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M23

16-Bit
Binary Output
M-Module

Hardware Documentation

20M023-00 E3

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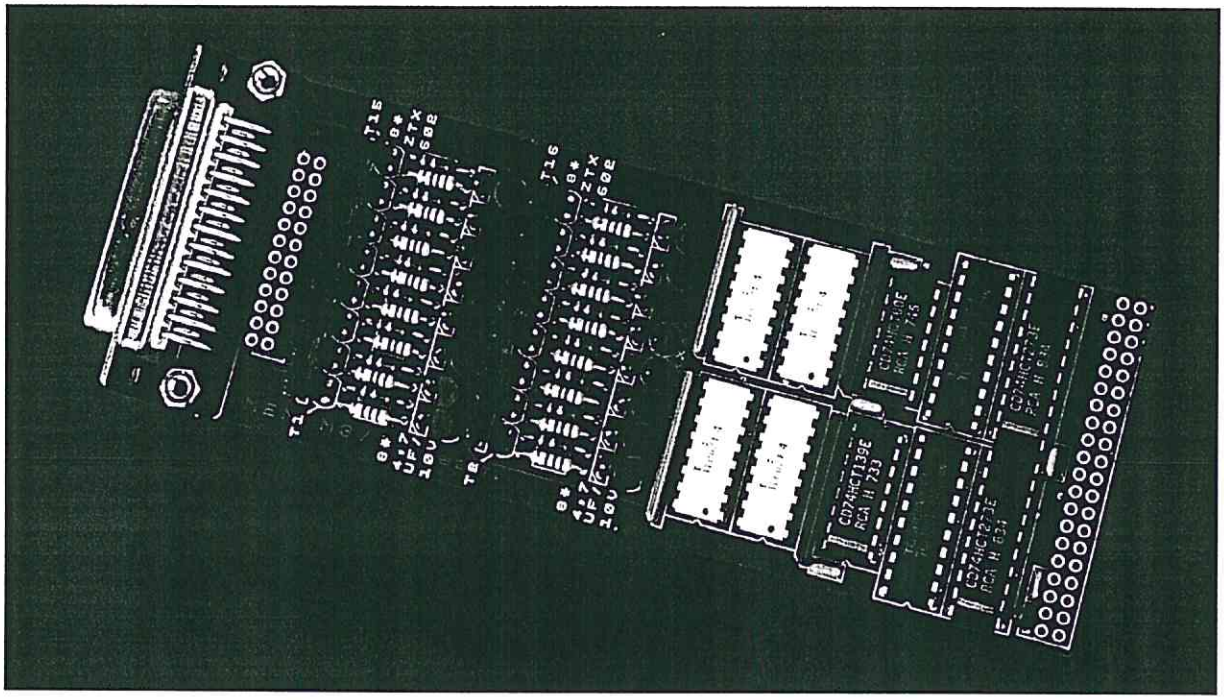
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The M23 Module

The M23 M-Module was designed for optically isolated load switching in process I/O applications. It can control 16 binary outputs using open-collector switching transistors.

If there are currents of above 500mA the thyristor guarantees that the respective transistor is switched off. Suppressor diodes protect the module against overvoltage due to inductive loads.

The output registers can be re-read. The M23 is fully software-compatible with the M3 but the output load is on ground.



Features

Output Voltage:

- 12V..36V

Output Current:

- max. 500mA per channel

Miscellaneous:

- load on ground
- optical isolation
- overload and short-circuit protection using thyristor cutoff
- overvoltage protection with inductive loads using free-wheeling diodes

Peripheral Connections:

- via front panel on a shielded 25-pin D-Sub connector (female)
- via base board connector

M-Module Compliance:

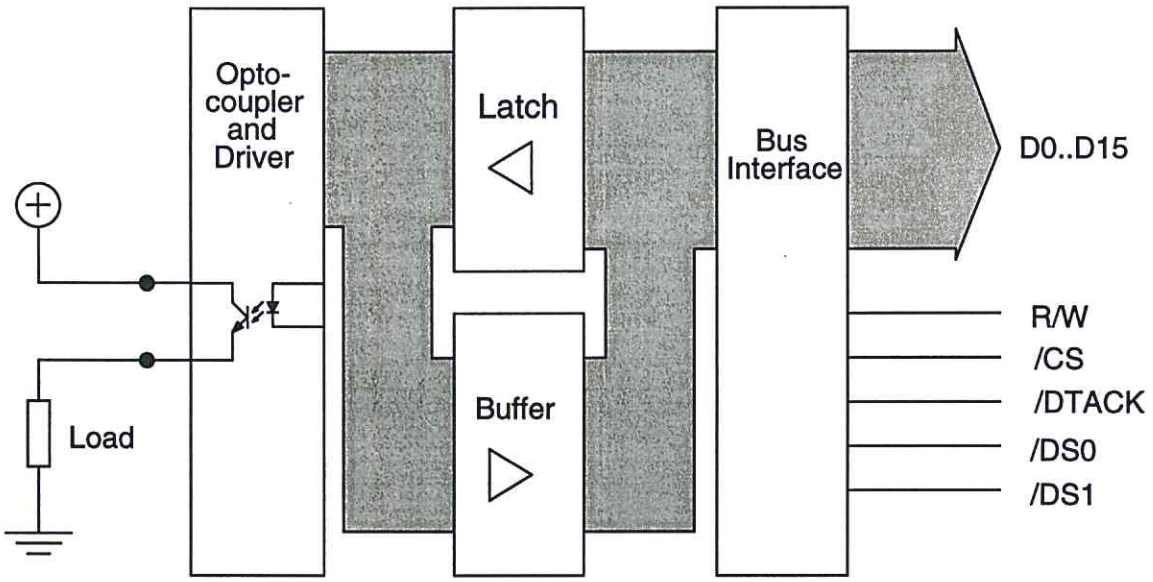
- A08, D16

Software Support:

- MDIS driver concept

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Block Diagram



Ordering Information

04M023-00	M23 hardware
20M023-00	M23 hardware documentation
13M003-00	OS-9 driver software (MDIS)
13M003-20	LynxOS VME/68k driver software (MDIS)
13M003-30	HP-RT driver software (MDIS)
13M003-40	MS-DOS driver software (MDIS)
13M003-60	VxWorks VME/68k driver software (MDIS)
21M003-00	M3/M23/M27/M28 software documentation

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About the Manual

This manual describes the installation of the M-Module, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

The manual describes the hardware of the board.

History of the Manual

Edition	Description	Technical Content	Date of Issue
D2	German edition	Manfred Schmitz	December 9, 1991
E2	English edition	Manfred Schmitz	December 9, 1991
E3	Revised edition	Manfred Schmitz	July 22, 1996

Using the Manual

Hexadecimal numbers are preceded by "0x", which is the usual C-language convention, for example: 0x800000 or 0xbfffff.

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1 Installation and Setup

1.1 First Steps

To test proper functioning of the module you can proceed as follows:

- Install the system with the M-Module base board but without the M23.
- Test the base board.
- If O.K., plug the module into slot 0 of the M-Module base board.
- The M-Module is completely trimmed on delivery.
- Initially, do not change any jumpers or switches.
- Load a suitable debugger.
- Access the base address as set, reading word by word.
- If a bus error is occurring now, the module is not plugged properly.
- Write the word 0x55aa to the base address.
- It should be possible to re-read this value.
- Observe the installation manuals for operating system dependent software.

1.2 Connection of the Module

1.2.1 Power Supply

Power supply to the logic part is done via the base board. The necessary voltage is +5V. The optically isolated part is supplied with an external voltage (nominal voltage 24V). The module cannot operate unless this voltage is applied.

1.2.2 Peripherals

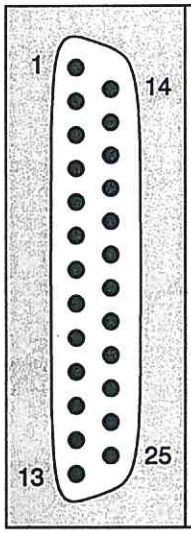
There are two possibilities for connecting peripherals:

- connection via 25-pin D-Sub connector or
- connection via the base board.

When a base board with a 96-pin DIN 41612 PCB connection is used for peripheral signals (for example a 6U VMEbus base board), these are fed to the module through the female 24-pin connector. You can connect up to four 21-pin connectors to the 96-pin connector (cf. base board manual). When these connectors are used, for each module three pins of the DIN 41612 PCB connector cannot be used. The pin numbers for the 96-pin connector shown below are valid for module slot number 3. If other module slots (2, 1 or 0) are used, the value 8, 16 or 24 must be added as appropriate.

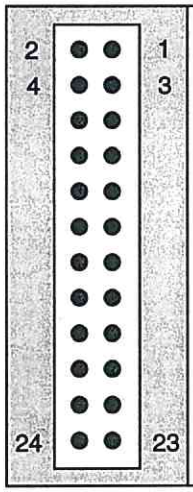
The M23 module has the following pin assignments:

Table 1a: Pin Assignment of the 25-Pin D-Sub Connector



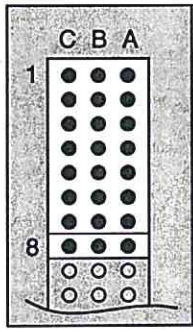
1	DO0	14	DO1
2	DO2	15	DO3
3	DO4	16	DO5
4	DO6	17	DO7
5	DO8	18	DO9
6	DO10	19	DO11
7	DO12	20	DO13
8	DO14	21	DO15
9	IGND	22	IGND
10	IGND	23	I+24V
11	I+24V	24	I+24V
12	I+24V	25	I+24V
13	I+24V		

Table 1b: Female 24-Pin Connector



2	DO1	1	DO0
4	DO3	3	DO2
6	DO5	5	DO4
8	DO7	7	DO6
10	DO9	9	DO8
12	DO11	11	DO10
14	DO13	13	DO12
16	DO15	15	DO14
18	IGND	17	IGND
20	I+24V	19	I+24V
22	I+24V	21	I+24V
24	I+24V	23	I+24V

Table 1c: Signal Correspondence between 24-Pin Module and 96-pin Base Board Connector



	C	B	A
1	DO2	DO1	DO0
2	DO5	DO4	DO3
3	DO8	DO7	DO6
4	DO11	DO10	DO9
5	DO14	DO13	DO12
6	IGND	IGND	DO15
7	I+24V	I+24V	I+24V
8	I+24V	I+24V	I+24V

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Table 2: Signal Mnemonics

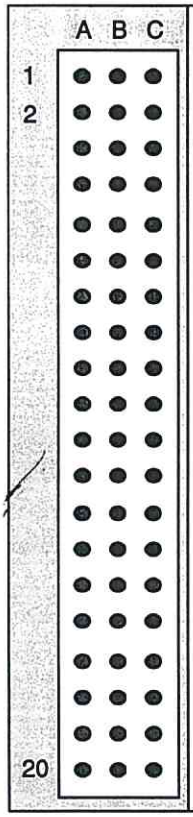
Signal	Function
DO15..DO0	Binary output lines
IGND	Isolated ground
I+24V	Isolated +24V power supply

1.2.3 Host Interface

The M23 module supports the following pin assignment of the 60-pin base board interface connector:

Note: Only two rows - A and B - of the 60-pin connector are mounted on the M23!

Table 3: Pin Assignment of the 60-Pin Female Connector



	A	B	C
1	/CS	GND	-
2	-	+5V	-
3	-	-	-
4	-	-	-
5	-	GND	-
6	-	-	-
7	-	-	-
8	A07	-	-
9	D08	D00	-
10	D09	D01	-
11	D10	D02	-
12	D11	D03	-
13	D12	D04	-
14	D13	D05	-
15	D14	D06	-
16	D15	D07	-
17	/DS1	/DS0	-
18	/DTACK	/WRITE	-
19	-	-	-
20	/RESET	-	-

2 Address Organization

When using the driver software supplied, you do not need to be familiar with the hardware of the M23 module in detail. However, familiarity with the address organization of the board is essential if you wish to write your own software for the module or do low-level development.

The 256-byte I/O area of the M23 module is hardware-mapped. The address at which individual functions can be addressed from the base board is computed from the base address of the module plus the address in the following table.

Table 4: Address Map

Address	D15..D8	D7..D0
0x00	Output Register (r/w)	

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3 Functional Description

3.1 Switching Loads

The M23 module can switch up to 16 loads individually. The load must be wired to the external ground. The "switches" on the M23 module make or break a connection with the positive supply voltage.

These "switches" use bipolar transistor technology. To prevent these transistors from being damaged by a short-circuit, the current through each load branch is measured. If the current exceeds the permissible maximum value, a thyristor is triggered, which switches the transistor off. The thyristor remains active until the load is removed and the corresponding output is switched off. There is a time delay to prevent this overload protection from being activated when switching inductive loads. Each output is additionally protected with a free-wheeling diode.

The switching transistors are isolated from the system by optocouplers. For the module to operate, the isolated side must be supplied with the external voltage (nominal voltage 24V).

3.2 Programming

The module can be accessed using the appropriate module base address. The 16 output bits can be accessed on a word, byte or bit basis. Bit 0 of the word on the line corresponds to DO0 on the plug connector (pin 1 of the 25-pin D-Sub connector). The output register can be read or written; so the bit instructions of the CPU can be used. It is not necessary to maintain "shadow" registers in memory.

If a bit is set to "1", the corresponding transistor is switched through - the switch is closed. After reset all bits are "0", so all transistors are open.

Output Register (0x00) (read/write)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DO15..DO0															

4 Appendix

4.1 Literature

- Specification for accessing the modules: M-Module Specification, MUMM association

4.2 Differences from Previous Versions

Table 5: Table of Revisions

Rev.	Comment	Restrictions
0.0	first version released	When switching light loads (in the kΩ region) the switch-off times are very high (in the ms region)
0.1	The time was reduced to a few µs by soldering on resistors (SMD components) to deplete the base capacitance of the output transistor.	none known
1.x	New layout taking account of the change.	none known

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4.3 Technical Data

Table 6a: Electrical Specifications

Output voltage and current	U_{min} = 12V U_{max} = 36V I_{max} = 500mA
Overload protection	from approx. 550mA using thyristor cutoff
Isolation voltage	500V DC
Supply voltage range	+5V: 4.85V..5.25V / 100mA typ.
Mean Time Between Failures	58,000h/50°C

Table 6b: Mechanical Specifications

Dimensions	conform to M-Module Standard
Weight	tbd.

Table 6c: Environmental Specifications

Temperature range (operation)	0..60°C
Temperature range (storage)	-25..70°C
Relative humidity range (operation)	max. 95% without condensation
Relative humidity range (storage)	max. 95% without condensation
Altitude	-300m to + 3,000m
Shock	15g/0.33ms, 6g/6ms
Vibration	1g/5..2,000Hz

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