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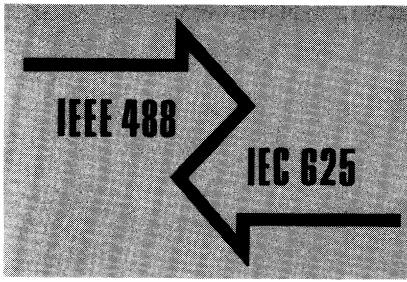
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PM 6652 PROGRAMMABLE
PM 6654 TIMER/COUNTERS

Pocket guide 831015 9499 460 11111

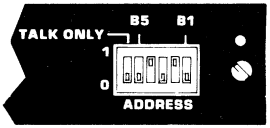
BUS INTERFACE CHARACTERISTICS

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	PP0	No parallel poll
Device clear function	DC1	Complete
Device trig. function	DT1	Complete

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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

F	F	SP	X	X	X	X	X	X	X	X	X	X	E	±	X	D	(D)
		O															

Bytes 1,2	FF = Function code, see table.
Byte 3	Normally a space character. On overflow, O is sent.
Bytes 4..14	XXXXXXXXXXX; 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

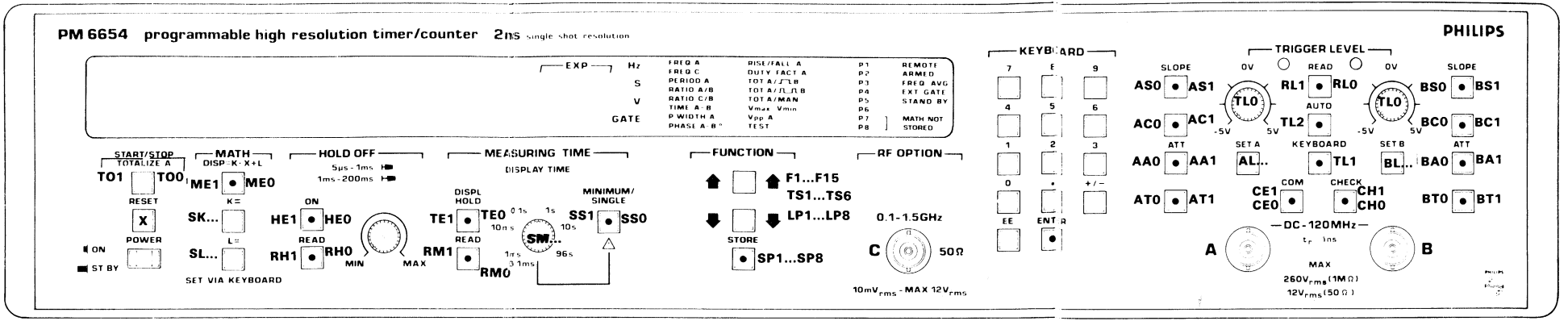
Codes	Functions
DF	Duty Factor A
FA	Frequency A
FC	Frequency C
HT	Hold-off Time
MT	Measuring Time
PA	Period A
PH	Phase A-B
PW	Pulse Width A
RA	Ratio A/B
RC	Ratio C/B
RT	Rise/Fall Time A
TG	Tot A gated by B
TI	Time Interval A-B
TL	Trigger Levels A, B
TM	Tot A, Manual
TS	Tot A, Start/Stop by B
VM	V_{max},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

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PROGRAMMING CODES

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Measuring/Display time	Programming code
Set measuring time (100µs...99s)	SM...*
Single/min. meas. time (on, off)	SS1, ***SS0***
Read meas. time (on, off)	RM1, ***RM0***
Display Hold, off	***TE0***
Display Hold, on	TE1
''RESET'' (start new measurement)	X

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

NOTE: individual mesurements, ''TE1'', are trigged 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, ***RH0***
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
V_{max}, V_{min} A	F14
V_{pp} 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, ***RL0***

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, ***CH0***

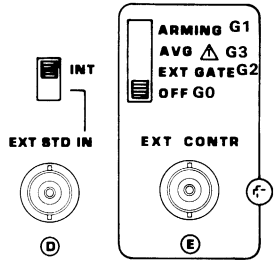
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** numerical value according to NR1, NR2 or NR3 formats*

Default setting

** numerical value according to NR1, NR2 or NR3 formats*

PROGRAMMING CODES



External controls	Programming code
No external control	***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$, B$... Code P1*	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

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OUTPUT DATA FORMAT

NORMAL OUTPUT FORMAT

F F 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, O is sent.
Bytes 4..14	XXXXXXXXXXX; 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.
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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	$V_{peak-peak}$ A

OUTPUT DATA FORMAT

LEADING ZERO SUPPRESSION

Example: without leading zero suppression (''LE0'')

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

will be reduced to:

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

with leading zero suppression (''LE1'').

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

F F SP ± 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).

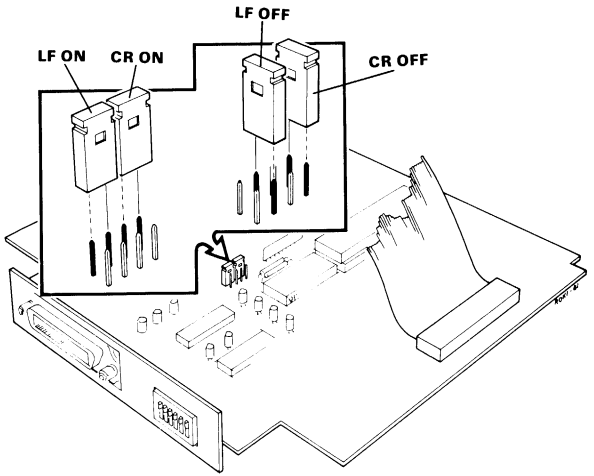
HIGH SPEED DUMP OUTPUT

Code X X X X X X X X X X X X X X X X X X 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 trigged 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.

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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):

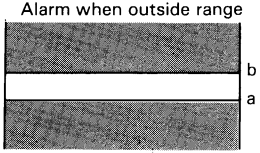
SRQ is sent:

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

MONITORING OF ALARM LIMITS

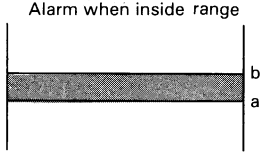
- Enable limit monitoring (SQ2 or SQ3)
- Enable MATH (ME1)
- Set limits (SK..., SL...)

Alarm when outside range



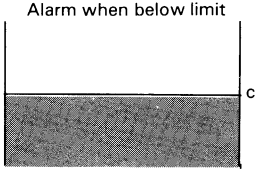
''SQ2'', $K = \frac{1}{b-a}$ $L = \frac{-a}{b-a}$

Alarm when inside range



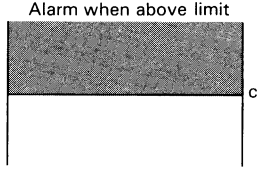
''SQ3'', $K = \frac{1}{b-a}$ $L = \frac{-a}{b-a}$

Alarm when below limit



''SQ2'', K = 1 L = − c

Alarm when above limit



''SQ3'', K = 1 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	Outut 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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