

Technical Data and Instructions

DataPlot Printer Control Board Model CB3000

VERSATILE ANALOG & DIGITAL I/O FOR CUSTOM APPLICATIONS

The model CB3000 control board is intended to serve those B-G Instruments' printer applications that require one or more channels of analog input data. The standard serial and parallel interfaces can also be used as well as all the commands for printing and plotting.

Because of the wide variety of possible applications and desired plotting formats for multiple, or even single analog input, it is likely that a custom version of DataPlot software will be needed to optimize every new application. For an OEM application, however, that prospect is not a cause for alarm. B-G Instruments' DataPlot system was created to permit fast, efficient writing of such programs at a very moderate one-time cost. Contact B-G Instruments to discuss a fixed-price quotation for writing a custom DataPlot software version for your application. The following is a partial list of ideas:

- Data can be accepted in any desired format, not just the common standards.
- Repetitive information such as headings, labels, logos, graphics, etc., and the formatting of the variable data, can be included in the program and need not be sent repeatedly with the data.
- The time and date can be incorporated into the printed/plotted record, in whatever format is most appropriate.

Contact B-G Instruments to discuss your application needs!

GENERAL DESCRIPTION

This control board accepts input data from a parallel, serial RS232 or USB data interface and provides the logic and drive functions to operate several B-G Instruments' print mechanisms, including model numbers PM1448 and PM1832. The board is based on a C8051F120 microprocessor with a complement of other CMOS chips. It also provides 12-bit analog-to-digital conversion of up to 8 analog voltage inputs, a keypad interface, a number of other I/O lines and a paper take up reel driver. This board is primarily intended for applications that require its analog input capability. Applications that just need digital input can use the CB2448, or CB2832 control board. For basic wiring instructions please refer to the cabling diagram at <http://www.bginstruments.com/cb3000cablingdiagram.pdf> along with this datasheet.

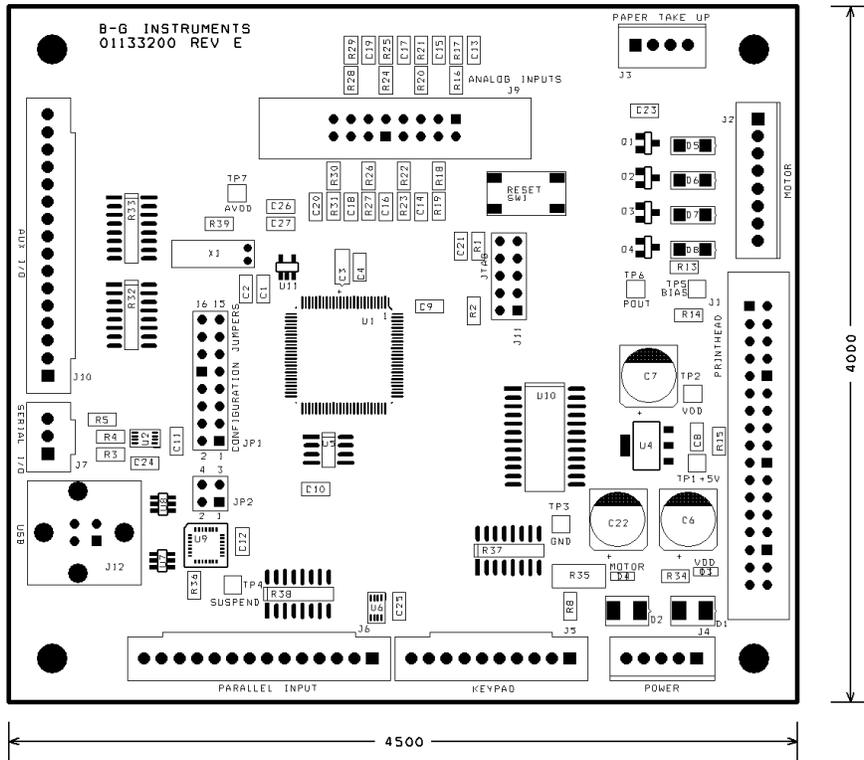


Figure 1, CB3000 board layout

MATING CONNECTORS

The stepper motor (J2), and the printhead (J1) mating cables and connectors are supplied by B-G Instruments. If the paper take up unit and/or power supply are ordered the mating cables and connectors are supplied for (J3) and/or (J4) respectively. Other mating cables are:

- J4: MOLEX 22-01-3057 or equivalent
- J5: MOLEX 50-57-9410 or equivalent
- J6: MOLEX 50-57-9414 or equivalent
- J7: MOLEX 50-57-9403 or equivalent
- J9: AMP 746285-3 or equivalent
- J10: MOLEX 50-57-9416 or equivalent

CONNECTING TO PRINT MECHANISM

This control board connects to the print mechanism it drives through 2 cables that are supplied with that print mechanism. The 8-pin cable attached to the stepper motor connects to J2. The 34-pin ribbon cable attached to the printhead connects to J1.

The pin 1 ends of these plugs and sockets are marked by red dots. **Observe correct polarity!** Do not make or break these connections while power is applied to the board!

OPTIONAL PARALLEL INTERFACE – J6

J6 includes the parallel input and other I/O lines. The data lines are positive true TTL. Bits 0-7 form the parallel input byte. The STROBE line to the printer is normally high and should go low for at least 2 microseconds before returning to the high state. The data lines should be stable for the duration of

the strobe low time. When a STROBE pulse is received the parallel input lines are read and stored in an internal buffer. When the buffer fills (1280 bytes), the output BUSY line to be set high indicating that the printer cannot accept any more data. The bytes in the buffer are then processed and when the buffer empties enough (1024 bytes remaining), the BUSY returns low and the printer can accept more data. In order to permit the sending computer time to recognize the busy state, the input buffer has a 256 byte pad. This means that up to 256 bytes may be sent to the printer after the BUSY line goes high. If more than 256 bytes are transmitted while the BUSY line is high, the additional bytes will be lost.

The POUT signal will go high when the printer is out of paper. Driving the PADV signal will cause the paper to advance through the mechanism. Table 1 lists the connections for J6.

Pin	Signal
1	Strobe
2	D0 (LSB)
3	D1
4	D2
5	D3
6	D4
7	D5
8	D6
9	D7 (MSB)
10	Not used
11	BUSY
12	POUT
13	PADV
14	GND

Table 1, J6 connections

ANALOG INPUTS – J9

The CB3000 control board includes a 12-bit analog to digital converter that can accept and digitize up to 8 channels of analog input under microprocessor control. Each analog channel is unipolar and has 160Hz low pass filter on it. The analog input pins are listed in table 2.

Pin	Signal
1	ANA0
2	AGND
3	ANA1
4	AGND
5	ANA2
6	AGND
7	ANA3
8	AGND
9	ANA4
10	AGND
11	ANA5
12	AGND
13	ANA6
14	AGND
15	ANA7
16	AGND

Table 2, J9 analog input connections

The full scale input voltage for all 8 channels can be set to one of the ranges indicated in table 3 by grounding (0) or leaving open (1) the indicated pins on J10. Note that due to the VDD limit of the processor the 10 volt range saturates if the input goes above 6.9 volts.

J10-12	J10-11	J10-10	Volts FS
0	0	0	Invalid
0	0	1	Invalid
0	1	0	10
0	1	1	0.32
1	0	0	0.63
1	0	1	1.25
1	1	0	2.5
1	1	1	5.0

Table 3, Analog full scale values

The digitizing resolution for each channel is 12 bits, or 1 part in 4096. The sampling rate is tied to the plotting speed and can be set to one of the 8 values shown in table 4. The rates are selected by grounding a pin of J10 (0) or leaving it open (1). Each plot value will be the peak reading spanning the specified number of 'oversample' cycles.

J10-9	J10-8	J10-7	Plot Speed mm/sec	Oversampling	Samples per second
0	0	0	47	5	2005
0	0	1	40	6	1925
0	1	0	30	8	1925
0	1	1	25	10	2005
1	0	0	20	12	1925
1	0	1	15	16	1925
1	1	0	10	25	2005
1	1	1	5	50	2005

Table 4, Analog sampling and plotting speeds

The number of input channels is controlled by J10 pins as indicated in table 5. Note that the selection of the number of channels does not affect the sampling rate, only the format of plotting the data.

J10-3	J10-2	J10-1	Plot Channels
0	0	0	8
0	0	1	7
0	1	0	6
0	1	1	5
1	0	0	4
1	0	1	3
1	1	0	2
1	1	1	1

Table 5, Plot channel selection

Grounding J10-6 activates the plot mode. When this pin is grounded (0), the specified analog channels will be sampled and plotted at the specified full scale value and plot rate. When J10-6 is open (1), the unit is idle and no plotting will occur.

For convenience in testing, a synchronization signal is output on J10-5 that toggles every time a full set of ADC samples are taken. J10-13, J10-14 and J10-16 are all digital ground signals. Note that for best noise immunity the digital ground pins and analog ground pins on J9 should not be connected. They are connected together on the control board in one spot near the analog inputs to the processor and should not otherwise be tied together. This caveat also applies to the digital power supply pins.

SERIAL INTERFACE – J7

The serial interface is available on J7. It operates at a fixed baud rate of 115,200 baud, 8 data bits, one stop bit, no parity and XON / XOFF protocol. To use this interface, jumper JP2 should have pins 1-2 open and pins 3-4 shorted. The connections to a standard DB9F connector that would mate with the serial port on a computer are listed in table 6. The mating connector for J7 is MOLEX 50-57-9403.

As bytes are received on the serial interface, they are placed into the input buffer. The input buffer thresholds for busy and not busy are the same as for the parallel interface. The XOFF character will be transmitted (0x13) when the input buffer's full limit is reached and the XON character (0x11) will be transmitted when the buffer is drained to the point where it can accept more data. The overrun pad is also effective in the serial mode.

J7	DB9F	Signal
1	2	Data to computer
2	3	Data from computer
3	5	GND

Table 6, J7 serial port connections

OPTIONAL USB INTERFACE – J12

A USB interface may be used instead of the serial interface. To select the USB interface, jumper JP2 should have pins 1-2 shorted and pins 3-4 open. The CP2102 USB driver available from Silicon Laboratories must be installed on the computer. This software emulates a COM port connection and when in use, the emulated port should have the same settings indicated above for the serial interface. The computer software then communicates with the printer using the emulated COM port. XON/XOFF handshaking should be utilized in the same manner as for the serial interface mode.

KEYPAD INTERFACE – J5

An interface is provided for various test functions as well as for inputting data for custom applications. Table 7 lists the connections for this interface. Any type of keypad that has up to 4 rows and 4 columns of normally open buttons may be used. The required pullup resistors are provided on the control board. PADV is the paper advance signal that is also connected to the parallel input connector J6 pin 13. Connecting J5-1 to J5-2 will active the paper advance function in exactly the same manner as connecting J6-13 and J6-14.

J5	Signal	Keypad				
1	PADV					
2	GND					
3	ROW0	—	'1'	'2'	'3'	'a'
4	ROW1	—	'4'	'5'	'6'	'b'
5	ROW2	—	'7'	'8'	'9'	'c'
6	ROW3	—	'*'	'0'	'#'	'd'
7	COL0	—				
8	COL1	—				
9	COL2	—				
10	COL3	—				

Table 7, J5 keypad connections

A typical keypad such as the Digitran NKL-0471 is wired as shown in table 8.

HEX DUMP DIAGNOSTIC MODE

The standard DataPlot program includes a HEX DUMP mode that is established by pressing the '9' key on the keypad (or otherwise connecting pins 5 and 9 of J5 together). This mode remains selected until power is turned off or the '9' key is pressed again. While in HEX DUMP mode, the printer will not respond normally to the data it receives, but will instead print all received characters, in hexadecimal, 16 bytes per line. This feature is often useful for troubleshooting a system by verifying the characters actually received by the printer.

KEYPAD FUNCTIONS

Additional functions are available through the keypad when JP1 pins 13 and 14 are open (i.e. not shorted together). These functions are listed in table 8 and are always available. For custom applications, JP1 pins 13 and 14 can be shorted together to select a different set of keypad functions.

KEY	Function
0	Bump font number
1	Print X test pattern
2	Print Y test pattern
3	Toggle enhanced
4	Toggle Y invert
5	Toggle X invert
6	Bump font size
7	Print logo
8	Toggle compatibility mode
9	Toggle hex dump
*	Toggle contrast

Table 8, Test functions available via the keypad

POWER REQUIREMENTS – J4

This control board requires +5 VDC +/- 5% logic power @300 mA and 16 VDC at 4 Amps (nominal 2 Amps for most applications) for the printhead and stepper motor. The drive voltage should be adjustable over a +/- 10% range about its 16 VDC nominal value to compensate for normal differences in printhead resistivity and for use as a contrast control. The drive voltage must never be applied before applying the +5 VDC logic power or when the +5 VDC is outside its tolerance limits. The +5 VDC supply must be free of noise spikes that might cause the microprocessor to reset and thereafter run improperly. Table 9 lists the power connections on J4. If your system is supplied with a B-G Instruments UPS-11/16 VDC power supply, connect its cable connector to J4 matching pin 1 for correct polarity.

J4	Signal
1	+5VDC
2	5V_RETURN
3	+16VDC
4	16V_RETURN

Note: do not tie 5 VDC return and 16 VDC return together at the control board. These lines must be returned to power source.

POWER ON DIAGNOSTICS

The printer automatically runs self-diagnostic tests when power is turned on. If any errors are detected, the processor will print an appropriate error message. If no messages are printed on power up, the diagnostics passed and the printer is functioning properly.

PTU CONNECTION – J3

The 4-pin connector J3 is used for driving a B-G Instruments' Paper Take-Up Unit type PTU1448, or PTU1832 to re-roll the printed paper automatically. If your system includes a PTU, connect its cable connector to J3, matching pin 1 for correct polarity. The PTU runs only while the printer is printing and for approximately 1/2 second after it stops, and maintains tension in the printed paper. The PTU also has a manual drive switch.

CONTROL SOFTWARE

A special monitor program that connects to the printer through either the serial port or USB port is available. Pins 11-12 on JP-1 must be shorted to use this program. The program permits selecting all the printing and plotting settings and provides the means for loading new firmware into the processor. Contact B-G Instruments for more information on this software.

WARRANTY

B-G Instruments will repair or replace, at its option, any DataPlot CB3000 control board that malfunctions due to a manufacturing defect within one year after the original date of sale, provided that it is used only for control of the correct type of DataPlot print mechanism and:

1. Neither the control board nor the attached print mechanism have been modified in any way not specifically authorized in writing by B-G Instruments, and
2. Electrical power supplied to the control board has always been within the specifications given in this data sheet, and
3. The control board has not been damaged electrically, mechanically, thermally or in any other way.

Note for further warranty information see <http://www.bginstruments.com/Warranty.html>

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