

D104-MO32**32 MOSFET Relay Output Card
for
PC/104 Systems****Rev B.01
5th December 2000**

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Introduction

The D104-MO32 provides 32 optically isolated MOSFET relay outputs. The relay contacts are single pole, normally open (form A) capable of switching both AC and DC loads. The loads can be commoned on either the positive side or negative side of the power source.

A feature of the D104-MO32 is the ability for the MOSFET relays to act as an analog switch allowing low level analog signals and medium power audio levels to be controlled.

The module is available in two models, a low-voltage/high-current and a high-voltage/low-current version which makes the D104-MO32 suitable for a wide range of applications.

Targeted for industrial applications, the D104-MO32 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-MO32 include:

- **32 MOSFET relay outputs**
- **60V and 350V versions**
- **AC and DC switching**
- **Grounded load switching**
- **Off state on power up/reset**
- **PC/104 compliant**
- **CMOS construction**
- **Low power consumption**
- **+5V power supply**

Bus Interface

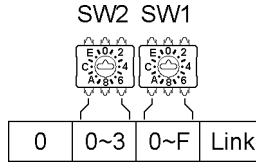
The D104-MO32 is an I/O mapped, polled, write-only, digital controller occupying 4 contiguous locations in the I/O address space. The module's address is set on a 16 byte boundary by two hex-encoded rotary switches (SW2, SW1). Jumper links are provided to economise on I/O space usage by allowing this address to be offset. Additional D104-MO32 (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-MO32 interfaces to the 8-bit bus through J1/P1, it is fitted with the J2/P2 stack-through 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 1 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 3 is selected, the module's base address is 338h.

Link1 Settings	
Jumper	Offset
1	+0
2	+4
3	+8
4	+C

Table 1: Link LK1 Settings

Control Registers

Four, write-only registers are provided, each controlling a bank of eight MOSFETs. A logic 1 in a register's bit causes the corresponding MOSFET to conduct. A logic 0 turns the device off. Table 2 shows the I/O address map for the D104-MO32

Address Map			
Base	Function	MOSFETs	Access
+0	Port PA data	1 - 8	Write only
+1	Port PB data	9 - 16	
+2	Port PC data	17 - 24	
+3	Port PD data	25 - 32	

Table 2: Address Map

Power Up and Reset

On power-up and reset, the MOSFETs go to their non-conducting state. Systems builders will appreciate the importance of having the D104-MO32 power up in a known "all outputs off" state.

MOSFET Relays

The MOSFET relays provide optical isolation and are capable of switching both AC and DC loads. Each MOSFET has three terminals which are mapped to I/O connectors J3 and J4. Figure 1 below shows three connection configurations.

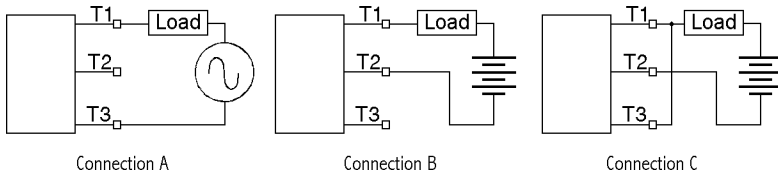


Figure 1: MOSFET Connection Configurations

Connection A is for AC and bipolar DC loads. It also allows for the connection of positively commoned or negatively commoned loads (see Figure 2).

Connections B and C are for DC loads. Connection C yields an increase in the switched current capacity and lower ON resistance than that for connection B.

Commoned Load Switching

Figure 2 shows the various ways of connecting loads with type A connections.

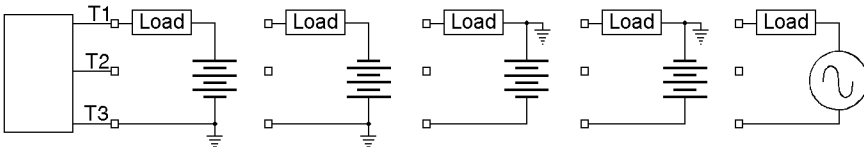


Figure 2: Connections to commoned/grounded loads.

Analog Switching

Since the MOSFET devices are inherently linear in their on-state characteristics, the D104-MO32 is capable of switching analog signals. The MOSFETs when in the conducting state, appear as a low ohms resistor in series with the signal. The relays have a frequency characteristic qualified up to 10MHz and have an essentially flat response over the DC to 2MHz region.

Users may find this feature useful in the multiplexing or the de-multiplexing of analog signals, or row / column redirection of audio levels.

Current Derating

The current switching capacity of the MOSFETs is specified for an ambient temperature of 25°C. The table below shows the derating required at elevated temperatures for connection types A, B and C.

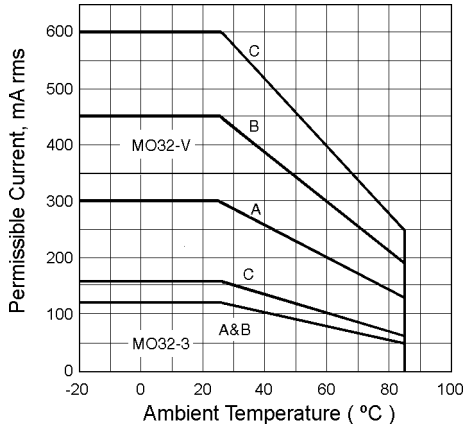


Figure 3: Current Derating Curves

Testing the D104-MO32

If the D104-MO32 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-MO32 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> ; activate MOSFETs 1 to 8 inclusive
-O331,FF<Cr> ; activate MOSFETs 9 to 16 inclusive
-O332,FF<Cr> ; activate MOSFETs 17 to 24 inclusive
-O333,FF<Cr> ; activate MOSFETs 25 to 32 inclusive
-O330,0<Cr> ; MOSFETs 1 to 8 off
-O331,0<Cr> ; MOSFETs 9 to 16 off
-O332,0<Cr> ; MOSFETs 17 to 24 off
-O333,0<Cr> ; MOSFETs 25 to 32 off
-O330,55<Cr> ; 55h = 01010101 = MOSFETs 1, 3, 5 and 7 on
-O330,AA<Cr> ; AAh = 10101010 = MOSFETs 2, 4, 6, 8 on, MOSFETs 1, 3, 5, 7 off
-O330,0<Cr>
-Q<Cr> ; exit debug.exe
C:> ; MS-DOS prompt
```


Table 4 shows the port/bit and pin assignments for the 50 pin IDC headers. Each of the MOSFET relay's three terminals are mapped to the header.

J3 Connector Pin Assignments				J4 Connector Pin Assignments					
Port	Bit	Term	Pin	Pin	Term	Bit	Port		
PA	0	T1	1	2	T2	0	PA		
	0	T3	3	4	T1	1			
	1	T2	5	6	T3	1			
	2	T1	7	8	T2	2			
	2	T3	9	10	T1	3			
	3	T2	11	12	T3	3			
	4	T1	13	14	T2	4			
	4	T3	15	16	T1	5			
	5	T2	17	18	T3	5			
	6	T1	19	20	T2	6			
	6	T3	21	22	T1	7			
	7	T2	23	24	T3	7			
	PB	0	T1	25	26	T2		0	PB
		0	T3	27	28	T1		1	
1		T2	29	30	T3	1			
2		T1	31	32	T2	2			
2		T3	33	34	T1	3			
3		T2	35	36	T3	3			
4		T1	37	38	T2	4			
4		T3	39	40	T1	5			
5		T2	41	42	T3	5			
6		T1	43	44	T2	6			
6		T3	45	46	T1	7			
7		T2	47	48	T3	7			
NC				49	50			NC	

J4 Connector Pin Assignments				J4 Connector Pin Assignments					
Port	Bit	Term	Pin	Pin	Term	Bit	Port		
PC	0	T1	1	2	T2	0	PC		
	0	T3	3	4	T1	1			
	1	T2	5	6	T3	1			
	2	T1	7	8	T2	2			
	2	T3	9	10	T1	3			
	3	T2	11	12	T3	3			
	4	T1	13	14	T2	4			
	4	T3	15	16	T1	5			
	5	T2	17	18	T3	5			
	6	T1	19	20	T2	6			
	6	T3	21	22	T1	7			
	7	T2	23	24	T3	7			
	PD	0	T1	25	26	T2		0	PD
		0	T3	27	28	T1		1	
1		T2	29	30	T3	1			
2		T1	31	32	T2	2			
2		T3	33	34	T1	3			
3		T2	35	36	T3	3			
4		T1	37	38	T2	4			
4		T3	39	40	T1	5			
5		T2	41	42	T3	5			
6		T1	43	44	T2	6			
6		T3	45	46	T1	7			
7		T2	47	48	T3	7			
NC				49	50			NC	

Table 4: Connectors J3 and J4 Pin Assignments

Specifications

D104-MO32 Specifications	
Bus Interface:	8 bit, PC/104 compliant.
I/O Space:	Occupies 4 I/O locations within 16-byte boundary. Jumper offset by 0,4,8,C
Connectors	
Bus:	J1/P1, J2/P2 (stackthrough)
I/O:	2 x 50 pin IDC headers
Power Requirements:	+5Vdc, 2.2mA all outputs off, 12.5mA per ON channel
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:	

MOSFET Specifications		
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	D104-MO32-V	D104-MO32-3
Configuration:	SPST (form A).	
Rated Load:		
Connection A:	300mA / 60Vac peak, ±60Vdc	120mA / 350Vac peak, ±350Vdc
Connection B:	450mA / 60Vdc	120mA / 350Vdc
Connection C:	600mA / 60Vdc	160mA / 350Vdc
On Resistance:		
Connection A:	1.4 Ohm typ, 2.0 Ohm max	22 Ohm typ, 35 Ohm max
Connection B:	0.7 Ohm typ, 1.0 Ohm max	13 Ohm typ, 23 Ohm max
Connection C:	0.35 Ohm typ, 0.5 Ohm max	7 Ohm typ, 12 Ohm max
Leakage Current:	1uA max.	
Frequency Response:	Qualified to 10MHz, essentially flat DC to 2MHz	
Operate Time:		
Engage:	1mS max	
Release:	1mS max	
Isolation Voltage:	2,500Vac min	

Note: MOSFET relays do not have zero-crossing circuit

Ordering Information

Part Number	Description
D104-MO32-V	PC/104 32 MOSFET Relay Output Module, 60V
D104-MO32-3	PC/104 32 MOSFET Relay Output Module, 350V
D104-MO32-TM	Technical Manual

Products in the D104 Series of PC/104 Modules

D104-MO32 The D104-MO32 provides 32 optically isolated, single pole, normally open (form A), MOSFET relay outputs. The relay contacts are capable of switching both AC and DC loads. The loads can be commoned on either the positive side or negative side of the power source. A feature of the D104-MO32 is the ability for the MOSFET relays to act as an analog switch allowing low level analog signals and medium power audio levels to be controlled.

The module is available in two models, a low-voltage/high-current and a high-voltage/low-current version which makes the D104-MO32 suitable for a wide range of applications.

D104-RO32C The D104-RO32C provides 32 electromechanical relay outputs. The relay contacts are single pole, changeover (form C). Typical applications for the D104-RO32C include light power switching and signal multiplexing/demultiplexing.

D104-RO16A 16 medium power, electromechanical relay outputs. The relay contacts are single pole, single throw (SPST, form A) which are capable of switching 5 Amps at 250Vac. The module can optionally be fitted with SPST MOSFET devices for solid-state switching of 600mA/250V ac/dc loads.

The module is fitted with heavy-duty, two-part detachable terminal blocks for quick connect/disconnect of field wiring.

D104-DIO64 The D104-DIO64 provides 64 lines of digital I/O for systems based on the PC/104 format. The digital I/O is configured as eight ports of eight lines with each port individually jumper programmable for input only or for input/output. It has industry-standard connectors for attaching solid-state modules and racks.

Buffer Modules A series of external buffer modules providing opto-isolation of inputs, MOSFET outputs and relay outputs. The modules connect to the D104-DIO64 I/O and other form-factor I/O cards having the industry-standard pinouts.

These modules have the PC/104 footprint and can be bolted onto the PC/104 stack.