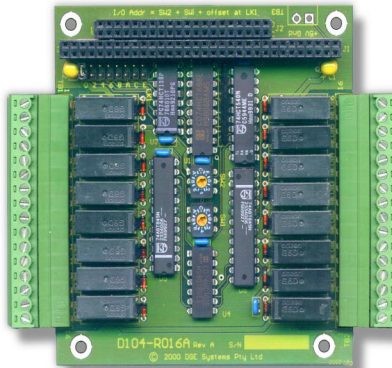


**D104-RO16A**

**16 SPDT Relay Output Card**  
**for**  
**PC/104 Systems**

**Rev A**  
**1st July 1999**



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## Introduction

The D104-RO16A provides 16 relay outputs. The relay contacts are single pole normally open (form A) capable of switching up to 150 watts.

Targeted for industrial applications, the D104-RO16A is constructed with CMOS logic devices which are rated for operation over an extended temperature range. CMOS components also reduce power requirements.

Features of the D104-RO16A include:

- **16 SPST relay outputs**
- **5 Amp power switching**
- **Heavy duty, 2-part terminal blocks**
- **Option for MOSFET relays**
- **Off state on reset**
- **PC/104 compliant**
- **CMOS construction**
- **Low power consumption**
- **+5V power supply**

## Bus Interface

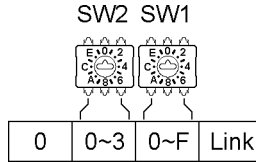
The D104-RO16A is an I/O mapped, polled, write-only, digital controller occupying 2 I/O locations. The module's address is set on a 16 byte boundary by two hex-encoded rotary switches (SW2, SW1). Jumper links are provided to economise on I/O space usage by allowing this address to be offset. Additional D104-RO16A (and other) modules can reside within the same 16-byte boundary.

Users should note that while the I/O address is decoded to 12-bits on the D104-MO32, most PC processors output 10-bit I/O addresses on the system bus. This means addresses 400h and above will not be output by the PC processor limiting the maximum selectable address by SW2 and SW1 to 3F0h.

For the same reason aliasing will occur where the D104-MO32 will respond to a number of different addresses. For example if the base address is set to 330h the module will also be seen at 730h and B30h and FF0h.

While the D104-RO16A interfaces to the 8-bit bus through J1/P1, it is fitted with the J2/P2 stackthrough bus connector to retain 16-bit integrity on the PC/104 stack.

**Setting the Base Address**



**Base Address = Address set by SW2, SW1 + Offset at Link 1**

Table 2 shows jumper links LK1 positions and the corresponding offset from the address set by SW2 and SW1. Only one position is selected. As an example, if the address set by SW2 and SW1 is 330h and link position 5 is selected, the module's base address is 338h.

Link1 Settings	
Jumper	Offset
1	+0
2	+2
3	+4
4	+6
5	+8
6	+A
7	+C
8	+E

Table 1: Link LK1 Settings

Table 2 shows the I/O address map for the D104-RO16A

Address Map			
Base	Function	Relays	Access
+0	Port PA data	1 - 8	Write only
+1	Port PB data	9 - 16	

Table 2: Address Map

## Control Registers

Two, write-only registers are provided, each controlling a bank of eight relays. A logic 1 in the corresponding bit energises the relay. A logic 0 turns the relay off.

Register PA, Base + 0

D7	D6	D5	D4	D3	D2	D1	D0
REL8	REL7	REL6	REL5	REL4	REL3	REL2	REL1

0 = Relay off, 1 = Relay on (energised)

Register PB, Base + 1

D7	D6	D5	D4	D3	D2	D1	D0
REL16	REL15	REL14	REL13	REL12	REL11	REL10	REL9

0 = Relay off, 1 = Relay on (energised)

Figure 1: Control Registers Bit Map

## Reset

On power-up and reset, the relays go to their unenergised state. Systems builders will appreciate the importance of having the D104-RO16A power up in a known “all outputs off” state.

## Relays

Sealed, long life, medium power relays are implemented on the standard product. Up to 250Vac and 30Vdc at 5 amps can be switched.

As an option, the D104-RO16A can be ordered fitted with MOSFET relays. These are solid-state devices able to switch both AC and DC loads. See relay contact specifications and ordering information for more details.

## Field Wiring

Heavy duty, 2-part terminal blocks are fitted for connecting to field devices. The 2-part construction allows quick connect/disconnect of wiring looms and harnesses.

## Testing the D104-RO16A

If the D104-RO16A is installed on a PC system running MS-DOS, users can test the module by invoking Debug.exe which is an utility program able to execute input and output statements. Inexperienced users are cautioned in the use of debug.exe, erroneous and misguided commands can cause interference with the system, possibly with unwanted results.

The following sequence assumes a D104-RO16A module is set for a base address of 330h. <Cr> is the **Enter** key on main keyboard or on the numeric keypad. Note: the character after the dash is the alpha character 'O' (for Output), not the number zero

```
C:>debug           ; invoke debug.exe from the MS-DOS prompt
-O330,FF<Cr>      ; energise relays REL1 to REL8 inclusive
-O331,FF<Cr>      ; energise relays REL9 to REL16 inclusive
-O330,0<Cr>       ; REL1 to REL8 off
-O331,0<Cr>       ; REL9 to REL16 off
-O330,55<Cr>      ; 55h = 01010101 = REL1, 3, 5 and 7 on
-O330,AA<Cr>      ; AAh = 10101010 = REL2, 4, 6, 8 on, REL1, 3,5,7 off
-O330,0<Cr>       ;
-Q<Cr>           ; exit debug.exe
C:>              ; MS-DOS prompt
```

**Component Layout**

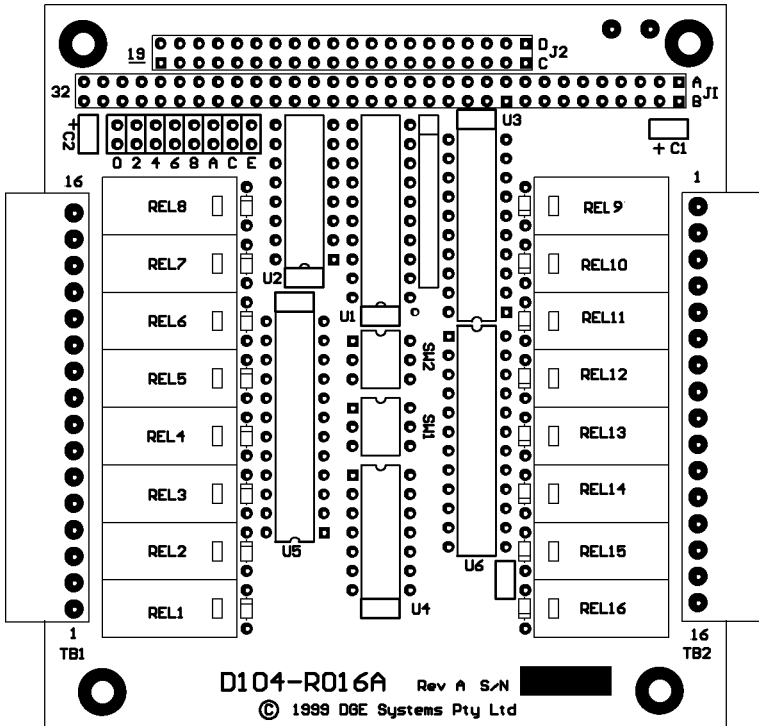


Figure 2: Component Layout

## Connector Pin Assignments

Connector J1/P1 Pin Assignments			
Signal	Pin	Pin	Signal

/IOCHCHK		1a	1b	□	0V (Gnd)
SD7	□	2a	2b	□	RESETDRV
SD6	□	3a	3b	□	+5V (VCC)
SD5	□	4a	4b		IRQ2/9
SD4	□	5a	5b		-5V
SD3	□	6a	6b		DRQ2
SD2	□	7a	7b		-12V
SD1	□	8a	8b		/ENDXFR
SD0	□	9a	9b		+12V
IOCHRDY		10a	10b		(KEY)
AEN	□	11a	11b		/SMEMW
SA19		12a	12b		/SMEMR
SA18		13a	13b	□	/IOW
SA17		14a	14b		/IOR
SA16		15a	15b		/DACK3
SA15		16a	16b		DRQ3
SA14		17a	17b		/DACK1
SA13		18a	18b		DRQ1
SA12		19a	19b		/REFRESH
SA11	□	20a	20b		CLK
SA10	□	21a	21b		IRQ7
SA9	□	22a	22b		IRQ6
SA8	□	23a	23b		IRQ5
SA7	□	24a	24b		IRQ4
SA6	□	25a	25b		IRQ3
SA5	□	26a	26b		/DACK2
SA4	□	27a	27b		TC
SA3	□	28a	28b		BALE
SA2	□	29a	29b	□	+5V
SA1	□	30a	30b		OSC
SA0	□	31a	31b	□	0V (Gnd)
0V (Gnd)	□	32a	32b	□	0V (Gnd)

Connector J2/P2 Pin Assignments			
Signal	Pin	Pin	Signal

0V (Gnd)		0c	0d		0V (Gnd)
/SBHE		1c	1d		/MEMCS16
LA23		2c	2d		/IOCS16
LA22		3c	3d		IRQ10
LA21		4c	4d		IRQ11
LA20		5c	5d		IRQ12
LA19		6c	6d		IRQ15
LA18		7c	7d		IRQ14
LA17		8c	8d		/DACK0
/MEMR		9c	9d		DRQ0
/MEMW		10c	10d		/DACK5
SD8		11c	11d		DRQ5
SD9		12c	12d		/DACK6
SD10		13c	13d		DRQ6
SD11		14c	14d		/DACK7
SD12		15c	15d		DRQ7
SD13		16c	16d		+5V (VCC)
SD14		17c	17d		/MASTER
SD15		18c	18d		0V (Gnd)
(KEY)		19c	19d		0V (Gnd)

□ Signals used on the D104-RO16A

Table 3: Connector J1/P1 and J2/P2 Pin Assignments

Table 4 shows the pin assignments for the 16 pin terminal blocks. The normally open contacts are shown for an unenergised relay.

Terminal Block TB1			
Port	Bit	Relay	Pin
PA	0	1	1
			2
	1	2	3
			4
	2	3	5
			6
	3	4	7
			8
4	5	9	
		10	
5	6	11	
		12	
6	7	13	
		14	
7	8	15	
		16	

Terminal Block TB2			
Port	Bit	Relay	Pin
PB	0	9	1
			2
	1	10	3
			4
	2	11	5
			6
	3	12	7
			8
4	13	9	
		10	
5	14	11	
		12	
6	15	13	
		14	
7	16	15	
		16	

Table 4: Terminal Block TB1 and TB2 Pin Assignment.

## Specifications

Specifications	
Bus Interface:	8 bit, PC/104 compliant.
I/O Space:	Occupies 2 I/O locations within 16-byte boundary. Jumper offset by 0,2,4,6,8,A,C,E.
Connectors	
Bus:	J1/P1, J2/P2 (stackthrough)
I/O:	2 x 50 pin JIDC headers
Power Requirements:	+5Vdc
Temperature:	
Operating:	-20 to +70°C.
Storage:	-55 to +100°C.
Humidity:	5% to 95% non condensing.
Dimensions:	90 x 96mm (3.55 x 3.775")
Weight:	

## Relay Contact Specifications

	D104-RO16A	D104-RO16A-DZ
Configuration:	SPST (form A).	SPST (form A). *
Rated Load:	5A, 250Vac, 30Vdc.	0.6A 260Vac, 125Vdc
Rated Carry Current:	5A max.	0.6A max.
Switching Current:	5A max.	0.6A max.
Resistance:	100mOhm max.	2.4 Ohm (ON-Resistance)
Maximum Load:	1,250VA, 150W	
Minimum Load:	10mA at 5Vdc	100µA
Leakage Current:		10µA max at 125Vdc.
Operate Time		
Engage:	10mS max.	6mS max.
Release:	5mS max.	10mS max.
Withstand Voltage:	3,000Vac, 1 minute, coil to contact	2,500Vac, 1 minute.
Life		
Mechanical:	20,000,000 operations min.	
Electrical:	100,000 operations min at 5A.	

\* No Zero-Crossing Circuit

## Ordering Information

Part Number	Description
D104-RO16A	PC/104 16 SPST Relay Output Module
D104-RO16A-DZ	PC/104 16 SPST MOSFET Relay Output Module
D104-RO16A-TM	Technical Manual