Programmable Seebeck Controller
SB100

USER'S MANUAL

MMR Technologies, Inc.
1400 North Shoreline Blvd., Suite A5
Mountain View, CA 94043
(650) 962-9620
www.mmr-tech.com

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Warning

NEVER DISCONNECT CABLES TO, HANDLE OR WORK ON AN MMR REFRIGERATOR/HOTSTAGE WHEN IT IS CONNECTED TO THE K-20/SB-100 WHILE THE POWER TO THE K-20/SB-100 IS ON!

1. General Information.

The MMR Programmable Seebeck Controller SB100 has been developed as a special tool for performing measurements of the Seebeck coefficient of metals and semiconductors. The SB100 measures the thermovoltages, of samples mounted on the MMR Seebeck Stage. The SB100 functions as part of the MMR Seebeck Measurement System, that includes a K20A MMR Temperature controller, a PC, and MMR supplied software.

The SB100 does not have any front panel controls, other than Reset, as it should be connected to a computer as the front end controller. The SB100 can also be controlled by the MMR hand held terminal C2000. There does not appear to be a significant demand for this kind of manually controlled system configuration except for system testing.

The SB100 is controlled on the macro command level using RS232 as well as IEEE488 interfaces. The standard SB100 version has the IEEE-488 disabled. If one wants to have the IEEE 488 activated, this should be specified when ordering.

The SB100 has two 16 bit ADCs, which acquire data simultaneously from the two input channels (reference and test samples voltages outputs of the MMR Seebeck Stage.). A two channel front end pre-amplifier is built into the Seebeck Stage dewar (See Fig. 2). The SB100 also has two 12 bit DACs. One of these controls the output power to the heater on the Seebeck Stage. The other provides an output for general use.

2. Characteristics:

•Thermo voltage range with pre-amplifier gain of 1000, full scale	±3 mV;
•Resolution	50 nV;
•Matching of gains of reference and test channels	<0.1%;
•Maximum output power on the 100 Ohm heater	0.9W;
•Step of the power control settings	0.1 mW;
•Maximum number of readings to be averaged	128;
•Range of output voltage for the user DA channel	-1.3 to +1.3V;

The RS232C interface is configured as a NRZ 8 bit word, single stop bit, NO parity. It can use one of the four Baud rates: 38,400 Baud, 4,800 Baud, 600 Baud, and 150 Baud. No handshaking is used.

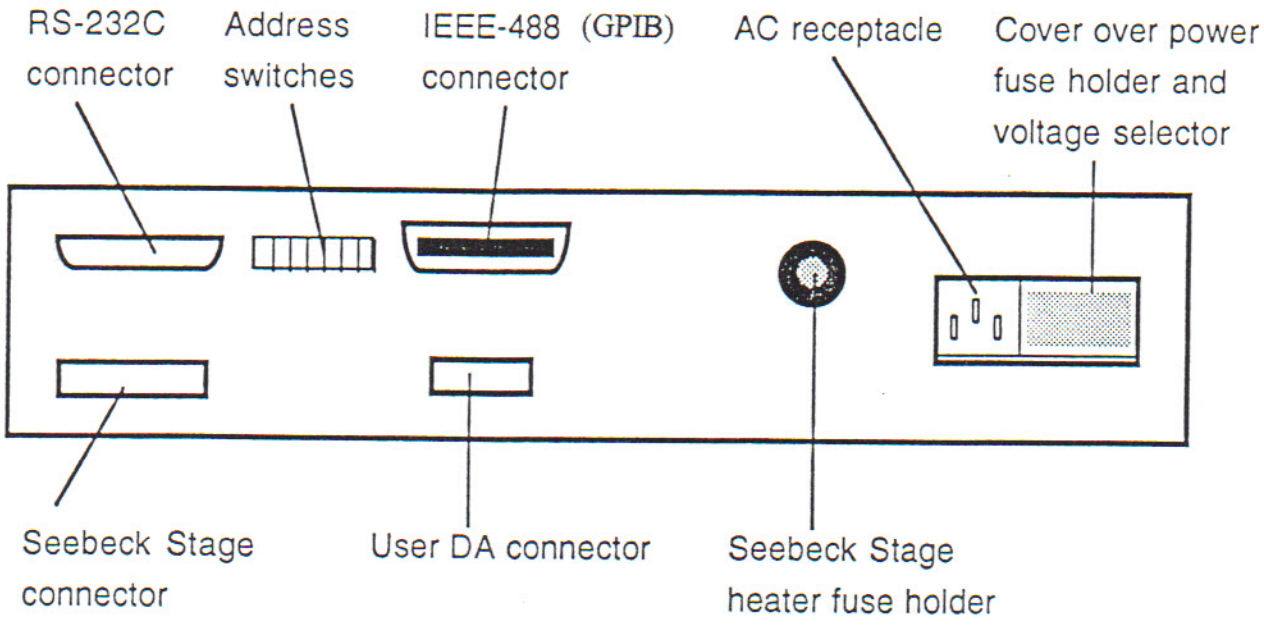
The IEEE488 description can be provided upon request, if the SB100 has been supplied with IEEE488 option.

3. Front and Back Panels.

The front panel has an ON/OFF switch, a Reset button and four status lamps. The POWER lamp is illuminated when the K20 power is on. This lamp is firmware controlled, so the fact that the POWER lamp relights after reset, or lights upon turning on the power, can be interpreted as a simple test of a normally functioning controller. The LISTEN and TALK lamps light when the attending computer instructs the SB100 either to listen (to receive data), or to talk (to transmit data). The DATA lamp lights when the SB100 is in the process of acquiring data from the Seebeck Stage.

The Back panel has several features which are shown on the Fig. 1.

Fig. 1. SB100 back panel.



Use a 1 ampere quick blow fuse for 100-120 VAC operation and 0.5 ampere fuse for 220-240 VAC operation. Heater fuse: use 0.3 ampere fuse of any voltage rating for the Seebeck Stage heater fuse holder.

4. The SB100 Connectors.

4.1. Seebeck Stage connector.

Pin number	Pin designation	Pin number	Pin designation
1	Not connected	2	Not connected
3	Not connected	4	+12 V Power supply
5	Not connected	6	ADC2 Input
7	Not connected	8	+12 V Heater supply
9	Not connected	10	ADC1 Input
11	Not connected	12	Analog ground
13	Not connected	14	Heater low
15	Not connected	16	Analog ground
17	Not connected	18	-12 V Power supply
19	Not connected	20	Not connected

4.2. User AD connector.

Pin number	Pin designation
1	Analog ground
2	Analog output
3	Not connected
4	Not connected
5	Not connected
6	Not connected
7	Analog ground
8	Not connected
9	Not connected
10	Not connected

4.3. RS232 C connector.

Pin number	Pin designation
2	Receive data
3	Transmit data
7	Ground
22	+5 V Power supply

4.4. IEEE488 connector.

The IEEE488 connector has the standard IEEE488 pin designations.

5. Address switch.

There are seven positions on the address switch, located at the SB100 back panel. Five of these (1 through 5) control the address of the IEEE488 interface, while the remaining two (6 and 7) control the Baud rate of the RS232C interface. The switches are labeled "ON" and "OFF". The table of addresses and corresponding switches combinations is shown below. Factory default address is 10.

Address	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5
4	ON	ON	OFF	ON	ON
5	OFF	ON	OFF	ON	ON
6	ON	OFF	OFF	ON	ON
7	OFF	OFF	OFF	ON	ON
8	ON	ON	ON	OFF	ON
9	OFF	ON	ON	OFF	ON
10	ON	OFF	ON	OFF	ON
11	OFF	OFF	ON	OFF	ON
12	ON	ON	OFF	OFF	ON
13	OFF	ON	OFF	OFF	ON
14	ON	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF	ON
16	ON	ON	ON	ON	OFF
17	OFF	ON	ON	ON	OFF
18	ON	OFF	ON	ON	OFF
19	OFF	OFF	ON	ON	OFF
20	ON	ON	OFF	ON	OFF
21	OFF	ON	OFF	ON	OFF
22	ON	OFF	OFF	ON	OFF
23	OFF	OFF	OFF	ON	OFF
24	ON	ON	ON	OFF	OFF
25	OFF	ON	ON	OFF	OFF
26	ON	OFF	ON	OFF	OFF
27	OFF	OFF	ON	OFF	OFF
28	ON	ON	OFF	OFF	OFF
29	OFF	ON	OFF	OFF	OFF
30	ON	OFF	OFF	OFF	OFF
31	OFF	OFF	OFF	OFF	OFF

The positions of switches 6 and 7 with the corresponding RS232C Baud rates are shown below:

Switch 6	Switch 7	Baud Rate
OFF	OFF	38,400
OFF	ON	4,800
ON	OFF	600
ON	ON	150

Factory default is 4.800.

6. Commands

The SB100 is controlled by the commands that are sent through the interface in ASCII format. The list of commands is below:

SMX- Start Measurement. X is the averaging parameter that can have values from 0 to 7. This parameter corresponds to the number of acquired readings in the range from 2^0 to 2^7 (1-128). Default is 3 (averaging of 8 readings). A command with no parameter instructs the SB100 to keep the pervious setting. Response is 'OK', after the command has been executed. During the execution of the SM command, the SB100 collects from the two input channels the predetermined number of readings, calculates the average values of the input voltages and puts the results into the controller's memory. For high averaging parameters the execution of the SM command can take a long time, up to 45 sec. One can monitor the execution of the command by watching the front panel status lamps (See section 3).

GVX- Get Voltage. Getting the value of the thermo voltage, which has been acquired and averaged by the execution of a preceding SM command. X can be 1 or 2, for the first or second ADC channel respectively. The response has the format ±####.##. Units are μV.

SHX- Set Heater Power. Format X is ####.#. Units are mW. The upper setting limit is 900. Response is 'OK'. The zeros to the left of the most significant digit can be disregarded during input.

SAX- Set Analog output. Format X is ±#.### . Units are Volts. The setting limits are ±1.300V. Response is 'OK'.

TC- Test Communication. Response is 'OK', if communication is good. No response indicates the communication failure.

7. Error messages.

Error 1. Illegal Input.	Response to the input of an unknown command.
Error 2. Format.	Response to an illegal command format.
Error 3. ADC Overflow.	Response to the GVX command if ADC overflow has occured during data collection.
Error 4. Out of Range.	Response to an attempt to set a command parameter exceeding a legal range.
Error 6. Input SM Now. not	Response to the GVX command if the SMX command has been executed at least once after reset.

8. Setup.

8.1. Verify, that the voltage selector on the SB100 back panel is set for the AC voltage to be used.

8.2. Check the presence, condition and values of the power and Seebeck Stage fuses (See section 3).

8.3 Check the position of address switches 6 and 7: switch 6 should be OFF, switch 7 should be ON. This corresponds to the RS232C's 4,800 Baud rate.

8.4 Connect the power cable. Connect the SB100 to your computer through the RS232 cable. Do not connect the measurement cable!

8.5 Turn the power on on the SB100. After a moment, the lamp labeled "Power" should light. No other lamps should light. If the lamp POWER does not light in a couple of seconds after turning on power, then turn the power off and check the power fuse and cable. If either no lamps light or more than one lamps light after the power has been turned on, or the RESET button has been pushed, then there is an SB100 malfunction. Call MMR Technologies for technical support (650) 962-9620.

8.6 The SB100 overall performance should be tested as part of the MMR Seebeck Effect Measurement System. Refer to the System Manual.

8.7 If you have the MMR Technologies' hand-held terminal C2000, you can make a simple test of the SB100 communication link and determine if the SB100 is functioning. Connect the C2000 to the RS232 port in place of the computer. Using the C2000 keyboard, send to the SB100 the commands which are listed in Section 6. Every command should be terminated by pushing Enter. Observe the SB100 responses.

9. Technical Support

Customer service and support is provided by MMR Technologies on all of its cryogenic cooling and thermal stage systems from its Customer Service Department, located at the factory, between the hours of 8:00 a.m. and 5:00 p.m. Pacific Time. This office can be reached by calling (650) 962-9620 or by sending a facsimile to (650) 962-9647.

10. Specifications

Physical	Width		17.0 inches
	Height		3.5 inches
	Depth		14.0 inches
	Weight		9.0 pounds
Electrical	Voltage		100-120 Vac or 220-240 Vac
	Frequency		50 - 60 Hz
	Power		60 VA
	Fuse Ratings	Line Fuse	
			1.0A 3AG Fast-Acting (100-120 V)
			0.5A 3AG Fast-Acting (220-240 V)
		Heater Fuse	0.3A 3AG Fast Acting

Environment Temperature: 0°C - 40°C

Fig.2 MMR Seebeck Stage Assembly.

(Upper Cover is not shown)