

Technical Data and Instructions

DataPlot Printer Control Board Model CB1100

VERSATILE ANALOG & DIGITAL I/O FOR CUSTOM APPLICATIONS

The model CB 1100 control board is intended to serve those B-G Instruments' printer applications that require accepting one or more channels of analog input data, possibly in addition to digital input. Applications that need only serial and/or parallel byte input can be better served by one of the CB 1224/ 1320/ 1416 control boards, which include the standard DataPlot software for printing alphanumeric characters in several different sizes, fonts and degrees of boldness, as well as dot-addressable graphics.

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 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 program may manipulate (scale, convert, combine, calculate, select, etc.) raw data to produce a record that is more appropriate to the application. For example, the input data may be just a train of heartbeat pulses, while the printer calculates and prints or plots a record of heart rate vs. time and produces high and low rate alarms.

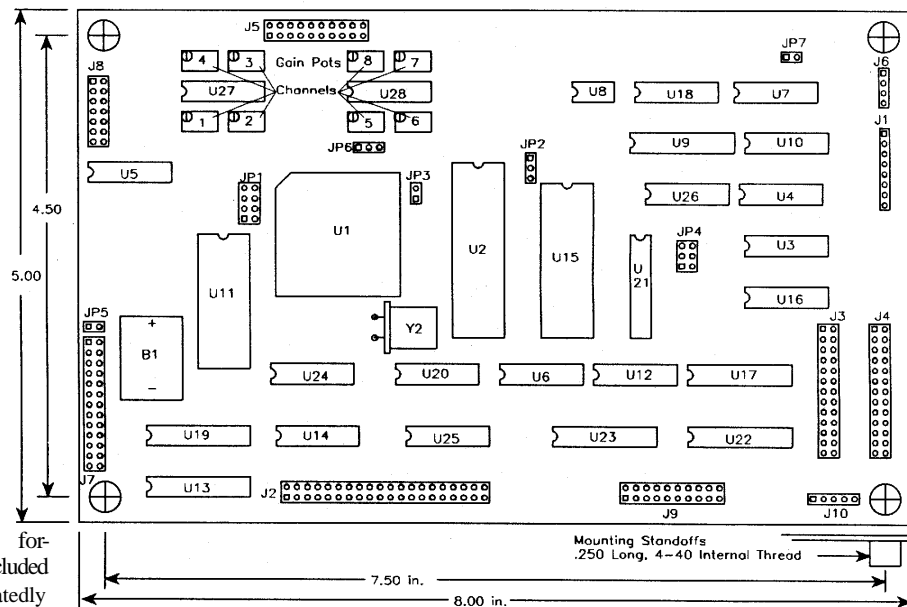
*The scale and offset of plotted data can be changed automatically to produce the effect of a very smart chart recorder. The program could also automatically quantify graphical features such as peak amplitudes and areas beneath curves.

*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 or serial RS232 data interface and provides the logic and drive functions to operate several B-G Instruments' print mechanisms, including model numbers PM 1224, PM 1320 and PM 1416. The board is based on an 80C552 microprocessor with a complement of other CMOS chips. It also provides 10-bit analog-to-digital conversion of up to 8 analog voltage inputs, a keypad interface, a number of other I/O lines, a paper takeup reel driver and an optional battery-backed clock/calendar. This board is primarily intended for applications that require its analog input capability. Applications that just need digital input can use the CB 1224/1320/1416 control board.



MATING CONNECTORS

The stepper motor (J1), the printhead (J3 or J4) and the paper take-up unit (J6) mating cables are supplied by B-G Instruments. Other mating cables are:

- J2: T&B Ansley 609-4000M or equivalent**
- J5: T&B Ansley 609-2000M or equivalent**
- J7: T&B Ansley 609-2600M or equivalent**
- J8: T&B Ansley 609-1400M or equivalent**
- J9: T&B Ansley 609-2000M or equivalent**
- J10: Molex 22-01-3057 housing, 08-50-0114 terminals**
- JP1 and JP4: Aries ML100S 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 J1. The supplied 26-pin ribbon cable connects to the print mechanism's printhead connector on one end and to either J3 or J4 on the control board.

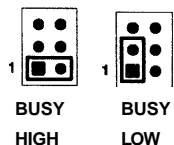
Use J3 for PM1224 or PM1416 Print Mechanism.
Use J4 for PNI320 Print Mechanism.

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!

PARALLEL INTERFACE - J7

J7 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. When a STROBE pulse is received, its trailing edge causes the data to be read and the output BUSY line to be set high. After BUSY returns low, the printer can accept more data. The polarity of the BUSY signal can be inverted to BUSY* by changing a jumper on JP4, as shown at the left.

Select BUSY Polarity
Using JP4 Jumpers



Outbits 0-7 are used for custom programmed applications that require TTL output. The pin assignments are:

1	BUSY	2	Ground
3	STROBE*	4	Ground
5	Bit 0	6	PAPER OUT
7	Bit 1	8	Ground
9	Bit 2	10	Ground
11	Bit 3	12	Outbit 0
13	Bit 4	14	Outbit 1
15	Bit 5	16	unused/special app.
17	Bit 6	18	unused/external reset
19	Bit 7	20	PAPER ADVANCE
21	Outbit 2	22	Outbit 3
23	Outbit 4	24	Outbit 5
25	Outbit 6	26	Outbit 7

INPUT DATA BUFFER

All characters received by the printer are placed in a FIFO buffer. In the standard DataPlot program, this buffer can hold 5120 characters, the BUSY condition is signaled when it reaches 5088 characters and the READY condition is again signaled when it drops to 5056 or fewer. Additional buffers in the standard DataPlot program are used to store characters for x-printing, for y-printing and for graphic grid storage. These are discussed fully in the data sheet entitled "Standard DataPlot Commands". The capacities and other aspects of the buffers may be different if your application uses a custom application program. In that case, please refer to the special documentation for that application.

ANALOG INPUTS - JS

The CB 1100 control board includes a 10-bit analog to digital converter that can accept and digitize up to 8 channels of analog input under microprocessor control. Each analog channel has its own input scaling/isolation amplifier whose gain can be set individually. Full scale input voltages must be unipolar and can range from 0.1 volt to as much as 40 volts.

The digitizing resolution for each channel is 10 bits, or 1 part in 1024. The maximum sampling rate will depend on several factors, including the number of active channels, the amount of processing that goes on during sampling, etc., but can normally be as high as 1 KHz or possibly up to 10 KHz in limited circumstances.

Connector J5 has the following pinout for the 8 inputs:

Pin #	+ Input Channel #	Ground Pins
1	1	2
3	2	4
5	3	6
7	4	8
9	5	10
11	6	12
13	7	14
15	8	16

Because there is such a wide range of possible applications for a device that can accept a number of analog input signals, producing a graphical and/or alphanumeric printed record based on those and other inputs, it is likely that each new application will require a custom program. A generic analog input program could probably not be much more versatile than a standard chart recorder, unable to provide anything near the range of functions of which this hardware is capable. For this reason, B-G Instruments has developed an application development service that can create, quickly and at low cost, the custom program that will best fit your application's needs.

If you can describe to our sales engineer the kind of signals that are available from your system and how you want the printed record to appear, we can prepare for you a written functional specification and a fixed-price quotation for writing the necessary software. For a simple application, this onetime cost may be just a few hundred dollars; for something more complete, perhaps a couple of thousand. In any event, we think it is a very efficient way to develop an instrument system that so effectively meets the needs of your application.

Of course, we won't exactly be starting from scratch to write your application program. In over 15 years of writing dozens of proprietary and custom application programs, we have built a substantial library of routines that can be called on to help build new programs to run on B-G Instruments' printers. That's why we are able to complete most new applications within a month or so and at such modest cost. Let us know how we can help you.

SERIAL INTERFACE - J8

J8 is a 14-pin connector that provides full duplex serial data I/O to and from the printer. The format is RS232C with 1 start bit, 8 data bits, no parity and 1 stop bit. The baud rate may be set to 1200, 2400, 4800 or 9600 by placing the jumpers on JP1 in one of the patterns shown at the right. These jumpers are sensed and the respective baud rate is established only at power-up.

Two serial protocols are available for sending data to the printer: DATA BUSY and XON/XOFF. If the DATA BUSY protocol is used, the host computer should monitor the RTS line before sending each byte. A high condition at the connector indicates READY, while low indicates BUSY. When the printer changes from the READY state to the BUSY state, it transmits the XOFF character (\$13) via the connector. When it changes from BUSY to READY, it transmits the XON character (\$11). This enables the host to implement the XON/XOFF protocol, eliminating the need to monitor the RTS line. At power-up, the printer sends an XON character to the host. After that, XON and XOFF characters will be sent alternately, as needed.

The standard DataPlot program does not implement any protocol for use of the XON, XOFF, DC2 and DC4 characters in transmissions from printer to host; ie., the printer assumes the host is always ready to receive. In custom applications, however, the printer program can be modified to use this protocol or to monitor the DSR line to determine the host's readiness to receive data.

The following lists the serial interface pin assignments on J8. This pinout matches the standard 25-pin RS232C "D" connector when connected by ribbon cable:

J8 Pin	"D" Pin	Signal Name	Meaning & Direction
3	2	TXD	transmitted data from printer
5	3	RXD	received data to printer
7	4	RTS	ready to send from printer
14	20	RTS	"
11	6	DSR	data set ready to printer
13	7	GND	signal common return

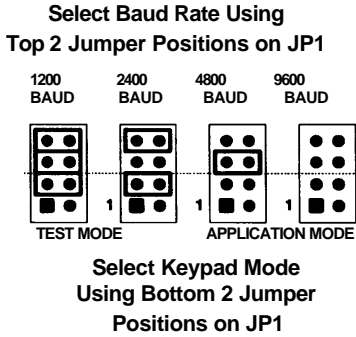
HEX DUMP DIAGNOSTIC MODE

The standard DataPlot program includes a HEX DUMP mode that is established by holding down the 9 key on the keypad (or otherwise connecting pins 9 and 10 of J9 together) while turning on the printer power. This mode remains selected until power is turned off. 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.

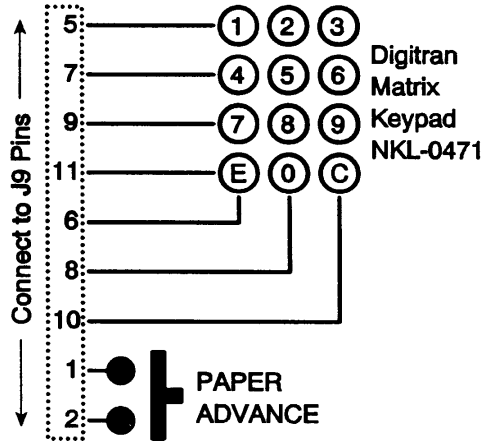
KEYPAD INTERFACE – J9

Connector J9 includes 8 sense lines and 8 drive lines which may be used for various switching, sensing and output functions in a custom application program. In the standard DataPlot program, 4 of the sense lines and 3 of the drive

lines are used to interface a 3x4 matrix keypad, which may be used to set and read an optional clock/calendar in "application" mode and for various test and font selection purposes in "test" mode. These functions are described further under "CLOCK/CALENDAR" and "SELF-TEST PRINTOUTS" in this data sheet and in the "Standard DataPlot Character Fonts" data sheet, respectively. The diagram at the left shows the jumper positions on JP1 that establish "test" and "application" modes for the keypad in the standard DataPlot



The diagram below shows the portion of the J9 interface that is used for a keypad and paper advance switch in the standard DataPlot program. J9 also has 4 additional sense lines and 5 additional drive lines that are not used by the standard DataPlot program but are available for use by a special application program that may need the additional I/O lines. If your printer has such a custom application program, refer to its special documentation for these interface pin assignments.



SELF-TEST PRINTOUTS

The standard DataPlot program includes a test printout feature. With the keypad connected and the application mode jumper removed, pressing key "1" or key "2" will cause test patterns to be printed in the x and y -directions respectively, using the currently selected font, size and boldness. See the "Standard DataPlot Character Fonts" data sheet instructions for selecting other fonts, size, boldness and print orientation using the keypad. Refer to the "KEYPAD INTERFACE - J9" section of this data sheet for pinout information.

POWER REQUIREMENTS - J10

This control board requires +5V +/- 5% logic power @ 300 mA and one higher voltage for the printhead and stepper motor. This drive voltage depends on the model:

CB1224 +20V @ 3.0 amperes peak*

CB1320 + 18V @ 3.4 amperes peak*

CB1416 + 16V @ 4.5 amperes peak

**May be ordered for +12V operation*

The drive voltage should be adjustable over a +/- 10% range about its 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 +5V logic power or when the +5V is outside its tolerance limits. The +5V supply must be free of noise spikes that might cause the microprocessor to reset and thereafter run improperly. The J10 pin assignments:

Pin 1	+5 volts
Pin 2	5 volt return
Pin 3	+drive voltage
Pin 4	drive voltage return
Pin 5	External battery (if used)

CLOCK/CALENDAR OPTION

If your printer is equipped with the clock/calendar option, there may also be a custom application program installed in the printer. If so, refer to the documentation that describes that program to determine the clock function and the manner of setting the time and date.

The standard DataPlot program also provides for setting and reading the time and date by using a keypad that is connected to J9 as described under "KEYPAD INTERFACE" elsewhere in this data sheet. For such use, the keypad must be in "application" mode.

To set the clock, key in the date and time in the format: MMDDYYhhmm, then press the E key. If the time and date are valid, the clock will be set and started and the date and time will be printed for verification. The date and time will also be printed whenever the keypad is in "application" mode and the E key is pressed with no previous numeric entry.

PAPER ADVANCE

The PAPER ADVANCE signal is applied to a line available on pin 20 of J7 and pin 1 of J9. It is pulled-up on the logic board. To advance paper, ground this line or drive it low through a TTL driver. Paper can also be advanced or reversed by software command. See the "Standard DataPlot Commands" data sheet for a full description.

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POWER-ON DIAGNOSTICS

The printer automatically runs self-diagnostic tests when power is turned on. If any errors are detected, the processor will not complete its power-on initialization. In this condition, the printer will not function, not even the paper advance function. If, therefore, the paper advance function works, you can assume that the power-on tests were completed normally, without error.

PTU CONNECTION - J6

The 4-pin connector J6 is used for driving a B-G Instruments' Paper Take-Up Unit type PTU 1224, 1320 or 1416 to re-roll the printed paper automatically. If your system includes a PTU, connect its cable connector to J6, matching the red dots for correct polarity. The PTU runs on 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.

PAPER-OUT SIGNALS

If the connected print mechanism is equipped with a paper-out sensor, the TTL signal appears on pin 6 of J7. A high level indicates the paper-out condition; a low level means paper-OK. In addition, when the paper state changes from OK to out, the printer sends a DC character (\$14) via the serial interface. When the paper state changes from out to OK, the printer sends a DC2 character (\$12).

In the standard DataPlot program, the paper state condition is also used to inhibit attempts to print when paper is out and to facilitate an autoloading function when paper is inserted into a powered-up empty printer.

WARRANTY

B-G Instruments will repair or replace, at its option, any DataPlot CB 1100 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.

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