MAX 12Vrms

KEYBOARD

7

8

9

4

5

6

1

2

3

0

+

-

EE

ENT R

TRIGGER LEVEL

OV

READ

OV

SLOPE

AS0

AS1

AC0

AC1

AA0

AA1

AT0

AT1

RL1

RL0

TL2

TL1

CE1

CE0

CH1

CH0

BS0

BS1

BC0

BC1

BA0

BA1

BT0

BT1

A

B

DC-120MHz

MAX

260Vrms(1MΩ)

12Vrms(50Ω)

Measuring/Display time	Programming code
Set measuring time (100µs...99s)	SM...*
Single/min. meas. time (on, off)	SS1, SSO
Read meas. time (on, off)	RM1, RMO
Display Hold, off	TE0
Display Hold, on	TE1
"RESET" (start new measurement)	X

Bus triggering	Programming code
Triggered mode (Display Hold)	TE1
Free run	TE0
Start new measurement	X

NOTE: individual measurements, "TE1", are triggered by GET (Group Execute Trigger) or by sending "X".

Miscellaneous settings	Programming code
Set math constants K, L	SK...*, SL...*
Math function (on, off)	ME1, ME0
Hold-Off (on, off)	HE1, HE0
Read Hold-Off time (on, off)	RH1, RHO
Tot A manual start	TO1
Tot A manual stop	TO0

Measuring functions	Programming code
Frequency A	F1
Frequency C	F2
Period A	F3
Ratio A/B	F4
Ratio C/B	F5
Time interval A-B	F6
Pulse width A	F7
Phase A-B	F8
Rise/Fall time A	F9
Duty factor A	F10
Tot A gated by B	F11
Tot A start/stop by B	F12
Tot A Manual start/stop	F13
Vmax, Vmin A	F14
Vpp A	F15

Miscellaneous functions	Programming code
Test mode (Test 1...6)	TS1...TS6
Store front panel menu in P1...P8	SP1...SP8
Load front panel menu from P1...P8	LP1...LP8

Trigger levels	Programming code
Trigger level-auto	TL2
Trigger level-keyboard	TL1
Trigger level-potentiometer	TLO
Set trigger level (channel A, B)	AL...*, BL...*
Read A and B levels (on, off)	RL1, RLO

Input setting	Programming code
Positive slope (A, B)	AS0 BS0
Negative slope (A, B)	AS1, BS1
Attenuator: ×1 (A, B)	AA0, BA0
Attenuator: ×10 (A, B)	AA1, BA1
Coupling: DC (A, B)	AC0, BC0
Coupling: AC (A, B)	AC1, BC1
Termination 1 MOhm (A, B)	AT0, BT0
Termination 50 Ohm (A, B)	AT1, BT1
Common via A (on, off)	CE1, CE0
Check (on, off)	CH1, CHO

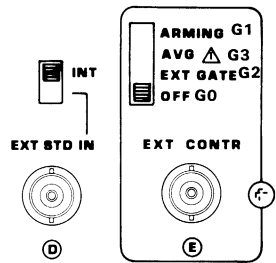
* numerical value according to NR1, NR2 or NR3 formats

Default setting

* numerical value according to NR1, NR2 or NR3 formats

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PROGRAMMING CODES



External controls	Programming code
No external control	G0
Arming	G1
External gate	G2
Frequency average	G3

Service request	Programming code
Service request disable	SQ0
Service request enable	SQ1
SRQ when outside limits or neg.	SQ2
SRQ when inside limits or pos.	SQ3

Output delimiters	Programming code
Message separator EOI (on, off)	MS1, MS0
Set output delimiter ETB (ETX)	SD0
Set output delimiter CR	SD1
Set output delimiter LF	SD2
Set output delimiter CR + LF	SD3

Other bus commands	Programming code
High speed dump mode (on, off)	HS1, HS0
Program data out-readable	P0
Program data out-compressed	P1
Device clear (default)	D
Leading zero suppression (on, off)	LE1, LE0

Default setting

THREE PROGRAMMING MODES

- Recall, with a single command, one of the eight front panel menus (P1...P8), stored in the **counters** memory.
- Use the BUS LEARN mode to recall, with a single command, a front panel menu, previously stored in the **controllers** memory.
- Use normal programming codes according to programming code table.

Mode	Set menu	Store menu	Recall menu
P1...P8	Manually via Front Panel	Manually in P1...P8	Via Bus Code LP1...LP8
Bus Learn	Manually via Front Panel	Via Bus in string A\$, B\$...	Via Bus Output of string A\$, B\$...
Normal	Via Bus	N.A.	N.A.

* programming example for:

HP controllers	PET/CBM controllers
10 REM STORE SETTINGS IN A\$	10 REM STORE SETTINGS IN A\$
20 DIM A\$(43)	20 OPEN 10, 10
30 OUTPUT 710: "P1"	30 PRINT #10, "P1"
40 ENTER 710: A\$	40 INPUT #10, A\$

DEVICE CLEAR ("D") RESULTS IN DEFAULT SETTINGS

- Hardware set output delimiter
- SM0.1 (100ms measuring time)
- AL0, BL0 (Trigger levels = 0V)
- SK1, SL0 (Math constants K = 1, L = 0)
- Plus all default-marked settings in the programming code table

Sending a "D" is the same as sending bus commands DCL (device clear) or SDC (selective device clear).

PROGRAM DATA OUT ("P0" or "P1")

The next counter output will be string(s) containing the settings of the counter.

"P1" results in an unreadable 43 character string intended for reprogramming the counter (BUS LEARN mode).

"P0" returns readable programming data, sent as 8 strings, each terminated by the selected delimiter.

F	X	X	S	M	X	X	.	E	+	X	S	S	x					
A	C	x	A	S	x	A	A	x	A	T	x	A	L	+	X	.	X	X
B	C	x	B	S	x	B	A	x	B	T	x	B	L	+	X	.	X	X
T	L	x	T	O	x	C	E	x	C	H	x	T	E	x				
S	Q	X	H	S	x	L	E	x	M	S	x	S	D	X				
G	x	H	E	x	M	E	x	R	M	x	R	H	x	R	L	x		
S	K	+	X	X	X	X	X	X	X	X	.	E	+	X	X			
S	L	+	X	X	X	X	X	X	X	X	.	E	+	X	X			

+ means + or - sign
X means digit 0...9
x means either 0 or 1

NOTE: "F16" (1:st line) indicates that one of Tests 1...6 is selected.

TESTS numbers 1...6

- Test 1 — ROM test
- Test 2 — RAM test
- Test 3 — EAROM test
- Test 4 — Measuring logic test
- Test 5 — Display test
- Test 6 — Tests 1...5 in sequence.

To call on a TEST via the bus:
— Enable Service Request (code "SQ1")
— Call e.g. test No. 1 (code "TS1")
— Recognize SRQ and check status byte

OUTPUT DATA FORMAT

NORMAL OUTPUT FORMAT

O
F F S P X X X X X X X X X E ± X D (D)

- Bytes 1,2 FF = Function code, see table.
Byte 3 Normally a space character. On overflow, O is sent.
Bytes 4..14 XXXXXXXXXX; 11 characters are digits; one is a floating decimal point.
Byte 15 E is an exponent pointer.
Byte 16 Exponent sign is + or -.
Byte 17 Exponent value X is either 0 or multiples of ±3.
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TL	Trigger Levels A, B
TM	Tot A, Manual
TS	Tot A, Start/Stop by B
VM	V_{\max} , V_{\min} A
VP	$V_{\text{peak-peak}}$ A

OUTPUT DATA FORMAT

LEADING ZERO SUPPRESSION

Example: without leading zero suppression ("LE0")

F A 0 0 0 0 0 0 1 2 . 3 4 E + 3 LF

will be reduced to:

F A 1 2 . 3 4 E + 3 LF

with leading zero suppression ("LE1").

OUTPUT OF VOLTAGES (CODE VM) AND TRIGGER LEVELS (CODE TL):

F F ± X X X X , ± X X X X D (D)

- Byte 1,2 Function code VM or TL.
Byte 3 Space character.
Byte 4 Sign + or - for channel A (TL) or for V_{\max} (VM).
Byte 5...8 XXXX indicates the level for channel A (TL) or V_{\max} (VM) in Volts. 3 characters are digits; one is a floating decimal point.
Byte 9 Separating comma (,).
Byte 10 Sign + or - for channel B (TL) or for V_{\min} (VM).
Byte 11...14 XXXX indicates the level for channel B (TL) or V_{\min} (VM) in Volts. 3 characters are digits; one is a floating decimal point.
Byte 15 delimiter CR, LF, ETX or ETB.
Byte 16 Second delimiter LF (only if delimiter combination is CR + LF).

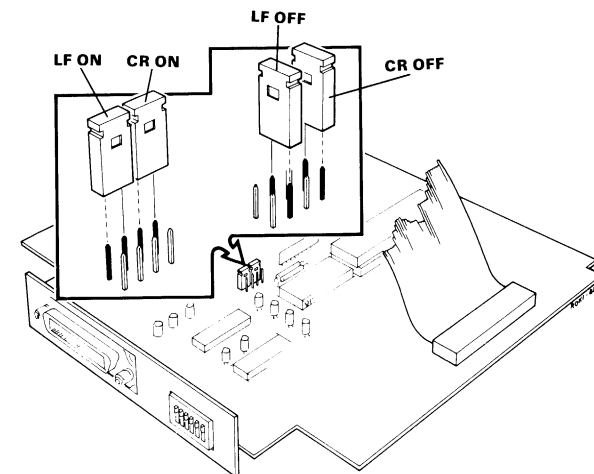
HIGH SPEED DUMP OUTPUT

Code X X X X X X X X X X X X X X X X X X D (D)

- Byte 1 Alphabetic code A...U specifying calculation to be made.
Byte 2...23 Event and Time count Register contents (numeric).
Byte 24 Delimiter CR, LF, ETX or ETB
Byte 25 Second delimiter LF (only if delimiter combination is CR + LF).

OUTPUT DELIMITER

The default delimiter is set by jumpers on the PM 9696 circuit-board (factory preset at LF).



The delimiter can be changed by sending "SD0" (ETB/ETX), "SD1" (CR), "SD2" (LF), or "SD3" (CR + LF). Note that when SD0 is selected, the delimiter will be ETB in free running mode (TE0) and ETX in triggered mode (TE1).

The EOI-line in the IEEE-488 bus will be active together with the last output byte sent when "MS1" has been programmed.

SERVICE REQUEST

SERVICE REQUEST IS ALWAYS SENT:

- On programming errors, such as false codes, measuring time out of range, trigger levels out of range etc.
- After the execution of a test (TS1...TS6) and an error is found.

SERVICE REQUEST IS ENABLED (SQ1):

SRQ is sent:

- When a measuring result is ready for output.
- When any of the tests TS1...TS6 is finished.

LIMIT MONITORING IS ENABLED (SQ2, SQ3):

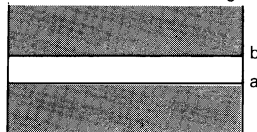
SRQ is sent:

- When the measuring result is outside (SQ2) or inside (SQ3) the set limits.

MONITORING OF ALARM LIMITS

- Enable limit monitoring (SQ2 or SQ3)
- Enable MATH (ME1)
- Set limits (SK..., SL...)

Alarm when outside range



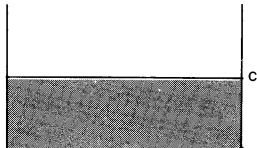
$$''SQ2'', K = \frac{1}{b-a} \quad L = \frac{-a}{b-a}$$

Alarm when inside range



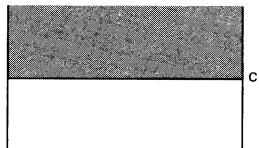
$$''SQ3'', K = \frac{1}{b-a} \quad L = \frac{-a}{b-a}$$

Alarm when below limit



$$''SQ2'', K = 1 \quad L = -c$$

Alarm when above limit



$$''SQ3'', K = 1 \quad L = -c$$

STATUS BYTE

- Bit 8: Always 0
 Bit 7: Service request has been sent (1) or not (0)
 Bit 6: Alarm condition (1) or not (0)
 Bit 5: Counter is busy (1) or ready (0)
 Bit 1-4: Counter status specification.

Status value			Status message
0	0000	0000	Normal output
6	0000	0110	Output T.M., gate closed
7	0000	0111	Test ready
8	0000	1000	Output H.O., M.T. or T.L.
12	0000	1100	Dump mode
14	0000	1110	Output T.M., gate open
16	0001	0000	Computing
17	0001	0001	Preparation ("TE1")
18	0001	0010	Preparation ("TE0")
19	0001	0011	Waiting for trigger
20	0001	0100	Waiting for input sync. to start
21	0001	0101	Busy, undefined task
22	0001	0110	Sensing T.M., gate closed
23	0001	0111	Performing Test
24	0001	1000	Waiting for input sync. to stop
26	0001	1010	Reading H.O., M.T. or T.L.
28	0001	1100	Measuring
30	0001	1110	Sensing T.M., gate open
64	0100	0000	Normal output with SRQ
70	0100	0110	Output T.M. with SRQ, gate closed
71	0100	0111	Test ready with SRQ
72	0100	1000	Output H.O., M.T., T.L. with SRQ
78	0100	1110	Output T.M. with SRQ, gate open
96	0110	0000	Ready with limit alarm
97	0110	0010	Error in test No. 1
98	0110	0010	Error in test No. 2
99	0110	0011	Error in test No. 3
100	0110	0100	Error in test No. 4
110	0110	1110	Limit alarm, T.M., gate open
111	0110	1111	Programming error

H.O. = Hold-Off

M.T. = Measuring time

T.L. = Trigger levels

T.M. = Tot. A Manual gating.

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