EPSON

● QX-10 OPTION

RS-232C I/F CARD

USER MANUAL

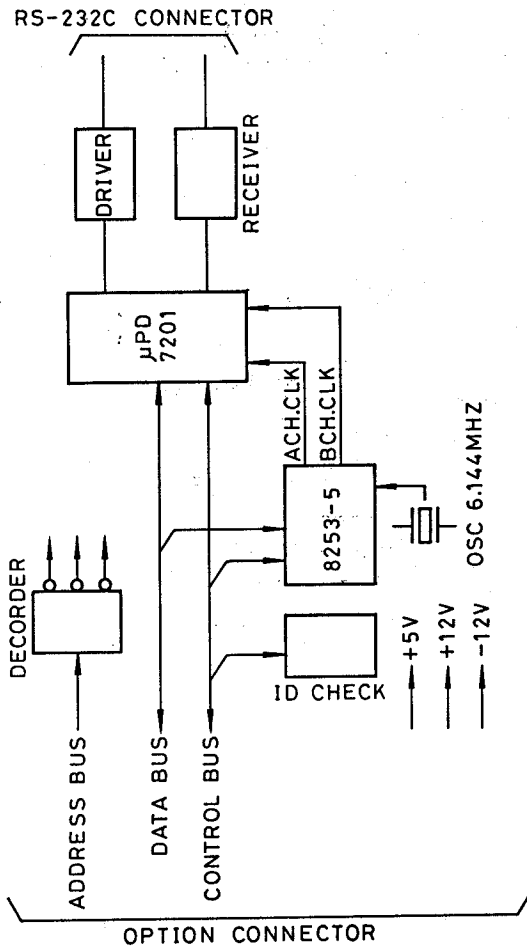Q8394015-1
Y135990007

1. General

The term "RS232C" refers to the standard established by the Electronic Industries Association (EIA) to govern conditions for connection between a data terminal and a data communication device for transfer of binary serial data. This standard is currently widely used in interfaces for low-speed, short distance communications.

The optional RS232C interface card which is described in this manual can be inserted in one of the QX-10's option slots for use as an RS232C circuit interface. Further, the device address of this option card can be changed by changing jumper connections, and up to two RS232C interface cards may be mounted in the option slots at the same time. Since each option card is capable of supporting two communication channels, a total of 5 channels can be supported when two option cards are used together with the standard RS232C interface built into the QX-10.

This interface card uses an NEC μPD7201 as a serial controller. This controller makes it possible for the interface to support both asynchronous and synchronous (SDLC or BY-SYNC) communications. Transfer rate is set by software, and speeds of up to 19200 bps are possible when using asynchronous communciation.

The interface card also includes an 8253-5 counter/timer to supply the send/receive clock signal to the μPD7201. Whether or not the card is mounted is made known to the QX-10 by means of a built-in ID check circuit. Either polling or interrupt processing can be used for interfacing with the CPU.

2. Block Diagram

RS-232C CONNECTOR

DRIVER

RECEIVER

μPD 7201

ACH.CLK

BCH.CLK

8253-5

OSC 6.144MHZ

DECORDER

ID CHECK

+5V

+12V

-12V

ADDRESS BUS

DATA BUS

CONTROL BUS

OPTION CONNECTOR

3. Component Layout

EPSON

QIO RS BOARD

UNIT Y13520700000

J8

DIPSW1-2

J6, J7

J1~5
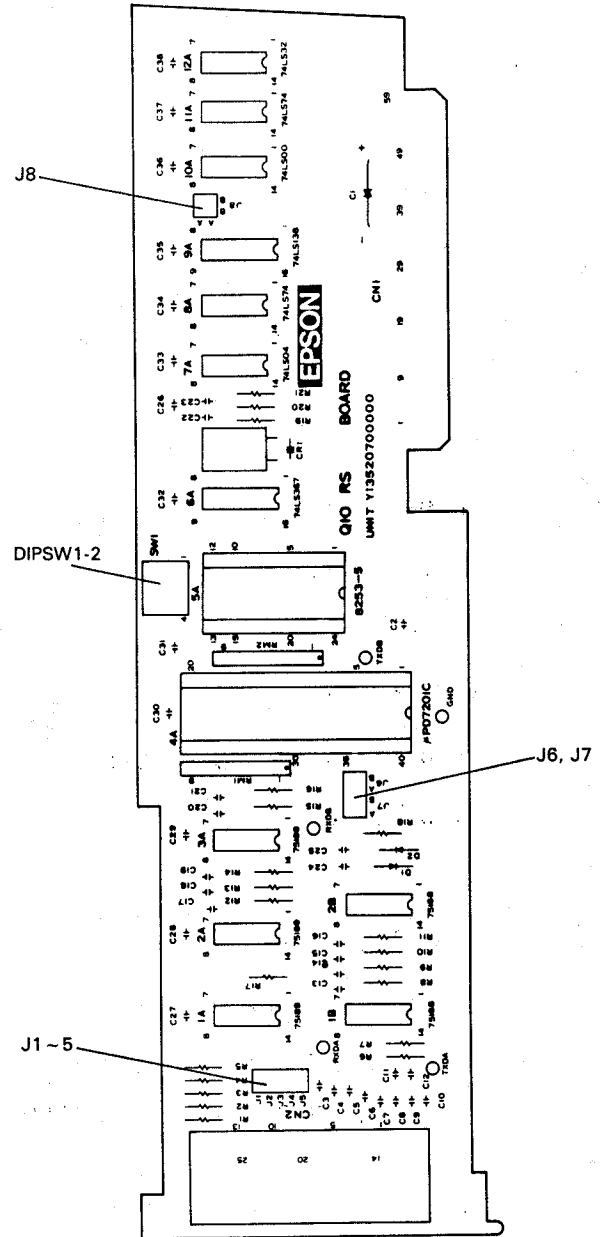
4. Condition Settings

The RS232C interface card is equipped with DIP switches and jumpers which make it possible for the user to set a wide variety of communication conditions. The functions of the various switches and jumpers and their settings at the time of shipment from the factory are as shown in the tables below.

4.1 Jumper Settings

Jumper	ON	OFF	Factory-set condition
J1	SCB pulled up.	SCB not pulled up.	ON
J2	SCF pulled up.	SCF not pulled up.	ON
J3	CF pulled up.	CF not pulled up.	ON
J4	CC pulled up.	CC not pulled up.	ON
J5	CB pulled up.	CC not pulled up.	ON

Synchronization mode		J6-A	J6-B	J7-A	J7-B
Asynchronous		OFF	ON	ON	OFF
Synchronous	Transmission clock supplied by the modem.	ON	OFF	OFF	ON
	Internal clock used.	OFF	ON	OFF	ON
Factory-set condition		OFF	ON	ON	OFF

Address map

("AA" Setting)　　　("BB" Setting)
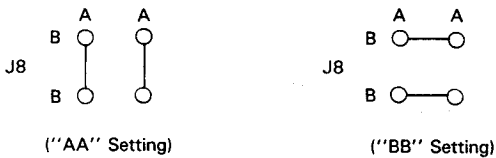
J8	Function
AA	Assigns I/O port addresses 0A4H - 0AFH to RS232C interface Q10RS.
BB	Assigns I/O port addresses 0C4H - 0FCH to RS232C interface Q10RS.

* J8 is set to "AA" at the time of shipment from the factory. If two RS232C interface cards are installed, the J8 setting of one must differ from that of the other.

4.2 DIP Switch Settings

SW1-2

| ON	CH (data rate selector) turned on.
OFF	CH (data rate selector) turned off.

Note:
DIP switches 1-1 to 1-4 are all set to ON at the time of shipment from the factory.

5. Installation

Refer to the "Interrupt level" appendix when selecting the slot for the option card so that the appropriate interrupt level is obtained.

1. Set the power switch of the QX-10 to the OFF position.
2. Remove the two screws from the back side of the option slot compartment cover, then remove the cover from the compartment.

Option slot compartment　　　Segmented connector cover
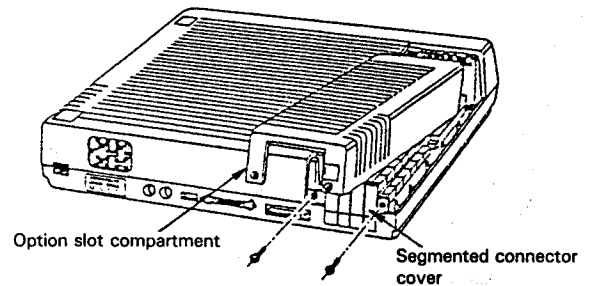
3. Remove the segmented connector cover from the back of the main unit by pulling it straight up.
4. Remove the screws from the black metal plate on the back side of the QX-10 option compartment, then remove the black plate itself.
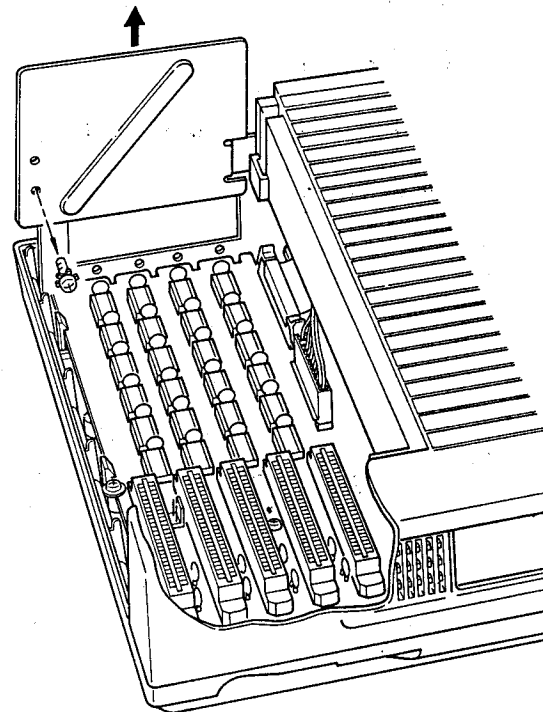
5. Insert the option card into any slot other than slot 5.
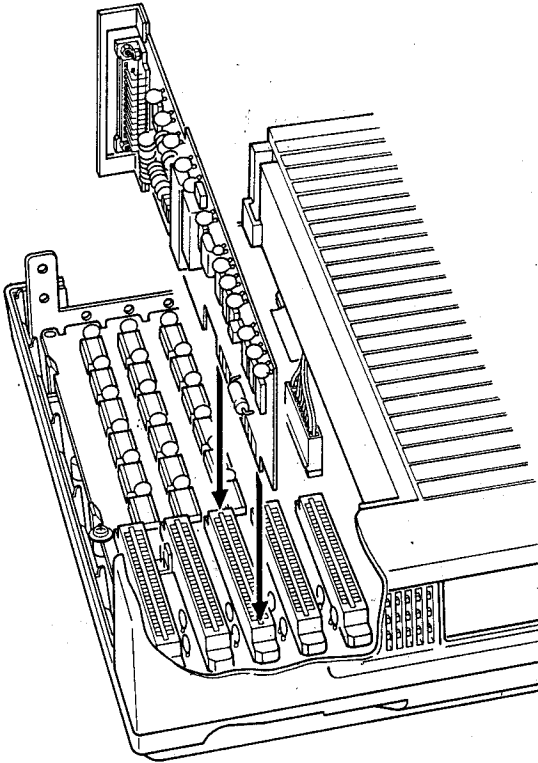
6. Fasten the brace plate on the end of the option card to the base plate after inserting the card into the option slot.

Brace plate

Lower case

Base plate

7. Break off the segment of the connector cover which corresponds to the slot used for installation of the option card.

8. Replace the remaining segments of the connector cover.
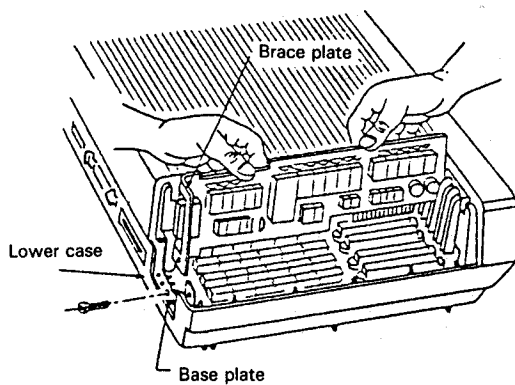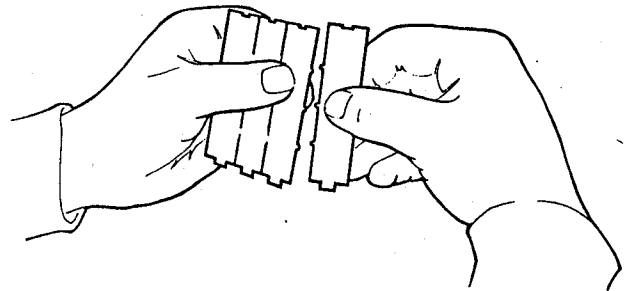9. Hold the option compartment cover vertically and insert the two hinge pins into their notches near the front of the main unit, then lower the cover into place. Check to ensure that it fits snugly, then replace the screws on the back side to secure the cover to the main unit.
10. Plug the cable to the RS232C device into the connector.

CAUTION
Always wait at least five seconds after turning off power before switching the power back on. Failure to observe this precaution may damage your computer.

Removing Option Cards

Follow the instructions for powering down and removing the cover, then disconnect the cable(s) from the option card.
Slide the card straight up and out of the notched guides.
Be sure to rewrap the card (preferably with the original packing), then place it inside a carton for safe storage.

6 Hardware

6.1 RS232C Interface Connector
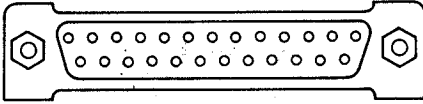
EIA standard 25-pin DB connector

Signals and pin assignments.

| Pin No.	Signal name	Function	Remarks
1	AA (PG)	Protection ground	
2	BA (TxD)	Send data	7201 CHA
3	BB (RxD)	Receive data	7201 CHA
4	CA (RTS)	Request to send	7201 CHA
5	CB (CTS	Clear to send	7201 CHA
6	CC (DSR)	Data set ready	Read with LS367
7	AB (SG)	Signal ground	
8	CF (DCD)	Carrier detect	7201 CHA
9	Not used	—	
10	Not used	—	
11	REV.		Same as CD. This is not a standard RS-232C signal.
12	SCF (Secondary DCD)	Carrier detect 2	7201 CHB
13	SCB (Secondary CTS)	Clear to send 2	7201 CHB
14	SBA (Secondary TxD)	Send data 2	7201 CHB
15	DB (TxC	Transmission clock	7201 CHA Input from modem
16	SBB (Secondary RxD)	Receive data 2	7201 CHB
17	DD (RxC)	Receive data	7201 CHA Input from modem
18	DSRB	Data set ready	7201 CHB (Assigned by EPSON.)
19	SCA (Secondary RTS)	Request to 2	7201 CHB
20	CD (DTR)	Data terminal ready	7201 CHA
21	Not used	—	
22	CE (RING IND)	Ring indicator	Read with LS367
23	CH (DATA RATE)	Data transfer rate selection	Selected by a DIP switch.
24	DA (TxC)	Transmission clock	Output to modem
25	DTR B		7201 CHB (Assigned by EPSON.)

The RS232C interface card includes a secondary EIA RS232C system. These two systems can be controlled independently of each other; for example, by using a branch cable, it is possible to use one interface card to support two channels. However, since the RS232C interface standard does not provide for secondary DTR and DSR signals, this method cannot be used to provide full support for two channels. Therefore, the following cable arrangement (Ex. cable set #525), which is not defined in the RS232C standard, is used to provide 2-channel support.

<Connection cables>
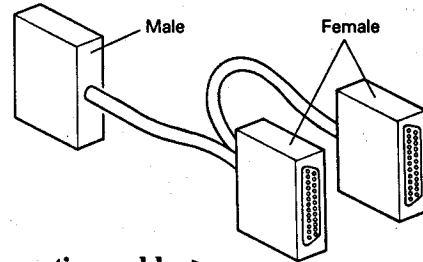
The following special cables are provided by EPSON for connection of the RS232C interface port to terminal equipment.

Cable set #523

Cable set #523 is used for connecting the RS232C interface card to an asynchronous modem or acoustic coupler. Signal lines and pin assignments with this cable are as shown in the figure below.

1	CGND	Shield	
2	TxD	Orange/red	Channel A
3	RxD	Orange/black	Channel A
4	RTS	Gray/red	Channel A
5	CTS	Gray/black	Channel A
6	DSR	White/red	Channel A
7	SG	White/black	Channel A
8	DCD	Yellow/red	Channel A
20	DTR	Yellow/black	Channel A

1	CGND	Shield	
2	TxD	Orange/red	Channel A
3	RxD	Orange/black	Channel A
4	RTS	Gray/red	Channel A
5	CTS	Gray/black	Channel A
6	DSR	White/red	Channel A
7	SG	White/black	Channel A
8	DCD	Yellow/red	Channel A
20	DTR	Yellow/black	Channel A

3000 mm

Cable set #524

Cable set #524 is used for connecting two QX-10s or a QX-10 and another computer equipped with an RS232C standard interface. Signal lines and pin assignments of this cable are as shown in the figure below.
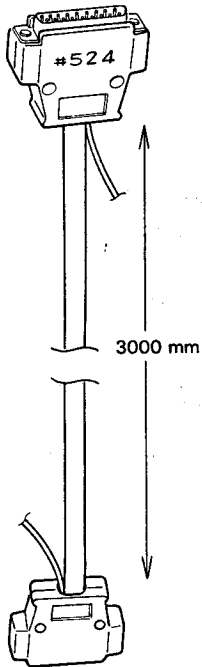
1	CGND	Shield	
2	TxD	Orange/red	Channel A
3	RxD	Orange/black	Channel A
4	RTS	Tin-plated	
5	RTS	Tin-plated	
6	DCD	Gray/red	Channel A
7	SG	Gray/black	Channel A
8	DCD	Gray/red	Channel A
17	RxC	White/red	Channel A
20	DTR	White/black	Channel A
24	TxC	Yellow/red	Channel A

3000 mm

1	CGND	Shield	
2	RxD	Orange/black	Channel A
3	TxD	Orange/red	Channel A
4	CTS	Tin-plated	
5	CTS	Tin-plated	
6	DTR	White/black	Channel A
7	SG	Gray/black	Channel A
8	DTR	White/black	Channel A
17	TxC	Yellow/red	Channel A
20	DCD	Gray/red	Channel A
24	RxC	White/red	Channel A

Cable set #525

Cable set #525 is the branched cable described in the section above. Signal lines and pin assignments of this cable are as shown in the figure below.

500 mm

QX-10 RS-232C side

Channel B
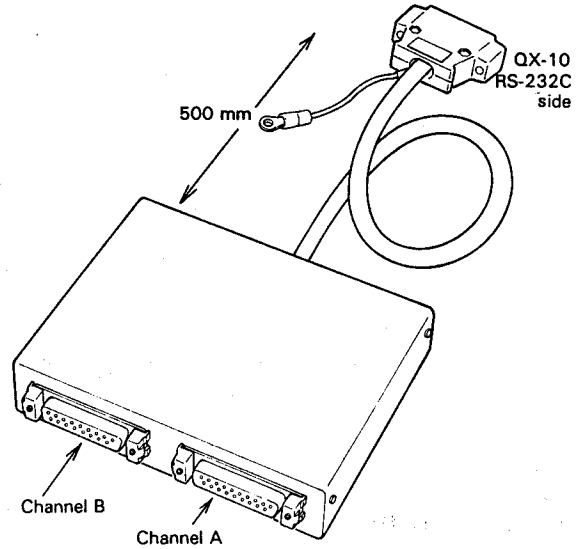
Channel A

QX-10 RS-232C side

1	CGND	Shield	
2	TxDA	Orange/red	Channel A
3	RxDA	Orange/black	Channel A
4	RTSA	Gray/red	Channel A
5	CTSA	Gray/black	Channel A
6	DSRA	White/red	Channel A
7	SG	White/black	Channel A
8	DCDA	Yellow/red	Channel A
12	DCDB	Yellow/black	Channel A
13	CTSB	Pink/red	Channel A
14	TxDB	Pink/black	Channel A
15	TxC (DB)	Orange/red	Channel B
16	RxDB	Orange/black	Channel B
17	RxC	Gray/red	Channel B
18	DSRB	Gray/black	Channel B
19	RTSB	White/red	Channel B
20	DTRA	White/black	Channel B
22	RING	Yellow/red	Channel B
23	RATE SEL	Yellow/black	Channel B
24	TxC (DA)	Pink/red	Channel B
25	DTRB	Pink/black	Channel B

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Channel A

1	CGND	Shield	
2	TxDA	Orange/red	Channel A
3	RxDA	Orange/black	Channel A
4	RTSA	Gray/red	Channel A
5	CTSA	Gray/black	Channel A
6	DSRA	White/red	Channel A
7	SG	White/black	Channel A
8	DCDA	Yellow/red	Channel A
11	DTRA	White/black	Channel B
15	TxC (DB)	Orange/red	Channel B
17	RxC	Gray/red	Channel B
20	DTRA	White/black	Channel B
22	RING	Yellow/red	Channel B
23	RATE SEL	Yellow/black	Channel B
24	TxC (DA)	Pink/red	Channel B

Channel B

1	CGND	Shield	
2	TxDB	Pink/black	Channel A
3	RxDB	Orange/black	Channel B
4	RTSB	White/red	Channel B
5	CTSB	Pink/red	Channel A
6	DSRB	Gray/black	Channel B
7	SG	White/black	Channel A
8	DCDB	Yellow/black	Channel A
11	DTRB	Pink/black	Channel B
20	DTRB	Pink/black	Channel B

6.3 Slot connector
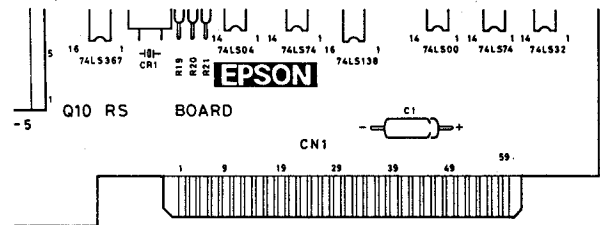
Signals and pin assignments

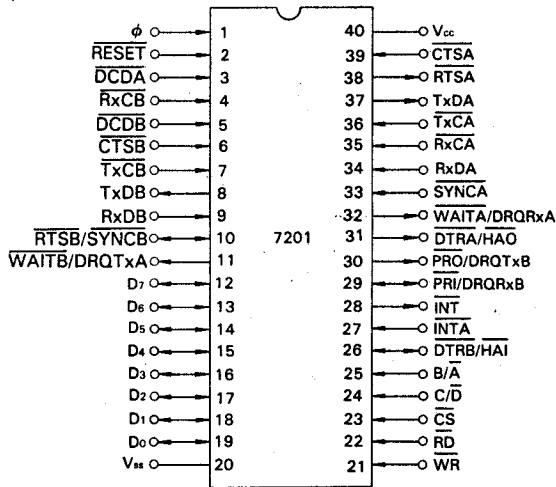| Pin No.	Signal	Pin No.	Signal
1	GND	2	GND
3	DTB0	4	DTB1
5	2	6	3
7	4	8	5
9	6	10	7
11	−12 V	12	−12 V
13	ADR0	14	ADR1
15	2	16	3
17	4	18	5
19	6	20	7
21	8	22	9
23	10	24	11
25	12	26	13
27	14	28	15
29	GND	30	GND
31	CLK	32	GND
33	BSAK	34	MEMX
35	IRD	36	IWR
37	MRD	38	MWR
39	RSIN	40	INT(H) 1
41	INT(H) 2	42	INT(L)
43	+5 V	44	RSET
45	+5 V	46	+5 V
47	DRQ(F)	48	DRQ(S)
49	RDY(F)	50	RDY(S)
51	WAIT	52	IWS
53	DAK(F)	54	DAK(S)
55	EOP(F)	56	EOP(S)
57	+12 V	58	+12 V
59	GND	60	GND

7. Software

7.1 I/O Map of the RS232C Interface Card

The I/O port addresses assigned to the devices on the RS232C card can be switched by changing the setting of a single jumper (J8).

| J8	MPSC 7201	Timer counter 8253-5	ID check
AA	A4 to A7	A8 to AB	AC to AF
BB	C4 to C7	C8 to CB	CC to CF

7.2 µPD7201

The µPD7201 is a multi-protocol serial controller which supports full duplex communications for two channels, and is located between the CPU and serial data processor for control and for conversion of serial data to parallel and vice versa.

φ	1	40	V_{cc}
$\overline{RESET}$	2	39	$\overline{CTSA}$
$\overline{DCDA}$	3	38	$\overline{RTSA}$
$\overline{RxCB}$	4	37	TxDA
$\overline{DCDB}$	5	36	$\overline{TxCA}$
$\overline{CTSB}$	6	35	$\overline{RxCA}$
$\overline{TxCB}$	7	34	RxDA
TxDB	8	33	$\overline{SYNCA}$
RxDB	9	32	$\overline{WAITA/DRQRxA}$
$\overline{RTSB/SYNCB}$	10 7201 31		$\overline{DTRA/HAO}$
$\overline{WAITB/DRQTxA}$	11	30	$\overline{PRO/DRQTxB}$
D_7	12	29	$\overline{PRI/DRQRxB}$
D_6	13	28	$\overline{INT}$
D_5	14	27	$\overline{INTA}$
D_4	15	26	$\overline{DTRB/HAI}$
D_3	16	25	B/$\overline{A}$
D_2	17	24	C/$\overline{D}$
D_1	18	23	$\overline{CS}$
D_0	19	22	$\overline{RD}$
V_{ss}	20	21	$\overline{WR}$

Pin assignments

I/O mapping for the µPD7201 ports can be changed as shown below by changing the setting of jumper J8.

	J8 AA		J8 BB
A4	Channel A data	C4	Channel A data
A5	Channel A control	C5	Channel A control
A6	Channel B control	C6	Channel B control
A7	Channel B control	C7	Channel B control

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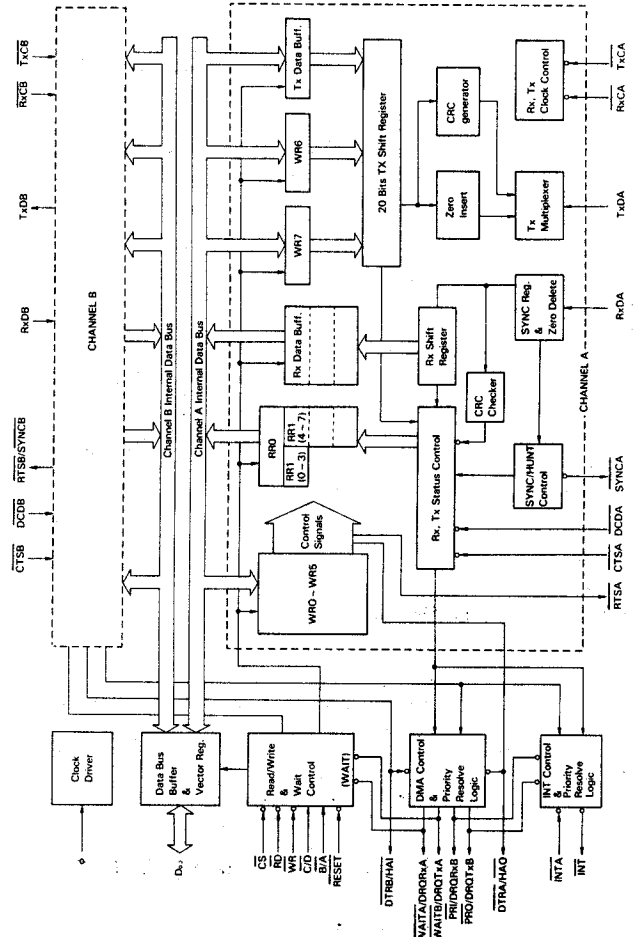
µPD7201 block diagram

The following points must be noted when accessing the µPD7201.

1 Use only non-vectored, 85/86 mode interrupts.
2 DMA cannot be used.
3 Set the $\overline{RTSB/SYNCB}$ terminal to RTSB. In other words, set the MSB of WR2A to 0.

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7.3 8253-5 timer counter

The 8253-5 includes 3 counters, designated #0, #1 and #2. Counters #0 and #1 are used as bit rate generators for CHA and CHB of the 7201, respectively. Counter #2 is not used by the system, so it can be used as general purpose counter/timer.

Example of programming

Step	Address	Data	RD/WR	Meaning
1	ABH	00110110B	WR	Sets counter #0 in mode 3.
2	ABH	01110110B	WR	Sets counter #1 in mode 3.
3	A8H	A	WR	Sets the 7201 channel A
4	A8H	B	WR	bit rate.
5	A9H	C	WR	Sets the 7201 channel B
6	A9H	D	WR	bit rate.

A, B, C and D are determined as follows.
(1) Asynchronous X 16 mode (the CLK frequency is 16 times the bit rate.)

$$\text{Data value} = \begin{array}{|c|c|} \hline B & A \\ \hline \end{array} \quad \text{(16-bit data)}$$

$$= \begin{array}{|c|c|} \hline D & C \\ \hline \end{array}$$

(positions: 15, U, 8, L, 0)

$$\text{Value set} = \frac{1.536 \times 10^6}{BR \times 16} \quad \text{where BR = bit rate}$$

Example: When the bit rate is 9600 bps

$$\text{Data value} = \frac{1.536 \times 10^6}{9600 \times 16} = 10$$

Therefore, $A = 0AH \quad B = 0$

(2) Synchronous mode

$$\text{Data value} = \frac{1.536 \times 10^6}{BR}$$

Example: When the bit rate is 4800 bps

$$\text{Value set} = \frac{1.638 \times 10^6}{4800} = 320 = 140H$$

Therefore, $A = 40H \quad B = 1H$

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7.4 ID Check Procedures

An ID check is performed to determine whether this card is mounted in an option slot and, if so, what slot it is mounted in. When data is written to address ACH (or any of ADH to AFH) or CCH, an interrupt is generated from the address corresponding to the slot in which the card is mounted. This interrupt is reset when address ACH or CCH is read. The contents of the data byte read from ACH or CCH are as shown below. The DSRA, DSRB, RINGER and DIP SW bits are 0 when the respective signals are active.
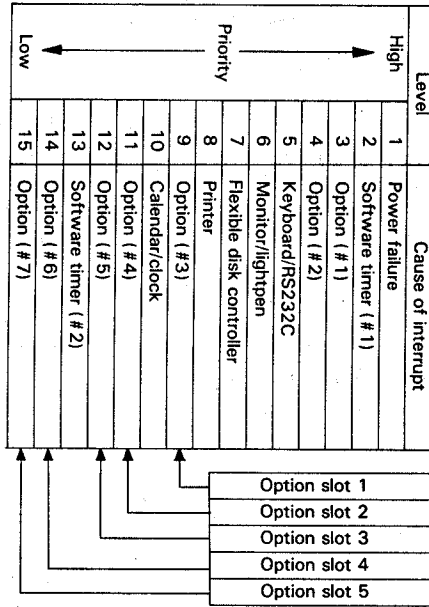
D7	6	5	4	3	2	1	0
DSRA (cc)	DSRB	RIN-GER (CE)		Always high			DIP SW

The DIP SW bit indicates the setting of the corresponding DIP switch. The DIP switches are used for purposes such as selecting the synchronization mode.
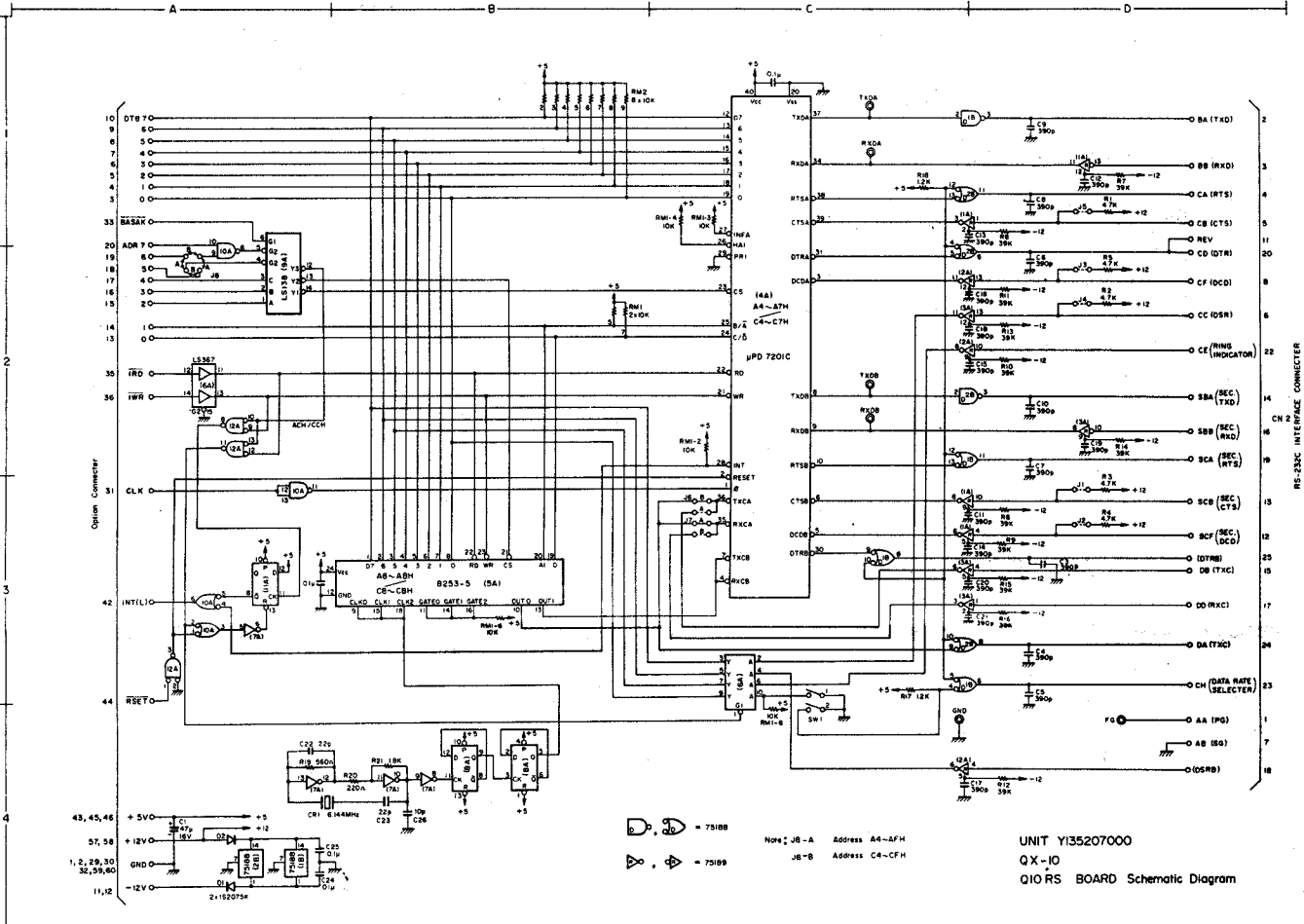
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Appendix - Interrupt Level

The QX-10 supports 15 interrupt levels. If an interrupt occurs, the QX-10 compares the priority of the program currently being executed with that of the interrupt to determine whether or not interrupt processing is started immediately. Different option slots have different interrupt levels as shown below. Select the slot for installation of the option card from among slots 1 to 4 after considering the frequency of use of the interface and data transfer rate.
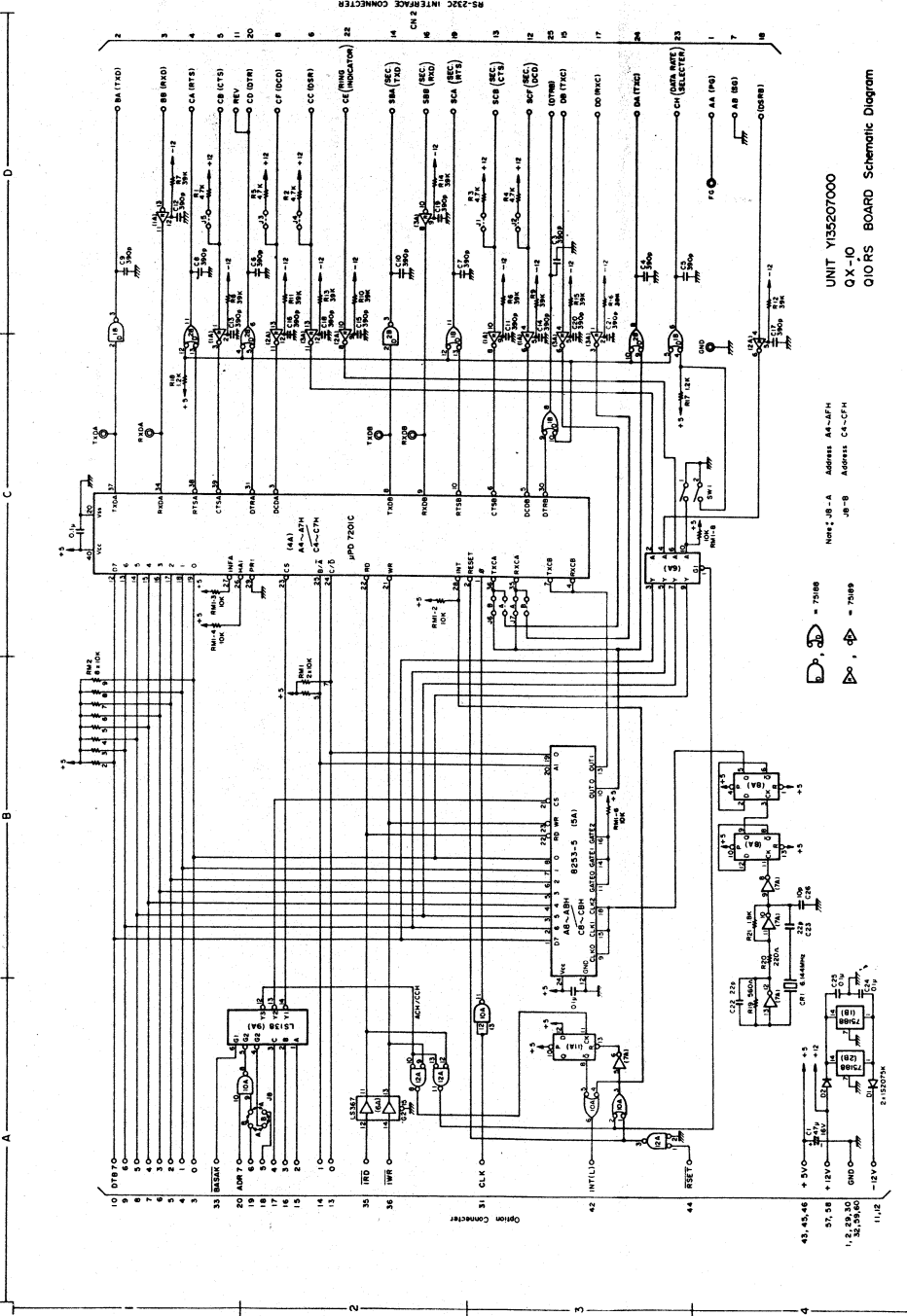
Interrupt level

	Level	Cause of interrupt
High	1	Power failure
	2	Software timer (#1)
	3	Option (#1)
	4	Option (#2)
	5	Keyboard/RS232C
	6	Monitor/lightpen
	7	Flexible disk controller
Priority	8	Printer
	9	Option (#3)
	10	Calendar/clock
	11	Option (#4)
	12	Option (#5)
	13	Software timer (#2)
	14	Option (#6)
Low	15	Option (#7)

Option slot 1
Option slot 2
Option slot 3
Option slot 4
Option slot 5

Schematic Diagram

UNIT Y135207000
QX-10
Q10 RS BOARD Schematic Diagram

Schematic Diagram

UNIT Y135207000
QX-10
QIORS BOARD Schematic Diagram

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