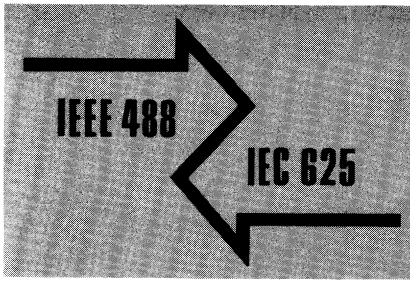


# PM 6652 PROGRAMMABLE
# PM 6654 TIMER/COUNTERS

**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 |

PHILIPS
Test & Measuring Instruments

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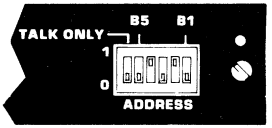
# SETTINGS




### 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

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | O | | | | | | | | | | | | | | | | |
| 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. |
| Byte 19 | Second delimiter LF (only if delimiter combination is CR+LF). |

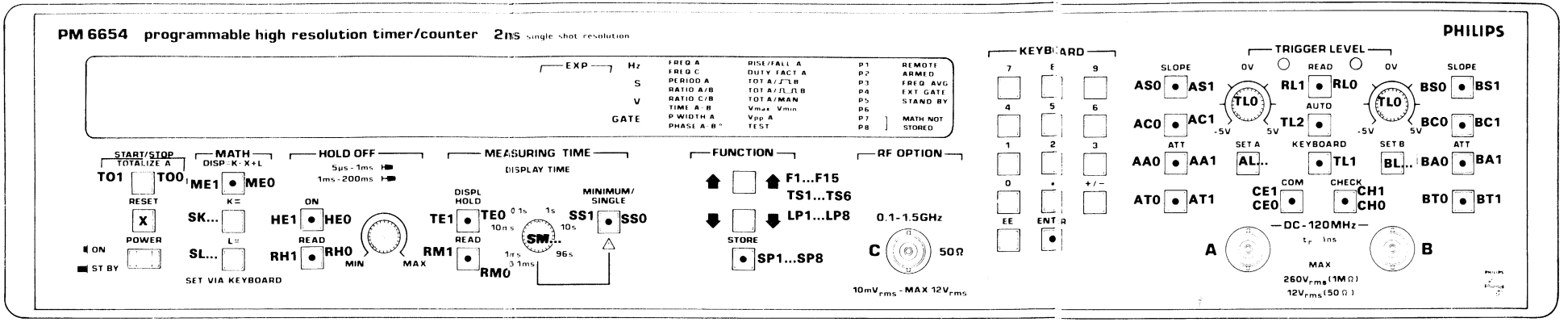
### FUNCTION CODES

| 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 | $V_{peak\text{-}peak}$ A |

# PROGRAMMING CODES

PROGRAMMING CODES

PROGRAMMING CODES




| 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*** |

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

| 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 |

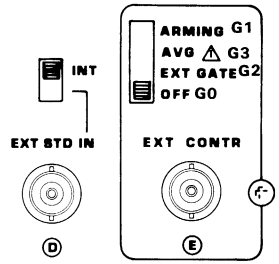
***Default setting***

| 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*** |

** 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 X . E + X X
S L + X 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 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. |
| Byte 19 | Second delimiter LF (only if delimiter combination is CR+LF). |

## FUNCTION CODES

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| 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 |

# 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 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). |

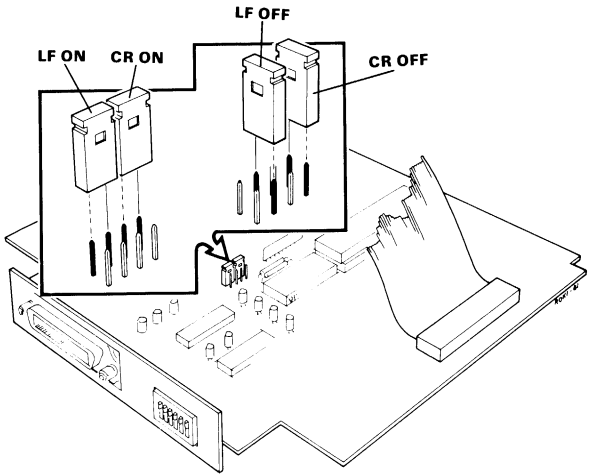
## HIGH SPEED DUMP OUTPUT

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.

# 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):

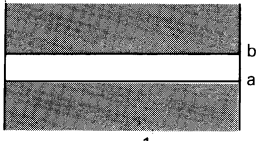
SRQ is sent:

- 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

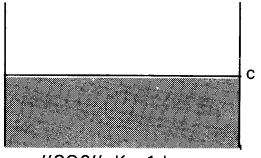



"SQ2", $K = \frac{1}{b-a}$ $L = \frac{-a}{b-a}$

Alarm when inside range

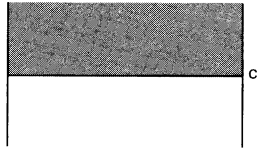

"SQ3", $K = \frac{1}{b-a}$ $L = \frac{-a}{b-a}$

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.