

CHAPTER 9 Q10LP - LIGHT PEN -

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9.1. General

The Q10 LP light pen is used, as shown in Fig. 9-1, to detect the light from the fluorescent element by touching the light receiving unit at the light pen tip and converting it into an electric signal. The photo signal converted into an electric signal is amplified in the light pen and then converted to the TTL level (negative logic) on the basis of a certain threshold level, and output as an address signal when the light pen detects the light on the CRT screen.

The light pen is provided with a photoelectric switch which is actuated by pressing the light receiving unit of the light pen tip onto the CRT screen. The switch output is output to the QX-10 as a light pen interrupt signal.

The light pen is connected to the DIN connector (5B type) on the rear panel of the main unit, and supported by EPSON Japanese BASIC and EPSON Multifonts BASIC.

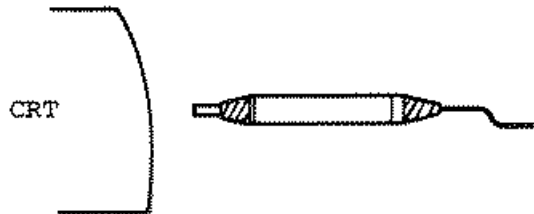


Fig. 9-1

9.2. Specifications

9.2.1 Electrical specifications

1. Signal output : TTL (negative logic)
2. Switch output : TTL (negative logic)
3. Response speed : 400 ns - 800 ns
4. Optics : 5L7
5. Resolution : 3 mm in diameter
6. Supply voltage : +5 V (50 mA)
7. Switch stroke : 1.2 mm \pm 0.2 mm
8. Switch pressure : 100 g \pm 30 g
9. Wavelength range : 420 - 980 nm

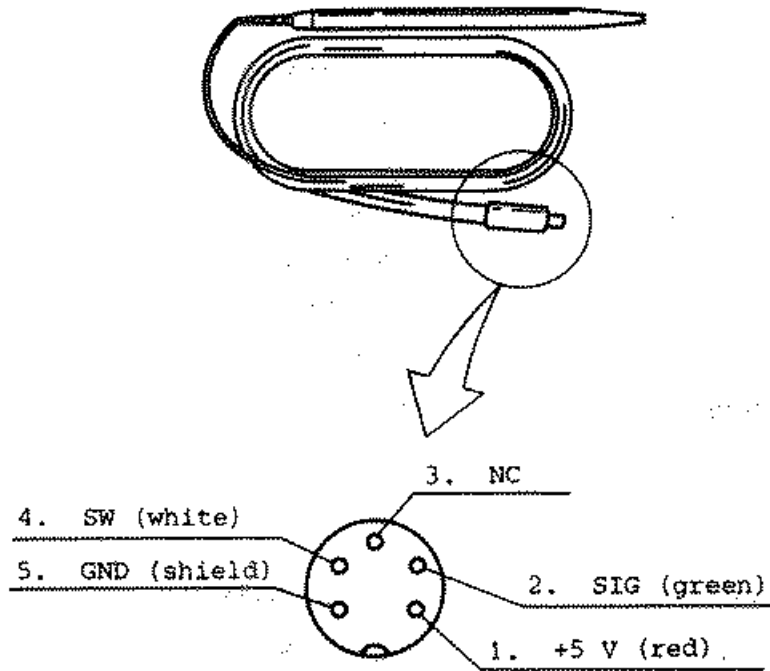
9.2.2 Environmental conditions

1. Temperature : Operational: 0 - +55°C
Storage : -10 - +75°C
2. Humidity : 0 - 95% (no dew)

9.2.3 Dimensions and weight

1. Dimensions : 12 ϕ x 140 mm
2. Weight : 40 g
3. Cable length : 1500 mm

9.2.4 Connector specifications



(TOP VIEW)

Fig. 9-2

9.3. Structure

9.3.1 Names of each part

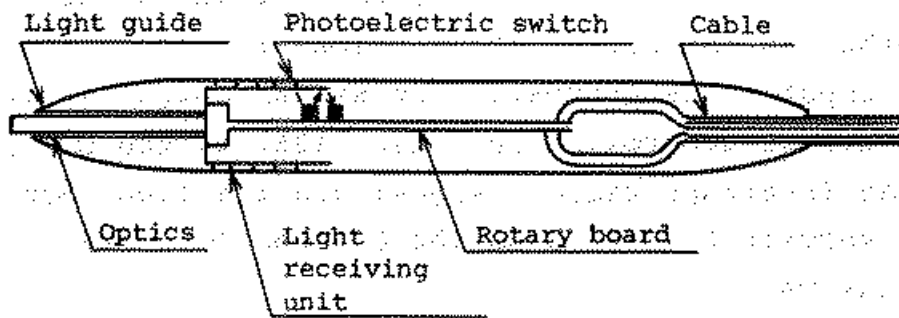


Fig. 9-3 (a)

9.3.2 Photoelectric switch

The photoelectric switch utilizes optical reflection as shown in Fig. 9-3 (b). An LED and phototransistor are combined to make a contactless switch.

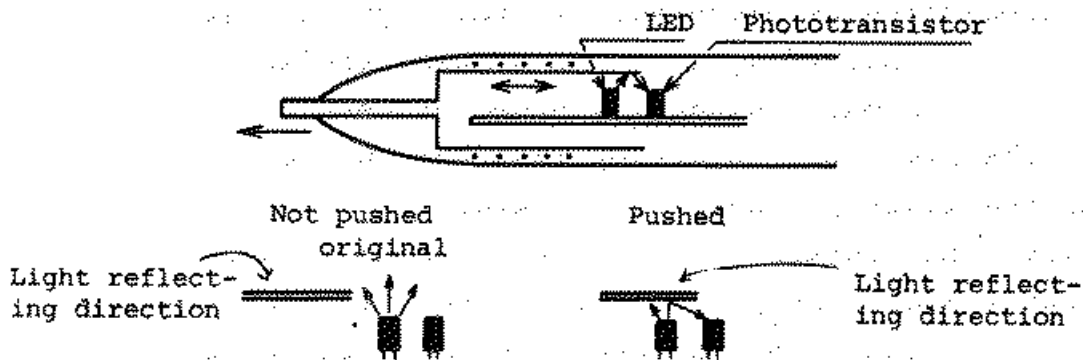


Fig. 9-3 (b) Photoelectric switch structure

9.4. Light Pen Sequence

The light pen has two outputs: one is the output of the switch (photoelectric switch actuated by pushing force), and the other is the signal (SIG) output responsive to the light input. The photoelectric switch output is sent to the interrupt controller μ PD8259A (12E) on the Q10 SYM board as an interrupt request signal via the light pen interrupt service flip-flop on the Q10 GMS (Q10 CMS) board in the QX-10.

The SIG output is applied to the light pen input terminal of the graphic display controller μ PD7220 and used to latch the address when the light pen detects the light on the CRT screen. It is also used to raise the light pen status flag in the GDC.

The photoelectric switch output is also turned on when the light pen is pushed against anything other than the CRT screen. Therefore, the light pen interrupt service routine needs to be executed after checking the light pen status flag in the GDC.

Fig. 9-4 is the flow chart showing the light pen sequence. As stated above, when the light pen is used, the interrupt processing is executed. If the light pen is continuously pushed against the screen, the interrupt occurs continuously disabling other processing. Therefore, the light pen interrupt mask must be set immediately after the light pen address is read.

The light pen interrupt level is as shown in Table 5-1. The above should be particularly noted, as the interrupt levels of floppy disk, printer, calendar clock option and software timer 2 are lower than that of the light pen.

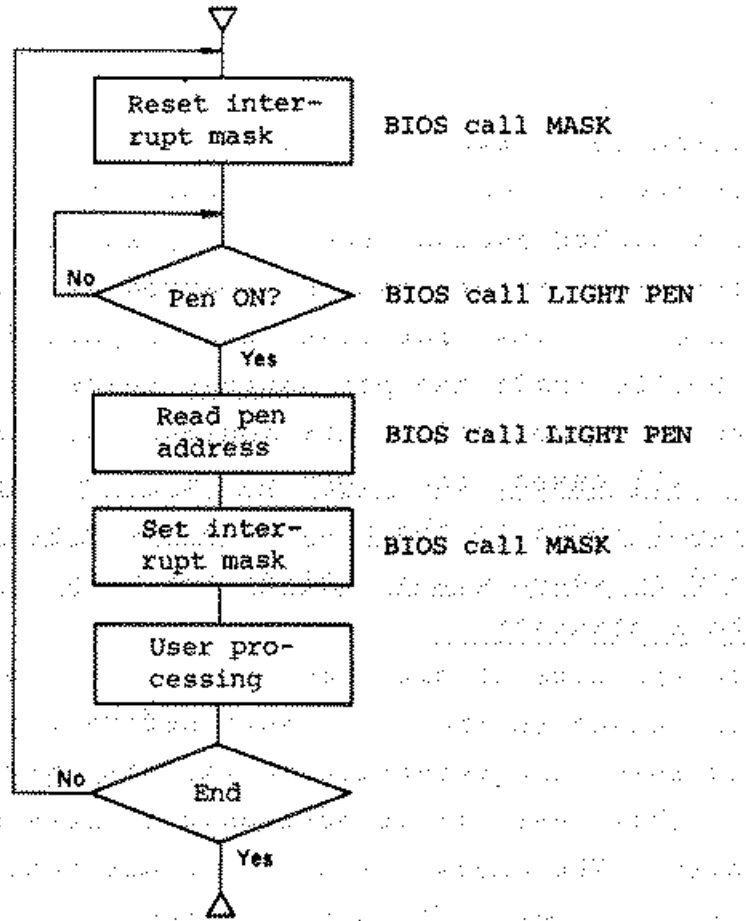


Fig. 9-4 Light pen sequence

9.5. Precautions on Using Light Pen

9.5.1. The display is divided into 400 dots in the vertical direction. Even a slight displacement (particularly in the vertical direction) while the light pen is being pushed against the display surface results in incorrect input, causing lowered sensitivity.

(Because, when the light pen is pushed once, the uPD7220 reads the pen address twice and does not make an interrupt unless the address coincides.)

In all cases, the light pen must be applied at a right angle to the display surface and pushed gently and released quickly after the display picture comes to a standstill.

In the case of green monitor, if the brightness is increased to the level just before the back raster is seen, the detection sensitivity may be lowered. In this case, it is advisable to make highlight display. The character with low dot density (e.g., "1") is sometimes difficult to detect. In this case, use an inverted character for a selector or color the back screen.

9.5.2. The light pen detects some colors easily and some with difficulty. Generally, the detection sensitivity becomes lower in the order of blue, green and red.

The light pen detection sensitivity is particularly low against red. Thus, detecting the part displayed red with the light pen should be avoided.

The light pen detects the color mixed with red, e.g., purple, normally.

9.5.3. An interrupt occurs continuously as long as the light receiving unit at the tip of the light pen is being pushed, and all other processings are suspended during this period. Therefore, avoid pushing the light receiving unit of the light pen unnecessarily.

9.6. Software

Support by QX-10 HP CP/M (BIOS entry address F657M)

LIGHT PEN

Functions : (1) Check if the light pen is pushed.
(2) Read the light pen input data.

Input parameters: C:2 in (1) above
C:3 in (2) above

Results : In (1) above
A:0 The light pen is not pushed.
A:0FFH The light pen is pushed and
data is input.

In (2) above

A:0 No data
A: Other than 0 Data is input.

BC: Position in the horizontal
direction
0 - 79 (green CRT used
non-MFBASIC, non-MF mode)
0 - 39 (green CRT used
non-MFBASIC, MF mode
MFBASIC width 80 mode
MFBASIC width 40 mode)
(Color CRT used)

DE: Position in the vertical
direction
0 - 24 (green CRT used
non-MFBASIC, non-MF mode)
0 - 399 (green CRT used
non-MFBASIC, MF mode
MFBASIC width 80 mode
MFBASIC width 40 mode)
(Color CRT used)

Zflag:0 Error
A:1 Parameter error

Others: Destruction

PEN

Function : Provides the data input from the light pen.

Format : PEN (< function >)

Description: PEN function provides information about the current state of the light pen. < Function > takes the value of 0 - 4 and has the following functions.

- PEN (0): Trigger sense
 - Indicates whether the light pen is pushed after PEN (0) function is last read.
 - True (-1) is returned if the light pen is pushed, false (0) if not.
 - Note that this information indicates whether or not the light pen has been pushed, not whether or not it is now being pushed. When PEN (0) function is once read, it is reset. As the coordinates used by PEN (1) - PEN (4) are also read when PEN (0) function returns a true value, it must be confirmed before PEN (1) - PEN (4) are used that PEN (0) function returns a true value.
- PEN (1): Returns the horizontal coordinates when the light pen is pushed as graphic coordinates. The value of 0 - 624 is returned. As the light pen resolution is 16 dots in the horizontal direction, the value is returned skipping 16 numbers.

- PEN (2): Returns the vertical coordinates when the light pen is pushed as graphic coordinates. The value of 0 - 400 is returned.
- PEN (3): Returns the horizontal coordinates when the light pen is pushed as character coordinates. In the 40-digit mode, the value of 1 - 40 is returned. In the 80-digit mode, the value of 1 - 80 is returned. As the light pen resolution is two characters in the horizontal direction, the value is returned skipping two numbers.
- PEN (4): Returns the vertical coordinates when the light pen is pushed as character coordinates. The value of 1 - 20 is returned.

Before using the PEN function, be sure to execute the ON statement to permit input of the light pen.

If not, "Illegal function call" error occurs. When the light pen is not used, it is better to execute the OFF statement to disable hardware interrupt of the light pen.

Support by QX-10 BASIC

PEN

Function : Controls ON/OFF of light pen input.

Format : PEN ON
OFF

Description: PEN ON enables use of PEN function, and
PEN OFF disables use of it. Before using
the PEN function, be sure to execute the
PEN ON statement.