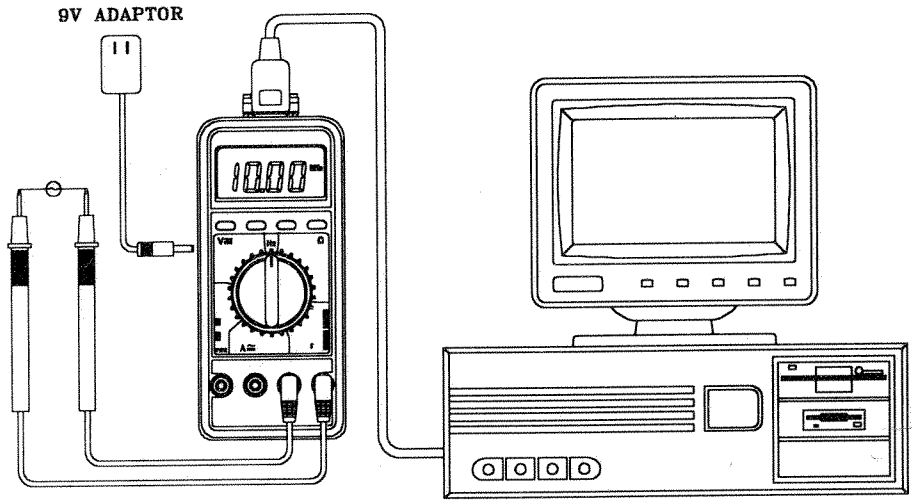
EXTECH

383273

DATA LOGGER MULTIMETER and DMM with RS-232 INTERFACE



INTERFACE WITH A PERSONAL COMPUTER

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1. Read Me First

This software manual is written for Data Logger Multimeter (briefed as Data Logger) and Digital Multimeter(briefed as DMM).

For DMM, connect it to a PC, user can do long time recording, on-line quality control or factory automation.

Data Logger is a step further comparing to the DMM. It is a stand-alone recorder using only battery power. User can record up to 4048 data anywhere possible without PC connected. At the right-hand side of the data logger, there is a mini DIN jack as alarm output used for control purpose.

Design objective of hardware and software are user-oriented. They are very easy to use, and this manual is really not necessary unless you are going to write your own application for DMM or Data Logger.

For regular user, just read the following parts of the software manual

2. Hardware Setup
   2.1 Connect the Multimeter to a PC
   2.4 Initialize DMM/DATA LOGGER
4. Ready_To_Use Windows™ Application Program (All)

For programmer, refer to the following parts of the manual

2. Hardware Setup
   2.1 Connect the Multimeter to a PC
   2.2 RS-232 Cable Wiring Diagram
   2.4 Initialize DMM/DATA LOGGER
   2.5 Default RS-232 Settings
3. Software Communication (All)
5. BASIC Sample Program (For an easy start)

2. Hardware Setup
DMM/DATALOGGER

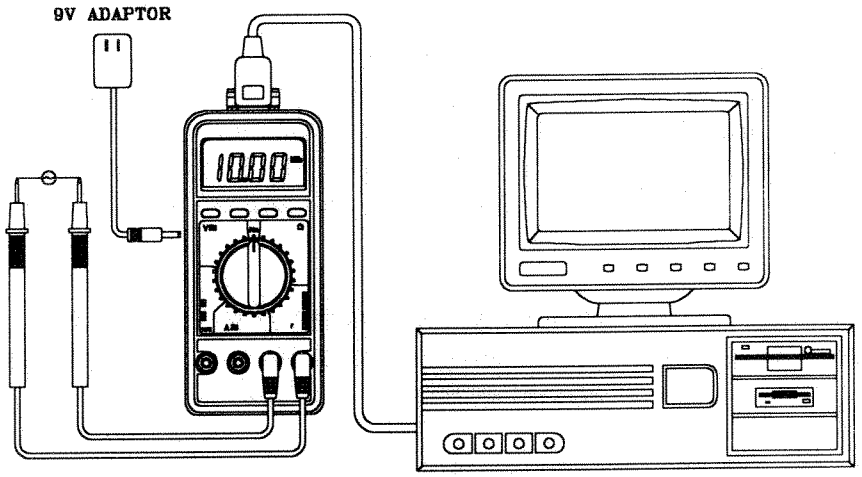

Figure 1

2.1 Connect the DMM/DATA LOGGER to a PC

Referring to Figure-1, connect the RS-232 9 pins male connector to the DMM/DATA LOGGER, and connect the 9 pins female connector to the 9 pins COM1 of PC. If COM1 is used by mouse(usually), then connect 25 pins female connector to the 25 pins COM2 of PC (Of course, you need a 9 pins to 25 pins adaptor).

Most note-book computer has only one RS-232 port, COM1. But it always comes with a system mouse. So you can use 9 pins COM1 for communication.

For desktop computer, there are two RS-232 ports, COM1, and COM2. Most of the time, COM1 is used for mouse. So you have to used COM2(25 pins).

2.2 Cable/DIN Jack Wiring Diagram

DMM/DATA LOGGER

In order to ignore hardware handshake, the RS-232 wiring should be wired as in Figure 2(9 pins to 9 pins). The RTS must be pulled low (-10V or -12V) by the software in order to communicate with PC.

DMM Side (Male) Computer Side(Female)

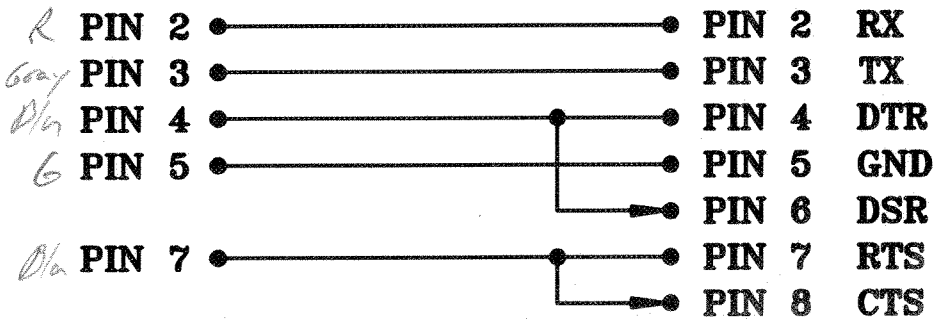

Figure-2 RS232 Wiring Diagram

The RS-232 9 pins to 9 pins cable comes with the DMM or data logger is wired as in Figure-3

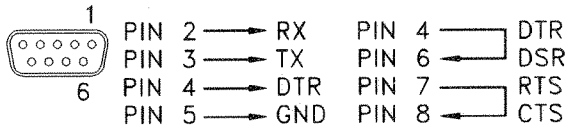

Figure-3 Connector Wiring Diagram

If COM2 is used, you need a 9 pins (male) to 25 pins (female)

adaptor. Following is the wiring diagram for it.

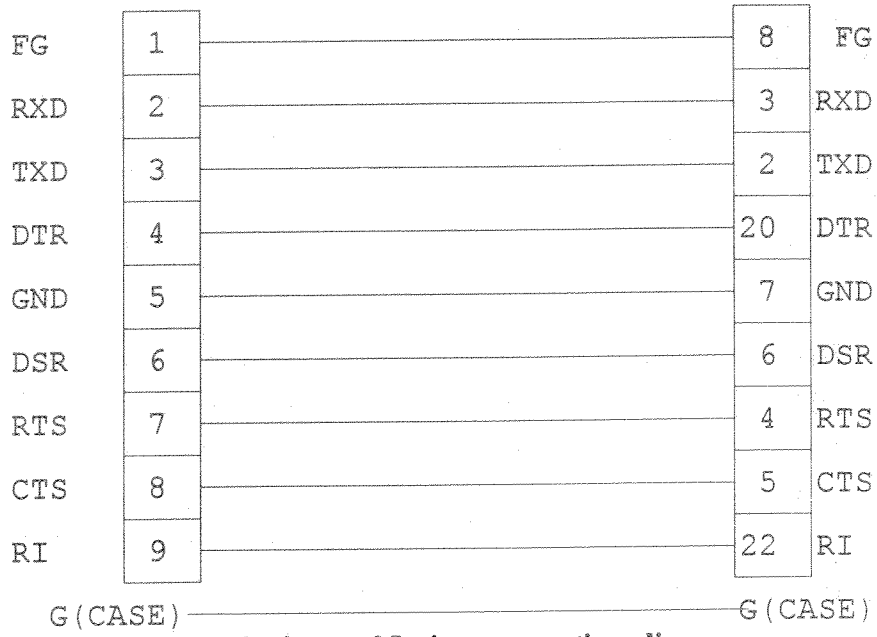

Figure-4 9 pins to 25 pins connection diagram

DATA LOGGER
Mini DIN JACK Pin Assignment:

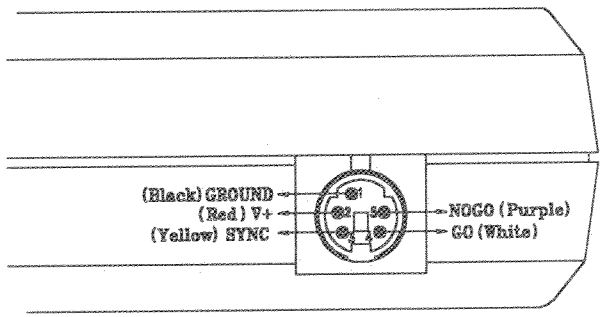

Figure-5 Mini DIN Jack

Pin 1: Ground
The common ground.
Pin 2: V+(5V)
The 5V signal with respect to pin 1.
Pin 3: SYNC
Pin 4 (Go) and Pin 5(No-Go) signals have to be synchronized with pin 3. The pin 3 and pin 4 will not function (always low) unless SYNC signal(pin 3) is in the high(5V) state. If SYNC signal receives a low signal, then pin 4 and 5 will be in the low state. When no signal is connected to SYNC, it is internally pull high. Namely, Go and No-Go pins are always enabled.
Pin 4[1]: Go
If the reading is within the range[2] set in the meter, then Go pin(pin 4) will go high. If not, then Go pin (pin 4) will go low.
Pin 5[1]: No-Go
The No-Go functions oppositely to Go pin (pin 4). If the reading is within the range[2] set in the meter, No-Go pin(pin 5) goes low. If not, No-Go pin(pin 5) goes high.

[1]The output of Pin 4 and 5 might have delay of 0.4 sec. due to the A/D scanning time in the data logger. Also the states of pin 4 and 5 can be control from PC by issuing G (Go pin high) or N(No-Go pin high) commands. The data logger will override the state set by PC if any conflict exists.

[2]To set the lower and upper limits of the range, run the Windows™ application comes with the meter. Select the data logger under the options menu, then select alarm of the menu of the data logger window.

Description of the mini DIN cable:

1. Red wire: V+
2. Black wire: Ground
3. Yellow: SYNC
4. White: Go

5. Purple: No-Go

2.3 Life of the Non-volatile Memory:
The non-volatile memory is guaranteed 100,000 times of WRITE by the IC manufacturer. If the user sets the sampling time at 0.4 seconds and records 24 hours a day every day continuously, it can last for 5 years. If the user uses it once a day, then the memory can last for 273.9 years.

The firmware in the data logger always reads to verify every WRITE to the memory. If WRITE ever fails, data logger will WRITE again. If the second WRITE fails, data logger will increment the WRITE FAILURE COUNTS (memory location 41 and 42), and writes down the most recent memory WRITE failure address in memory location 43 and 44.

2.4 Initialize DMM/DATA LOGGER
DMM:
For old version DMM, user need to push the COMM button to enable the RS-232 communication with PC, and a COM symbol will be displayed on LCD. Press again to disable the RS-232 communication and the COM symbol on the LCD will disappear.

For new DMM or Data Logger without COMM button, the RS-232 communication is always enabled. The COMM button is eliminated.

Once enabled, the DMM or Data Logger is ready to communicate with PC.

DATA LOGGER:
Press the RECORD button to start recording (wait until the COM symbol on LCD to appear). To stop recording, press it again (wait until the COM symbol to disappear).

2.5 Default RS-232 Settings
DMM

When RS-232 communication enabled ,the default RS-232 settings are

Baud Rate	9600
Stop bit	1
Data bits	8
Parity	None

DATA LOGGER
User can set the power-on baud rate for data logger in its memory. Run the windows application program to set the baud rate, or refer to section 3.7 memory map for data logger and program it by yourself.

2.6 Connect two DMMs (w/RS-232) to PC
User can connect two DMMs to the PC at the same time. One is connected to COM1 (9 pins), the other is connected to COM2 (25 pins). For version 2.00 Windows™ Application software, it can record two set of data from two DMMs.

In the Windows™ Setup of Main, select Microsoft Mouse or None(no mouse), exit Windows™ and run Windows™ again. Thus, Windows™ will free COM1 without allocating it. Otherwise, Windows™ will still allocate COM1 even no mouse is connected.

3. Software Communication
3.1 Communicate with the Multimeter
To request data from the multimeter, send a character to the DMM/DATA LOGGER through PC's RS-232 port. Any character can be sent except the reserved characters (9, 4, 2, 1, EEE, G, N, R, W, U, S, T, X, EEE). It is recommended that user send a SPACE character to the multimeter (The ASCII code of SPACE key is 20 in hex). As having received a character (except the reserved characters) from PC, the meter will sent out 5 bytes to PC. The data include the information of "Function, Range and Digital Reading"

3.2 Decoding the 5 Data Bytes
Each byte of the 5 data bytes contains specific information and used for specific purpose. The information contained in the 5 data bytes is

as following:

1st byte : 02 (Leading byte).
2nd byte : xx (Function and Range).
3rd byte : xx (Polarity and Digital Reading).
4th byte : xx (Digital Reading and Decimal Point).
5th byte : 03 (Ending byte).

1st and 5th Byte

The first byte and the fifth byte are fixed numbers of 02 and 03. They can be used as check bytes. If they are not 02 and 03, then probably there is a hardware problem either with PC or the DMM/DATA LOGGER. It is also possible that the baud rates of PC and the DMM/DATA LOGGER mismatch.

2nd Byte

The second byte contains the information of the function and the range. To find out the corresponding function and range, refer to table 1.

HEX	Decimal	FUNCTION	HEX	Decimal	FUNCTION
00	0	DCV 200mV	24	36	DCA 20mA
01	1	DCV 2V	28	40	DCA 2mA
02	2	DCV 20V	30	48	DCA 200μA
03	3	DCV 200V	40	64	TEMP. 200°F
04	4	DCV 1000V	41	65	TEMP. 2000°F
05	5	FREQ KHz/MHz	42	66	TEMP. 200°C
06	6	DIODE/CONTINUITY	44	68	TEMP. 1370°C
08	8	OHM 200Ω	80	128	ACV 200mV
09	9	OHM 2KΩ	81	129	ACV 2V
0A	10	OHM 20KΩ	82	130	ACV 20V
0C	12	OHM 200KΩ	83	131	ACV 200V

10	16	OHM 2MΩ	84	132	ACV 750V
11	17	OHM 20MΩ	A1	161	ACA 20A
12	18	CAPACITANCE 20μF	A2	162	ACA 200mA
14	20	CAPACITANCE 2μF	A4	164	ACA 20mA
18	24	CAPACITANCE 200nF	A8	168	ACA 2mA
20	32	CAPACITANCE 2000pF	B0	176	ACA 200μA
21	33	DCA 20A	FF	255	HOLD
22	34	DCA 200 mA			

[Table 1: Function Code]

3rd and 4th Bytes

The format of the 3rd and 4th bytes is as following.

	4th byte	3rd byte
Bit No	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Bit 0 Polarity (1: +,0: -) except in measuring Hz.
0: KHz, 1: MHz in frequency measurement
Bit 1 Most Significant Digit.(0 - 1)
Bit 2 - 5 The second digit 0 - 9(0000 - 1001)
Bit 6 - 9 The third digit 0 - 9(0000 - 1001)
Bit 10 - 13 Least Significant Digit 0 - 9(0000 - 1001)
Bit 14 - 15 Decimal point position.

Bit 14	Bit 15	
0	0	None (0000)
0	1	Right most position (000.0)
1	0	Next position(00.00)
1	1	Left most position(0.000)

Note1: Programmers watch for the bit order, it is reversely interpreted.

Note2: If you reverse the bit order after data is received, you can see that the data is actually BCD coded. It is actually easier to decode the data this way.

3.3 Example: Data 02 0C 21 B1 03 (in Hex)

Byte 1 : 02
Byte 2 : 0C
Byte 3 : 21
Byte 4 : B1
Byte 5 : 03

Byte 1 and 5 are 02 and 03.
They are the right leading and ending bytes. The connection is O.K. and the data is valid.

Byte 2 is 0C.
Referring to table 1, it is the measurement of resistance of 200K ohm range.

Byte 3 and 4 are 21 and B1

	Byte 4		Byte 3	
Bit No	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
Binary	1 0 1 1	0 0 0 1	0 0 1 0	0 0 0 1
Hex	B	1	2	1

Bit 0	1,positive value
Bit 1	0,the most significant digit is 0
Bit 2 - 5	0001,the second digit is 1
Bit 6 - 9	0010,the third digit is 2
Bit 10-13	0011,the least significant digit is 3
Bit 14 - 15	01, decimal is at the right most position (000.0)

The reading is +12.3 K ohm

3.4 Change the Baud Rate

To change the baud rate, send the ASCII code of 9,4,2 or 1 to change from the current baud rate to the desired baud rate. Be sure to change PC's RS-232 baud rate accordingly

9 : 9600
4 : 4800
2 : 2400
1 : 1200

3.5 Special Codes of Byte 3

When the multimeter is in initial starting state, positive overload state or negative overload state.It sends out special code embedded in byte 3 (Refer to table 2).

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Initial State	x	x	1	1	1	1	1	1
Positive Overload	x	x	0	0	1	1	1	1
Negative Overload	x	x	0	0	1	1	1	0

x: don't care

[Table 2]

3.6 Reserved Characters

The characters of G, N, EEE, R, U, W, S, T, and X are reserved for data logger commands. 9, 4, 2, and 1 are used to change the baud rate of DMM/DATA LOGGER (for details, refer to section 3.8 commands for DMM/DATA LOGGER).

3.7 Memory Map for Data Logger

Address	Contents
0-1	Memory Write Counts (Increment if reset and record)
2-3	ID (Identification number for each meter, user can enter his/her own ID)
4	Firmware version
5	Recording Mode 1: max mode: record the maximum value measured during the sampling interval 2: min mode: record the minimum value measured during the sampling interval Others: normal: record the value measured at the end of sampling interval
6	Memory size, 1: 1K, 4: 4K
7	Reserved
8-17	Date and Time MM DD HH MM SS (10 bytes). Used as memo to user.
18-19	Sampling time in counts, 1 count = 0.4 second
20-21	Last record address if user press record button to stop recording
22	Counts of range changes
23-24	Reserved
25	First selected range
26-27	Address of the first record for the first selected range
28	Second selected range

29-30	Address of the second record for the second selected range
31	Third selected range
32-33	Address of the third record for the third selected range
34	Fourth selected range
35-36	Address of the fourth record for the fourth selected range
37	Fifth selected range
38-39	Address of the fifth record for the fifth selected range
40	Memory status, 1: record full, 0: not full
41-42	Counts of memory write failure, 0 when reset
43-44	Last write failure memory address, 0 when reset
45	Self-test enable byte when power on and as self-test result byte. 150(96 in hex): enable, others: disable Result: 1: pass, 2: fail, 0: when reset
46-47	First memory write failure address encountered
48	Power-on baud rate, 1: 1200, 2:2400, 4:4800, others: 9600
49	Alarm(Go/No-Go) enable byte when power-on, 150(96 in hex): enable, others: disable
50	Select range to perform Alarm(Go/No-Go) function. Refer to function code table for specific range.

51-52	Alarm's Lower limit in the format in section
53-54	Alarm's Upper limit in the format in section
55-95	Reserved
96-8191	Data area, 2 bytes/record Record number 1 = Memory Address 96

3.8 Commands for DMM and DATA LOGGER

DMM/DATA LOGGER

Command	Function
Any character (except reserved characters)	request for data
9 (ASCII code 57)	change the baud rate to 9600
4 (ASCII code 52)	change the baud rate to 4800
2 (ASCII code 50)	change the baud rate to 2400
1 (ASCII code 49)	change the baud rate to 1200

DATA LOGGER

Commands are case sensitive.

Cmd	Mnemonic	Format
R	Read	R[1 byte] Address [2 bytes]
W	Write	W[1 byte] Address[2 bytes] Data[1 byte]
U	Read All	U[1 byte]
S	Start Recording	S[1 byte]

T	Terminate Recording	T[1 byte]
G	Go	G[1 byte]
N	No-Go	N[1 byte]
EEE	Erase Memory	EEE[3 bytes]
X	Inquire Status	X[1 byte]

Whole command has to be sent to DATA LOGGER in 0.4 second, otherwise, command becomes invalid.

R *ADDRESS*: read one byte data at address *ADDRESS* from data logger.

ADDRESS: from 0 to 8191, the first byte is the low byte and the second byte is the high byte.

Example: Read the data at address 720

720 = 2*256+208

= 02(hex, first/high byte) D0 (hex, second/low byte)

= 2(decimal, high byte) 208(decimal, low byte)

Command string = "R" + CHR$(208) + CHR$(2)

Response: data logger send out the data stored at address *ADDRESS* with the leading and ending byte 02 and 03.

Return data string: 02 DATA 03.

W *ADDRESS* DATA: write one byte data DATA to address *ADDRESS*.

ADDRESS: from 0 to 8191, the first byte is the low byte and the second byte is the high byte.

Example: Write 150 to address 981

981 = 3*256+213

= 03(hex, first/high byte) D5 (hex, second/low byte)

= 3(decimal, high byte) 213(decimal, low byte)

Command string = "W" + CHR$(213) + CHR$(3)+CHR$(150)
Response: data logger write the data to the specified address.
Return data string: None.

U: read all the data stored in the memory from 0 to 8191.
Command string = "U"
Response: data logger sends out all the data in bytes with leading and ending byte 02 and 03
Return data string: 02 byte0 byte1 ... byte8190 byte8191 03

S: command data logger to start recording (equivalent to pushing RECORD button on the front panel of data logger)
Command string = "S"
Response: data logger start recording
Return data string: None

T:command data logger to terminate recording (equivalent to pushing the RECORD button again on the front panel of data logger)
Command string = "T"
Response: data logger terminate recording
Return data string: None

G: command the Go pin of the min DIN jack at the right side of the data logger to go high (5V). If data logger's ALARM(Go/No-Go) is enabled, it will override the G command.
Command string = "G"
Response: Go pin goes high and No-Go pin goes low if SYNC pin is high
Return data string: None

N: command the No-Go pin of the min DIN jack at the right side of the data logger to go high (5V). If data logger's ALARM(Go/No-Go) is enabled, it will override the N command.
Command string = "N"
Response: No-Go pin goes high and Go pin goes low if SYNC pin

is high
Return data string: None

EEE: reset the data logger (equivalent to pressing the RECORD and POWER button).
Command string = "EEE"
Response: data logger clear memory
Return data string: None

X: inquire the status of the data logger
Command string = "X"
Response: data logger send out status byte
Return data string: 02 STATUS 03
Status Bit Map:
Bit0: 1: recording, 0:idle
Bit4: 1: DMM or memory locked, 0:data logger and memory OK
Bit5: 1: data logger is self-testing, 0: not self-testing
Bit6: 1: parts of the data logger memory is locked, 0:OK
Bit7: 1:DMM/data logger busy, 0: ready

4. Ready_To_Use Windows™ Application Program

4.1 Features

a. Connect and use, no setup required.
b. Display DMM's reading in several way.
c. Store DMM's reading at a user specified interval in a file.
d. Retrieve data from data logger easily.
e. Setting lower and upper limits for alarm function (data logger).
f. Self-testing (data logger).
g. Display the maximum and minimum values ever measured.
h. Check against the upper and lower limits set by the user.
i. Load data file directly into Microsoft EXCEL™ or Lotus 123™
j. menu driven by mouse or keyboard.

4.2 Hardware and Software Requirements

386/25 personal computer,4 Mbytes of memory or better.
Windows™ 3.0 or above.

486 personal computer is recommended for displaying all the windows on the screen at a fast sampling interval such as 0.5 or 1 second. If 386/25 PC is used, you can only open one of the LIST, ANALOG, or GRAPHIC DISPLAYS at 0.5 or 1 second sampling interval.

4.3 Installation of the Windows™ Application Program

A. Start **Microsoft™ Windows™**
B. Insert disk in drive A (or B)
C. From the **Program Manager**, select **File** menu and choose **Run**
D. Type a:\setup (or b:\setup) and press **Enter** key
Note: If you are using 386 PC, it might takes more than 3 minutes.

4.4 Description of Windows™ Application Program

When the ICON "Recording Meter" is selected and executed, the program automatically search for connected DMM/Data Logger or available serial port. If no serial port is available, then a message of "No communication port" shall be displayed, and the program exits itself. Once communication port is setup, a main window will be displayed on the screen. The Layout of the window is as Figure 6:

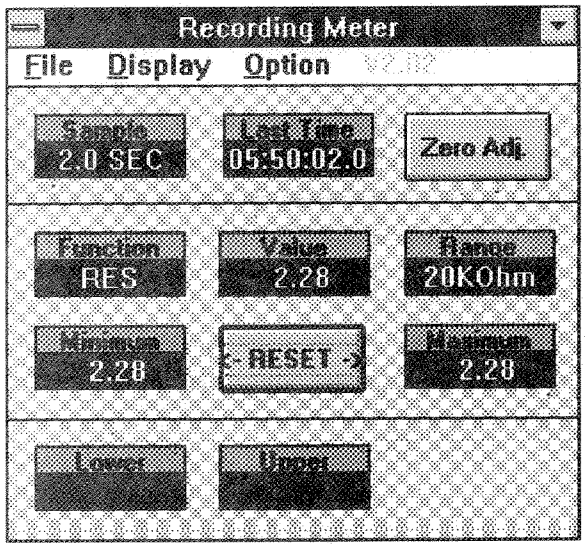

Figure-6 Main Window

Sample: The value under SAMPLE is the sampling time.
Last Time: The value under LAST TIME is the last recording time.
ZeroAdj: Once this button is selected, current reading shall be set to zero, and all subsequent readings shall become relative value with respect to the current reading. To disable this function, select the button again. If user wants to enter his/her own offset value, it can be done by press any key from the keyboard (except ESC and ENTER), but the ZERO command button must be selected already.
Function: The text under FUNCTION is the function selected at the DMM/Data Logger.
Value: The value under VALUE is the reading from the DMM/Data Logger.
Range: The text displayed under RANGE is the range selected at the DMM/Data Logger.
Minimum: The minimum value ever recorded.
Reset: Clear minimum and maximum value recorded.
Maximum: The maximum value ever recorded.
Lower: The minimum value of the range specified.
Upper: The maximum value of the range specified.

FILE: File menu has five options, NAME, START RECORDING, END RECORDING, PRINT DATA, PLOT DATA FROM FILE, and EXIT.

NAME: if user wants to store the data in a file, click at this option. Then the user shall be asked to enter a file name. Once recording is started by selecting START option, data shall be stored in a file under the name entered.
START RECORDING: click at this option to start recording.
END RECORDING: click at this option to stop recording
PRINT DATA: once user enters a file name, the data file can be printed any time during the recording.
PLOT DATA FROM FILE: Select this option to plot data from the file saved before.

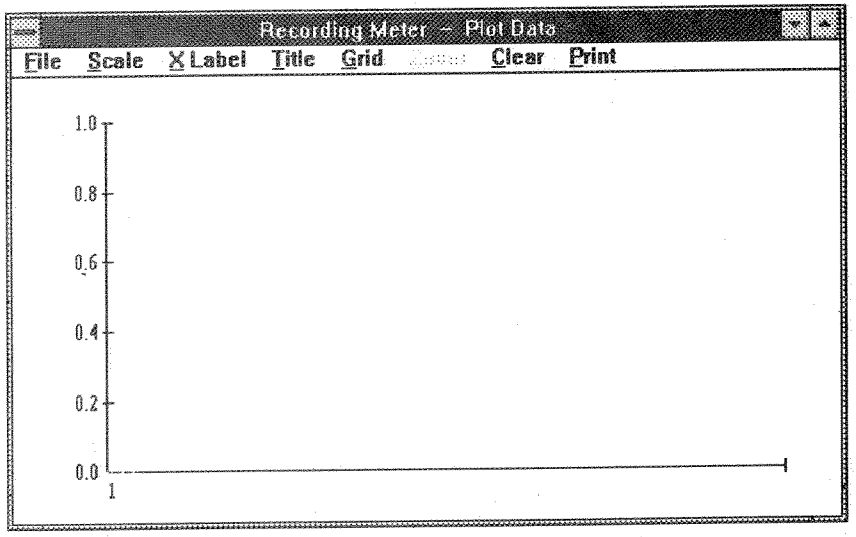

Figure 7

File: Open file
Exit: Exit PLOT DATA FROM FILE
Scale: Set Y min and Ymax
XLabel: select either time or sequence number as x label
Title: set the title for X axis, Y axis, or Graph
Grid: select horizontal grid, vertical grid, or both
Zoom: zoom into the whole graph
Clear: clear graph
Print: print graph

EXIT: click at this option to exit the Windows™ application program.

DISPLAY: DISPLAY menu has four options: DIGITAL, ANALOG, LIST, and GRAPHIC.

DIGITAL: If this option is selected or CTRL+D is pressed, a window, which emulates multimeter's LCD display, shall appears on the screen.

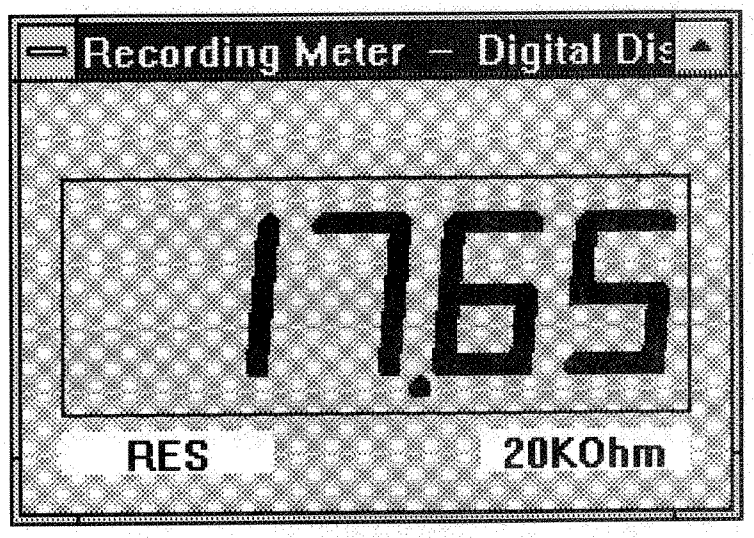

Figure-8

ANALOG: If this option is selected or CTRL+A is pressed, a window, which emulates an analog meter, shall appear on the screen.

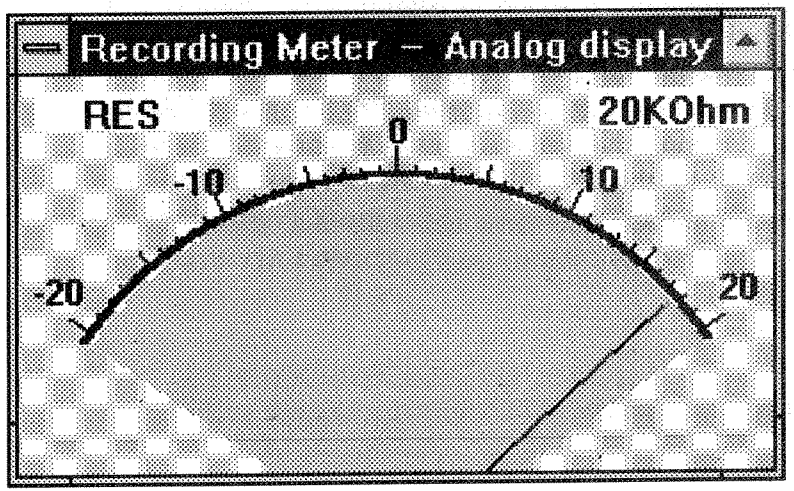

Figure-9

LIST: If this option is selected or CTRL+L is pressed, a window, which lists the date, function, range, and value every sampling, shall

appear on the screen.

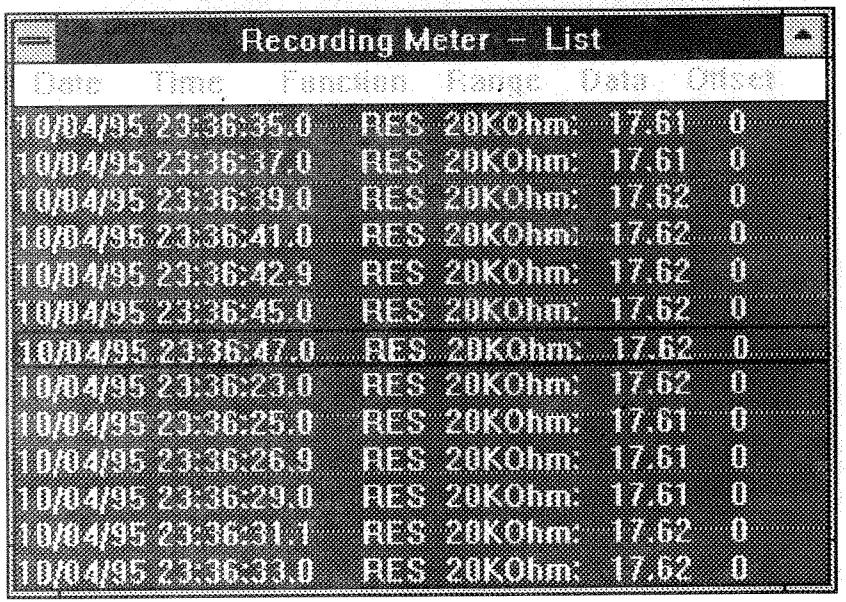

Figure-10

GRAPHIC: If this option is selected or CTRL+G is pressed, a window, which emulates strip chart recorder, shall appear on the screen. The graphic window has two menu, PRINT and SCALE. Select the PRINT menu, the graphics will be printed through any printer connected to the PC. The SCALE menu allows user to set the minimum and maximum value for the Y (vertical) axis.

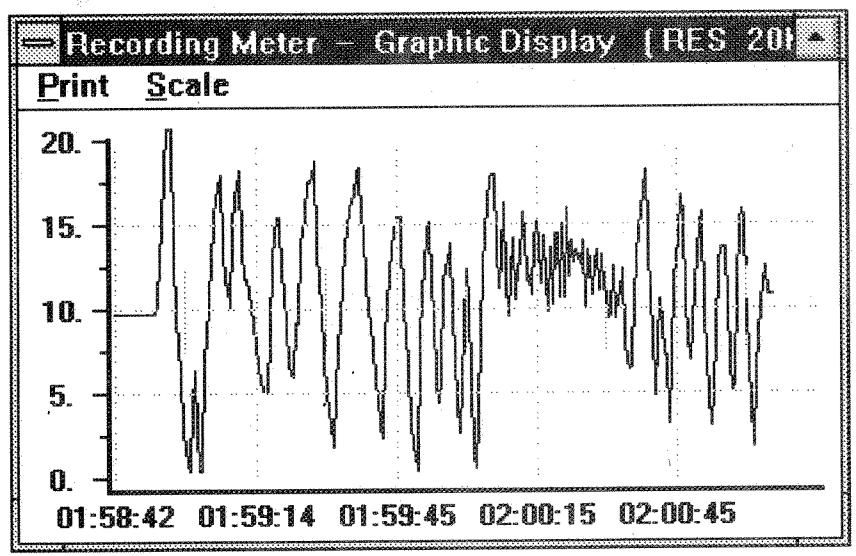

Figure-11

Note: if user wants to use keyboard to select options, the main window must be the active window. If a window is active, it's title bar should be blue. By default, the main window is the active window. Somehow, if the main window is not active, click the mouse at the main window to make it active. If no mouse is available, press the ESC key, the control will return to the main window.

OPTIONS: OPTIONS has four options: SAMPLE RATE, UPPER LIMIT, LOWER LIMIT, GRAPHIC MODE, OPEN CHANNEL 2, and DATA LOGGER.

SAMPLE RATE: user can change sampling rate by selecting this option. Only the positive integer number can be entered except the number 0.5. Except 0.5, all the number shall be converted or truncated to an integer. The range of sampling time is from 0.5 to 32767 seconds.

UPPER and LOWER LIMIT: user can specify a range by entering the UPPER and LOWER LIMIT. If the reading is within the range,

nothing is shown. Otherwise, either message of UNDER or OVER shall be shown on the screen.

Note: To enter the sampling time, upper limit, or lower limit, user can also click the mouse at the values displayed in the main window directly.

GRAPHIC MODE: By selecting this option, user can select either DOT or BAR to plot the curve in the graphic display window.

OPEN CHANNEL 2: If more than one COM are available, this option will be enabled. This option allows user to connect a second DMM to the additional COM port, and the software will record data from 2 DMMs.

DATA LOGGER:

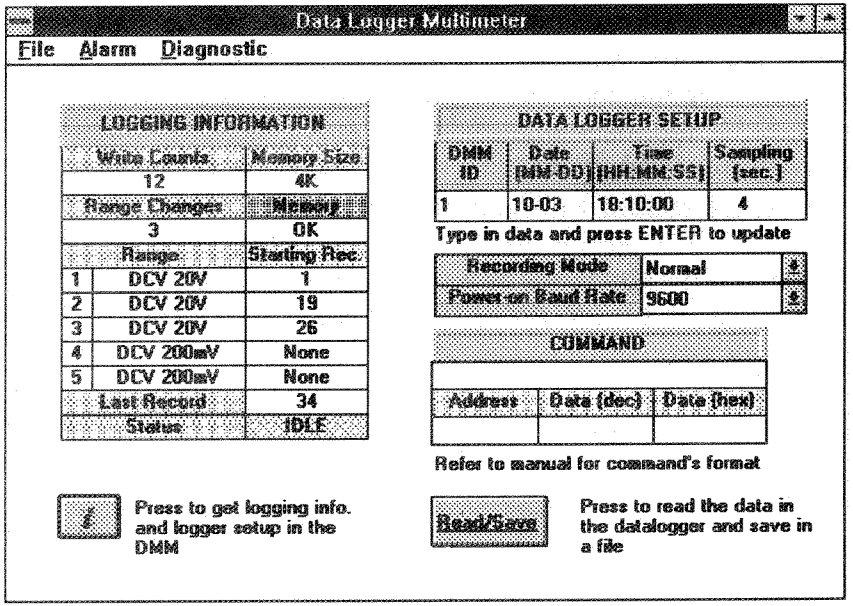

Figure-12

LOGGING INFORMATION:

Write Counts:
For every reset, Write Counts increments by one.
Memory Size:
the size of data logger memory
Range Changes:
Indicate range changes during recording, max. 5, if more than 5, data logger stop recording.
Memory:
Indicate if there was any WRITE FAILURE during recording. 0: None. If the reading is not OK, please run diagnostic to check the memory.
Range:
The name of the range selected.
Starting Rec.:
The starting record number for each range (from 1 to 4048). Record number 1 is actually in the data logger memory address 96.
Last Record:
Current last record number.
Status:
Status of data logger, idle or recording.

DATA LOGGER SETUP

DMM ID:
This is used to identify each data logger, user can enter the number from 0 to 65535.
Date:
This is used as memo for user, must enter in the format of MM-DD. There is no real-time clock in the DMM.
Time:
This is also used as memo for user, must enter in the format of HH:MM:SS: There is no real-time clock in the DMM. But it will be used as starting time (reference only) when converting the raw data stored in data logger.
Sampling:
This is used to set the sampling time for data logger. Every time

user press the RECORD button, it will be read and become effective. Range is from 0.4 seconds to 13106.8 seconds.

Recording Mode:
It is a drop-down list. User can select either Normal, Max, or Min recording mode

Normal mode: data logger record the data at the end of the sampling interval.

Max mode: data logger record the maximum value measured during the sampling interval.

Min mode: data logger record the minimum value measured during the sampling interval.

Power-on Baud Rate: Select 9600, 4800, 2400, or 1200 when power on. User can still use 9, 4, 2, or 1 to change baud rate when the data logger is already on.

COMMAND:

It is not recommended to use this utility unless you are very familiar with the data logger. Refer to section 3.8 for the format of commands.

FILE:

This is used to convert raw data file collected from the data logger. Every time user press the Read/Save button, a RAW_DATA.DMM is created to store the raw data collected from data logger. It is only 8K bytes long. If user wants to save disk space, he/she can rename the raw data file. Once ASCII data file is needed, user can use the CONVERT function under FILE to convert the raw data file to ASCII file (170K bytes long).

ALARM:

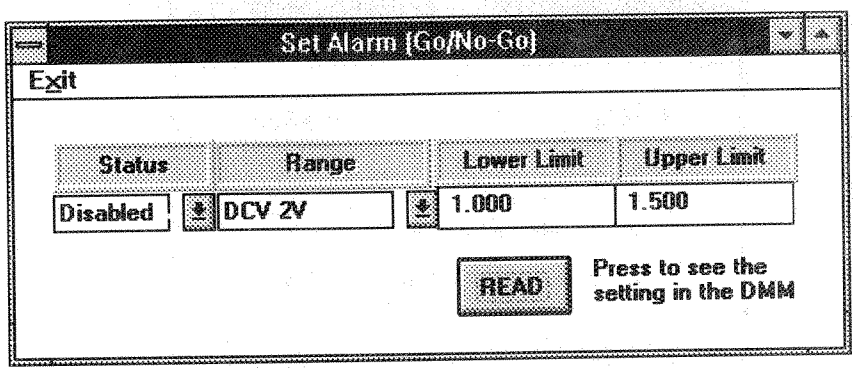

Figure-13

Status:
Indicate if alarm function is enabled. If enabled and the range of the DMM is the same as specified in the memory, the mini DIN will output signals accordingly. If the reading is within the lower and upper limits, GO pin goes high (5V), NO-GO pin goes low. If the reading is out of range, GO pin go low (0V) and NO-GO pin goes high (5V). (SYNC pin is pulled high normally. Once it is pulled low, then GO and NO-GO pins will both go low)

Range:
user selects the range which is the range to perform ALARM function. If this range mismatches with DMM's range, alarm will not function.

Lower Limit: type in data and press ENTER to update.

Upper Limit: type in data and press ENTER to update.

DIAGNOSTIC

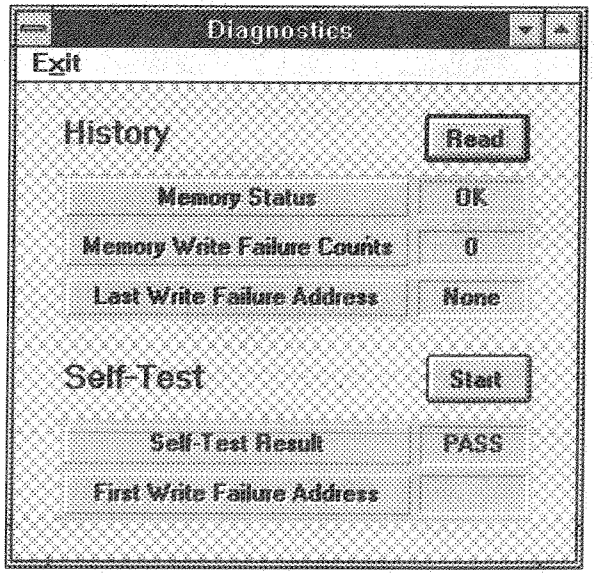

Figure-14

READ:

Press this button to see the memory status, memory write failure counts, and last write failure address. Also READ is used to check the self-test result.

START:

Once press, program will write 150 to memory address 45. User turn the power of the data logger off, and turn it on again. Then data logger will start self-testing. In self-test, data logger write and read to every byte of memory. If any byte fails this check, self-test stop, write 2 to memory address 45 and the write failure address to memory 46-47.

Memory Status:

If memory is locked in some way, it will show LOCK.

Memory Write Failure Counts:

The counts of WRITE FAILURE ever happened during recording is recorded in memory address 41-42.

Last Write Failure Address:

Memory address 43-44 always keeps the last WRITE FAILURE address.

Self-Test Result:

Memory address 45 also keep the result of self-test. 1: pass, 2: fail

First Write Failure Address:

Memory address 46-47 keep the WRITE FAILURE address first encountered in self-test.

NO COM:

If connection is lost in any way (ie. broken cable), message of "NO COM" shall be displayed to indicate that request of data is not acknowledged.

4.5 Change the Size of Windows

All the windows in this program can be resized except the main window. Sometimes, the user would like to change the size of window for better visibility. It is useful to enlarge the display area for GRAPHIC DISPLAY WINDOW. To do that, move the mouse cursor to the border of the window. Once the cursor is changed to a two-headed arrow, hold the left button of the mouse and drag the mouse to change the window's size.

4.6 Estimate DMM Recording File Size

When you use this Windows™ application program to record data,

1 DMM: 49 bytes/record (This number might be changed).

2 DMM: 69 bytes/record (This number might be changed).

For example, if you want to record a data every 10 seconds in 10 hours, the disk space you need is:

10 (hrs) * 60 (min/hr) * 60 (sec/min) = 36000 sec.

36000 (sec) / 10 (sec/record) = 3600 records
3600 records * 49 bytes/ record = 176400 bytes = 176.4 K bytes
176400 + 52 (header) = 176452 bytes=176.452K bytes

4.7 Important Notes for Users and Programmers

In the frequency measurement, if the "HOLD" button is pressed, the multimeter stops sending out data. So "No ACK or No COM" will appear to indicate that no data is received

In the frequency measurement, the fastest interval for the multimeter to send out data is one second. Though user can select 0.5 second, the readings is the same in the one second interval.

In the frequency and diode measurement, the analog and graphic displays are disabled.

It is strongly recommended that when use opens the COM port, it is opened by the following command:

OPEN "COM1:9600,N,8,1,CS,DS,CD,RS" AS #1

Though it can be open without "CS,DS,CD", then the RS-232 cable wiring shall be connected the way specified in section 2.1.

The RTS pin must be disabled by software. In QBASIC, add RS in the OPEN statement to disable RTS, then voltage level of RTS becomes low (-10V).

5. BASIC Sample Programs

Three BASIC sample programs, BAS_DEMO.BAS, COM_DEMO.BAS and CTML1.BAS are included in the floppy disk. They can give the programmer a clear picture of how the data are

collected from DMM/DATA LOGGER and decoded.

6. Load Data File into EXCEL™ or LOTUS 123™

For this Windows™ application program, data is saved in ASCII and EXCEL™ CSV(Comma Separated Variables) format. The file can be reviewed or typed using any text editor, and printed by PRINT command under DOS. If advance graphics is needed, user can port the data into EXCEL™, and achieve that in EXCEL™.

Follow the following steps to load your data file into EXCEL™:

a. If you already have a data file using the program, rename your file to a name with extension CSV (eg. ABCDE.CSV) or enter a file name with extension CSV when user opens a file in the program.

b. When opening the file in EXCEL™, select the file type *.CSV (text file *.txt, *.csv). Then load the file into EXCEL™.

Follow the following steps to load your data file into LOTUS 123™:

1. select File and choose Import
2. select File type .CSV with delimiter ",".
3. enter your data file name

7. Use the Quick Debugging Tool (CTML1.EXE)

A debugging program also comes with the multimeter - CTML1.EXE. When the function, range and reading in the application program do not match with those of the multimeter, user can use this program to verify if there is a hardware problem. It is also very useful when you

are writing your own application. The source code CTML1.BAS is also included in the floppy. It can be run in QBASIC or compiled by QUICK BASIC.

Type CTML1 under DOS™ operation system, then the following text will appear on the screen:

Communication Port <1> :
Baudrate <9600> :

Enter the correct communication port (1 or 2), and the correct baud rate (9600, 4800, 2400, 1200). If nothing is entered, the default communication port is COM1, and the baud rate is 9600.

Then when the space bar is pressed, the character is sent out to the multimeter, and 5 bytes of data received from the multimeter shall be displayed in hex format on the screen.

This program can be used to change the baudrate of the DMM/DATA LOGGER. If you press 9, 4, 2, or 1, the ASCII code is sent out to the DMM/DATA LOGGER, and the multimeter will change the baud rate accordingly. Always remember to set the PC's baudrate to the right speed in order to match with the DMM/DATA LOGGER.

8. Quick Start for Users and Programmers

Regular Users:

a. Connect the DMM/DATA LOGGER with PC.
b. Click the mouse at the ICON of Recording Meter.

Programmers:

a. Connect the multimeter with the PC.

b. Run the debugging program CTML1.EXE to verify if the hardware connector is O.K.
c. Write code (ie. C or BASIC etc.) to set RTS low and send a SPACE character to the multimeter.
d. Write code to receive 5 data bytes from the multimeter.
e. Write code to decode 5 data bytes.
f. Write code to perform your desired function.

9. Trouble Shooting

8.1 If you can not install the program

If CMDIALOG.VBX is being used by some unclosed program, such as Microsoft™ Office™, setup program is not able to install the program. Close the active ICON, then run the setup again.

8.2 If your data is displayed at an irregular time interval.

Slow PC(386 PC):

You might be using a slow PC and you choose a time interval less or equal to 1 second. If your PC does not have enough processing power, Window™ can not update the screen in time. So the timing is out of order. To fix it, do not open LIST, and GRAPHIC DISPLAYS. Though, Windows™ still has a timing errors of 0.055 seconds which can not be avoided. So the time stamp could see an error of 0.1 second.

Power Management:

You might be using a note-book computer which has power management and you choose a long sampling interval. Note book computer shuts off hard disk if it is not accessed for a certain period. As the program try to write to the disk, note book needs time to start hard disk. That is why the recording interval is irregular.

8.3 If no data is received from the multimeter.

You can run the CTML1 debugging program to make sure the hardware connection is OK. If CTML1 also receives no data, check your cable to see if there is any broken wire or wiring is not correctly connected.

10. Update Information

Last update Oct. 11, 1995