7.17 RWC-MUX : MULTIPLEXER MODULE

7.17.1 FUNCTIONAL DESCRIPTION

The RWC-MUX Real-World interface module provides 16 multiplex channels of 3 lines each, and a common return. The 3 multiplexed lines together with the common line are brought to a 4-pin male connector on the module. These four lines are also carried by a 15 cm long 4-wire flat cable connected to the RWC-MUX at one end, with a female connector at the free end. This arrangement enables several RWC-MUX modules to be directly connected in cascade.

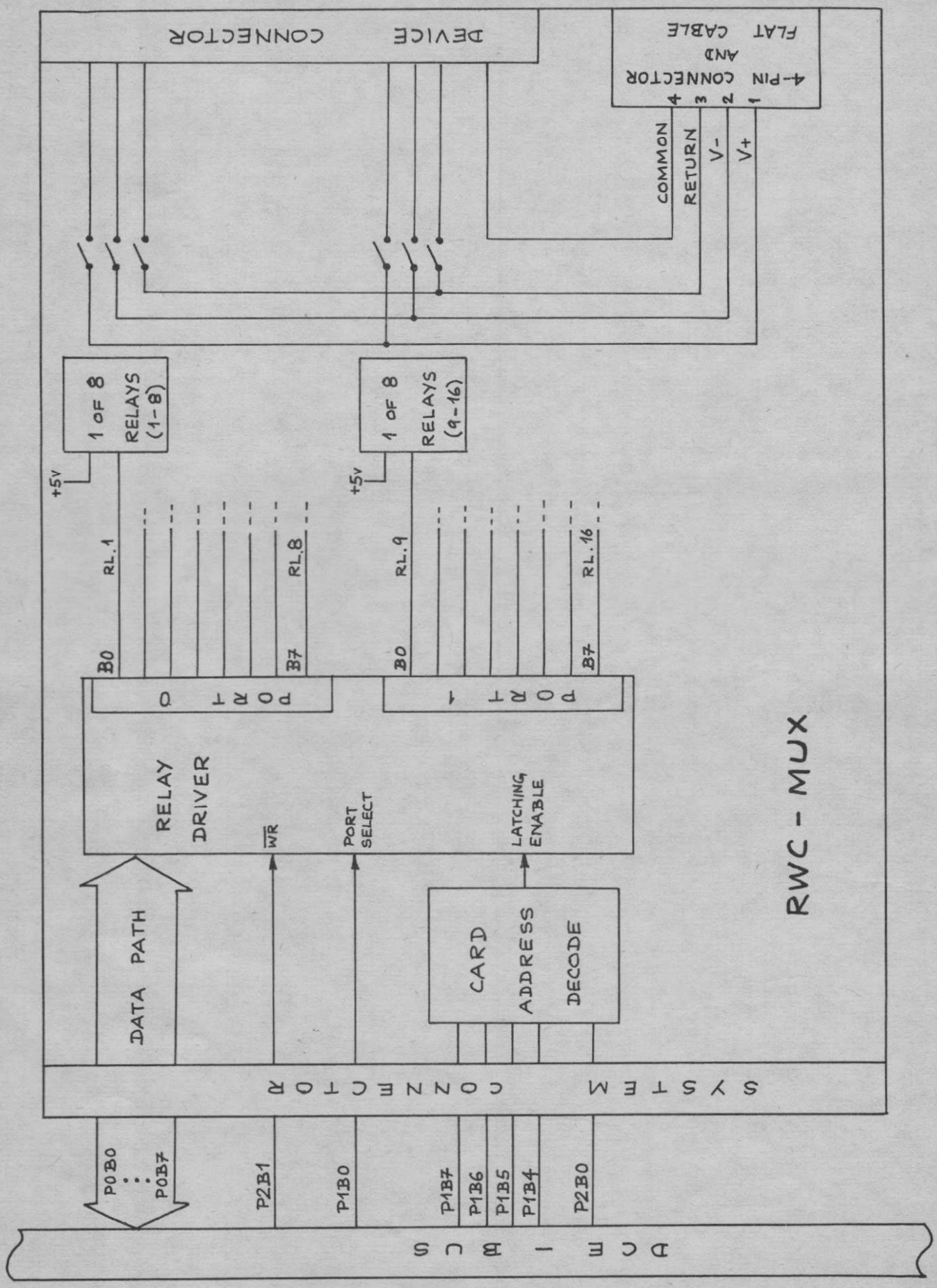
The RWC-MUX is ideal for use with the RWC-PTM Position and Temperature Measurement module. In this configuration each multiplex channel provides the 10mA constant current output from the RWC-PTM, and the resulting voltage input to the RWC-PTM. Upto 14 RWC-MUX modules can be directly connected to a RWC-PTM module.

Each card has an identification address defined by a hexadecimal switch, and upto 14 cards may be directly connected to the DCE-BUS.

7.17.2 FEATURES

- 16 multiplex channels of 3-lines each, and one common line
- 4-pin male connector for the 3 multiplexed lines and the common line
- 4-wire flat cable with a female connector at the free end for connecting several modules in cascade
- directly connectable to the RWC-PTM module
- standard hardware and software interface to the DCE-BUS
- switch selectable card address
- single 100 x 160 mm eurocard format

7. 17. 3 FUNCTIONAL BLOCK DIAGRAM



7.17.4 SYSTEM DESIGN PARAMETERS

7.17.4.1 Hardware Configuration

The functional block diagram in Section 7.17.3 illustrates the hardware configuration of the RWC-MUX module. The module does not use a RIC device for interfacing to the DCE-BUS.

The 16 multiplex channels are activated via 16 3-contact relays. The relays are grouped into two banks of eight each, and are controlled by active-low outputs from two 8-bit latching ports. System software must ensure that only one out of the 16 latched outputs controlling the relays are low at any time.

When the RWC-MUX module is correctly addressed, one out of the two ports will be selected. The 8 outputs of the selected port will follow the data on the DCE-BUS Data Path, while the $\overline{WR}$ signal is active and the port remains selected. Latching will occur when either becomes inactive.

The RWC-MUX module does not use the system Reset signal. Therefore a system reset has no effect on the status of the relays.

After power-on, the outputs of the ports and therefore the status of the relays will be random. System software must initialise the 16 latched relay-controlling signals high in order to open all the relays.

The module does not use the $\overline{RD}$ signal from the DCE-BUS, and therefore software Read operations are not recognised by it.

7.17.4.2 Programming Specifications

The RWC-MUX module is addressed via the standard DCE-BUS interface. Programming specifications for driving the DCE-BUS are given in Section 4.1 of this manual.

Device Addresses

The module will accept and latch data from the DCE-BUS Data Path during Write operations ($\overline{WR}$ low and then high), when the upper four bits of the card/device address on the DCE-BUS correspond to the setting of the module address select switch (1 to F). The least significant bit of the above card/device address is used to select one out of the two ports. The remaining 3 bits of the card/device address are irrelevant.

Signals from the DCE-BUS Data Path are gated onto the two ports controlling the relays according to the card/device address on the DCE-BUS as follows :

address Y1 (Hex) : DCE-BUS Data to Port 0 controlling Relays 1-8.
Port 0 Bit 0 - Relay 1 (1 = open; 0 = close)
Port 0 Bit 7 - Relay 8

address Y0 (Hex) : DCE-BUS Data to Port 1 controlling Relays 9-16.
Port 1 Bit 0 - Relay 9 (1 = open; 0 = close)
Port 1 Bit 7 - Relay 16

where Y = card address switch setting in Hex (1 to F).

Since address bits 1, 2, 3 are don't care states, address Y1 for example is equivalent to Y2, Y4, Y6, . . . YE.

The contents of the DCE-BUS Data Path are latched to control the selected bank of 8 relays when the $\overline{WR}$ signal goes from low to high. The relay settings remain unchanged until altered by a subsequent Write sequence to the corresponding port.

Initialisation

After power-on the 16 relays on the RWC-MUX module must be initialised to the open state by writing 0FFH to the two ports. A typical sequence using the WRRWC write routine is given below for a card with the address select switch set to 'A':

```
MVI     A,0A0H
STGI    01              ; address Port 0
MVI     A,0FFH
CALL    WRRWC           ; write all one's to open relays 1 to 8
MVI     A,0A1H
STGI    1               ; address Port 1
MVI     A,0FFH
CALL    WRRWC           ; write all one's to open relays 9 to 16
```

RWC-MUX / DCE-BUS Protocol

After the above power-on initialization sequence to open all relays, any required relay can be closed by writing a control word to the relevant Port as shown in Table 7.17.1.

Number of the Relay to be Closed	Device Connector Pins			Card/Device Address on DCE-BUS	Control Word (Hex) for Closing Specified Relay
	V+	V-	Return		
1	23	6	22	Y0	FE
2	20	3	19		FD
3	14	13	30		FB
4	1	18	2		F7
5	32	31	15		EF
6	29	28	12		DF
7	5	21	4		BF
8	8	24	7		7F
9	9	25	26	Y1	FE
10	37	38	39		FD
11	17	16	33		FB
12	40	41	42		F7
13	43	44	45		EF
14	49	50	48		DF
15	34	35	36		BF
16	11	10	27		7F

Pin 47 = common line; Pin 46 not used

Table 7.17.1 : Relay Connections and Control Words

Notes:
1. Relay numbering is arbitrary.
2. The device connector pin designations V+, V- and Gnd are meaningful only when the module is used with a RWC-PTM.
3. The Common line at pin 47 carries the 10mA constant current when the module is used with a RWC-PTM.

When switching between two relays controlled by the output signals from the same port, one Write operation can open the currently closed relay and also close another one. But when switching between two relays controlled by different ports, the currently closed relay should be opened by writing 0FFH to that port, and the desired relay closed by writing the appropriate data word to the other port. This procedure will ensure that not more than one out of the 16 relays is closed at any time.

7.17.4.3 Module Connector Definitions

System Connector

See Section 6.1.4 for the pin definitions.

Device Connector

Pin definitions for the 50-pin D-type female connector are given in Table 7.17.1.

4-Pin Connector

The physical pin definitions for the 4-pin connector are shown in the diagram of Section 7.17.3. These connections are automatically matched when cascading several RWC-MUX modules.

When connected to the RWC-PTM module, the Common signal at pin 4 carries the 10 mA constant current, returned via the multiplexed Return signal at pin 3.

7.17.4.4 Operational Requirements

Relay Characteristics

Contact Rating : 10VA maximum
150V dc maximum
0.75A maximum

Environmental Requirements

Operational temperature	:	0°C to 55°C
Storage temperature	:	-25°C to +85°C
Relative humidity	:	up to 95% non-condensing

Bus Loading

The RWC-MUX module presents 1 unit-load to the DCE-BUS (see Section 4.4).

7.17.5. ORDERING INFORMATION

RWC-MUX : Standard Version including 4 wire flat-cable for cascading several modules.

7.18 RWC-DI24 : ISOLATED DIGITAL INPUT

Preliminary specification.

7.18.1 FUNCTIONAL DESCRIPTION

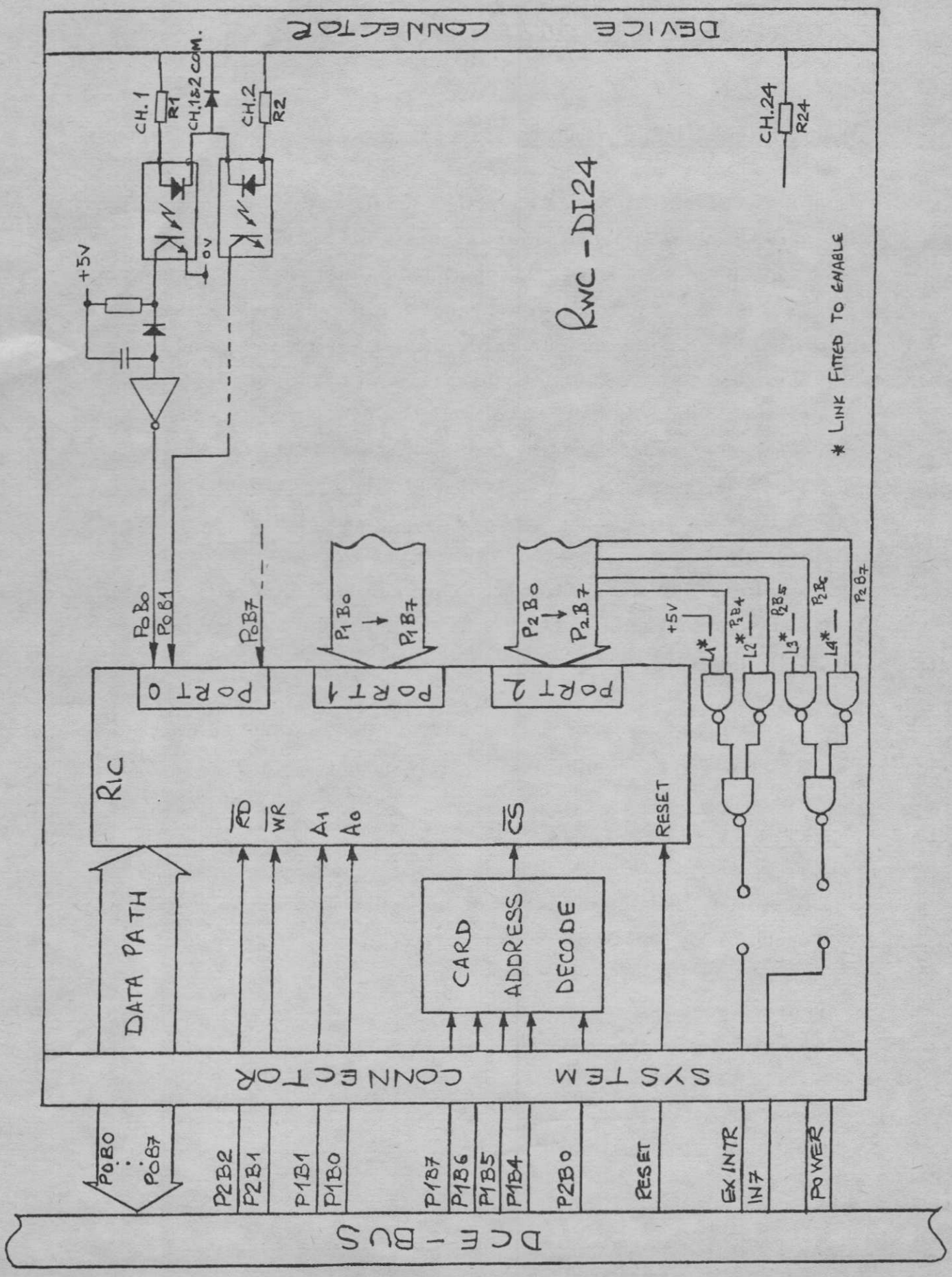
The RWC-DI24 Real-World interface module enables the connection of up to 24 optically isolated digital inputs to the DCE microcomputer system. Both A.C. and D.C. input signals up to 24V are accepted by the module. The input signal range for any channel can be modified by changing the current limiting resistor connected to its opto-isolator. An Earth connection is available on the device connector, which can be used to provide a protective ground between the external circuitry and the module. This can provide a further measure of safety in addition to the optical isolation, specially when using higher voltage A.C. input signals.
A jumper network enables four of the input signals to generate system interrupts automatically. They can be individually enabled, and merged by pairs to the two interrupt lines on the DCE-BUS by selection of jumper links.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

7.18.2 FEATURES

- 24 optically isolated digital input channels.
- Accepts A.C. and D.C. input signals.
- Automatic interrupt generation from four input lines via a jumper network.
- An Earth connection for extra safety.
- Standard hardware and software interface to the DCE-BUS.
- Switch selectable module address.
- Single 100 x 160 mm eurocard format.

7.18.3 FUNCTIONAL BLOCK DIAGRAM



7.18.4 SYSTEM DESIGN PARAMETERS

7.18.4.1 Hardware Configuration

The functional block diagram in Section 7.18.3 illustrates the hardware configuration of the RWC-DI24 module. The 24 RIC I/O lines are programmed for input, and used to read the opto-isolated input signals. Both A.C. and D.C. input signals upto 24V are accepted by the module. The input signal range for any channel can be modified by changing the current limiting resistor connected to its opto-isolator.

The positive end of each input channel is connected to an individual pin on the 37-pin device connector. Each pair of input channels is provided with a shared COMMON line. An EARTH connection is available on the device connector which can be used to provide a protective ground between the external circuitry and the module. This provides a further measure of safety in addition to the normal optical isolation provided by the card, specially when using higher voltage A.C. input signals.

A jumper network enables four of the input signals to generate system interrupts via the IN7 and EXINTR lines of the DCE-BUS. Input channels 21 to 24 corresponding to the four high-order bits of RIC Port 2 can be gated to the interrupt lines via the jumper links as shown in the functional block diagram. Any two of the above four input signals can be made to generate an interrupt individually, or they can be merged in pairs by suitable selection of the links.

7.18.4.2 Programming Specifications

The RWC-DI24 module is addressed via the standard DCE-BUS interface. Programming specifications for driving the DCE-BUS are given in Section 4.1 of this manual.

RIC Initialization

The RIC device on the RWC-DI24 module can be initialized by writing control word 9BH to the RIC Command Register. This configures all RIC I/O lines in input mode for reading the 24 opto-isolated input signals.

RIC Device Addresses

The RIC on the RWC-DI24 module has 3 data ports and a command register. Different modes of communication between RIC Ports 0,1,2 and the DCE-BUS Data Path are established depending on the Device Address received by the RWC-DI24 module from the DCE-BUS. Table 7.18.1 shows the Device Addresses needed for the different communication modes:

DEVICE ADDRESS (HEX)	$\overline{RD}$	$\overline{WR}$	OPERATION
Y0	0	1	RIC Port 0 → DCE Data Bus
Y1	0	1	RIC Port 1 → DCE Data Bus
Y2	0	1	RIC Port 2 → DCE Data Bus
Y3	0	1	Illegal Condition
Y0	1	0	Illegal Condition
Y1	1	0	Illegal Condition
Y2	1	0	Illegal Condition
Y3	1	0	DCE Data → RIC Command Register
ZX	X	X	RIC Data Bus in 3-state

Notes:

1. Y is the card address select switch setting in hex (1 to F)
2. Z is any number other than Y.
3. X means don't care.
4. Bits 2 and 3 in the Device Addresses are don't care states.
5. RDRWC and WRRWC software routines provide the $\overline{RD}$ and $\overline{WR}$ signals accordingly.

Table 7.18.1 : Device Address Table for RWC-DI24.

Format and Interpretation of Data

The input signals read via RIC Ports 0, 1, 2 are all active high. An active signal at any input channel will be read as a logic 1.

RIC input signal definitions are given in Section 7. 18. 4. 4.

Interrupt Processing

The four input channels connected to RIC Port 2 Bits 4-7 can be gated in several ways to generate a system interrupt via the DCE-BUS. If two input channels are merged together to produce one interrupt request signal, the service routine must read RIC Port 2 and test the corresponding bits to determine which input channel caused the interrupt.

7. 18. 4. 3 User Options

Input Current Limiting Resistors

The RWC-DI24 module is delivered with twenty-four 1. 5 kΩ 1/2 Watt current limiting resistors in positions R1 to R24, corresponding to the input channels 1 to 24. They allow inputs of 10 to 24 volts, nominal. If higher voltage signals are to be input, the user must change these resistors accordingly.

Interrupt Generation Jumpers

Jumper network 1-2-3-4 together with links L1, L2, L3, L4 allow the user to connect input channels 21 to 24 in various combinations to the DCE-BUS interrupt lines, as shown in the functional block diagram. The links L1, L2, L3, L4, when installed, enable interrupt generation by input channels 21 to 24 respectively.

7.18.4.4 Module Connector Definitions

System Connector

See Section 6.1.4 for pin definitions.

Device Connector (37-pin D-type female)

The following table relates the channel number, RIC port bit allocation, and device connector pin definition.

Connection Channel N°	RIC Allocation	Pin N°.	Connection Channel N°.	RIC Allocation	Pin N°.
1	P0B0	1	13	P1B4	17
1 & 2 com.		2	13 & 14 com.		35
2	P0B1	21	14	P1B5	18
3	P0B2	20	15	P1B6	36
3 & 4 com.		22	25 & 16 com.		19
4	P0B3	3	16	P1B7	37
5	P0B4	23	17	P2B0	14
5 & 6 com.		4	17 & 18 com.		32
6	P0B5	5	18	P2B1	15
7	P0B6	6	19	P2B2	33
7 & 8 com.		7	19 & 20 com.		16
8	P0B7	24	20	P2B3	34
9	P1B0	25	21	P2B4	11
9 & 10 com.		26	21 & 22 com.		29
10	P1B1	9	22	P2B5	12
11	P1B2	27	23	P2B6	30
11 & 12 com.		10	23 & 24 com.		13
12	P1B3	28	24	P2B7	31
			Earth		8

7.18.4.5 Operational Requirements

Power Requirements

The RWC-DI24 module uses a single +5 volt supply. Typical power consumption is:

+5V : 65 mA

Environmental Requirements

Operating temperature	: 0°C to 55°C
Storage temperature	: -25°C to +85°C
Relative humidity	: 95 % non-condensing (isolation may be reduced with high humidity).

Bus Loading

The RWC-DI24 module presents 1 unit-load to the DCE-BUS (see Section 4.4).

7.18.5 ORDERING INFORMATION

RWC-DI24	: Standard Version. Includes current limiting resistors for 10 to 24 volt inputs.