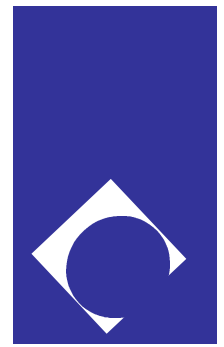


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COMPUKIT- M1 Module User's Guide



Chapter 1 INTRODUCTION

The CompuKit line has been developed for educational purposes and small projects in the field of data acquisition and control.

The line consists of the M1 module that works as a motherboard, and an assortment of peripheral kits that address the different aspects of data acquisition and control. Some examples of peripheral CompuKits are: Digital/Analog, Digital/Analog conversion, active filters, DC, stepping and servo-motors, memory and other storage devices, etc.

Once assembled, the M1 becomes a 40 pin module which can be plugged into any ordinary experimenting breadboard (not included). The peripheral kits are then assembled on the breadboard and connected to the M1 pins thus allowing the student hobbyist, or technician to concentrate on the circuits of interest, rather than wasting time on the computer link every time a new project is started. The pictures at the end of this manual show a lateral view of the M1 module and how it is used in a breadboard. Several circuits can be tested in sequence by just pulling out the M1 module from its place and inserting it into another location. No more fussing with 40 wires and the time it takes to move them around.

The CompuKit M1 contains an ITC232-A chip that minimizes the hassle associated when communicating with a PC. For example, should the user wish to place a given value on an 8 bit port (i.e. PA) then all he or she has to do is to type on a computer terminal program (included), PWA value [Enter] (where PWA=Port Write A and a value that is a number between 0 and 255).

The following is a brief description of the ITC232-A features:

To send or receive data in either Decimal, Hexadecimal or Binary format.
High and Low multiple interrupt recognition via 2 pins; IRQH and IRQL.

10 - 10000 Hz, 0 - 100% duty cycle Pulse Width Modulation.
Hardware and software selectable Baud rate over the 300 - 115200 range.
Four channels for reading relative resistance or capacitance.
Three stepper motor ports with all the necessary logic to instrument monophasic, biphasic and half-step stepping modes. Emphasis has been placed in making the stepper interface easy to use.
A 1 keystroke "Again" command to repeat the previous command.
On-screen help (a summary of all commands is sent to the terminal).
A configuration report feature which sends the active configuration of any parallel port, the PWM or the stepper motor ports back to the terminal.
Remote operation via a phone link using a modem chip in place of the RS-232 voltage driver.

Please refer to the ITC232-A User Guide for more information on these features.

The CompuKit M1 works equally well with a **Mac**[®], an **Apple**[®] II (with a serial port) or an **IBM** compatible (XT or higher).

Circuit Description

Figure 1 at the end of this manual shows the schematics of the M1 module. Simplicity and low cost are at the core of this design.

Chapter 2 GETTING STARTED

Power Supply

The RS232 protocol requires a voltage between -3 V and -15 V to represent a logic 1. In order to generate this negative voltage, 2 Zener diodes (Z2 and Z3) are used. Ground is derived from the center of the voltage divider constituted by these 2 Zeners. Since their cut-off voltage is set to 5.1 Volts, any power supply producing more than 10.2 Volts will generate +5.1 (VCC) and -5.1 (-VDD) referenced to ground. These voltages are adequate to drive a RS232 port. VCC (+5.1 Volts) is also used to power the ITC232-A and other components in the experimenter breadboard, provided they do not consume too much power. Should the circuit's power requirements be higher, a second power supply with an adequate voltage regulator (i.e. 7805, etc.) should be added.

It is worth noting that the -12 V side of the power supply **must not** be connected to the computer ground.

A suitable power supply is a 12 Volts wall transformer.

Serial Link

RX line: The polarity of this line swings between +15 V and -15 V. Since the ITC232-A accepts TTL levels, Q2 is used as a level translator: When Rx is at a negative voltage (which corresponds to logic 1), Q2 does not conduct and therefore pin 29 on the ITC232-A is connected to VCC (logic 1) via R5. When Rx is positive (logic ϕ), then Q2 conducts and pin 29 is grounded (logic ϕ). Adding a diode in series with R8 would be more elegant but it is not mandatory.

TX side: Q1 works between VCC and -VDD. A logic ϕ on pin 30 must translate into a positive voltage above 3 Volts. This is done by cutting off Q1 and therefore having TX connected to VCC via R7. The problem arises when pulling TX to -VDD for a logic 1 on the RS232 link.

This requires the emitter of Q1 to be at -VDD. If the base of Q1 were connected to pin 30, without using Z1, then both a 1 or a ϕ on pin 30 will make Q1 conduct since the base voltage would be either 5.1 or 10.2 Volts above the emitter voltage and therefore Q1 would conduct in either case. Z1 prevents this from happening since it only conducts at 7.5 V, a level only reached when a 1 (10.2 V referenced to Q1's emitter) is placed on pin 30.

ITC232-A Section

The rest of the circuit corresponds to the standard ITC232-A configuration. A 10K resistor pulls each interrupt pin (2 and 37) to the non-asserted level.

The reset circuit on pin 1 works as follows: When power is applied, C3 is discharged. Thus, it represents a low resistance path to ground until it charges to a given voltage through R2. That time is long enough to create a reset condition. To reset the M1 module, the RESET command can be issued directly from the computer or the power supply can be momentarily interrupted.

IMPORTANT: Most of the ITC232-A pins are brought to the connectors (H2 and H3) **with the exception of pins 3 and 36** which deliver the voltage from the power supply (+12 and -12 Volts {-VDD} respectively).

It should be noted that the pin strips can be used not only to connect the M1 module to an experimenter breadboard, but also to suitable female connectors on a target printed circuit board. Thus, the M1 module can be used as a complete communication unit to the computer which can be plugged into place just the same way as an IC or a hybrid circuit would be.

If the M1 module is to be used in a permanent application, solder the control lines directly to the pads rather than using the pin strips.

Operation:

You can explore the functionality of the M1 module using the EVB software (included) for Windows®. Otherwise, you can type commands from a terminal program or run one of the Basic programs in the enclosed diskette.

To quickly get into commanding ports, hook up an LED in series with a 1K resistor to PA. ϕ Type PCA 255 [Enter] to configure all pins of PA as outputs. Type PWA 1 [Enter] or PWA ϕ [Enter] to turn the LED ON or OFF respectively.

To read PB, place a 10K resistor from PB. ϕ to ground or to VCC and type PRB [Enter]. For more details refer to the ITC232-A User Guide.

Chapter 3 ASSEMBLY INSTRUCTIONS (If required)

1. Solder the 40 pin socket in place, respecting the orientation marks in order to know which way to insert the ITC232-A later on. **Never** solder the ITC232-A directly to the board.
2. Work toward the right and the left of the IC socket in an orderly fashion. Leave the serial connector for last.
3. It is good practice to place all resistors with the same orientation so that they can be easily read afterwards.

4. Make sure that the polarity of the diodes and the capacitors is respected. Otherwise the circuit will not work. The positive side on the electrolytic capacitors is on the end with the groove (which should be toward the LED on the board).
5. Do not mix up diodes IN4733 and IN4737. The IN4733 diodes go by the power jack with the band toward the LED and the IN4737 diode goes by the ITC232-A with the band towards the serial cable connector.
6. The LED base has a flat side. The pin by the flat side goes toward ground and the other one goes toward VCC (+).
7. Serial cable: Solder the ground of the shielded cable to GND on the M1 serial port pads. The red cable goes to the RX pad and the remaining cable should be connected to TX.

B25 Pin Connector: On the DB25 side, slide the provided shrink tube onto the shield cable first and then solder it to pin 7 (pins are numbered on the connector). Heat shrink the tube around the shield cable. This prevents the mesh from accidentally touching any other pins. The red cable goes to pin # 2 and the remaining cable goes to pin # 3. Thus, GND on the board goes to pin # 7 on the DB25 connector, RX to pin # 2 and TX to pin # 3. Make a knot in the cable near the connector and leave the knot inside the connector when you close the plastic sleeve around it. This way, pulling the cable will not rip off any connections inside.

B9 Pin Connector: Connect the shielded cable to pin # 5, the red cable (RX on the board) goes to pin # 3 and the remaining cable goes to pin # 2.

MacIntosh Connector: The easiest way to proceed is to purchase a commercial Mac to DB25 adapter. Figure 2 shows the Mac serial port pin-out.

Set Up

1. Verify that the circuit is assembled correctly.
2. Without applying power to the M1 unit, connect the serial cable to the computer's serial port. Measure the voltage between the GND and RX pads on the connector. RX should show about -9 to -15 Volts (-3 to -15 is acceptable). The voltage on TX should be ϕ . If the cables are reversed, change them around.
3. Load a terminal program into your computer. The diskette provided contains the EVB software which can also be used with the M1 in Windows®, and the ITCTTY.EXE program for DOS. Set up the COM port in the program using the port number to which the M1 is connected, 9600 Bauds, N,8,1 (no parity, 8 bit, 1 stop bit).
4. Apply power to the board. (The tip of the power supply plug should be + 12 V.) The LED should be ON. You should see the "Welcome" message appearing on your string. Press ? [Enter] and you will get 3 pages of help from the ITC232-A.

Chapter 4 TROUBLESHOOTING

1. Verify that your software is using the correct port number and the parameters required by the M1 module (9600 Bauds, N,8,1, see Set Up.)
2. Verify that the ITC232-A is inserted in the right orientation.

3. Make sure all the ITC232-A socket pins are soldered onto the PCB (sometimes a pin can get bent and not go through the PCB).
4. Verify the position and polarity of the Zener diodes. The 2 identical ones should be by the power jack with the band towards the LED. The 3rd, different Diode should be by the ITC232-A with its band toward the serial link connector.
5. Verify the connections to the serial port. Remove power from the M1 module. Connect the serial cable to the computer and measure the voltage between GND and RX on the serial link pads. The reading should be around -9 to -15 Volts. The voltage between TX and GND should be ϕ (or close to ϕ if you are using a very high impedance Volt meter). If you obtain the opposite readings, just reverse the cables. If it still does not work, you may have blown up Q1. Any NPN transistor such as the 2N3904 or 2N2222 can be used as a replacement.
6. If the connections to the serial port are OK and the board still does not work, remove the ITC232-A from its socket and connect pins 29 and 30 together. Now, what comes through pin 29 is echoed back to the computer via pin 30. Type something on your computer terminal program. If the echo is on, you should see the character repeated twice. If this works, then the ITC232-A is the culprit, otherwise, the link is at fault.
7. If, based on the former test, the ITC232-A is not working, verify the reset circuit. If that is OK then contact RMV ELECTRONICS INC. or its local distributor or representative for a replacement.

PLEASE READ THIS CAREFULLY:

RMV ELECTRONICS INC. does not assume any liability arising from the application and/or use of the product/s described herein. RMV ELECTRONICS INC. products are not authorized for use as components in medical, life support or military devices without written permission from RMV ELECTRONICS INC. The material enclosed in this package may not be copied, reproduced or imitated in any way, shape or form without the written consent of RMV ELECTRONICS INC. This limitation also applies to the firmware that the Integrated Circuits in this package might contain.

WARRANTY: *RMV ELECTRONICS INC. will replace, free of charge, faulty components in this package with the exception of the Integrated Circuits it might contain, for a period of 6 months after the date of purchase.*

Parts list

Part	Qty	PartType	Designators
1	1	Printed circuit board	
2	1	0.47	C3
3	3	1K	R7, R6, R5
4	2	1N4733	Z3, Z2 Zener diodes
5	1	1N4737	Z1 Zener diode
6	1	2.2K	R8
7	1	3.3K	R9
8	1	3.6864 MHZ	X1 Crystal
9	3	10K	R4, R3, R2
10	1	10M	R1
11	2	10uF	C5, C4
12	2	27pF	C2, C1
13	1	39 OHMS 1 Watt	R10
14	1	ITC232-A	U1
15	1	LED	LED1
16	2	NPN	Q1, Q2 Transistors
17	1	PINS 1-20	H3
18	1	PINS 21-40	H2
19	1	PWR	J1 Jack
20	1	Serial cable	
21	1	Serial port connector	
22	1	40 pin IC socket	

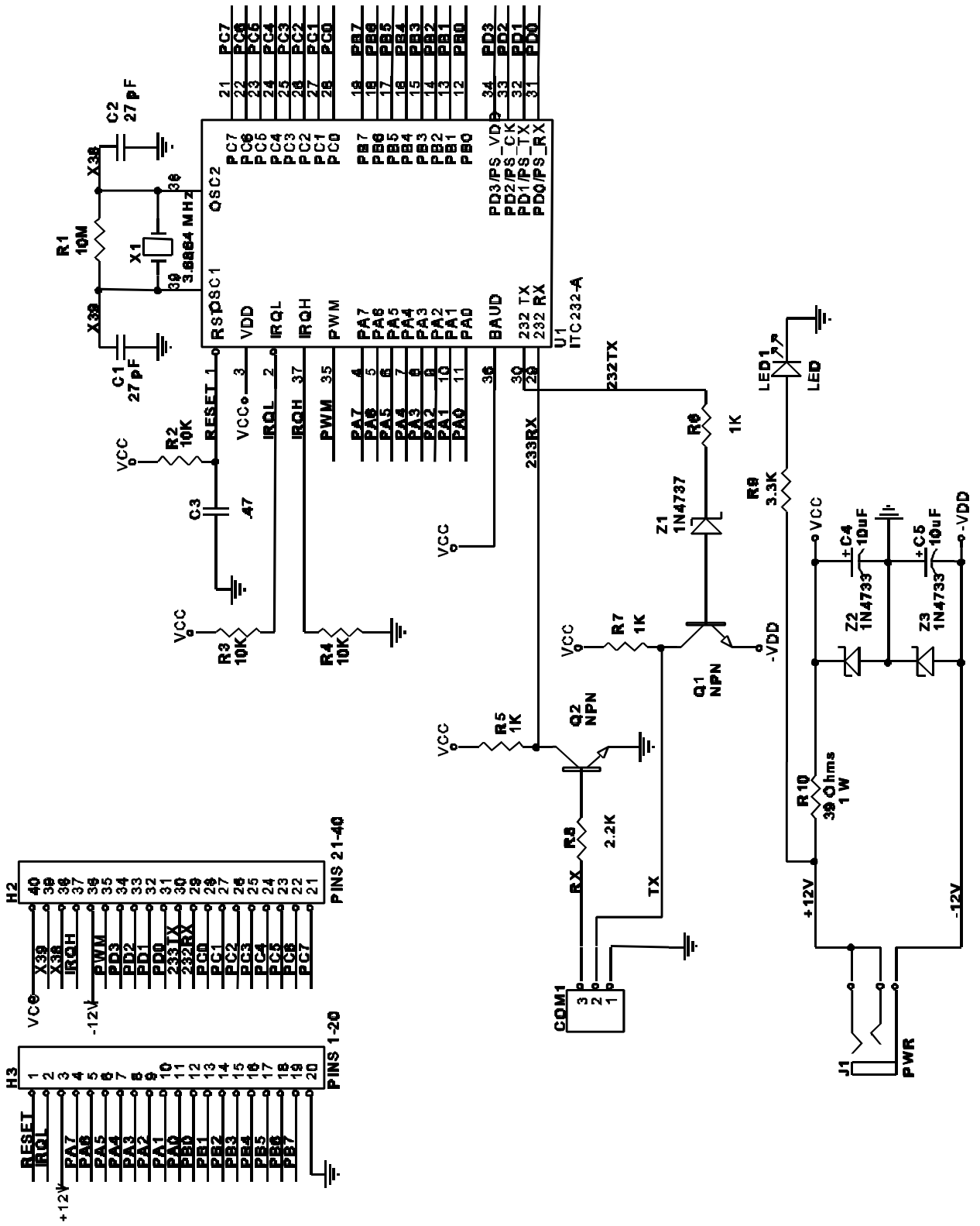
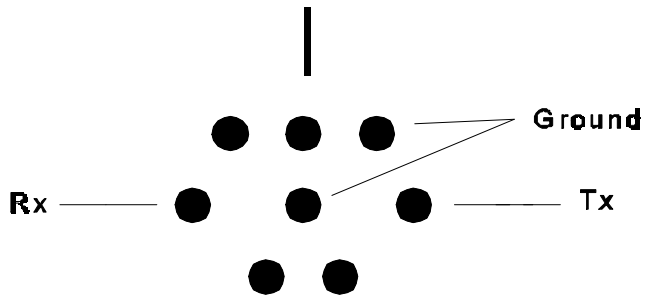


FIGURE 1

The Macintosh phone connector



As viewed from inside the computer

FIGURE 2

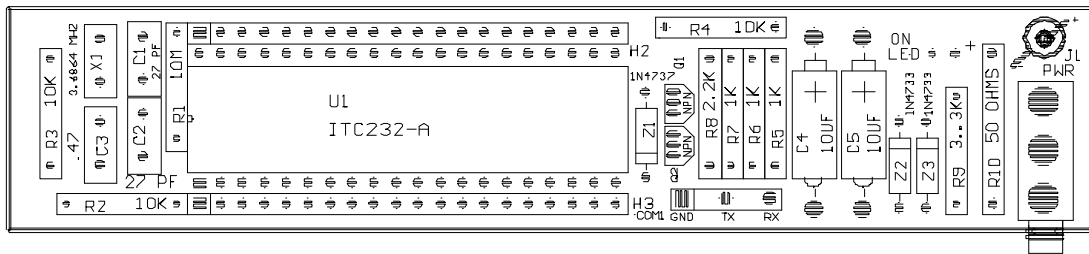
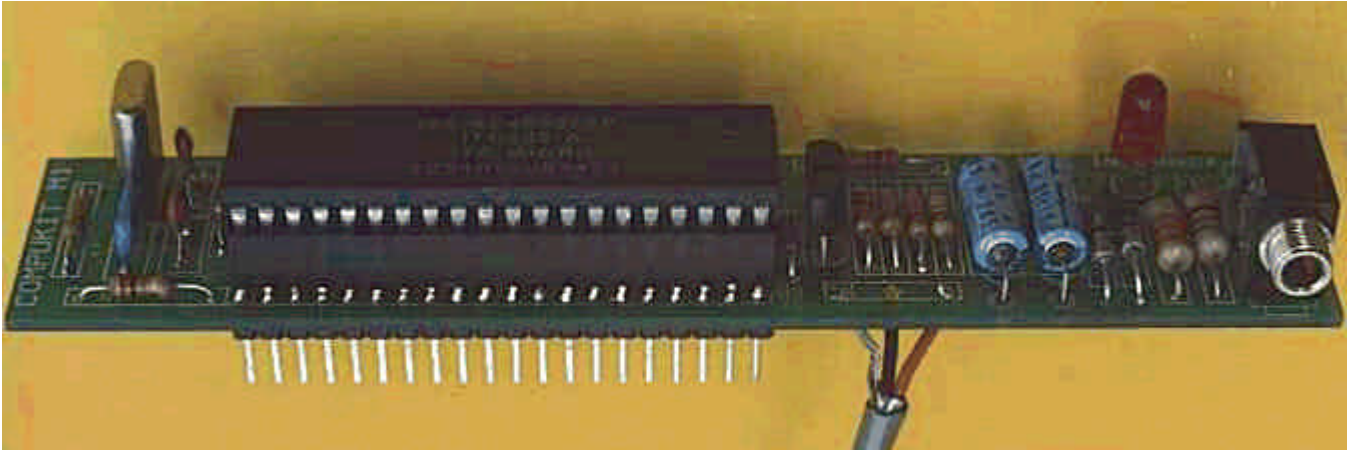
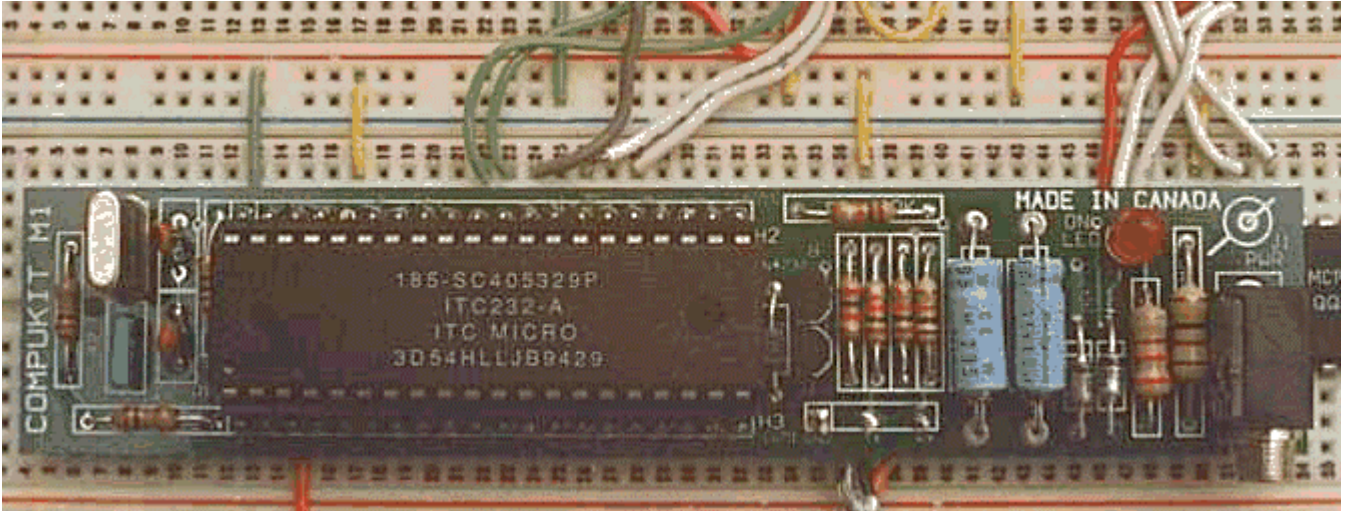


FIGURE 3



Lateral view of the M1 showing the position of the pin strips.



COMPUKIT M1 inserted on prototyping breadboard