



M. D. INSTRUMENTS, INC.

EZ LAB SPECIFICATIONS

Hardware:

Microprocessor based, fully programmable digital temperature readout system. Unit is factory programmed ready to use or it can be easily modified for operator preferences.

Displays:

Large 3" high seven segment LED main display. Program screen is a high performance 16 x 20 LCD display with back light. Displays are protected by replaceable Lexan windows.

Keypad:

Patented Piezoelectric 16 key, totally sealed, one piece, solid metal construction with no moving parts.

Thermocouple calibration:

Types K, R, S, & B. Field changeable. Internally compensated. Dual Channel Operation, Type K Channel #1, Types R, S, or B on Channel #2.

Measurement range:

User selectable IPTS - 1968 or IPTS-48

Type S & R: 500 to 3200°F (260 to 1815°C)

Type B: 1000 to 3400°F (538 to 1871°C)

Type K: 0 to 2600°F (-18 to 1427)

Accuracy:

+/-3°F over measurement range.

Operating temperature:

40 to 130°F

Outputs:

EIA std. RS232, for data transfer. A scalable 0-5V analog output. RS485 port for plant wide data acquisition.

Enclosure:

The enclosure is of strong metal sealed construction. Unit dimensions are 12" H x 17.45" W x 7.25" D.

Data logging:

Up to seventy-five test curves with their calculated results are stored in the units battery backed memory. Each tests' stored data consists of a test number, date, time, pole temperature, liquidus temperature, % CE, %C, %Si, solidus temperature and a user programmed alphanumeric heat number (8 char. max.). Stored test results as well as curve data, can be recalled from memory and displayed on the 16x20 LCD display and simultaneously sent to the RS232 port.

Power requirements:

85 to 130VAC, 50 to 60 Hz. Five year lithium battery backed memory.

Description of EZ Lab Screens

In general all screens may be exited or data entry fields accepted by pressing either '0' or 'ENT' from the keypad. If a screen does not contain a return prompt, press one of these two keys.

Upon powering the EZ Lab, the system will load and run the program stored in EEPROM memory. Depending upon the initial condition of the system, different opening screens may appear. These are listed below as well as the conditions leading to their display.

After loading the initial setup program, a newly built and powered unit, or a unit that has lost it's RAM battery backup, will force the operator to set the units date and time by displaying the SET SYSTEM CLOCK screen shown below.

SET SYSTEM CLOCK
ENTER MONTH (1 - 12)

Using '<' , 'Clr' or 'Ent'

The screen scrolls from month to day to year, then to the time setting of hours and minutes. All entries are checked for valid ranges before writing to hardware and will redisplay any entry screen if entered data is beyond normal limits. This screen is also accessible through a utility screen described later. Any entry that displays a correct field of data may retain this data by pressing the 'ENTER' key to advance to the next parameter.

Units will normally bypass this screen under normal operation and display an opening screen showing the instrument name, program date and the MD Instruments address and phone number.

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MD INSTRUMENTS

For Tech Support
231-773-4739

After approximately three seconds, this screen will be replaced by the normal operating screen for production testing. The normal operating screen is shown below.

11:19:24		05/09/01	
HEAT #			
TEMP	PEAK	STATUS	
75 F	2434	CHG CUP	
2500			
#			
13			
RCP			
1			
2000			
0	SECS	150	
PRESS 0 FOR MENU			

The current time and date are shown on the top line. The second line shows the entered heat number. The third line is the heading for the fourth lines' temperature, peak temperature and the status of the test. The test temperature up to the liquidus temperature is also displayed on the three inch LED display. Below the numerical data, is a graphical display of the test temperature vs. time. In the above screen, pressing the keypad 0 will advance the display to the main option menu. Pressing the left arrow key, '<', is a shortcut to enable the operator to change the Silicon and Carbon offset values. Pressing the right arrow key, '>', is a shortcut to enter a heat number. When the unit is used in one of the two test modes, it will remain in that mode until the other test mode is started. At that time it will automatically switch modes and begin the current test analysis. Staying in a last use mode allows the operator to repeatedly view the last accepted test results. If the pole test was the last run test and the cup test results are desired, pressing the '^' key will manually force the instrument into the cup mode and begin scrolling the last cup test results. Pressing the 'Clr' key when data is scrolling will stop scrolling and clear the display.

During normal testing the large display will scroll the last tests values of the last pole temperature, % CE, % C, and % Si. The status display will show CHG CUP until the cup is removed. When the cup is removed the large display will show the open thermocouple temperature. When the cup is again attached the display will temporarily show CUP and begin scrolling the last test values. If the system has just been powered up and there has not been a previous test, CUP will be displayed until the next test temperature exceeds the lower graph temperature. An open cup is indicated by the blue test light being out. A non-open cup below the lower graph temperature will display the blue light. A test in progress is indicated by the blue and yellow lights being on and red light being off. Test completion is indicated by the red and blue lights being on and the yellow light off. When the % Si has been calculated, the yellow light goes out the red light comes on and the heat data is saved to battery backed RAM. The red light goes out when the temperature cools below the lower graph temperature to indicate that a new cup is needed. Data is stored for future recall until cleared or the stored number exceeds seventy-five tests. If the setup option for data storage full warning is enabled, a warning screen will appear and ask if a data download is desired. A keypad response of 0 is required to continue. If data is not downloaded, the next test will 'wrap around' and overwrite stored heat data. The sample number will be reset to number one and the display of the prior stored tests will be prohibited.

If a good pole connection is made the green light will be lit. In the event that the pole channel temperature input exceeds approximately 900 to 1600 degrees, the EZ Lab begins its pole test mode. When the temperature rises above the graph temperature, the large display will update to a peak or plateau test value. As explained above, the yellow light indicates a test in progress and the red light indicates a completed test or a time-out condition. The pole temperature will continue to be displayed on the large led display unless the previous cup test mode is accessed, in which case, the display will again begin scrolling the pole temperature and cup test values.

The last measured pole temperature will be stored with the next cup test data at the end of the cup test cycle.

Pressing 0 from the main operating screen will display the main option menu below.

<p style="text-align: center;">PRESS KEYPAD FOR THE FOLLOWING</p> <p>1 ENTER HEAT # 2 ENTER OFFSET TEMP 3 SETUP VALUES 4 TEMPERATURE STATUS 5 CLEAR STORED DATA 6 VIEW STORED DATA 7 CALIBRATE SYSTEM 8 UTILITY MENU 9 SELECT RECIPE</p> <p>0 RUN EZLAB</p>
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Pressing 1 from the keypad 'ENTER HEAT #' will allow entry of the test heat number using the keypad. This ID number can be up to eight characters in length. Alpha and numerical characters are accessed by scrolling through groups using the up and down arrow keys and pressing the key number below the character desired. The backspace key erases one character. Press enter when finished.

Selecting main menu option 2 'ENTER OFFSET TEMP.' will allow the user temperature offset entry. Units are of integer values of degrees F or degrees C depending on the user preferences in the EZ LAB setup.

Selecting main menu option 3 'SETUP VALUES' displays a second screen to select either the CUP setup values or the POLE setup values.

Under the CUP setup option, the following are chosen;

- a. Temperature display units
- b. The maximum open TC temperature for loss of blue light and no data storage.
- c. Upper Graph Temp, (upper vertical scale limit).
- d. Lower Graph Temp, (lower vertical scale limit) and the temperature at which the large LED display is unlatched and updated.
- e. Graph Time in Seconds, (horizontal scale).
- f. Turn Around Temp. This is the number of degrees below the peak temperature before the liquidus check begins.
- g. Cup Drop Temp. This is the maximum cup cooling rate before an error is declared.
- h. Liquidus Window Deg. This is the maximum temperature variation allowed during the liquidus reading validation time.
- i. Liquidus Window Time. This is the time that the liquidus temperature stability must be maintained.
- j. Liquidus Recalescence Deg. The maximum number of degrees of temperature increase allowed above the

calculated liquidus temperature before and error is reported. The error code displayed on the LCD screen will be %CE = 99.92.

k. Solidus Window Deg. This is the maximum temperature variation allowed during the solidus read validation time.

l. Solidus Window Time. This is the time that the solidus temperature stability must be maintained.

m. Solidus Recalescence Deg. The maximum number of degrees of temperature increase allowed above the calculated solidus temperature before and error is reported. The error code displayed on the LCD screen will be %C = 99.93.

n. Liquidus Read Time. The maximum time allowed for the system to check for the liquidus temperature after the turnaround temperature is detected. If this time expires, an error is reported. Error code displayed on the LCD screen will be %CE = 99.94.

o. Solidus Read Time. The maximum time allowed for the system to check for the solidus temperature after the liquidus temperature is detected. If this time expires, an error is reported. Error code displayed on the LCD screen will be %C = 99.95.

p. Si Offset %. An entry to allow the operator to modify the calculated Si % by adding the entered value to the calculation.

q. C Offset %. An entry to allow the operator to modify the calculated C % by adding the entered value to the calculation.

r. CE Offset %. An entry to allow the operator to modify the calculated CE % by adding the entered value to the calculation.

s. Liquidus to Solidus Degrees. The number of degrees of drop below the calculated liquidus temperature before the solidus temperature check begins.

t. Display Scroll Seconds. The amount of time each value is displayed on the large LED display upon test completion. Entering too large of value will slow down the keypad response when in the main operating screen and slow down the automatic test reset after temperature rises above the minimum display temperature.

u. Save as Recipe. This allows the storage of up to six sets of the above setup parameters for future recall.

Under the POLE setup option, the following are chosen;

a. Pole Temp Time Secs. The number of seconds above the minimum display temperature before the red light is activated. In the peak test mode, temperature at timeout is displayed and may not indicate the true peak temperature. In the plateau test mode, if the timeout value is reached before the specified number of readings are achieved in the plateau window, FAIL will be displayed, followed by the last good pole test data. In the peak mode, readings are taken at one second intervals. These readings are the average of the number of A to D conversions specified under the analog options. In the plateau mode, readings are taken at about 0.5 second intervals, again readings are and average specified in the analog option.

b. Pole Max Open TC. The temperature used to indicate an open pole channel thermocouple, also causing the green light to extinguish.

- c. Pole TC Type. This selects the proper millivolt to temperature curve to match the pole thermocouple type.
- d. Pole Test Mode. This selects if the peak or plateau mode is to be used.
- e. Plateau Window Degrees. This will only appear if the Plateau test mode was selected. This specifies the plus and minus window height that consecutive samples must remain in if a test is considered valid. A window specified at 2, will require the sample readings to be within 4 degrees of one another.
- f. Plateau Window Samples. This will only appear if the Plateau test mode was selected. This the number of consecutive samples within the window, taken at 0.5 second intervals, required before the Pole Temp Time Secs has been reached.

Selecting main menu option 4 'TEMPERATURE STATUS' displays a screen showing the temperature of each channel in degrees, as well as, millivolts and the enclosure internal temperature. In this display there is no operation of the test lights, data storage, latched large display or minimum test threshold temperature. This screen is useful for calibration verification of the instrument without affecting stored data. The LED display will show the K channel temperature, the rear analog output will be proportional to the pole channel temperature.

Selecting main menu option 5 'CLEAR STORED DATA' will prompt for a security number (1234). When this is entered, execution to clear all data in memory begins. A confirmation screen will be displayed.

Selecting main menu option 6 'VIEW STORED DATA' allows the user to recall up to 75 stored tests. The liquid crystal display screen scrolls from the last test to the first test stored. This display can be stopped, forwarded and reversed by keypad. The automatic display-scrolling rate is normally two seconds but can be changed in the UTILITIES menu described later. If the data scrolling is stopped, the options at the bottom of the display will change, indicating that the data can be plotted to obtain the original screen curve. All scrolling data values are also being sent out the RS232 rear port for possible downloading. When the plot stored curve is selected, numerical temperature data is also sent to the RS232 port. Each temperature output indicates one-second intervals. A sample screen follows;

STORED TEST DATA	
SAMPLE #	1
TIME	09:00:08
DATE	05/11/01
HEAT #	1276AF54
POLE	2443
LIQUIDUS	2147
%CE	4.10
%C	3.52
%Si	1.74
SOLIDUS	2045
PRESS C r FOR CURVE	
BACK=^ FORWARD=v	
PRESS > TO RESUME	
PRESS 0 FOR MENU	

Selecting main menu option 7 'CALIBRATE SYSTEM' is used to calibrate the instrument. A warning that a millivolt source is required is displayed and a password prompt follows. An invalid password returns the operator to the main menu. A password of 1234 will begin the process, which is self-explanatory (see the end of this document for a step by step procedure). The signal source required is an IPTS-68 standard. Entering 8604678 for the password will reset the calibration slope and offset to their default values. Normal calibration can then be attempted again using 1234. Both channels must be calibrated when this mode is

entered. The cup K channel is done first followed by the pole S channel. The pole R and B calibration is calculated from the S values.

Selecting main menu option 8 'UTILITY MENU' displays the following screen;

**PRESS KEYPAD FOR
THE FOLLOWING**

**1 RESET SYSTEM
2 SET DATE & TIME
3 TEST OUTPUTS
4 DATA DISPLAY RATE
5 RS485 SETUP
6 DISPLAY CONTRAST
7 HEAT OPTIONS
8 ANALOG OPTIONS
9 SELECT IPTS CURVE**

0 RETURN

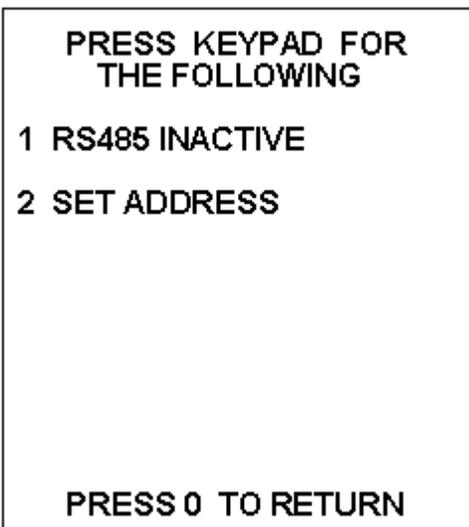
Selecting utilities menu option 1 'RESET SYSTEM' resets and stores all EZ Lab setup variables to their default values, reloads the program from EEPROM and starts running. All setup variables are reloaded and verified to be within valid limits.

Selecting utility menu option 2 'SET DATE & TIME' allows setting of the instrument real-time clock. Procedure was discussed under system startup.

Selecting utilities menu option 3 'TEST OUTPUTS' runs a utility that activates the large display digits 0 through 9 to check for bad elements or driver chips. Upon completion of the display test, the indicating lights are pulsed to allow detection of defective bulbs, output relays or blown fuses.

Selecting utilities menu option 4 'DATA DISPLAY RATE' allows the operator to change the auto scrolling stored data delay time. Setting this to zero before downloading stored data will output stored ASCII data out the RS232 port as fast as possible. Communication parameters are 9600 baud, 8 data bits, no parity, 1 stop bit. The startup default display rate value is two seconds between tests displayed. This number, if changed, is not stored and will go back to its default value if power is cycled. Data is output to the RS232 connector anytime the stored data is viewed. This is a standard equipment feature.

Utilities menu option 5 'RS485 SETUP.' Opens the following screen.



This is only necessary if the accompanying RS485 data download utility software is to be used.

Pressing the '1' key will toggle the device RS485 port from inactive to active.

Pressing the '2' key will open a screen prompting the user to enter the EZ Lab device station ID #. Multiple units may be 'daisy chained' on the same communication loop, but must each have a unique ID #.

The utilities menu option 6 'DISPLAY CONTRAST', is a feature to allow the user to adjust screen contrast by using the keypad. This is required because of the liquid crystal temperature properties.

The utilities menu option 7 'HEAT OPTIONS', allows the user to specify if the entered heat # is cleared for a new entry after each stored test or reused on several tests until a new heat # is entered. The user can also select if a warning screen is to prompt for data retrieval when the memory limit is reached or automatically overwrite stored data.

The utilities menu option 8 'ANALOG OPTIONS', allows the user to specify;

- a). Temperature Filter Value. The default value is 0.1. This represents 10% of the last temperature reading added to 90% of the newest temperature reading. Larger filter values will result in longer pole test completion time. This may result in lower than real peak temperatures or failure from incompatible plateau settings if the pole timeout value is reached. Try to keep entered values below 0.5.
- b). Averaged number of analog to digital conversions. Default value is twenty-five. Each temperature reading is the average of the specified number of analog to digital conversions. Twenty-five conversions take approximately 0.4 seconds. This option gives the user software filtering control of the preamp output in electrically noisy environments.
- c). Enter the low temperature degrees representing a zero volt analog output at the rear of the instrument.
- d). Enter the upper temperature degrees representing a five volt analog output.

These values can be used to calibrate the analog output to directly represent the measured temperature. The default values will provide 1 mV per degree. In operation, the analog output will normally represent the cup channel temperature. However, when the auto transfer to pole measurement mode occurs, the analog output will represent the pole temperature.

The utilities menu option 9 'SELECT IPTS CURVE', allows the user to select either the IPTS-48 or the

IPTS-68 thermocouple standards.

Selecting main menu option 9 'SELECT RECIPE' prompts the user to enter a recipe value. If a selected recipe value has not been stored, a non valid recipe prompt is displayed and the user is returned to enter another value. Pressing 0 or 'Enter' will return the operator to the main menu. If a valid recipe is requested the recipe parameter screens below will be displayed;

RECIPE 2 VALUES	
DEGREES F	
INIT. LED TEMP	2000
OPEN TC TEMP	2600
CUP DROP DEG/S	100
GRAPH TIME SECS	150
LOWER GRAPH T.	2000
UPPER GRAPH T.	2500
TURN AROUND DEG	15
LIQ WINDOW TEMP	7
LIQ RECAL. DEG	8
LIQ WINDOW TIME	7
PRESS 0 FOR MORE	

RECIPE 2 VALUES	
SOL. WINDOW DEG	7
SOL. RECAL. DEG	8
SOL. WINDOW SEC	15
LIQ. READ TIME	140
SOL. READ TIME	180
LIQ TO SOL DEGS	25
Si OFFSET %	0.00
C OFFSET %	0.10
CE OFFSET %	0.02
PRESS ENT TO ACCEPT	
PRESS C/r TO REJECT	
PRESS 0 FOR MENU	

Accepting the displayed recipe will replace the current operating parameters and return the operator to the main menu. Rejecting the displayed recipe will return the operator to the recipe select screen for further recipe selection

EZ LAB COMMUNICATIONS

The EZ Lab is equipped with an RS232 communication port on the rear of the unit. This document details the use of this port. The purpose of this port is to allow the user to download test data from the EZ Lab to a computer and to allow the EZ Lab program to be downloaded. The EZ Lab can store seventy-five tests before it starts to overwrite the oldest readings.

The cable required is a standard straight through 9-pin D-sub male-female serial cable.

Using Windows, under Programs and Accessories, select Hyper Terminal. Click on the "HYPERTRM" icon.

Give the program a name and select an icon for your program. Click on the "OK".

In the next window under "connect using:" select the communications port that the cable is connected to. Click on the "OK". Under the communications port properties, select the following settings:

Bits per second: 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

Click on the "OK", then close Hyper Terminal and save your changes.

Use the icon just created each time you want to download from the EZ Lab. To transfer the data, select "Transfer" from the menu bar and select the "capture text" program. Fill-in the file path and file name. Press "start". At the EZ Lab, press "0" for the menu, then "#6- Stored Data". After data has been transferred, go to "transfer" on the menu bar and select "capture text" push "stop". Once the data has been transferred to the .TXT file it can be imported into other software, and or printed. (Note, setting the display data rate to zero will speed the data transfer).

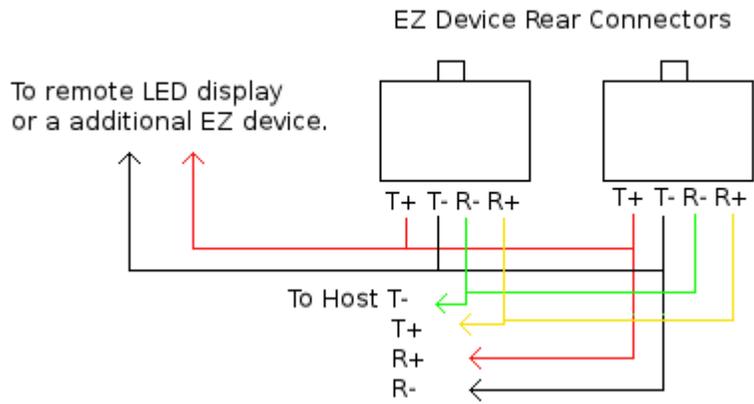
COMMUNICATION CABLES

Internal Programming Cable IDC-10 socket to 9 Pin D-sub Socket

IDC-10 Socket Pins	9 Pin D-sub Pins
2	2
3	3
5	5
8	8
9	9

RS485 Connection RJ11 connector Dual 8 position Shielded Cat 5,

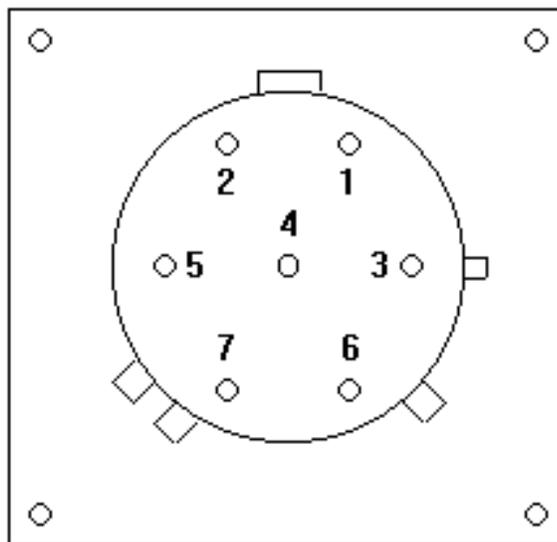
Siemon Part # CTS-SG-T4-T4-01



FOR EXTERNAL LIGHT OPTION

7 PIN SOCKET

Light Connection	Pin Number	Wire Color
Neutral	1	White
Blue Light Hot	2	Blue
Amber Light Hot	3	Yellow
Not Used	4	
Red Light & Horn Hot	5	Red
Green Light Hot	6	Green
Not Used	7	



1. With the EZLAB in the normal run mode, press zero on the keypad to display the operator menu.
2. Select “Calibrate System” by pressing number 7 on the keypad.
3. A message will appear on the display stating that this procedure requires a millivolt source (Thermocouple simulator).
4. After a few seconds the following message will appear “Enter Security Code”. Enter the number 1234 from the keypad and press enter.
5. A prompt for the type K cup channel will appear followed by a request to “Input 32 deg F”. Using an IPTS-68 type K thermocouple simulator connected to the yellow connector on the side of the EZLAB, input 32 degrees F.
6. Press the up or down arrow keys to adjust the internal offset until the displayed temperature value on the second line of the LCD display indicates 32 +/- 1 degrees. Press the zero key to continue.
- 7 A prompt to “Input 2450 deg F” appears. Again, with a type K thermocouple simulator input 2450 degrees F. The second line on the LCD display will begin the gain correction. This is complete when the displayed value flashes between 2450 and 2449, press the zero key.
8. The display will read “S Pole Calibration”. Press the enter key to continue.
9. Repeat steps five through seven above using an IPTS-68 type S thermocouple simulator connected to the black connector on the side of the EZLAB.
10. A message will appear indicating the type K and S multiplier and offset values. These are for information purposes only. At this point press the zero key.
11. Calibration is complete.

AVAILABLE REPLACEMENT PARTS

Description	Part Number
Large LED Display Lens	MD1010
LCD Display Lens	MD1019
Green Lamp Lens	MD1050
Red Lamp Lens	MD1051
Blue Lamp Lens	MD1067
Amber Lamp Lens	MD1052
Lamp Bulbs	MD1053
Stainless Keypad	MD1045
Instrument Face Plate	MD1069

