

IEEE 488

IEC 625

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

Pocket guide

831015

9499 460 11111

BUS INTERFACE CHARACTERISTICS

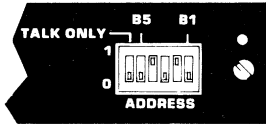
Description	Code	Capability
Source handshake	SH1	Complete
Acceptor handshake	AH1	Complete
Control function	C0	No controller
Talker function	T5	Complete
Listener function	L4	Complete (except listen only)
Service request	SR1	Complete
Remote/local function	RL1	Complete
Parallel poll	PPO	No parallel poll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



**Test & Measuring
Instruments**

PHILIPS

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



- 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

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

EXP Hz S V GATE

FRQ A PERIOD A RATIO A/B TIME A-B D WIDTH A PHASE A-B

RISE/FALL A DUTY FACT A TOT A / J L B TOT A / J L B Vmax Vmin Vpp A TEST

P1 REMOTE ARMED
P2 FREQ AVG
P3 EXT GATE
P4 STAND BY
P5
P6
P7 MATH NOT STORED
P8

START/STOP TOTALIZE A TO1 TO0
RESET X
POWER
ST BY

MATH DISP-K-X+L ME1 MEO
K=
L=
SL...

HOLD OFF 5µs - 1ms 1ms - 200ms
ON HE1 HE0
READ RH1 RHO
MIN MAX

MEASURING TIME DISPLAY TIME
DISPL HOLD TE1 TE0
MINIMUM/SINGLE SS1 SSO
SM...
RM0

FUNCTION
↑ 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

SLOPE 0V READ 0V SLOPE

ASO AS1 TLO RL1 RLO BS0 BS1
AC0 AC1 TL2 BC0 BC1
AA0 AA1 AL... TL1 BL... BAO BA1
AT0 AT1 CE1 COM CHECK CH1 CH0 BT0 BT1

DC-120MHz
MAX 260Vrms(1MΩ)
12Vrms(50Ω)

PHILIPS

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

Bus triggering	Programming code
Triggered mode (Display Hold) Free run Start new measurement	TE1 TEO 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 Math function (on, off) Hold-Off (on, off) Read Hold-Off time (on, off) Tot A manual start Tot A manual stop	SK...*, SL...* ME1, MEO HE1, HEO RH1, RHO TO1 TOO

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

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

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

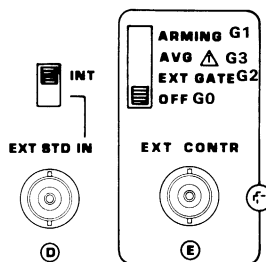
Input setting	Programming code
Positive slope (A, B) Negative slope (A, B) Attenuator: × 1 (A, B) Attenuator: × 10 (A, B) Coupling: DC (A, B) Coupling: AC (A, B) Termination 1 MOhm (A, B) Termination 50 Ohm (A, B) Common via A (on, off) Check (on, off)	ASO BSO AS1, BS1 AA0, BAO AA1, BA1 AC0, BCO AC1, BC1 AT0, BTO AT1, BT1 CE1, CEO CH1, CHO

* numerical value according to NR1, NR2 or NR3 formats

Default setting

* numerical value according to NR1, NR2 or NR3 formats

PROGRAMMING CODES



External controls

Programming code

No external control
Arming
External gate
Frequency average

G0
G1
G2
G3

Service request

Programming code

Service request disable
Service request enable
SRQ when outside limits or neg.
SRQ when inside limits or pos.

SQ0
SQ1
SQ2
SQ3

Output delimiters

Programming code

Message separator EOI (on, off)
Set output delimiter ETB (ETX)
Set output delimiter CR
Set output delimiter LF
Set output delimiter CR + LF

MS1, **MS0**
SD0
SD1
SD2
SD3

Other bus commands

Programming code

High speed dump mode (on, off)
Program data out-readable
Program data out-compressed
Device clear (default)
Leading zero suppression (on, off)

HS1, **HS0**
PD
P1
D
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
- SMO.1 (100ms measuring time)
- ALO, BLO (Trigger levels = 0V)
- SK1, SLO (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

FF O
FF SP XXXXXXXX E ± X D (D)

- Bytes 1,2 FF = Function code, see table.
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- Bytes 4..14 XXXXXXXXXX; 11 characters are digits; one is a floating decimal point.
- Byte 15 E is an exponent pointer.
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OUTPUT DATA FORMAT

LEADING ZERO SUPPRESSION

Example: without leading zero suppression ("LE0")

FA 00000012.34E+3 LF

will be reduced to:

FA 12.34E+3 LF

with leading zero suppression ("LE1").

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

FF ± XXXX, ± XXXX 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).

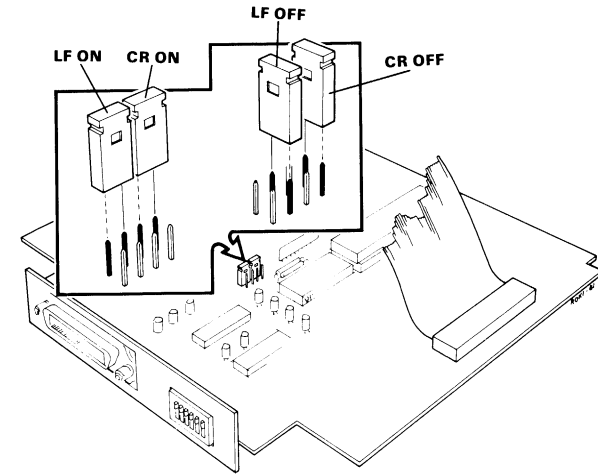
HIGH SPEED DUMP OUTPUT

Code XXXXXXXXXXXXXXXXXXXXXXX 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):

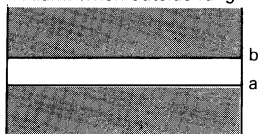
SRQ is sent:

- 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



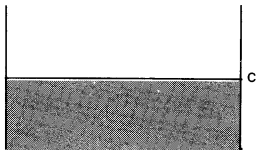
$$\text{"SQ2", } K = \frac{1}{b-a} \quad L = \frac{-a}{b-a}$$

Alarm when inside range



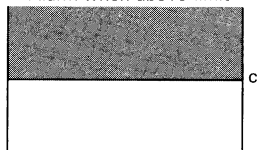
$$\text{"SQ3", } K = \frac{1}{b-a} \quad L = \frac{-a}{b-a}$$

Alarm when below limit



$$\text{"SQ2", } K = 1 \quad L = -c$$

Alarm when above limit



$$\text{"SQ3", } K = 1 \quad L = -c$$

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.