

TECHNICAL MANUAL TROUBLESHOOTING

QX-10

This Technical Manual provides technical information on the structure, maintenance, and repairs of the QX-10.

For the details of the operation, refer to the Technical Manual of QX-10 (Principles of Hardware Operation).

Major technical modifications, if made in the future, will be notified through Service Bulletins, and the Technical Manual should be revised accordingly. The details of the Manual are subject to change without notice.

All the information given in the Manual concerns the QX-10 to others.

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CHAPTER 1 GENERAL

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1.1 Features

The QX-10 is an all business computer system. It consists of a Z80A-compatible CPU, a memory of 256 KB maximum, two floppy disk drivers of double-sided, double-density, 5-1/4" disks, and a 12" full-graphic CRT display with a resolution of 640 by 400 dots.

The standard configuration includes a programmable timer, Centronics-compatible printer interface, RS-232C interface, C-MOS RAM backed up by battery, clock and calendar, and separate keyboard. It has five card slots which permit installation of optional cards as required.

Optional cards available include character generators of varying fonts, IEEE-488 interface, optical fiber interface, color CRT interface, and pulse transformer interface.

1.2 Hardware configuration

1.2.1 General

The QX-10 is composed of three units: the main system unit, the keyboard unit, and the monitor unit. The main system unit, the heart of the QX-10 system, includes the main circuit board, sub circuit board, power supply, two 5-1/4" floppy disk drives developed by Epson, and five slots permitting installation of optional cards.

The keyboard unit is connected to the main system unit with a curled cord through which signals may be transmitted in any direction.

The standard monitor unit is a 12" high resolution green monitor capable of displaying bit images.

1.2.2 Hardware

Main system

CPU	μ PD780AC-1 (Z80A compatible, 4 MHz)
Memory	RAM : 256 KB (maximum on main board)
	VIDEO RAM : 128 KB (maximum on CRT board)
	C-MOS RAM : 2 KB (standard, backed up by battery)
	EPROM : 2/4/8 KB (for IPL)
Clock	C-MOS real-time clock (backed up by battery)
Speaker	Permanent magnet speaker
Interfaces	Printer interface (Centronics-compatible)
	RS-232C communications interface
DMA	7 channels
Interrupt levels	15
Counter/timer	6 channels
FDD	5-1/4" FDD x 2
	320 KB x 2 drives
	48 TPI, double sided & double density
Card slots	5
Monitor	12" green monitor
	640 x 400 dots
Keyboard	ASCII, HASCI

1.3 Specifications

1.3.1 External Dimensions and Weight

(1) External dimensions

	(W)	(D)	(H)
Main system unit	ca. 508	x 340	x 103 (mm)
Green monitor unit	ca. 312	x 340	x 270 (mm)
Keyboard unit	ca. 508	x 224	x 48 (mm)
	(510)		
Optional card	280	x 80	(mm)

(2) Weight: approx. 18kg

1.3.2 Environmental Conditions

- (1) Temperature during operation : 5°C to 40°C
storage : -30°C to 70°C
- (2) Humidity..... during operation : 20 - 80% (no condensation)
storage : 10 - 90% (no condensation)
- (3) Resistance to shock during operation : max. 1 G, 1 msec
storage : max. 5 G, 1 msec
- (4) Resistance to vibration.... during operation : max. 0.25 G, 5-50 Hz
storage : max. 3 G, 5-50Hz

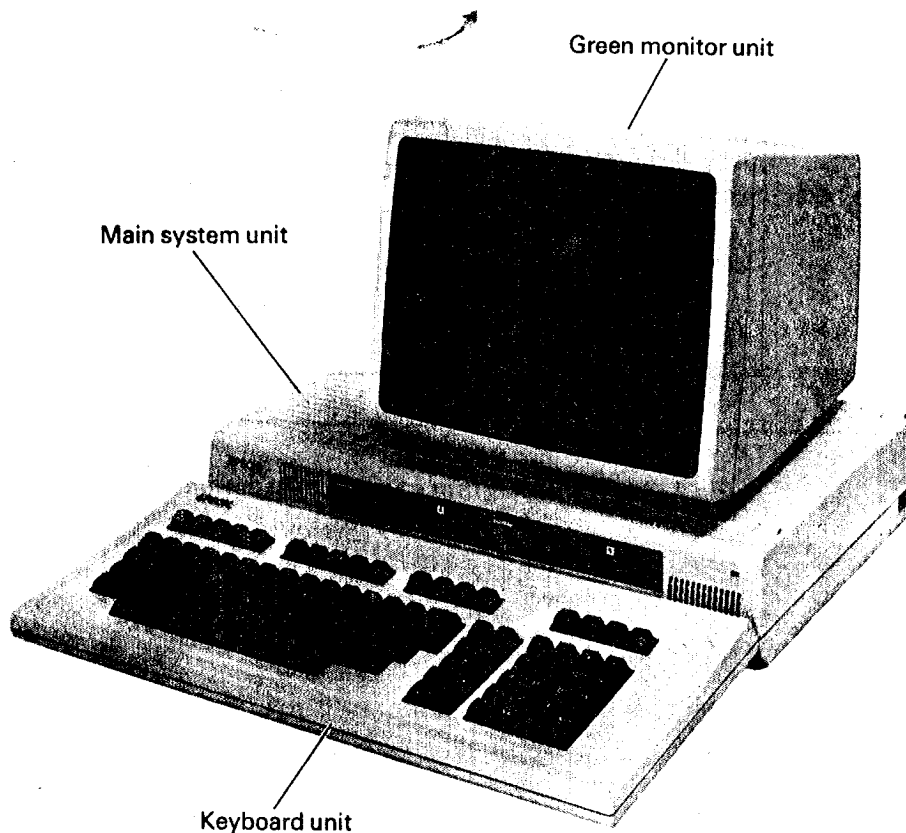


Fig 1-1 Hardware configuration of QX-10

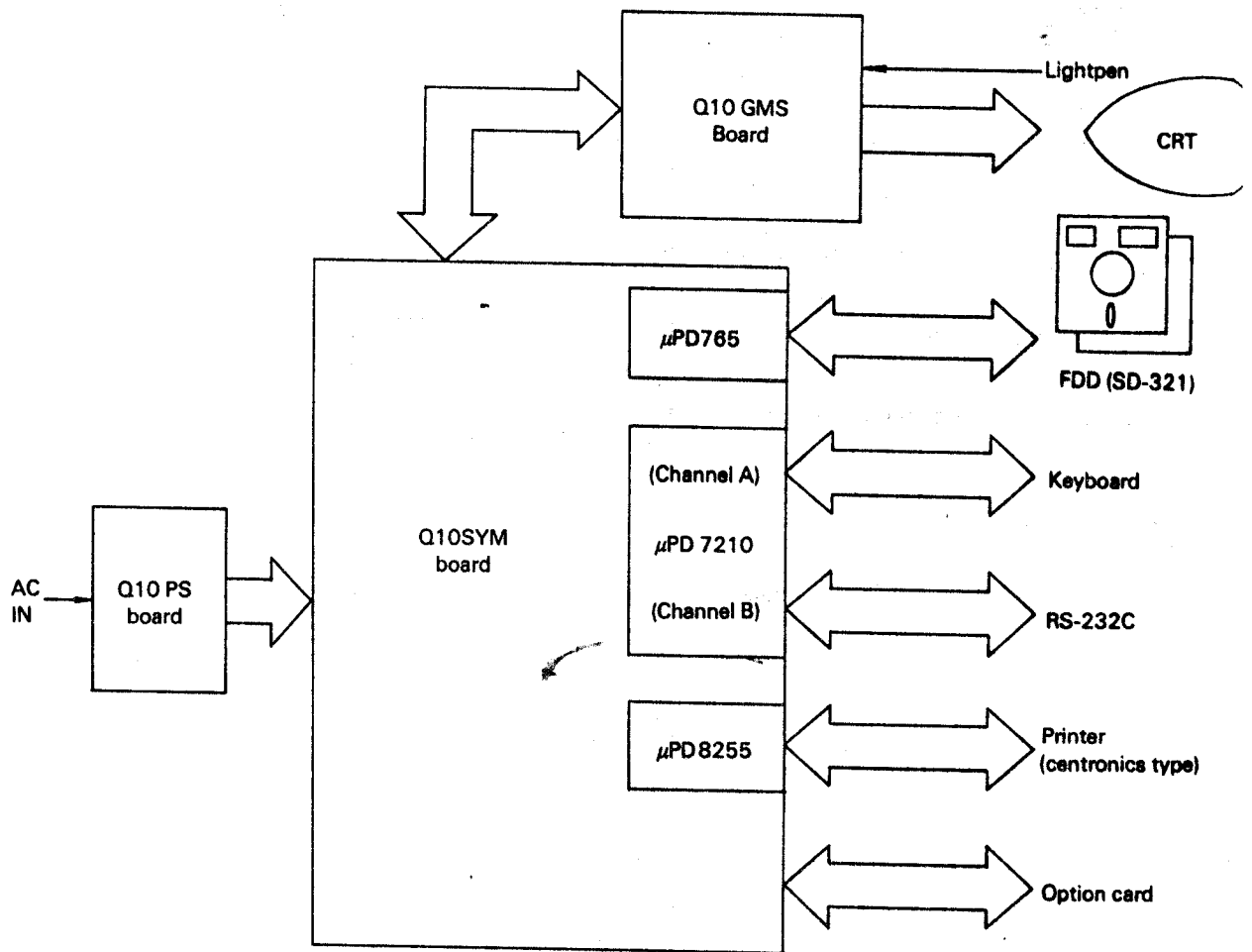


Fig 1-2 Block diagram of main component

(A) Q10S SYM board

This is a main control board including CPU, compatible with Z80A, Z80A family LSI and main memory.

Name	Model	Q'ty	Function
CPU	μ PD780C	1	CPU (4MHz) compatible with Z80A.
DMA controller	8237A	2	Provided with total of 7 channels for FDD, monitor and options.
Interrupt controller	8259AC	2	Controls the interrupt priority of total 15 levels interrupt including PWD output keyboard interrupt.
Interval timer	8253C	2	Controls the baud rate of keyboard clock and RS-232C.
Serial controller	7201C	1	Allocates channel A to the keyboard and B to RS-232C, and controls serial data transfer with CPU.
Printer controller	8255AC	1	Provided with an 8-bit parallel port. Acts as an interface with printer conformable to Centronix.
Real time clock	46818P	1	Provided with clock and calendar functions.
Floppy disk controller	765AC	1	Interface with FDD (SD-321)
I/O selector	LS154	1	Accesses each I/O point by decoding the 4-bit low order address (A2 ~ A5) of CPU.
Main memory	416/4164	8 32	Dynamic RAM is used. Provided with 4 banks maximum.
P-ROM	2716/32/ 64	1	Stores IPL programs.
CMOS RAM	449	1	Protects the data on power failure. (Backed up by an NiCd battery.)

Table 1-1 Primary configuration of Q10 SYM

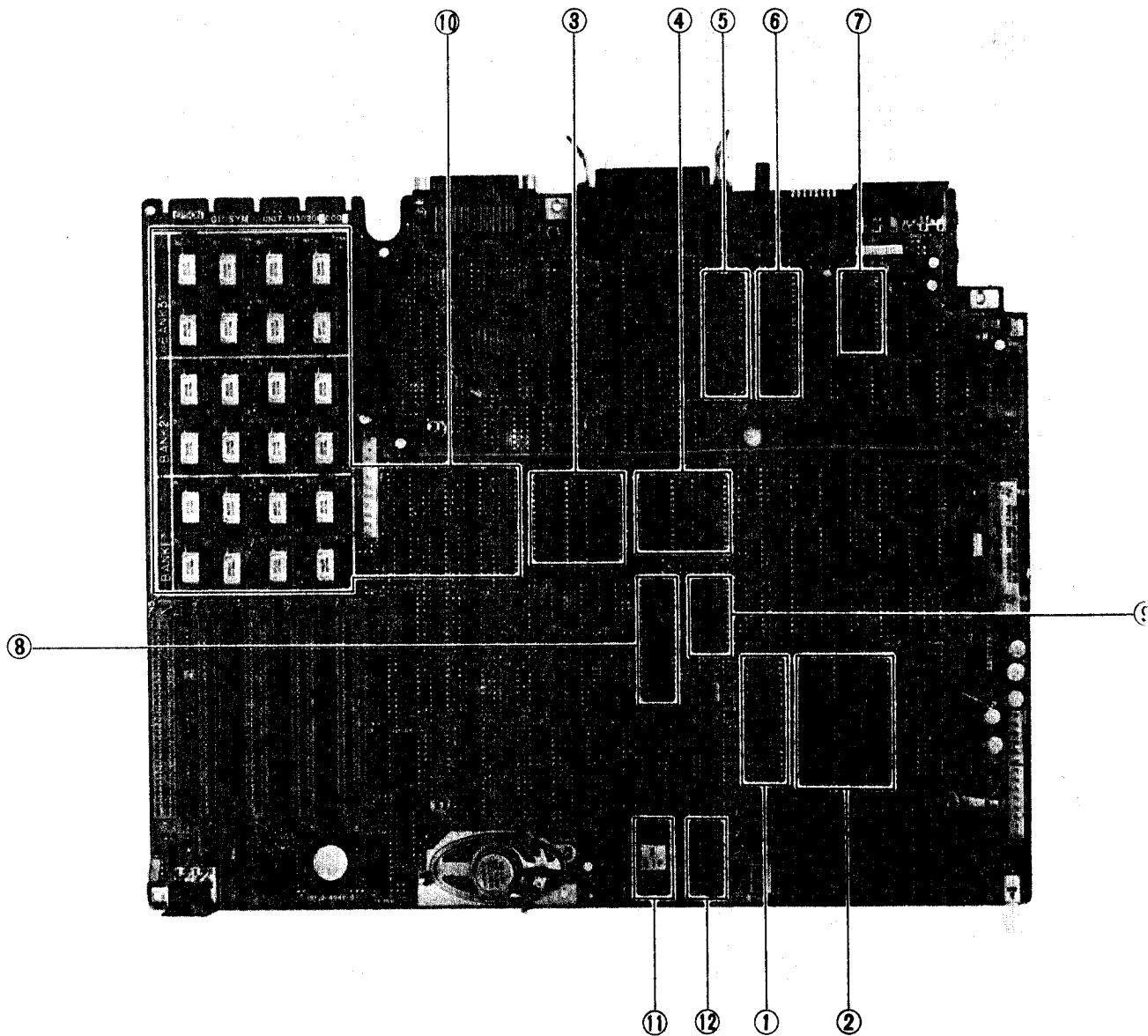


Fig. 1-3

- 1 μ PD780C (Z80A compatible CPU)
- 2 8237A (Programmable DMA Controller)
- 3 8259AC (Programmable Interrupt Controller)
- 4 8253C (Programmable Interval Timer)
- 5 7201C (Multi-protcol Serial Controller)
- 6 8255AC (Programmable peripheral Interface)
- 7 46818P (Real-time clock plus RAM)
- 8 765AC (Programmable Floppy Disk Controller)
- 9 LS154 (I/O Selector)
- 10 416/4164 (D-RAM)
- 11 2716/32/64 (P-ROM for IPL)
- 12 449 (C-MOS RAM)

(B) Q10 GMS board

The board includes graphic display controller μ PD7220 and V-RAM, and controls display of the green monitor.

Name	Model	Q'ty	Function
Graphic display controller	7220	1	A display controller with high speed drawing and magnifying functions.
Video RAM	416/4164	16	Dynamic RAM is used.
Character generator	2732/64	1	ROM storing display fonts to be sent to the display unit.

Table 1-2 Primary configuration of Q10 GMS

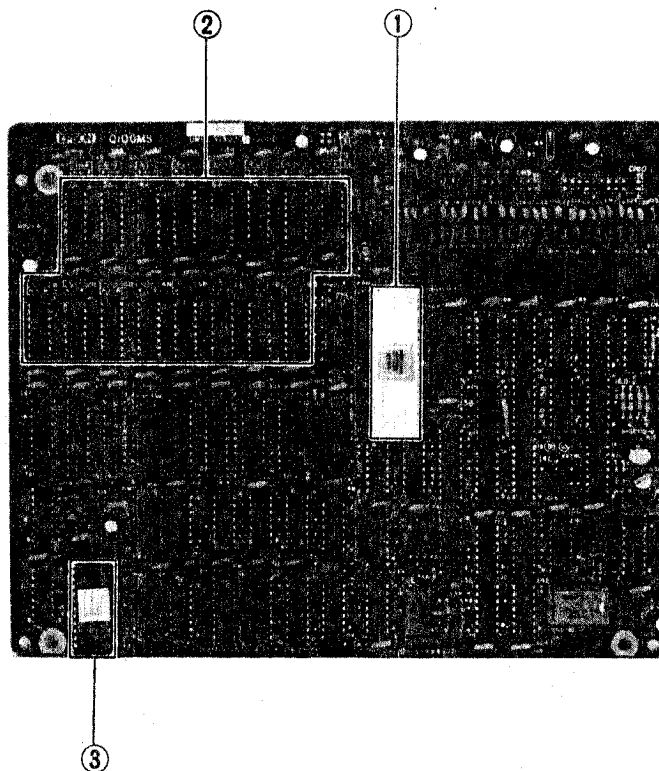


Fig. 1-4

- 1 7220 (Graphic Display Controller)
- 2 V-RAM (16/64 k bit dynamic RAM)
- 3 P-ROM (Character Generator)

(C) Q10 PS board

This is a power supply unit for the QX-10 system and a switching regulator with a flyback transformer. It accommodates to power supplies of 100V and 200V levels by switching jumper wire J1.

Specifications

- (1) Input voltage: 100V - 10% ~ 120V + 10%
200V channel 220V - 10% ~ 240V + 10%
- (2) Frequency: 50/60 Hz
- (3) Power consumption: Approx. 75W
- (4) Input surge current: 30A for 20 ms maximum
- (5) Leak current: 1 mA maximum
- (6) Insulation strength: 100V channel Can withstand 1 kV applied between AC power supply and case for 1 minute.
200V channel Can withstand 1.25 kV applied between AC power supply and case for 1 minute.
- (7) Insulation resistance: 10 MΩ for 500V DC minimum.
- (8) Output Voltage:

Output voltage	Limits of output voltage	Nominal current	USE
+5	5.0 ~ 5.1V	3.6 A	logic circuit
+12(C)	11.6 ~ 12.4 V	0.9A	green monitor
+12(F)	11.4 ~ 12.6V	1.2A	floppy disk drive
+12(L)	11 ~ 13V	0.45A	keyboard, RS-232C
-12	-11 ~ -13V	0.02 A	D-RAM, RS-232C

Table 1-3

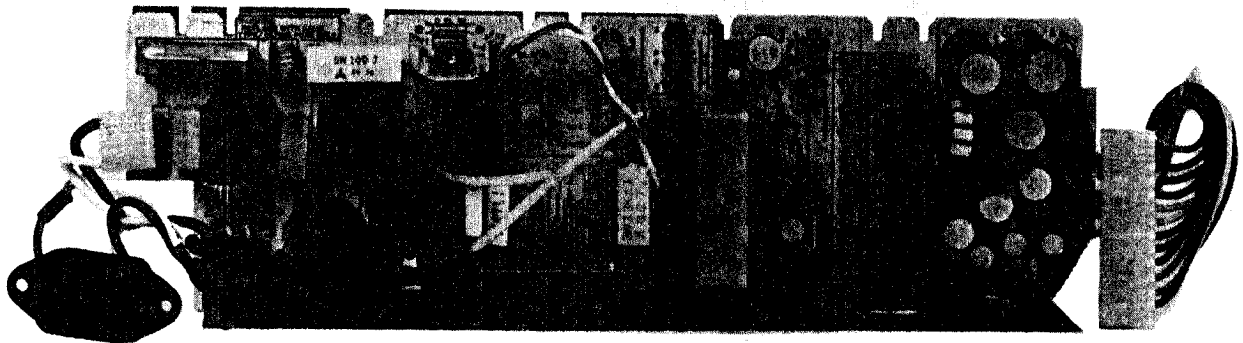


Fig. 1-5

(D) CRT display unit

Fig. 1-6 shows the standard green monitor unit of QX-10.

The CRT is characterized by high resolution of 640 x 400 dots and non-glare coating, preventing reflection.

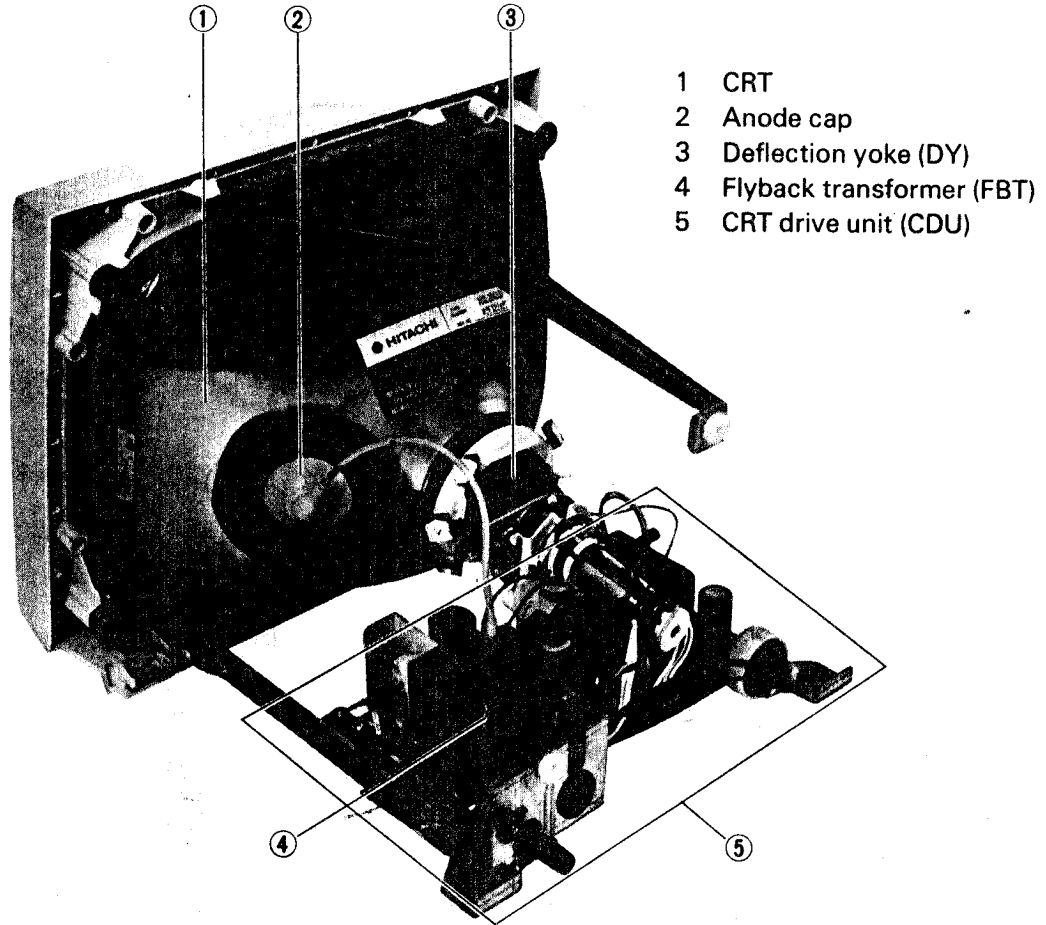


Fig. 1-6

1) Pin Definition

Pin No.	Function
1	Video signal -
2	Vertical synchronizing signal
3	Horizontal synchronizing signal
4	Power supply + 12V DC
5	Grounding (power supply, horizontal)
6	Grounding (video vertical)
7	Grounding (power supply, horizontal)
8	Frame grounding

Table 1-4

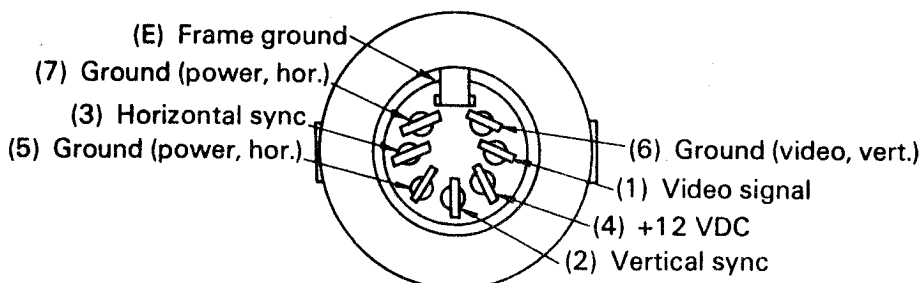


Fig. 1-7

2) Input Conditions

(1) Video signal:

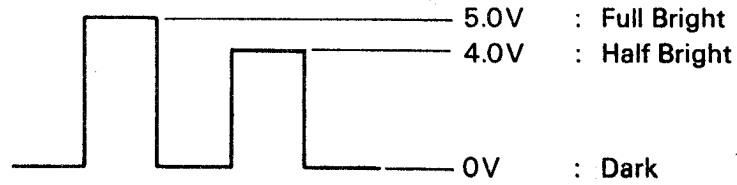


Fig 1-8

- (2) Video input impedance: 300 Ω min. 40 pF max.
- (3) Horizontal driving signal: TTL (positive)
L: 0 - 0.8 V H: 2.4 - 5.5 V
- (4) Horizontal input impedance: 500 Ω min.
- (5) Vertical driving signal: TTL (positive)
L: 0 - 0.8 V H: 2.4 - 5.5 V
- (6) Vertical input impedance: 3.0 k Ω min.

3) Input signal timing

(a) Horizontal driving signal
19.3 kHz

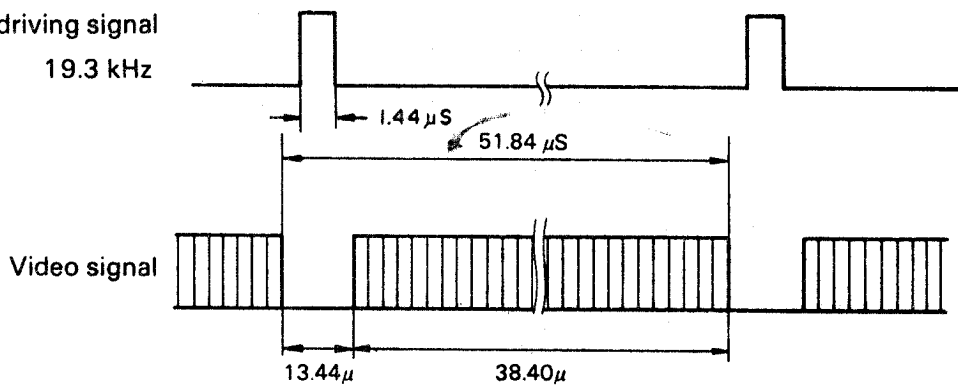


Fig. 1-9

(b) Vertical driving signal
45.8 Hz

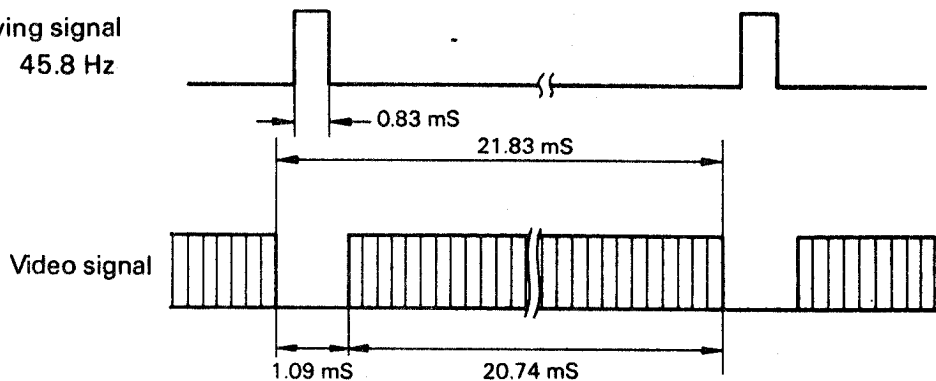


Fig. 1-10

(c) Video signal

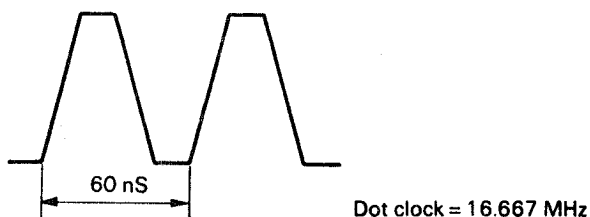


Fig. 1-11

(E) Keyboard

The keyboard of QX-10 is available in ASCII type and HASCI type, according to applications.

These two types are almost the same in hardware.

Keyboard data transfer is controlled by the CPU μ PD8049 used as a keyboard controller separately from the main CPU.

Data transfer is made with the main system unit in the start-stop turning system at the rate of 1200 BPS.

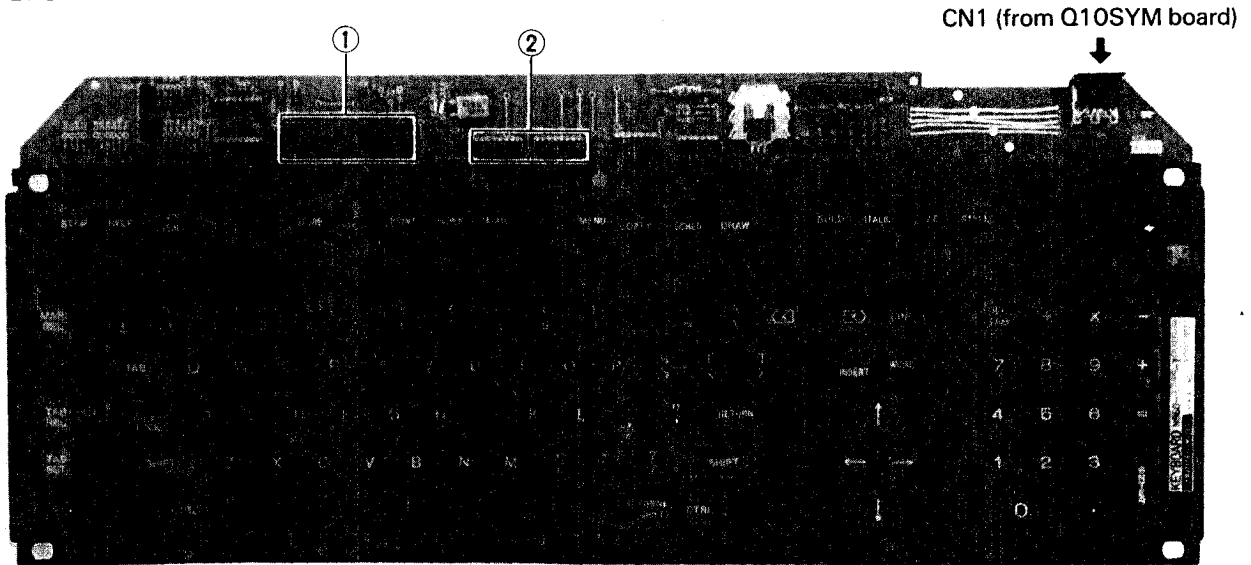


Fig 1-12

- 1 Keyboard controller (μ PD8049)
- 2 Key scan signal decoder (LS145)

Pin Definition of CN1

Pin No.	Signal Direction	Description of Signal
1	OUT	Received data
2	OUT	Clock (1200 BPS)
3	OUT	+12 V
4	IN	- Transmitted data
5	-	Ground
6	-	Ground
7	-	Ground
8	-	Ground

Note: The direction of signal is as viewed from the Q10SYM board

Table 1-5

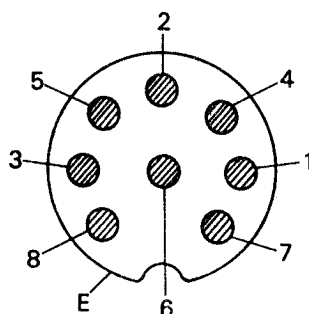


Fig. 1-13 Pin locations

(F) Floppy Disk Drive SD-321

Double sided, double density type of 5-1/4" floppy disk drive SD-321 has the features as described below:

- 1) SD-321 produces an ultra thin structure of 1/2 – 1/3 the conventional models.
- 2) In order to miniaturize the circuit board and get high reliability, most of the control circuit is integrated to two LSIs.

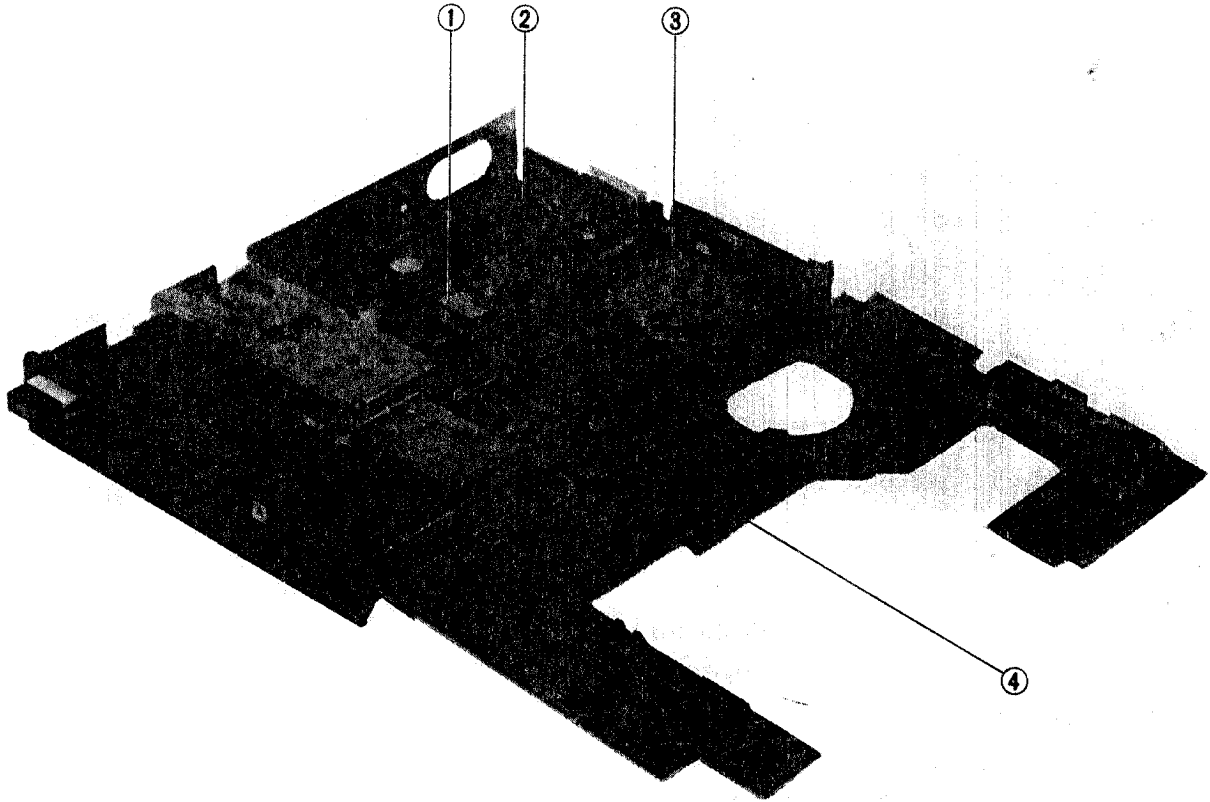


Fig. 1-14

- 1 Head pad
- 2 VCM
- 3 Drive motor
- 4 Main PCB

► Specifications of SD-321

1. Memory capacity
 - (1) Unformatted : 500 k byte (Double density recording)
 - (2) Formatted (16 sectors/track) : 328 k byte (Double density recording)
2. Recording density (side 1, trk 39) : 5876 BPI (Double density recording)
3. Transmission speed : 250 k bit/sec (Double density recording)
4. Track mean speed waiting time : 100 msec
5. Access time
 - (1) Between tracks : 15 msec
 - (2) Between tracks moving average : 220 msec
 - (3) Settling time : 15 msec
6. Motor starting time : 0.5 sec
7. Motor speed : 300 rpm
8. Track density : 48 TPI
9. Total number of tracks : 80
10. Inner circumference track radius : 36.52 mm (trk 39, side 0)
55.03 mm (trk 00, side 1)
11. Outer circumference track radius : 36.52 mm (trk 39, side 0)
34.40 mm (trk 39, side 1)
12. Recording system : MFM
13. R/W head positioning : Voice coil motor
14. Main axis motor : Outer rotor-type brushless transistor motor
15. Detectors
 - (1) Index hole detector : Photoelectric conversion
 - (2) Track No.00 detector : Photoelectric conversion
 - (3) Wright protect detector : Photoelectric conversion
 - (4) Track address detector : Photoelectric conversion
16. Ambient conditions
 - (1) Temperature : 4°C to 43°C
 - (2) Relative humidity : 20% to 80% (no condensation)
 - (3) Maximum wet-bulb temperature : 29°C
 - (4) Vibration : 0.6G, 5 ~ 60 Hz
17. Transportation and storage condition
 - (1) Temperature : -40°C to 65°C
 - (2) Relative humidity : less than 95% (no condensation)
 - (3) Vibration : less than 3G, 50 ~ 60 Hz
 - (4) Impact : less than 50G

18. Power supply
- (1) +12V ($\pm 5\%$) : 0.7 A (typ) (at reading/writing)
1.9 A (max) (at motor starting)
 - (2) +5V ($\pm 5\%$) : 0.25 A (typ) (at reading/writing)
0.4 A (max) (at motor starting)
19. Power consumption : 9.7 W (typ)
20. Reliability
- (1) MTBF : 1000 HOURS (POH)
 - (2) MTTR : 30 minutes
 - (3) Soft error rate : less than once every 10^9 bits
 - (4) Hard error rate : less than once every 10^{12} bits
 - (5) Seek error rate : less than once every 10^6 seeks
21. Connectors
- (1) Power supply connector : AMP. P/N 1-480424-0 or equivalent
 - (2) Signal connector : 3M P/N 3463-0001 or equivalent