

Technical Data and Instructions

DataPlot Control Board Models CB1224, CB1320 and CB1416

ONE CONTROL BOARD: MANY PRINTERS

This control board accepts input data from a data interface, such as parallel, serial RS232, etc. and provides the logic and drive functions needed to operate B-G Instruments' DataPlot print mechanism model numbers PM1224, PM1320, or PM1416. The corresponding control board part numbers are: CB1224, CB1320, or CB1416. Although it is possible to convert one model control board to another by replacing the program chip, that procedure should only be performed by B-G Instruments or under its direction. This document pertains to all 3 control board models.

CHARACTER FONTS.

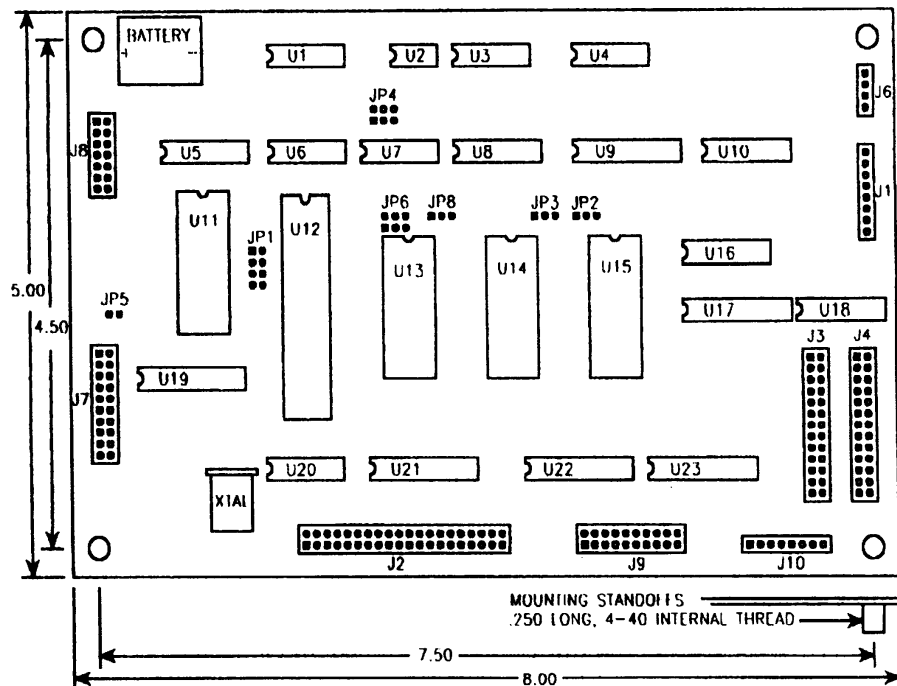
DataPlot printer models 1224, 1320, and 1416 are able to print either across the width of the paper (x-direction) or down its length (y-direction) in 5 different fonts, 4 different sizes of each font and 2 degrees of boldness. Two of these fonts include both-upper and lower case, subscripts and superscripts. Font selections can be made by software command or through an attached keypad. Refer to another data sheet entitled "Standard DataPlot Character Fonts" for examples and a complete discussion.

PRINT/PLOT COMMANDS

Printing in the x-direction is done much as on most printers; send the desired characters followed by a CR (\$O D). DataPlot printers are also able to print in the y-direction and plot high resolution curves, bar charts, etc., addressing individual dots and groups of dots as necessary. For a complete description of these functions and the commands used to invoke them, refer to another data sheet entitled "Standard DataPlot Commands".

GENERAL DESCRIPTION

This control board is based on an 80C31 microprocessor with a complement of other CMOS chips. It provides for both parallel and serial digital input, a battery-backed clock/calendar, and interfaces for a keypad and a paper take-up reel. For analog inputs and other special applications, a daughter board can be attached with full access to the microprocessor data bus.



MATING CONNECTORS

The stepper motor (J1) and printhead (J3 or J4) mating cables are supplied by B-G instruments. Other mating connectors are:

- For J7: T&B Ansley 609-2000M or equivalent.
- For J8: T&B Ansley 609-1400M or equivalent
- For J9: T&B Ansley 609-2000M or equivalent
- For J10: Molex 22-01-3077 housing, 08-50-0114 terminals
- For JP1 & JP4, Aries ML100S or equivalent

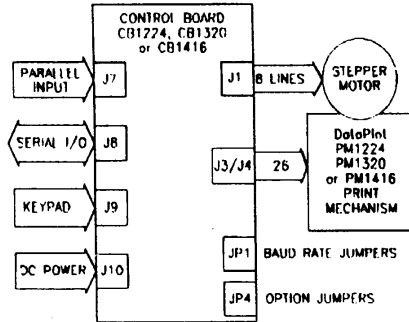
CONNECTING TO PRINT MECHANISM

As shown in the Interface diagram, this control board connects to the print mechanism it drives through 2 cables. The 8-pin plug attached to the stepper motor connects to J1. The supplied 26-pin printhead cable connects to J3 or J4.

Use J3 to connect to PM1224 or PM1416 printhead.

Use J4 to connect to PM1320 printhead.

The pin 1 ends of these plugs and sockets are marked by red dots. **Be sure to observe correct polarity!** These connections must not be made or broken while power is applied to the board.

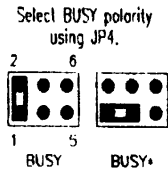


PAPER ADVANCE

The PAPER ADVANCE signal is a line available at 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 a specified number of steps by software command. See the "Standard DataPlot Commands" data sheet for a full description.

PARALLEL INTERFACE - J7

The parallel data input is on connector J7 and includes 8 data lines (bits 0 through 7), a STROBE* line to the printer and a BUSY output line from the printer. The data lines are positive true TTL logic. The STROBE* line is normally high. When a STROBE* pulse is put on this line, its trailing (rising) edge causes the data to be read and BUSY to be set high. (See the timing diagram.) After BUSY returns low, the print 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. Pin assignments are:

Pin	Signal	Pin	Signal
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	Ground
13	bit 4	14	Ground
15	bit 5	16	Not used
17	bit 6	18	Not used
19	bit 7	20	Paper Advance

PAPER-OUT SIGNALS

If the connected print mechanism is equipped with a paperout sensor, the TTL signal out appears on pin 6 of J7. A high level indicates paper-out; a low level indicates paper OK. In addition, when the paper state changes from OK to out, the printer sends a DC4 character (\$14) via the serial interface. When the paper state changes from out to OK, the printer sends a DC2 character (\$12).

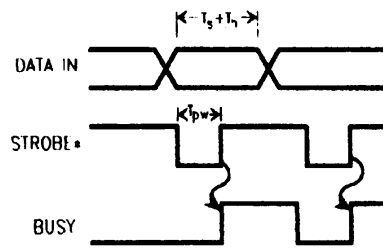
In the standard DataPlot program, the paper state condition is also used to inhibit attempts to print when paper is out and to facilitate an autoloop function when paper is inserted into a powered-up empty printer.

INPUT DATA BUFFER

All characters received by the printer are placed in a FIFO buffer which can hold 5120 characters. The BUSY condition is signaled when the FIFO reaches 5088 characters. The READY condition is again signaled when the FIFO drops to 5056 or fewer characters. Additional buffers in the 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 sheets entitled "Standard DataPlot Commands".

HEX DUMP DIAGNOSTIC MODE

The HEX dump mode 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 will remain selected until power is turned off. While in HEX dump mode, the printer will not respond normally to the data sent to



$$T_s = 50ns, T_h = 100ns, T_{pw} = 200ns \text{ min.}$$

Timing Diagram

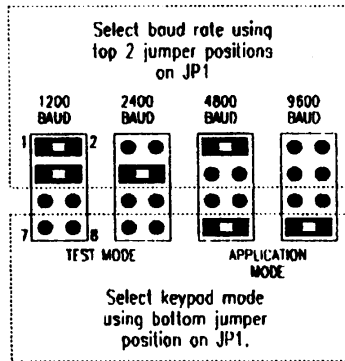
it, but will instead print all received characters, in hexadecimal, 16 bytes per line. This feature is often valuable for troubleshooting an instrument system by verifying the characters actually received by the printer.

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.

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 as normally shipped by B-G Instruments is set to 1200. This may be changed to 2400, 4800 or 9600 by removing one or both of 2 jumpers installed on JP1, as shown in the diagram at the right. These jumpers are sensed and the respective-baud rate is established at power-on, so that changing jumper positions after power on will not change the baud rate.



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 state of the RTS line before sending each byte. A high condition at the connector indicates READY, while a low condition indicates BUSY. When the printer changes from the READY state to the BUSY state, it transmits the XOFF character (\$13) via the serial output. 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-on, the printer sends an XON character to the host. After that, XOFF and XON characters will be sent alternately, as required by the BUSY/READY condition of the printer.

The standard printer program does not implement any protocol for use of the XON, XOFF, DC2 and DC4 characters in transmission from printer to host, i.e., the printer assumes the host is always ready to receive the characters. In custom applications, the printer can be programmed to use this protocol or to monitor the DSR line to determine the readiness of the host to receive data.

The following lists the serial interface pin assignments on J8. This pin out is such as to match the standard 25-pin RS232C "D" connector when connected via ribbon cable:

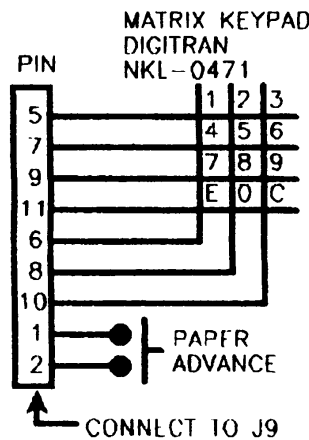
J8 Pin	"D" Pin	Signal Name	Meaning & Direction
3	2	TDX	transmitted data from printer
5	3	RXD	received data to printer
7	4	RTS	ready to send from printer
14	20	RTS	" "
11	6	DSR	data set ready to printer
13	7	Signal gnd	common return

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.

The diagram below and to the left 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 program but are available for use by a special application program that may need the additional input and/or output lines. If your printer has such a custom application, refer to its special documentation for assignment of any additional interface pins.

CLOCK/CALENDAR

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 then be printed whenever the keypad is in "APPLICATION" mode and the E key is pressed with no preceding numerical entry.

SELF TEST PRINTOUTS

With the keypad connected and the keypad 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 for how to select other fonts, sizes, boldness and print orientation using the keypad. Refer to the "KEYPADINTERFACE" section of this data sheet for keypad pin out information on connector J9.

PTU INTERFACE - J6

The 4-pin connector J6 is used for driving a Paper Take Up assembly to automatically re-roll the printed paper. If your system includes a PTU, connect its cable connector to J6 with the red dot at the pin 1 end (marked on the board).

WARRANTY

B-G Instruments will repair or replace, at its option, any DataPlot CB1224, 1320 or 1416 control board that malfunctions 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, Inc., and
2. electrical power supplied to the control board has always been within the specifications given in this document, and
3. the control board shows no evidence of electrical, thermal or mechanical damage.

POWER REQUIREMENTS - J10

This control board requires + 5V +/-5% logic power at 300 mA and one additional higher voltage to drive 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 with some sacrifice in maximum print speed. The drive voltage should be adjustable over a +/- 10% range about its nominal value to compensate for normal differences in printhead resistance 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. Internal logic reset circuitry is provided to prevent damage when the 2 supplies are energized simultaneously. The + 5V supply must be free of spikes that might cause the microprocessor to partially 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
Pins 5 through 7 are not used.	

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