MDM-WIN

Version 1.02

USER MANUAL

INDEX

Appendix F: **References**

WEBSITES

Programmers	http://www.microchip.com	
	http://www.rfsolutions.com	
MDM-DEV-1 components	http://www.microchip.com	(PIC 16F877)
	http://www.okisemi.com	(MSM 6544)
	http://www.maxim-ic.com	(MAX 232)
	http://www.analog.com	(AD 22100KT)
	http://www.semi.harris.com	(ICL 8069)
Optional components	http://www.microchip.com	(EEPROMs)
	http://www.eaoswitch.com	(KEYPADS)
	http://vero-uk.com	(ENCLOSURES)

Appendix E: **List of Optional Components**

Following is a list of components and programmers which are compatible with the MDM-DEV-1 system.

- Connectors
  34-way plug for MDM-1
  34-way socket for MDM-1 Repeater
  16-way socket for DMX display

- Keypads

4x3 keypad	SECME	ECO 12150 06
4x4 keypad	SECME	ECO 16250 06

- Dot Matrix Displays

16 Character x 2 Line	LASCAR	DMX 908
8 Character x 2 Line	LASCAR	DMX 916

  Other compatible character dot matrix displays, with a variety of character and line configurations and following the Hitachi II/IIa standard, are available from a multitude of manufacturers, including Lascar.

- EEPROMs
  Consult the following EEPROM manufacturer's product offerings.
  - Microchip Technology
  - ST Microelectronics
  - Fairchild Semiconductor
  - Xicor
  - Holtek
  - National Semiconductor
  - Philips

- PIC Programmers
  Contact the following PIC programmer manufacturers for their latest list of compatible programmers. See Appendix E for further details on these companies.
  - Microchip Technology
  - RF Solutions

III) MDM-WIN Windows Software

IV) Firmware Library

PREFACE

The MDM-DEV-1 system is designed to allow you to get acquainted with the ease of use and flexibility of the PIC 16F877 microcontroller in the context of a Multifunction Display Module. The development board is intended to host an MDM-1 display module. It includes sample circuits that allow you to conduct experiments and write software without the need to design your own hardware. Once you have proven in principle the various aspects of your design idea, you can develop your own hardware and connect this to the MDM-1 module. The development board can then still be used to program the MDM-1 module, or saved for your next design idea.

The development board allows you to experiment with the following types of circuit.

- Voltage measurement
- Temperature measurement
- Counting pulses
- Reading the status of I/O lines via DIL switches
- Using hardware interrupts
- Driving I/O lines (LED's, buzzer)
- Driving a character dot matrix display
- Using a keypad
- Using RS232 communications
- Using an EEPROM

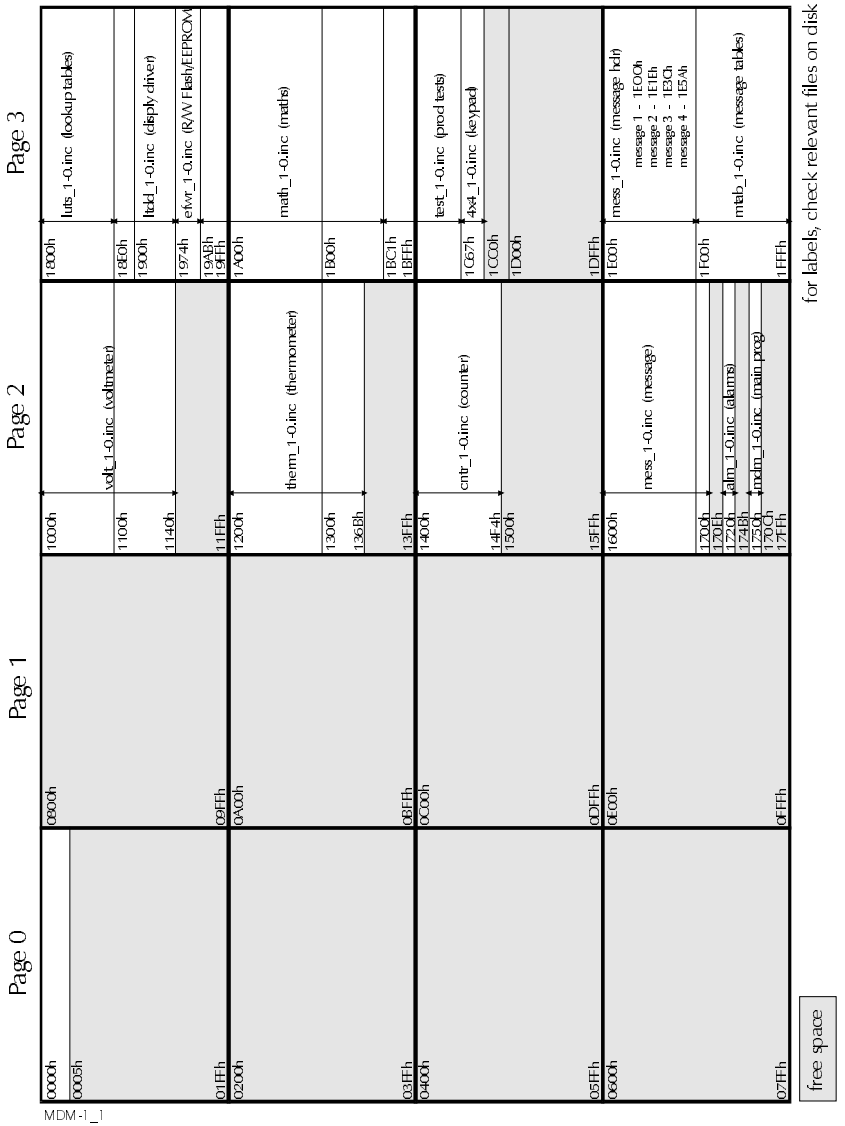
The board also features a supply voltage output, which allows you to connect some external circuitry, without the need for a separate power supply.

The MDM module is normally supplied with 4 built-in firmware applications, some of which rely on external inputs. These are catered for on the development board.

All data included with the MDM-DEV-1 is believed to be correct at time of going to press. A lot of the data, presented in this manual, is derived directly or indirectly from the manufacturer's datasheets of the integrated circuits used in the MDM-1 and MDM-DEV-1 designs. The user should confirm for himself that this data is correct.

Consult the References section at the end of this manual for a list of sources of information (datasheets, technical tips, application ideas, etc.)

Appendix D: The MDM-1 Memory Map



This memory map is valid for the standard MDM-1 module, as supplied by Lascar.

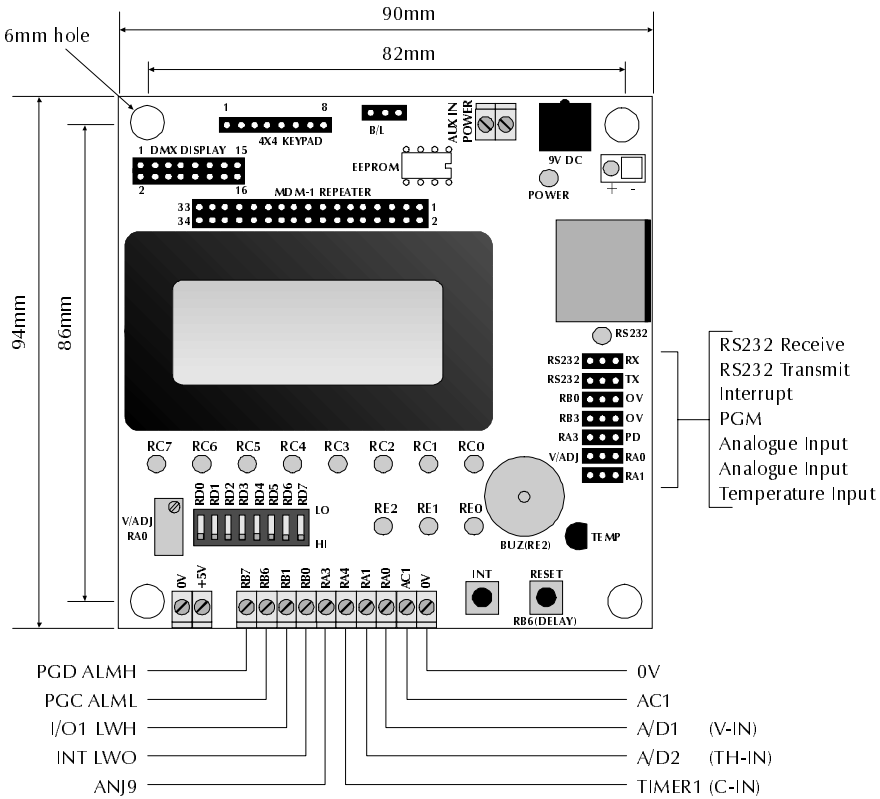
Appendix C: Programming the MDM-1 module

The MDM-1 module can be programmed in-situ on the MDM-DEV-1 board or as a separate module. In both cases, a suitable PIC16F877 compatible programmer must be used. The PIC 16F877 used in the MDM-1 module contains FLASH program memory, which can be programmed and then repeatedly re-programmed (see PIC 16F877 datasheet for full specifications) with modified software, as your program evolves.

Whichever programming method you use, ensure that you adhere to some basic rules.

a) Follow the correct PIC 16F877 programming algorithm, as specified by Microchip.
b) Use short programming cables, typically 6" (15cm) or less in length, such as the one supplied with the MDM-DEV-1. Longer programming cables may introduce programming errors.
c) Do not code protect your program unless you are confident you will not need to change it.
d) Use the correct programming software version, e.g. MPLAB for Windows 16, version 3.99.10 or higher. A copy of MPLAB is included on the enclosed CDROM. Older versions will not compile correctly for the PIC16F877.
e) Follow the programmer manufacturer's guidelines.

I) The MDM-DEV-1 Development Board



Component lay-out and dimensions
of the Development Board.

a) Connectors

The development board features a variety of connectors, whose functions are listed in order of appearance (top to bottom) on the development board.

4x4 Keypad (SK3)
- type: 8-way single-in-line socket, 0.1” (2.54mm) pitch
- purpose: connection of 4 column by 4 row keypad

DC Power Socket (SKT3)
- type: 2.5mm d.c. connector
- purpose: connection for smoothed 7-12Vdc power supply input

DC Power Screw Terminals (CON3)
- type: screw terminals, 3.5mm pitch
- purpose: connection for smoothed 7-12Vdc power supply input

DMX Display (PL2)
- type: 16-way dual-in-line 0.1” (2.54mm) pitch header
- purpose: connection to character dot matrix display

MDM-1 Repeater (PL1)
- type: 34-way dual-in-line 0.1” (2.54mm) pitch header
- purpose: allows access to all of the MDM-1’s pins

RS232 Socket (SK2)
- type: 8-way mini-DIN socket
- purpose: RS232 communications between development board and host PC or other device

MDM-1 Socket (SKT1)
- type: 34-way dual-in-line 0.1” (2.54mm) pitch socket
- purpose: connection for MDM-1 module

Power Output Screw Terminals (CON2)
- type: screw terminals, 3.5mm pitch
- purpose: regulated 5V d.c. output power for external devices

Interface Screw Terminals (CON1)
- type: screw terminals, 3.5mm pitch
- purpose: connection to analogue and digital user inputs

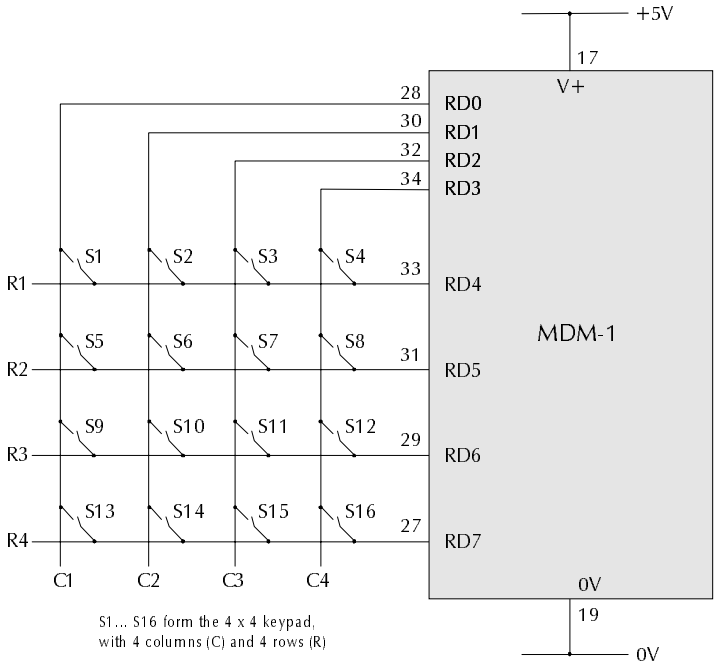
Appendix B: Factory Standard Settings

JUMPER LINKS		Factory Default	PCB Setting
J1	MAX232-RX	RS232 Enabled	1 - 2 3
J2	MAX232-TX	RS232 Enabled	1 - 2 3
J3	INT/RB0	Interrupt to 0V	1 2 - 3
J4	PGM/RB3	PGM to 0V	1 2 - 3
J5	RA3	Analogue Input	1 - 2 3
J6	VADJ/RA0	Variable Analogue Input	1 - 2 3
J7	LED Backlighting	LED Backlighting ON	1 - 2 3
J8	RA1 (RA2)	On-board Temperature sensor connected	1 - 2 3

POTENTIOMETERS		Factory Default
RV1	Input voltage experimenter	No position defined
RV2	DMX contrast control	No position defined

DIL SWITCHES	Factory Default
RD0	LO
RD1	LO
RD2	LO
RD3	LO
RD4	LO
RD5	LO
RD6	LO
RD7	LO

Adding a 4 x 4 Keypad to MDM-DEV-1



You can add an external matrix keypad to the RD port. The keypad can be up to 4 x 4 buttons in size. A keypad decoder routine is supplied with MDM-DEV-1 and is available for download from the Lascar website.

b) Power Supply

The MDM-DEV-1 circuit requires a regulated 5V d.c. supply to operate correctly. The 5V supply can be derived using one of three methods. To ensure correct power-up of the MDM-1 module, ensure that the power supply rise time is 50 microseconds or less.

- Apply 7 to 12V (smoothed) to the 2.5mm d.c. connector (SKT3). Note that the centre pin is the positive connection. This voltage is regulated via the on-board 78L05 linear voltage regulator to power the development board and any connected components.
- Apply 7 to 12V (smoothed) to the screw terminals (CON3) next to the 2.5mm d.c. connector (SKT3). This voltage is regulated via the on-board 78L05 linear voltage regulator to power the development board and any connected components.
- Apply 5V d.c. (regulated) to the screw terminals (CON2).

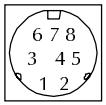
The on-board 78L05 regulated is rated at 100mA maximum continuous operation. Do not exceed this value by, for example, connecting excessive loads to the I/O pins.

A yellow Power-On LED will illuminate when power is applied to the board. The typical LED current is 5mA when illuminated.

The LED backlighting circuits of the MDM-1 and any connected dot matrix module are not supplied from the 78L05 circuit. You should therefore not add these to the 78L05 current calculations. The LED backlighting circuits are powered directly from SKT3 or CON3.

c) RS232 Communications

The RS232 section enables the MDM-1 to communicate with a host PC or other suitable device. The RS232 signals are derived from the RX and TX lines of the MDM-1 and are converted via a MAX232 IC into the correct voltage levels for communication with a host device. The connector lay-out and pin functions are as follows (Connector viewed from the front).



1. DTR
3. Tx
4. Ground
5. Rx

See Appendix A - circuit 9 for a detailed schematic diagram of the RS232 section.

d) LED Backlighting

The MDM-DEV-1 board has been designed to allow the user to drive an MDM-1 module and a Character Dot Matrix Display (DMX). The MDM-1 module may either be plugged straight into the development board, or connected to the board's MDM-1 REPEATER socket via a ribbon cable.

Each of the connected modules can feature LED backlighting, which can all be powered simultaneously from the voltage on the SKT3 or CON3 power inputs, as long as this power supply is capable of delivering the sum of the two backlighting currents (see module datasheets for backlighting current values).
The backlighting circuits are normally enabled by setting the B/L link (J7) at the top of the development board to the left-hand position. They can be disabled by setting the B/L link to the right-hand position.

Note that the LED backlighting circuits are not powered via from the 78L05 regulator. The LED backlighting circuits are powered, each through a 100R resistor on the development board, directly from the 2.5mm d.c. connector (SKT3)or the screw terminals (CON3) next to the 2.5mm d.c. connector (SKT3). You must ensure that your power supply can cope with the sum of the currents drawn by any modules attached, their backlighting circuits, the development board components and any other components attached.

e) Switches

RESET

Press the Reset switch momentarily to reset the module. This will connect the PIC's reset pin to 0V. See Appendix A - circuit 6 for a detailed schematic diagram of the RESET section.

INTERRUPT

Port RB0 is a software controlled interrupt pin, which can be triggered on a positive or negative edge.

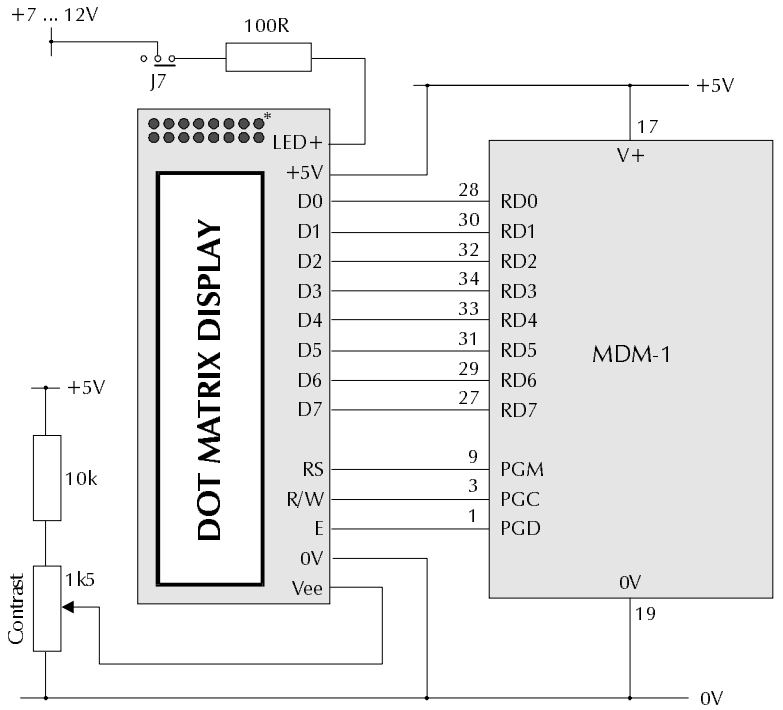
- With the 3-way jumper J3 on RB0 set to the left-hand position, pressing the INT (interrupt) switch momentarily can create an interrupt on port RB0 by connecting it to 0V via a 1k resistor.

- With the 3-way jumper RB0 set to the right-hand position, pressing the INT (interrupt) switch momentarily can create an interrupt on port RB0 by connecting RB0 to +5V via a 1k resistor.

The choice of either of these two options must be selected in software by the user, as the external interrupt on RB0/INT pin is edge triggered, depending on the status of bit INTEDG. (see PIC 16F877 datasheet, section 12.10.1) The INT interrupt can wake-up the processor from SLEEP.

See Appendix A - circuit 8 for a detailed schematic diagram of the Interrupt section.

Adding a Dot Matrix Display to MDM-DEV-1



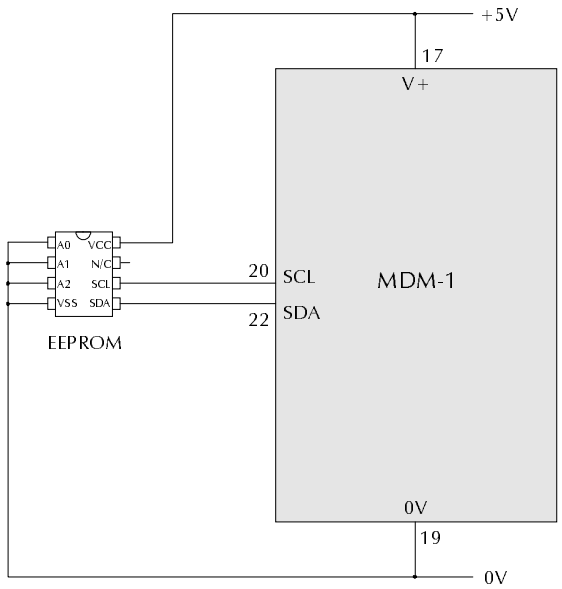
* Some character dot matrix display feature a single row of 16 connections, though the same pin functions are brought out.

Ensure that all 8 DIL switches are set to LO before connecting a dot matrix display.

Ensure that no keypad is connected.

Ensure that the RB3/PGM jumper link (J4) is set to the right side (LO).

Adding an optional EEPROM to MDM-DEV-1



You can solder an optional EEPROM device (not supplied) into the MDM-DEV-1 PCB. The use of an IC-socket is advised. Take care to insert the socket on the top of the PCB, and ensure that pin 1 is correctly located. The EEPROM footprint and pin-out are compatible with a variety of serial EEPROM families and memory sizes (e.g. Microchip 24LC65, 24AA65).

The main EEPROM criteria are:

- Supply voltage: 5V
- Interface bus: I^2C
- Package style: DIL-08
- Pin-out:

1) A0	8) VCC
2) A1	7) N/C
3) A2	6) SCL
4) VSS	5) SDA

Note: While some serial EEPROM families boast power supply inputs down to 1.8 or 2.5, they will operate correctly at the 5V supply level used on the development board. The EEPROM's three address lines A0, A1 and A2 are all connected to 0V on the Development Board, therefore the device address will be 00.

f) Analogue I/O

VOLTAGE MEASUREMENT

The development board features a voltage reference. The device used, an ICL 8069 bandgap reference, has a 1.22V output with excellent temperature stability. It can be used as the reference voltage for one or more of the MDM-1's A/D converter. The analogue input (screw terminal A/D1) is routed to analogue port AN0 of the PIC16F877 via jumper link J6 (marked V/ADJ - RA0). This jumper link allows AN0 to measure either the voltage on A/D1 (jumper link to the right) or the adjusted voltage via the on-board multi-turn potentiometer (jumper link to the left).

See Appendix A - circuit 1 for a detailed schematic diagram of the Voltage Measurement section.

TEMPERATURE MEASUREMENT

The MDM-DEV-1 features a temperature sensor IC of the type AD22100KT. This device produces a voltage output which is directly proportional to the IC's ambient temperature. This voltage can be measured by the MDM-1's analogue port AN1 via jumper link J8. This jumper link allows AN1 to measure temperature via the on-board sensor (jumper link to the left)

Touching the temperature sensor will cause its temperature to change, and this is reflected in the reading on the MDM-1 if the module has been configured to read temperature.

See Appendix A - circuit 2 for a detailed schematic diagram of the Voltage Measurement section.

g) Digital I/O

PORT RC 8x RED LED

Port RC is used to drive a set of 8 red LEDs. Each LED is connected to +5V via a 1K pull-up resistor, and is connected to 0V via a 100K pull-down resistor. The typical current per LED is 5mA when illuminated.

See Appendix A - circuit 3 for a detailed schematic diagram of the Port RC section.

PORT RD DIL SWITCHES

A set of 8 DIL switches are connected to port pins RD0 to RD7 (parallel I/O on the MDM-1 module). These allow the user to mimic high and low input levels on the RD port without the need for external switches and wiring.

When a DIL switch is set to LO, its associated RD port pin is connected to 0V via a 100K pull-down resistor. When a DIL switch is set to HI, its associated RD port pin is connected to +5V. Each RD port pin features a 10K current limiting resistor.

See Appendix A - circuit 4 for a detailed schematic diagram of the Port RD section.

PORT RE 3x GREEN LED + BUZZER

Ports RE0, RE1 and RE2, when high, will drive three green LEDs. In addition, port RE2, when high, drives the on-board buzzer. The typical current per LED is 5mA when illuminated.

See Appendix A - circuit 5 for a detailed schematic diagram of the Port RE section.

h) Options

DOT MATRIX DISPLAY

The RD port is also used to drive an optional character dot matrix display module (not supplied), e.g. a Lascar DMX 908 (8 characters by 2 lines) or DMX 916 (16 characters by 2 lines). RB3, RB6 and RB7 are used as control lines.

Pin number	PIN Function MDM-1	PIN Function DMX module	Description
1	0V	0V	Power Supply
2	+5V	+5V	Power Supply
3	CONTRAST	VEE	LCD Contrast Control
4	RB3 PGM	RS	Register Select input
5	RB6 PGC	R/W	Read/Write input
6	RB7 PGD	E	Enable signal
7	P I/O 0	D0	Data Bit 0
8	P I/O 1	D1	Data Bit 1
9	P I/O 2	D2	Data Bit 2
10	P I/O 3	D3	Data Bit 3
11	P I/O 4	D4	Data Bit 4
12	P I/O 5	D5	Data Bit 5
13	P I/O 6	D6	Data Bit 6
14	P I/O 7	D7	Data Bit 7
15	0V	LED-	Backlighting Supply
16	LED+	LED+	Backlighting Supply

Note: The LED backlighting on the target dot matrix display is optional and does not affect correct operation of the dot matrix display. It can be disabled by setting the B/L jumper link (J7) to the right-hand position.

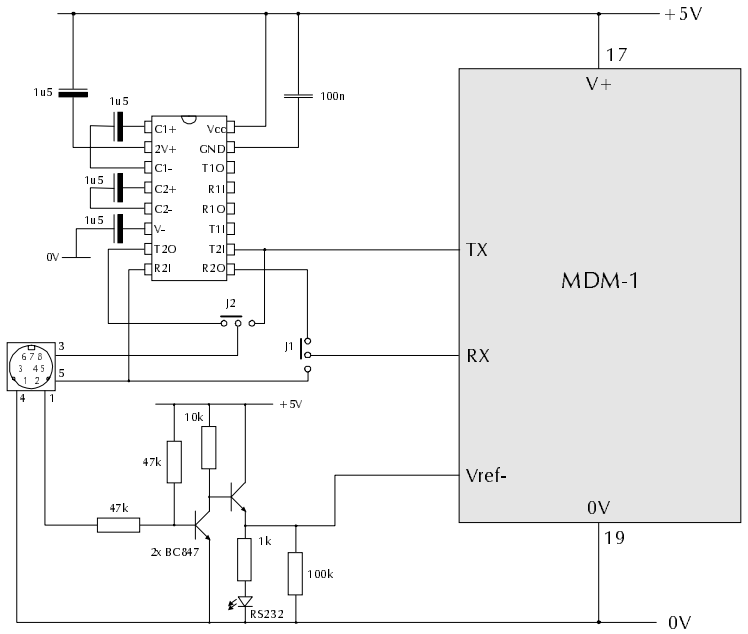
Ensure that all 8 DIL switches are set to LO before connecting a dot matrix display.

Ensure that no keypad is connected.

Ensure that the RB3/PGM jumper link (J4) is set to the right side (LO).

See Appendix A - circuit 11 for a detailed schematic diagram of the DMX section.

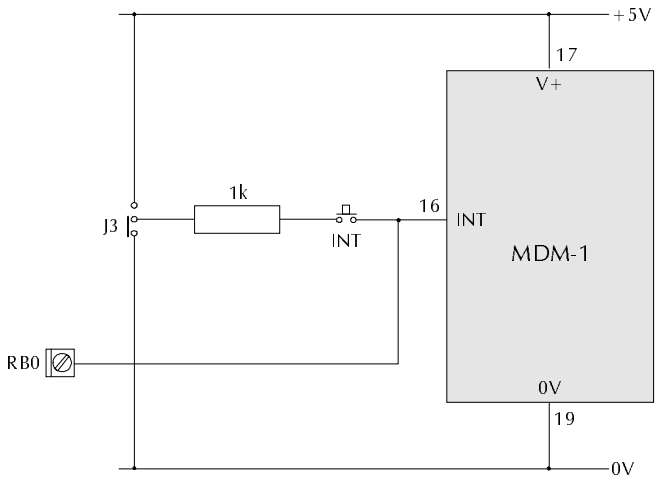
The RS232 Circuit on MDM-DEV-1



The development board features a complete RS232 conversion circuit, which accepts inputs from the Rx and Tx ports on the MDM-1, and allows the module to communicate with the outside world. Switching over J1 and J2 will bring out the MDM's Rx and Tx ports, which can then be used to interface to other communication protocols (e.g. RS485).

The MDM-1 is also available from Lascar with RS232, RS422 or RS485 circuits already fitted. Consult Lascar for pricing and availability.

Generating an Interrupt on MDM-DEV-1



It is possible to generate an interrupt in two ways.
- Use the on-board Interrupt switch, with Jumper link J3 taking the input high or low.
- Use the RB0 screw terminal to apply an external interrupt signal.

4 X 4 *KEYPAD*

The RD port is also used as Keypad input, allowing the user to connect a matrix keypad (not supplied) of up to 4 rows and 4 columns.

Pin-out:

1) Column 1	5) Row 1
2) Column 2	6) Row 2
3) Column 3	7) Row 3
4) Column 4	8) Row 4

Note: Set all 8 DIL switches to LO before connecting and driving a keypad.

See Appendix A - circuit 12 for a detailed schematic diagram of the Keypad section.

EEPROM

You can solder an optional EEPROM device (not supplied) into the MDM-DEV-1 PCB. The use of an IC-socket is advised. Take care to insert the socket on the top of the PCB, and ensure that pin 1 is correctly located. The EEPROM footprint and pin-out are compatible with a variety of serial EEPROM families and memory sizes (e.g. Microchip 24LC65, 24AA65).

The main EEPROM criteria are:

- Supply voltage: 5V
- Interface bus: I^2C
- Package style: DIL-08
- Pin-out:

1) A0	8) VCC
2) A1	7) N/C
3) A2	6) SCL
4) VSS	5) SDA

Note: While some serial EEPROM families boast power supply inputs down to 1.8 or 2.5, they will operate correctly at the 5V supply level used on the development board. The EEPROM's three address lines A0, A1 and A2 are all connected to 0V on the Development Board, therefore the device address will be 00.

See Appendix A - circuit 10 for a detailed schematic diagram of the EEPROM section.

II) The MDM-1 Display Module

a) The Datasheet

The datasheet for the MDM-1 module is included as a separate page, as is the module's circuit diagram. Note that, on the datasheet, we have suggested functions for several of the module's pins. As most pin functions on the MDM-1 are under software control, it follows that our datasheet merely offers example pin functions. You, the user, can decide on the function of the module by assigning functions to pins and writing appropriate software for your particular application.
Three of the PIC16F877 pins are not accessible by the user, as they control the MDM-1's display driver chip. They are RB2, RB4 and RB5.

b) Analogue Inputs

Port A can be configured in software to act as analogue input port. The analogue measurement ports use the PIC's built-in 8-channel multiplexed analogue to digital converter (ADC) section. This section comprises a 10-bit ADC preceded by an 8-way analogue multiplexer. The eight analogue inputs are denoted AN0 to AN7. The reference voltage is normally applied between AN2 (Vref-) and AN3 (VREF+). Care should be taken however not to damage the ports by applying excessive input voltages. Refer to the PIC16F877 datasheet for minimum and maximum voltage levels on analogue ports, and specifications of the A/D converter section.
To use the full set of 8 analogue inputs, V+ can be used as the reference for the A/D converter.

To reduce the effects of external noise (interference) on the analogue inputs, keep lead lengths as short as possible. Use shielded wire if required.

c) Digital Inputs

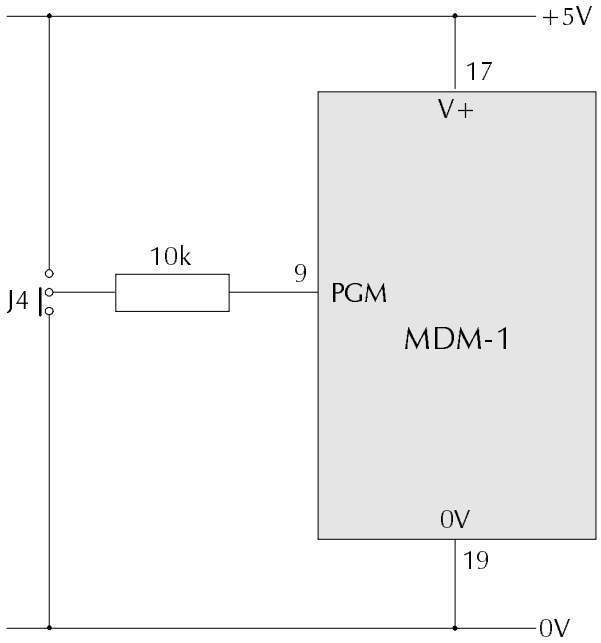
Ports A through E can be configured in software to act as digital inputs. Care should be taken however not to damage the ports by applying excessive input voltages. Refer to the PIC16F877 datasheet for minimum and maximum voltage levels on the I/O ports.

RA4 and RC0 can be configured in software to act as 8-bit and 16-bit counter inputs respectively.

d) Digital Outputs

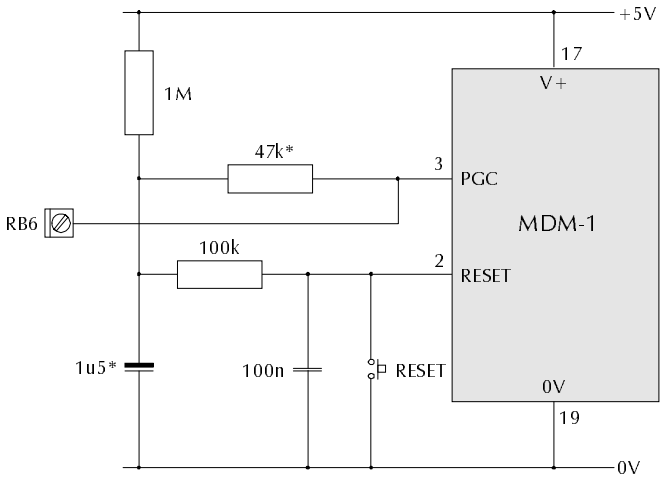
Ports A through E can be configured in software to act as digital outputs. Care should be taken not to damage the ports by overloading. Refer to the PIC16F877 datasheet for minimum and maximum sink and source current levels of the I/O ports and overall device limitations.

Using the RB3/PGM port on MDM-DEV-1



You can use the RB3/PGM port to mimic/simulate an input from a peripherals such as a switch, alarm trigger etc.

The RESET Circuit on MDM-DEV-1



Press the RSET switch momentarily to reset the module. This will connect the PIC's reset pin to 0V.

III) The MDM-WIN Windows Software

MDM-WIN is a configuration utility which runs under Windows 95 or 98. It allows you to select one of three applications on the MDM-1 module: Voltmeter, Thermometer or Counter. A fourth application, Message Display, can be configured with up to eight 25-character messages.

a) Setup

1. Switch on the PC, booting up into Windows 95 or 98.
2. Insert the floppy disk into A-drive.
3. Run *a:\setup.exe* to install the MDM-WIN software.
4. Plug the MDM-1 module into the MDM-DEV-1 board.
5. Connect the MDM-DEV-1 to a free PC COM port*.
6. Connect a suitable power supply or 9V battery to MDM-DEV1.
7. Double-click MDM-WIN program icon to display the COM port selector (see b) below).

* If the only free COM port is a 25-way one, then the user must purchase a 9-way to 25-way adapter. If all COM ports are occupied (e.g. by mouse and modem), then the user must acquire, install and configure a serial/parallel/IDE card.

b) COM Port Selection

Select the COM port to which the development system is connected. Ensure that the PC has been set up for 9600 Baud, no Parity, 8 Data bits, 1 Stop bit.
Be aware that some modems may capture a port which appears to be free and that this may impede correct operation of MDM-WIN.

c) Application Selection

To select one of the first three applications, click on its button. This will download the relevant commands to the MDM-1 via the development board. The MDM-1 module will remember this setting until it is changed in MDM-WIN.
To select the Message Display application, click on its button. A window will appear, allowing you to key in up to 8 messages, each up to 25 characters (capitals only) long.

d) Troubleshooting

If the PC fails to recognise the development board, then ensure that the following are correct.

- The communications cable must be connected to the PC and the development board.
- The development board must have an MDM-1 module installed.
- The development board must be powered by the correct supply voltage.
- The selected PC COM port must be free (Baud rate, Parity, Data bits etc. are automatically configured by MDM-WIN)

IV) The Firmware Library

The firmware library contains a set of 8 subroutines, as well as 4 fully functional applications, all included on the software disk.

a) 8 Subroutines

- Character Look-up Table
- EEPROM Read/Write
- LCD Display Driver
- Maths Routines
- A/D Converter
- Timer
- Keypad Decoder
- RS 232 Comms

You are free to use these subroutines as part of your application. Alternatively, consult the extensive Microchip resource library for application notes and software listings. The website too provides a wealth of information on PIC devices. Often software downloaded from these sources can reduce your code development time and help you debug your code. Also consult PIC bulletin boards and newsgroups.

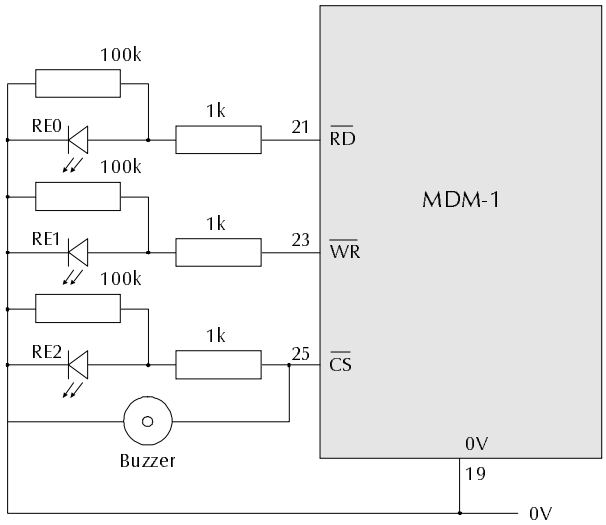
b) 4 Applications

a) Voltmeter
b) Thermometer
c) Counter
d) Message Display

These four basic applications are provided, free of charge, on the software disk to show you how easy it is to develop applications, using one or more of the 8 subroutines listed above. These four applications are also programmed as standard into the MDM-1 module and supported by the MDM-WIN configuration utility. See the enclosed datasheet for pin functions.

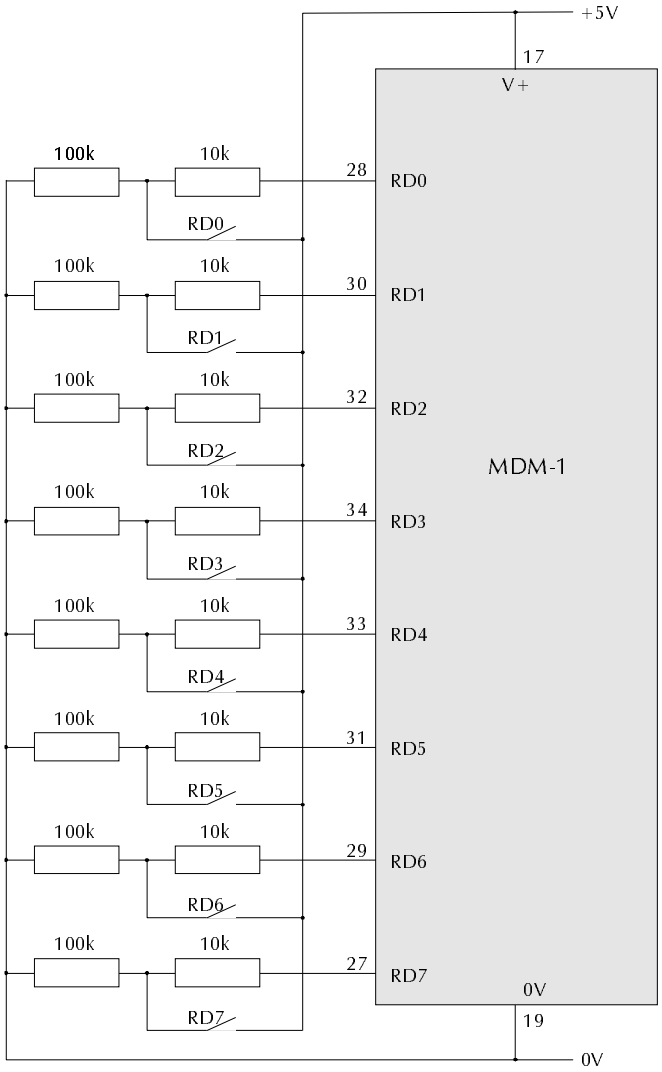
Consult the Lascar website periodically for additions to our software library.

Using the RE I/O Port on MDM-DEV-1



You can use the LEDs on the 3-bit RC port to indicate/mimic/simulate peripherals such as relays, annunciators, status of controlled equipment etc. In addition, the buzzer on Port RE2 can be used as an alarm indicator.

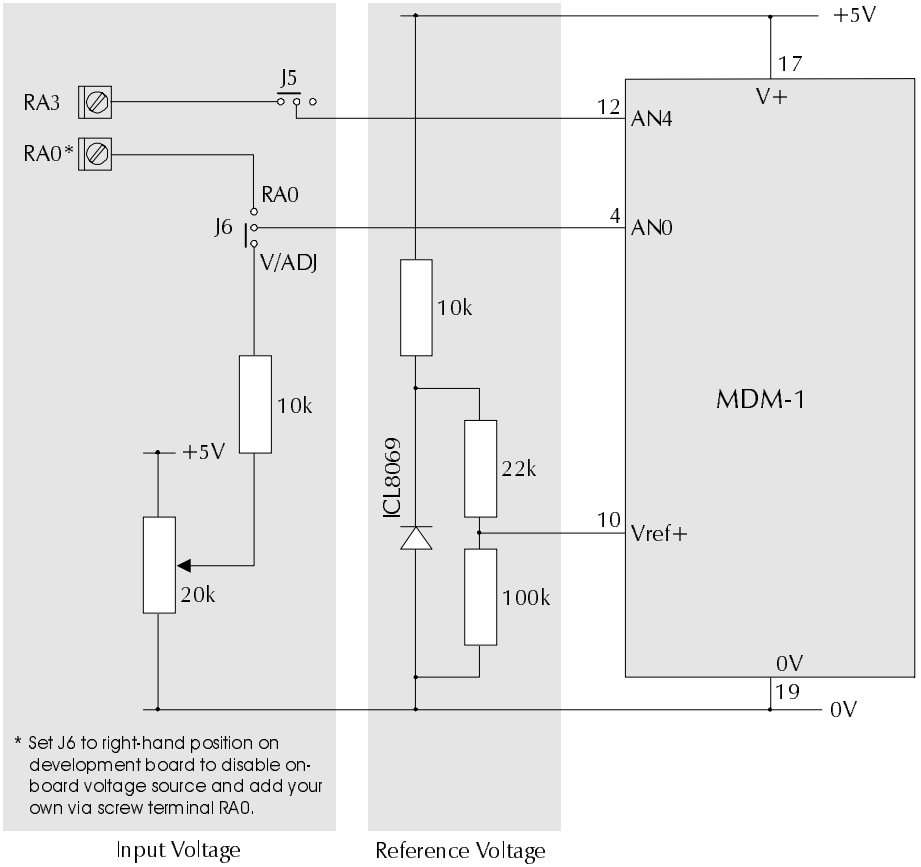
Using the RD I/O Port on MDM-DEV-1



You can use the switches on the 8-bit RD port to mimic/simulate inputs from peripherals such as switches, alarm triggers etc.

Appendix A: **Circuit Diagrams**

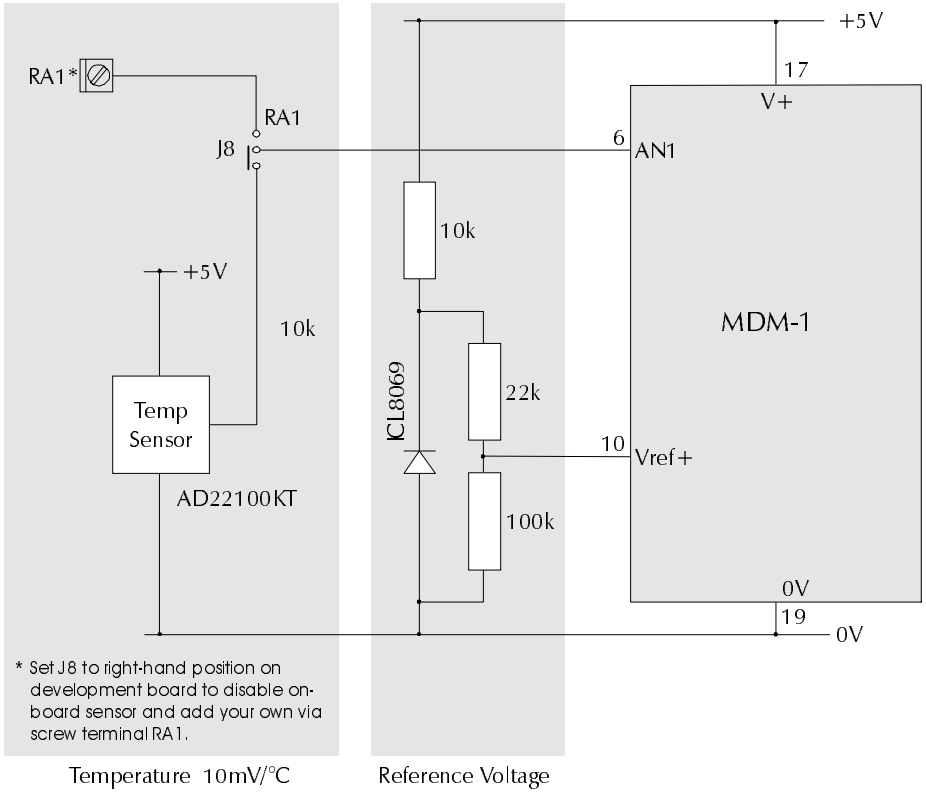
Voltage Measurement on MDM-DEV-1



SAFETY

To comply with the Low Voltage Directive (LVD 93/68/EEC), input voltages to the development board's terminals must not exceed 60Vdc. If voltages to the measuring inputs do exceed 60Vdc, then fit scaling resistors externally to the development board. The user must ensure that the incorporation of the development board into the user's equipment conforms to the relevant sections of BS EN 61010 (Safety Requirements for Electrical Equipment for Measuring, Control and Laboratory Use).

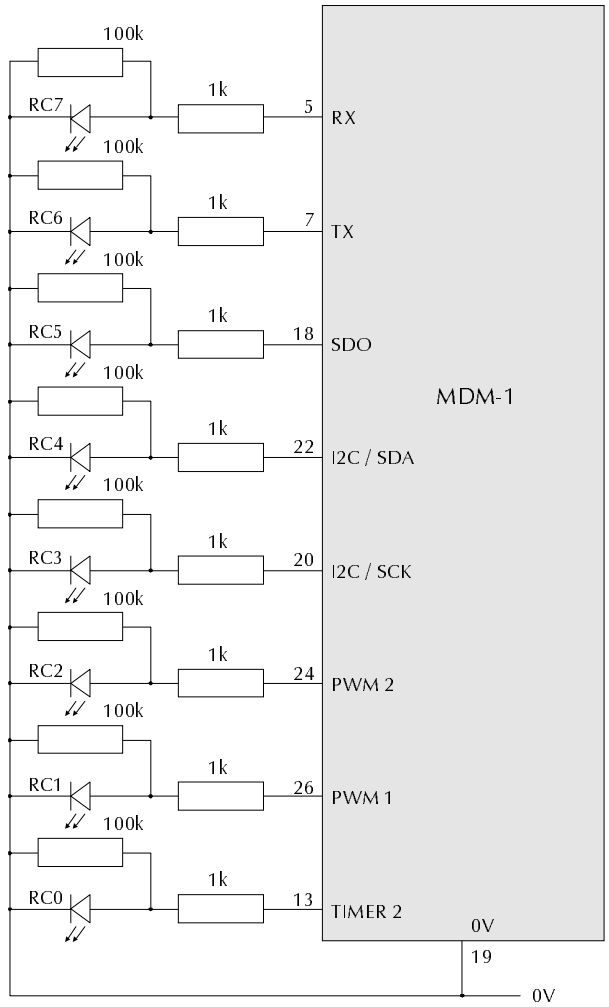
Temperature Measurement on MDM-DEV-1



A range of linear voltage-output temperature sensors can be used with MDM-DEV-1 (e.g. LM35xx, AD 22100xx, etc.). Note however that the module may require new calibration values in software if a sensor with an output voltage of other than 22.5mv/°C is used.

If you want to use a different type of sensor (e.g. Pt100, NTC, K-type, etc.) then a suitable condition circuit will be required between the sensor and the voltage input of the development board.

Using the RC I/O Port on MDM-DEV-1



You can use the LEDs on the 8-bit RC port to indicate/mimic/simulate peripherals such as relays, annunciators, status of controlled equipment etc.