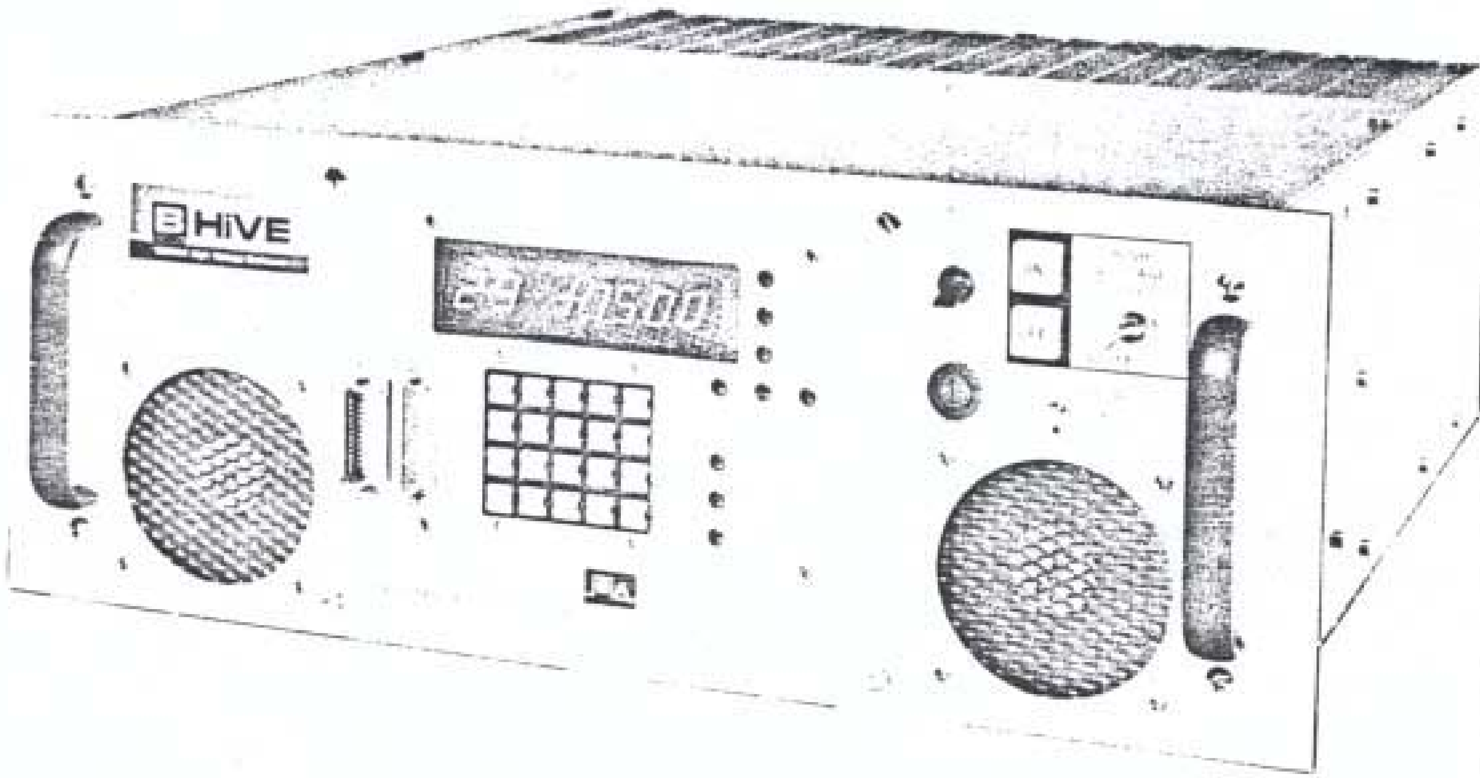
BERTAN

HIGH VOLTAGE

INSTRUCTION MANUAL
B-HiVE SYSTEM



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FIGURES

SECTION I

General Information

1.1 Introduction

This manual provides information pertaining to the installation and maintenance of the BERTAN ASSOCIATES B-HIVE and related products. This manual is separated into sections. The topics of each section are:

SECTION	TOPIC
I	General Information
II	Installation
III	Operation

1.2 Description

The BERTAN ASSOCIATES B-HiVE is a multiple output high voltage power system with independent control of each high voltage output. It consists of a mainframe housing a dedicated microcomputer and up to sixteen plug-ins. The plug-ins are called B-MODs or B-PACs.

B-MODs are high voltage generating modules with two outputs each. B-PACS are adapter/controllers for two each of the Model 205A/210 Series or the MWPC Series standard BERTAN high voltage supplies. Any combination of B-MODs and B-PACs, up to a total of 16 plug-ins can be operated simultaneously in one B-HiVE for up to 32 simultaneous outputs.

The dedicated B-COMP microcomputer provides control of voltage outputs and voltage/current monitoring. Operation is via the front panel keypad and display or via a remote controller. The remote controller can be a "dumb" terminal, an intelligent terminal, or another computer.

1.2.1 B-MOD Functional Description

1.2.1.1 B-MOD High Voltage Generation and Control

Each B-MOD has two high voltage output connectors. The voltage output to each connector is independently programmable. Each high voltage output is sampled with a feed-back voltage divider and fed to an error amplifier for comparison against a command voltage. The output of the error amplifier controls the generation of the high voltage. Each command voltage is derived from a digital to analog converter (D/A Converter). The exact output voltage of each D/A Converter is programmed by the digital control circuitry.

1.2.1.2 B-MOD Voltage and Current Monitoring

The output voltage and load current of each high voltage output are continuously monitored.

1.2.1.2.1 Internal Monitoring

Each B-MOD high voltage output is equipped with hard wired voltage and current limiting circuits. No outputs are possible in excess of the limits imposed by these circuits.

1.2.1.2.2 External (B-COMP) Monitoring

Each B-MOD is equipped with its own voltage and current measuring A/D circuits through which the B-COMP monitors high-voltage output and load current. If either the voltage or current reaches a pre-determined limiting value, the power supply is shut down. The limiting values of voltage and current can be programmed independently for each output.

1.2.1.2.3 Arc Protection

For protection of sensitive loads, each high voltage output connector is equipped with arc detection circuitry. Detection of an arc causes an immediate shutdown to avoid driving destructive energy into a malfunctioning load. This is called fast trip shutdown. It is programmably selectable.

1.2.2 B-PAC FUNCTIONAL DESCRIPTION

1.2.2.1 B-PAC High Voltage Control

Each B-PAC has two output connectors for external power supply interface. Each connector outputs a voltage from zero to -5 volts in proportion to the desired high voltage output of its own controlled external high voltage supply. Each command voltage is derived from a digital to analog converter (D/A converter). The exact output voltage of each D/A converter is programmed by the digital control circuitry.

1.2.2.2 B-PAC Voltage and Current Monitoring

The output voltage and load current of each high voltage output are continuously monitored.

1.2.2.2.1 Internal Monitoring

Each B-PAC controllable BERTAN high voltage supply is equipped with its own hardwired voltage and current limits. No outputs are possible in excess of the limits imposed by these circuits.

1.2.2.2.2 External (B-COMP) Monitoring

Each B-PAC accepts voltage and current monitoring inputs from its BERTAN high voltage supply(s) and is also equipped with its own A/D circuits through which the B-COMP monitors high voltage output and load current. If either the voltage or current reaches a pre-determined limiting value, the power supply is shut down. The limiting values of voltage and current can be programmed independently for each output.

1.2.2.2.3 Arc Protection

For protection of sensitive loads, each B-PAC is equipped to monitor arc detection circuitry within the controlled BERTAN high voltage supply(s). Detection of an arc causes an immediate shutdown to avoid driving destructive energy to a malfunctioning load. This is called fast trip shutdown. It is programmably selectable. Crowbar circuits are avoided in order not to force destructively large dv/dt's on to vulnerable electrostatic loads such as proportional wire chambers.

Arc detection is standard in the BERTAN MWPC series. It is an available option for the 205A/210 series. (Consult factory).

1.2.3 B-COMP FUNCTIONAL DESCRIPTION

The B-COMP FUNCTIONAL DESCRIPTION

The B-COMP is a dedicated, 8085A based microcomputer using STD-bus compatible circuit cards as follows:

1.2.3.1 FRONT PANEL CIRCUIT CARD

This card provides the following functions:

a) Manual entry from the 20-key keypad.
b) Seven segment numerical displays.
c) Discrete-lamp status display.
d) Local or remote control selection.
e) High-Power relay control.

1.2.3.2 ADSIOT CIRCUIT CARD

(Analog Digital Serial Input/Output Timing) this card provides the following functions:

a) Generation of timing signals for B-MOD and B-PAC A/D conversions.
b) Generation of high-voltage clock signal.
c) Transmission and reception of remote control signals using 20mA TTY or RS232C.

1.2.3.3 PROCESSOR CIRCUIT CARD

This card provides the following functions:

a) All process control and computations used in the B-HiVE System.
b) PROM storage of operating software.

1.2.3.4 CMOS RAM CIRCUIT CARD

This card provides the following functions:

a) Scratchpad.
b) Non-Volatile storage of its data contents during power down intervals.

1.2.3.5 CALENDAR-CLOCK CIRCUIT CARD (Optional)

This card provides the following functions:

a) Date and time-of -day for status readouts.
b) Interval timing for long-term status logging.

1.2.4 MAINFRAME FUNCTIONAL DESCRIPTION

The mainframe is a housing for up to sixteen B-MODs and/or B-PACs plus one B-COMP. It provides all operating power except for +28 volts for high voltage generation. System operating power and safety interlock connections are carried at the rear panel. All B-MODs and/or B-PACs are plugged in from the rear and secured in place with captive screws. The B-COMP is installed in the front panel and is also secured in place with captive screws.

1.2.5 28V SUPPLY FUNCTIONAL DESCRIPTION

An external 28 volt power supply powers the high voltage generating circuits of the B-MODs. It is optionally monitorable by B-PACs so that removal of 28 volt power also automotically shuts down the high voltage output(s) of externally controlled BERTAN high voltage power supply(s).

It may be powered from and/or controlled by switched AC power and relay contacts available at the B-HIVE Mainframe rear panel.

SECTION II

Installation

2.1 Introduction

This section contains information for unpacking, inspection, installation and storage.

2.2 Unpacking and Inspection

If the shipping carton(s) is (are) damaged, inspect the contents for visible damage. If the contents are damaged, notify the carrier and BERTAN ASSOCIATES, INC. immediately. Shipping cartons should not be discarded. They are specially designed for safe transit and should be re-used if equipment is to be returned.

2.3 Preparation For Use

The following sections show all preparations which must be made prior to operation of the B-HiVE.

2.3.1 AC Power

The BERTAN ASSOCIATES, INC. B-HiVE requires 115 or 230 volts, 50 to 60 Hz single phase power. Be sure to provide the correct AC line voltage as shown on the mainframe front panel.

WARNING:

The mains plug shall be inserted only in an outlet socket equipped with a protective earth ground contact. Protection shall not be negated by using an extension cord or a power cable lacking a protective grounding conductor.

2.3.2 Safety Interlocks

2.3.2.1 Remote Interlock input

A remote interlock signal at J103 is required. A TTL logic level or +5 volts DC may be applied to the remote interlock input in the polarity shown. Reversal of polarity will not damage the B-HiVE but the remote interlock will not function. See Figures 1 and 2.

2.3.2.2 Local 28 Volt Interlock

Interlock jumper connections at J101 are shown in Figure 3. The dash lines indicate the jumpers that are required to bring 28 volt DC operating power to each unit within the B-HiVE.

2.3.3 28 Volt Power

An external +28 volt DC power supply is required for operation of the B-MOD high voltage drive circuits and to optionally enable B-PAC outputs. Connections to it are made at J102.

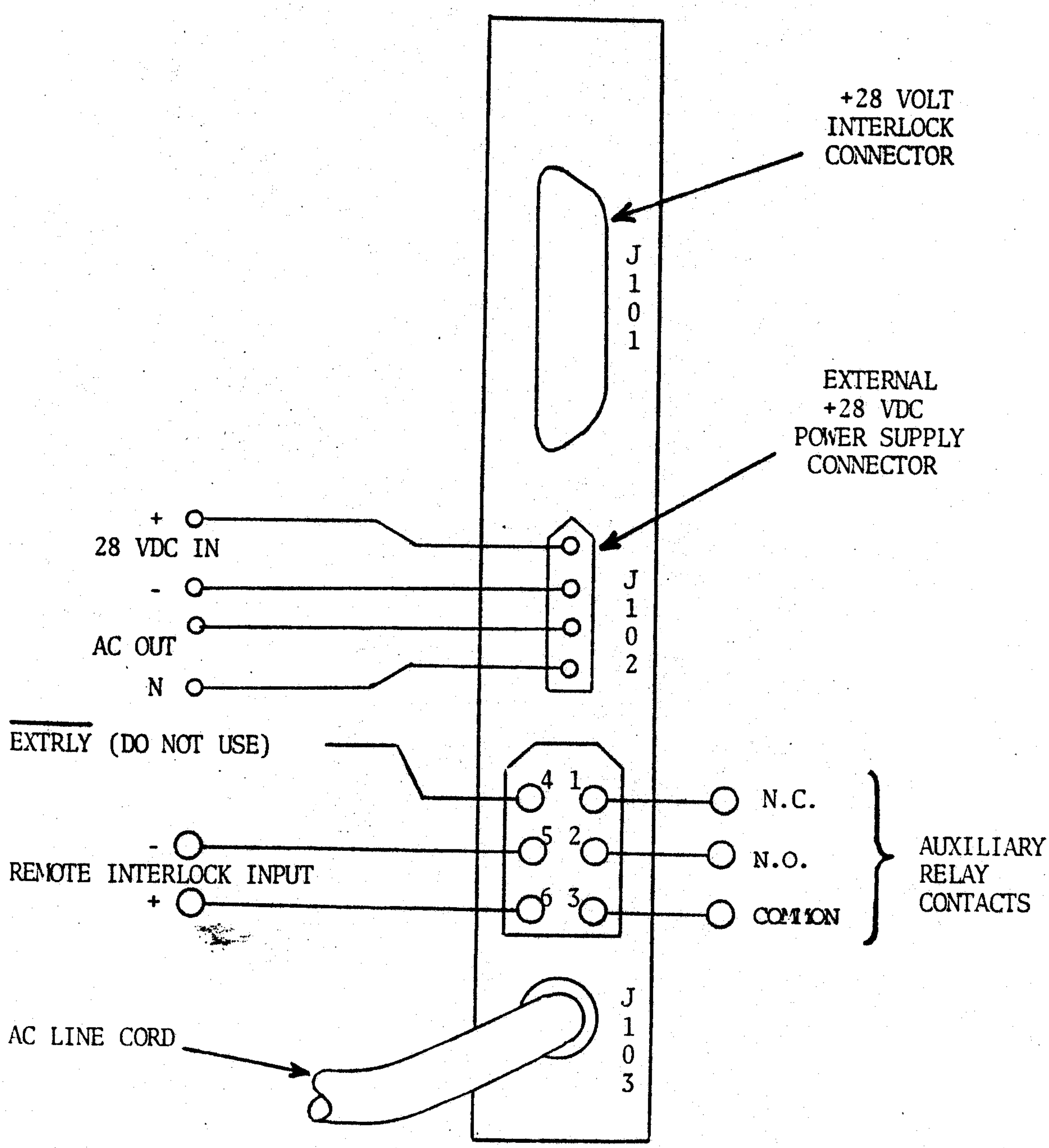


FIGURE 1: REAR PANEL INTERCONNECTIONS
B-HiVE MAINFRAMES S/N 001 THRU 025

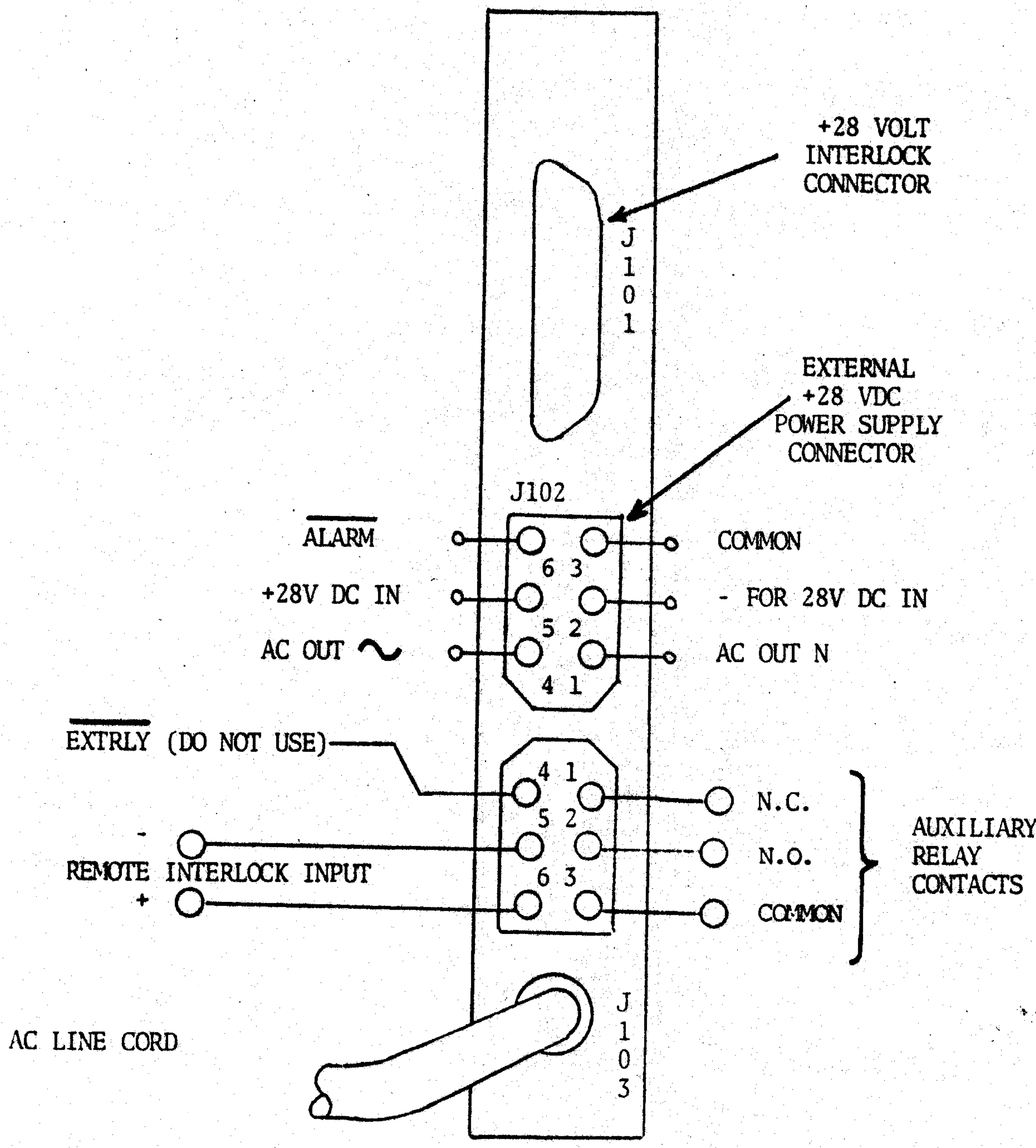


FIGURE 2: REAR PANEL INTERCONNECTIONS
B-HiVE MAINFRAMES S/N 026-UP

2.3.3 28 Volt Power (continued)

There are 16 slots that accept modules at the rear of the B-HiVE. The first slot consists of unit 0 and 1, the second slot of units 2 and 3, etc. See Figure 8. 28 volt DC power is carried within the B-HiVE from J102 to the interlock connector J101 and distributed to the 16 slots in accordance with the user installed jumpers of Figure 3.

The power supply itself (shown in Figures 4 thru 7, connects to J102 with four wires as shown. The +28 volt DC wires must be connected exactly as shown. The AC wires going to the power supply's power transformer could be switched without any harm. Note that the figures are drawn for schematic clarity only and that supplies and cabling may differ physically from the pictorial illustrations.

Power supply selection must be made on the basis of anticipated +28V power consumption as follows:

B-MOD Model	Output Rating (Each of two outputs)	+28V Supply Current Consumption
B3N B3P	0 to -3kV @ 3mA max. 0 to +3kV @ 3mA max.	20mA per kV output -150mA per mA output
B7.5N B7.5P	0 to -7.5kV @ 1mA max. 0 to +7.5kV @ 1mA max.	8mA per kV output -160mA per mA output

Example: Sixteen B3P's set to 3kV and 3mA on all outputs use 32x (3 x 20 + 3 x 150)mA =16.32 Amps.

Use a B-DC-10 series supply for up to 8 amperes per Figure 4 or Figure 5.

Use a B-DC-20 series supply for over 8 amperes per Figure 6 or two B-DC-10 series and one B-DC-ADAPT dual supply adapter per Figure 7.

2.3.4 RS232C and 20mA TTY

Remote control with RS232C or 20mA TTY may require settings other than those provided by the factory. Refer to sections 1.2.3.2, 3.2.3.1.

2.3.5 Overload Alarm (B-HiVEs S/N 026-Up)

An NPN open-collector-output alarm is provided at J102 for external alarm purposes when a "GLOBAL OVERLOAD" is issued by the B-COMP. (See section 3.2.1.2.4). Alarm is referenced to common, also at J102. "Overloads" are software responses to events in software. An "overload" indication does not signify anything dangerous in itself. Initially, it may be ignored. Its significance during system operation will be determined by the user's application.

2.3.5 B-MOD/B-PAC installation

After the preceding sections have been satisfied, install the desired plug-ins in the desired slots. Be sure to use both captive screws to secure each plug-in in place. Do not overtighten, merely make them secure.

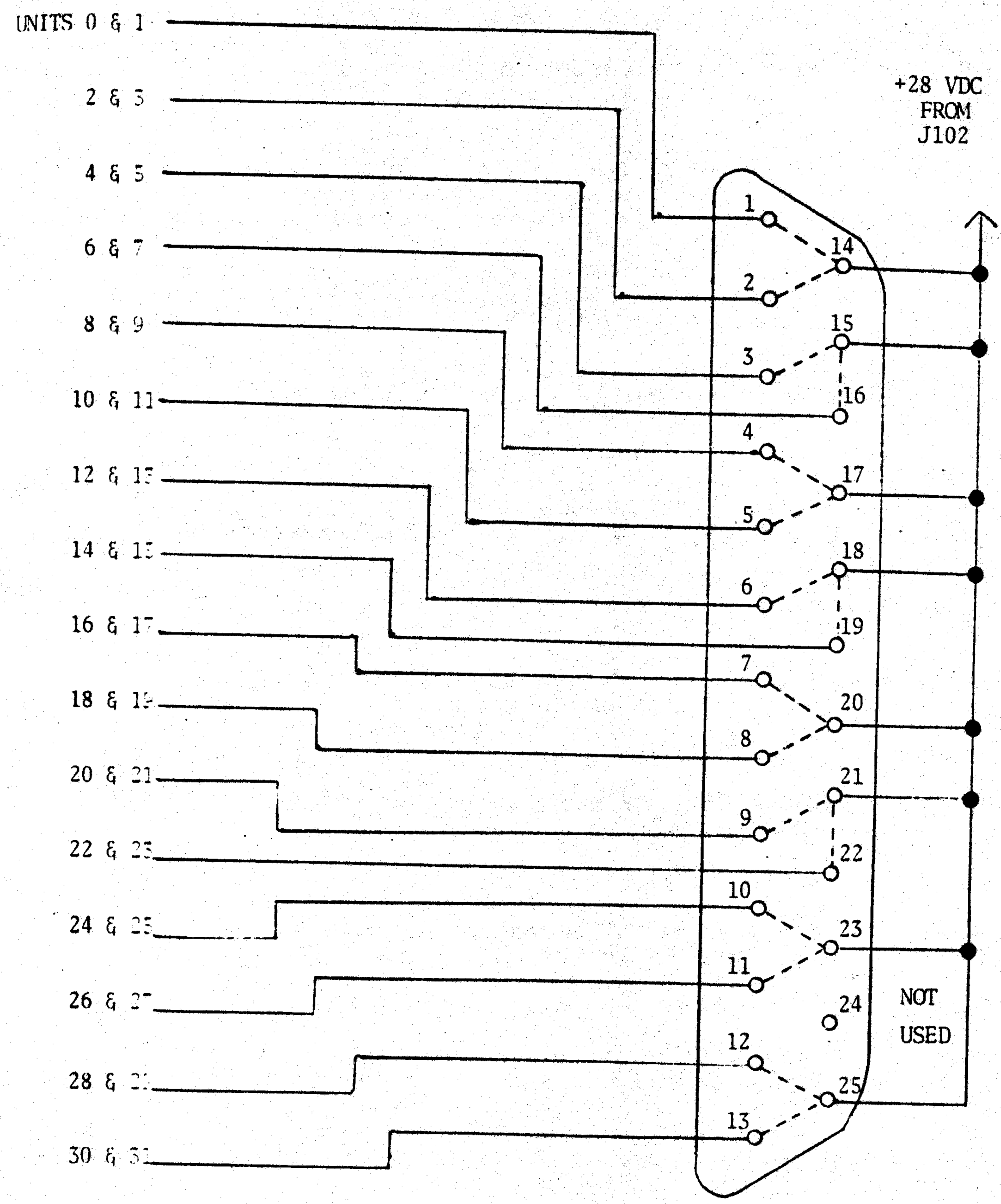
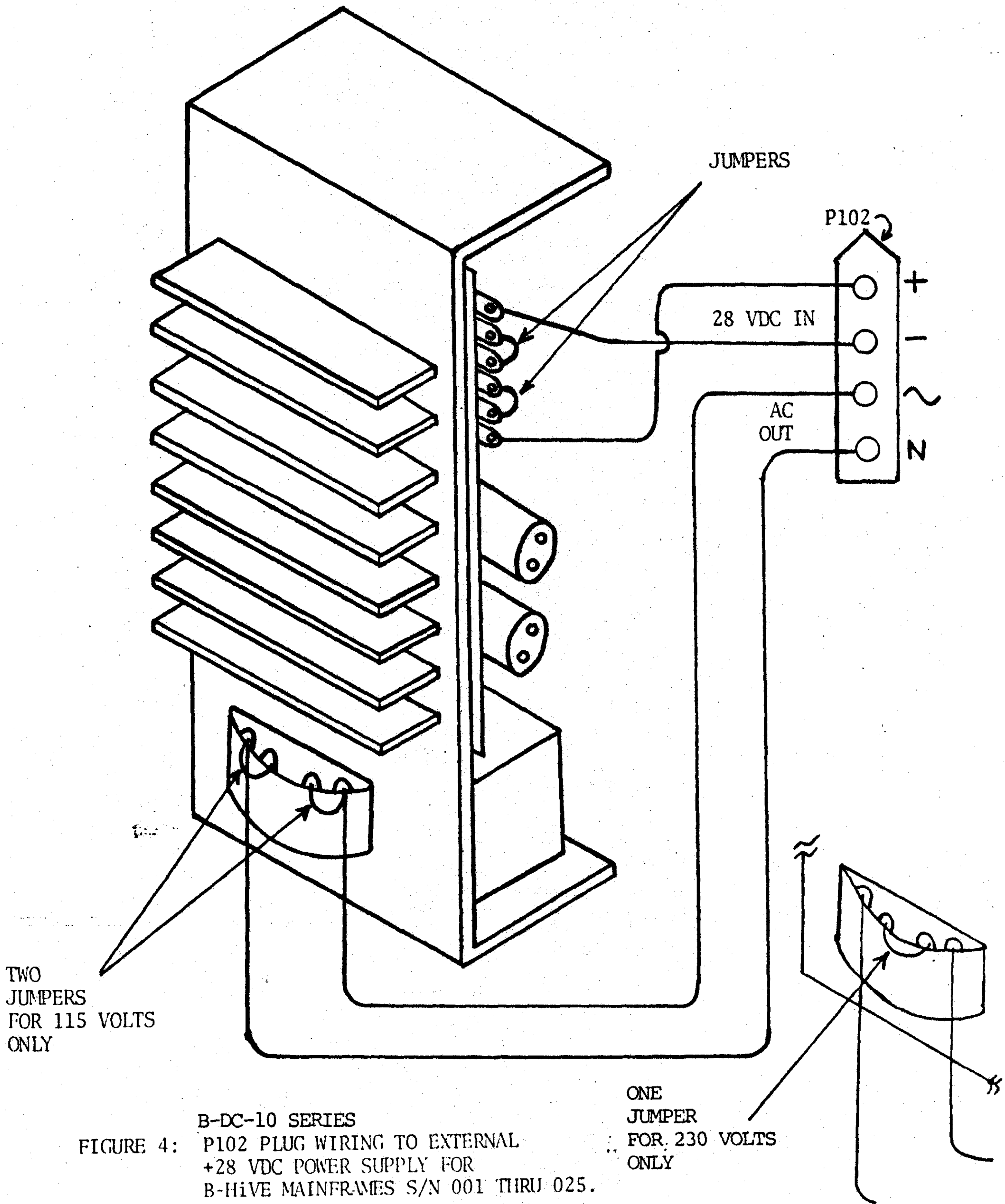
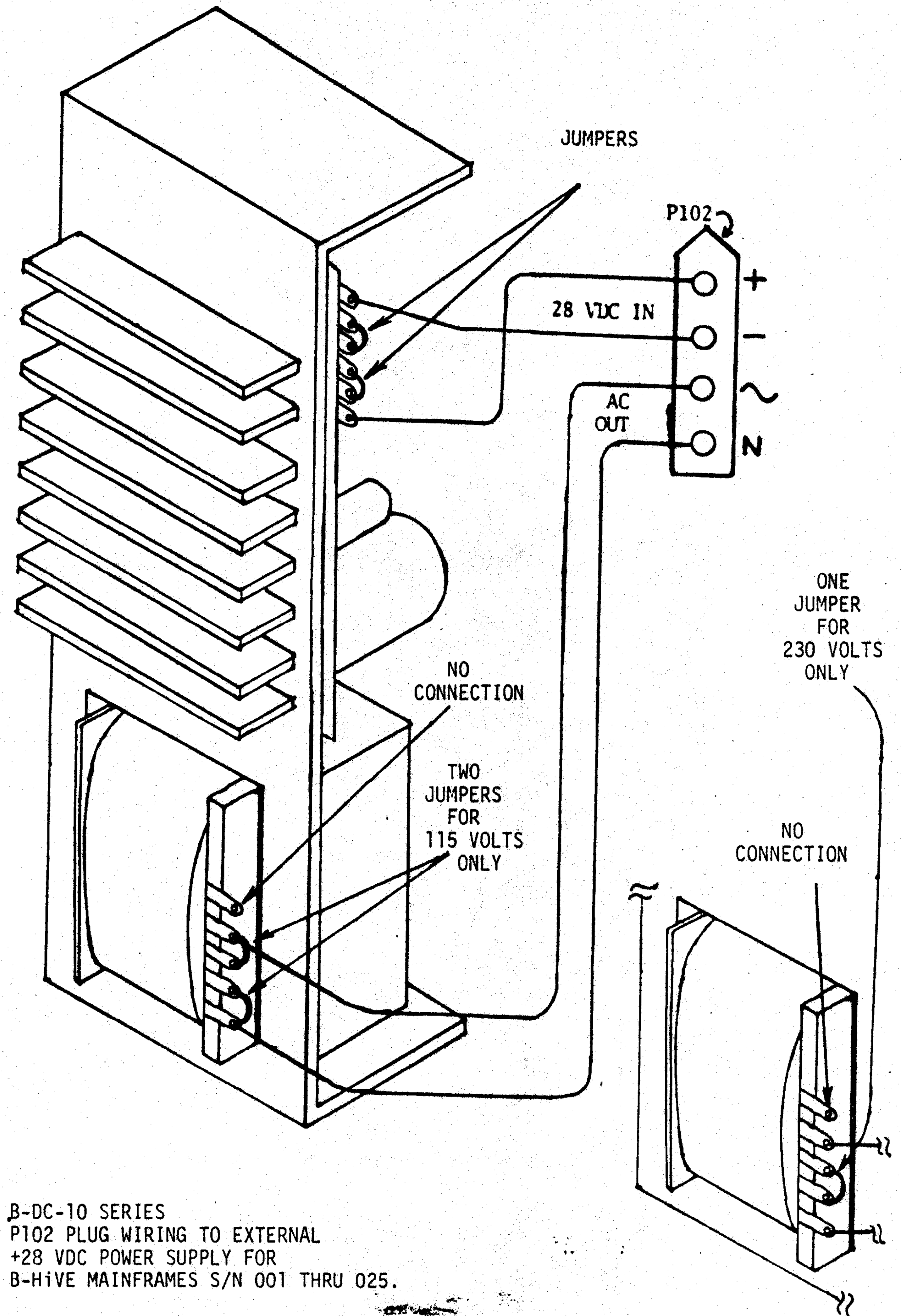


FIGURE [illegible] INTERLOCK JUMPER CONNECTIONS AT J101. DASHED LINES ARE THE JUMPER CONNECTIONS IN P101.



B-DC-10 SERIES
FIGURE 4: P102 PLUG WIRING TO EXTERNAL
+28 VDC POWER SUPPLY FOR
B-HiVE MAINFRAMES S/N 001 THRU 025.
115 VOLTS AC ONLY



IGURE 4A: B-DC-10 SERIES
P102 PLUG WIRING TO EXTERNAL
+28 VDC POWER SUPPLY FOR
B-HiVE MAINFRAMES S/N 001 THRU 025.

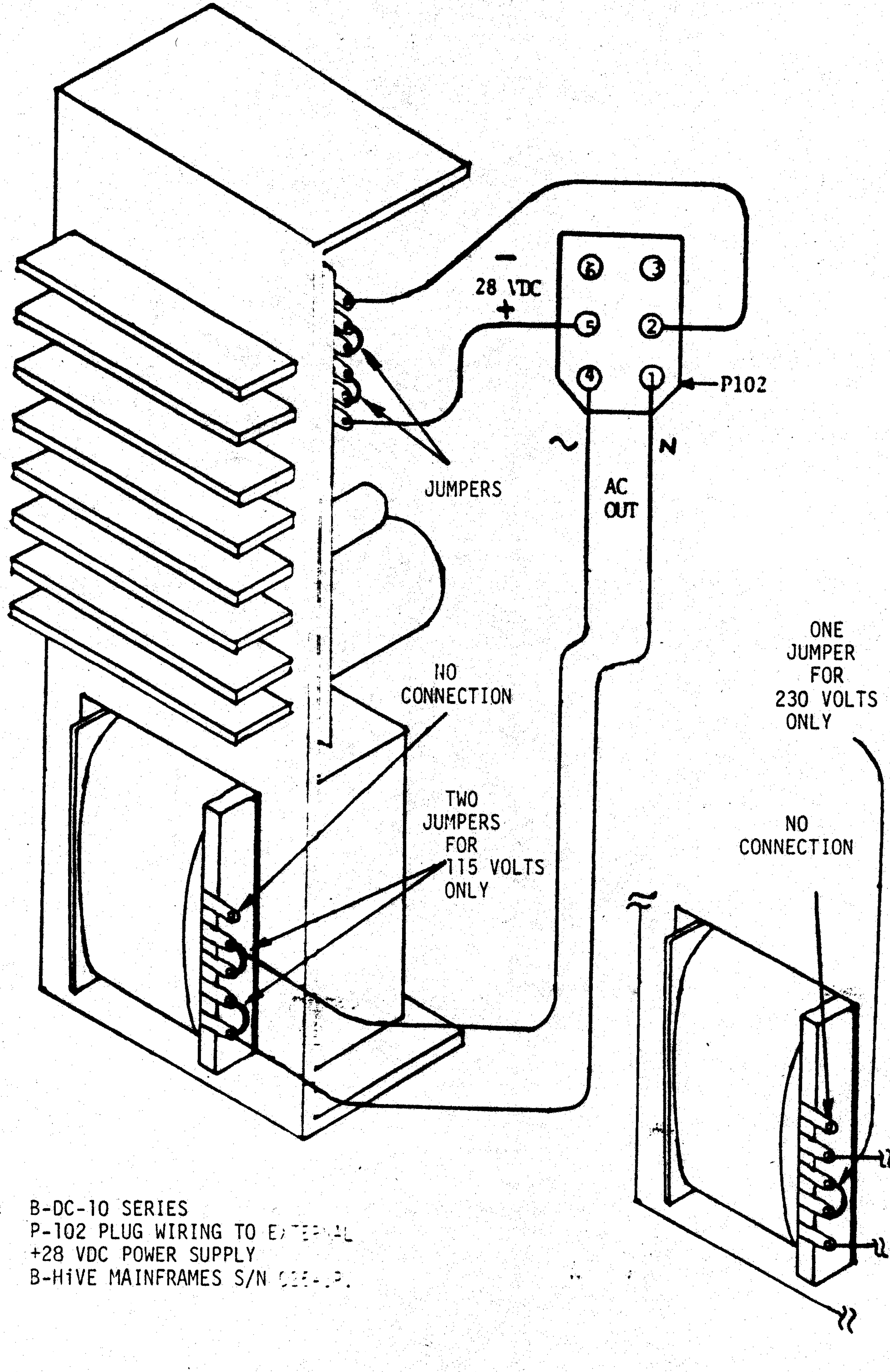
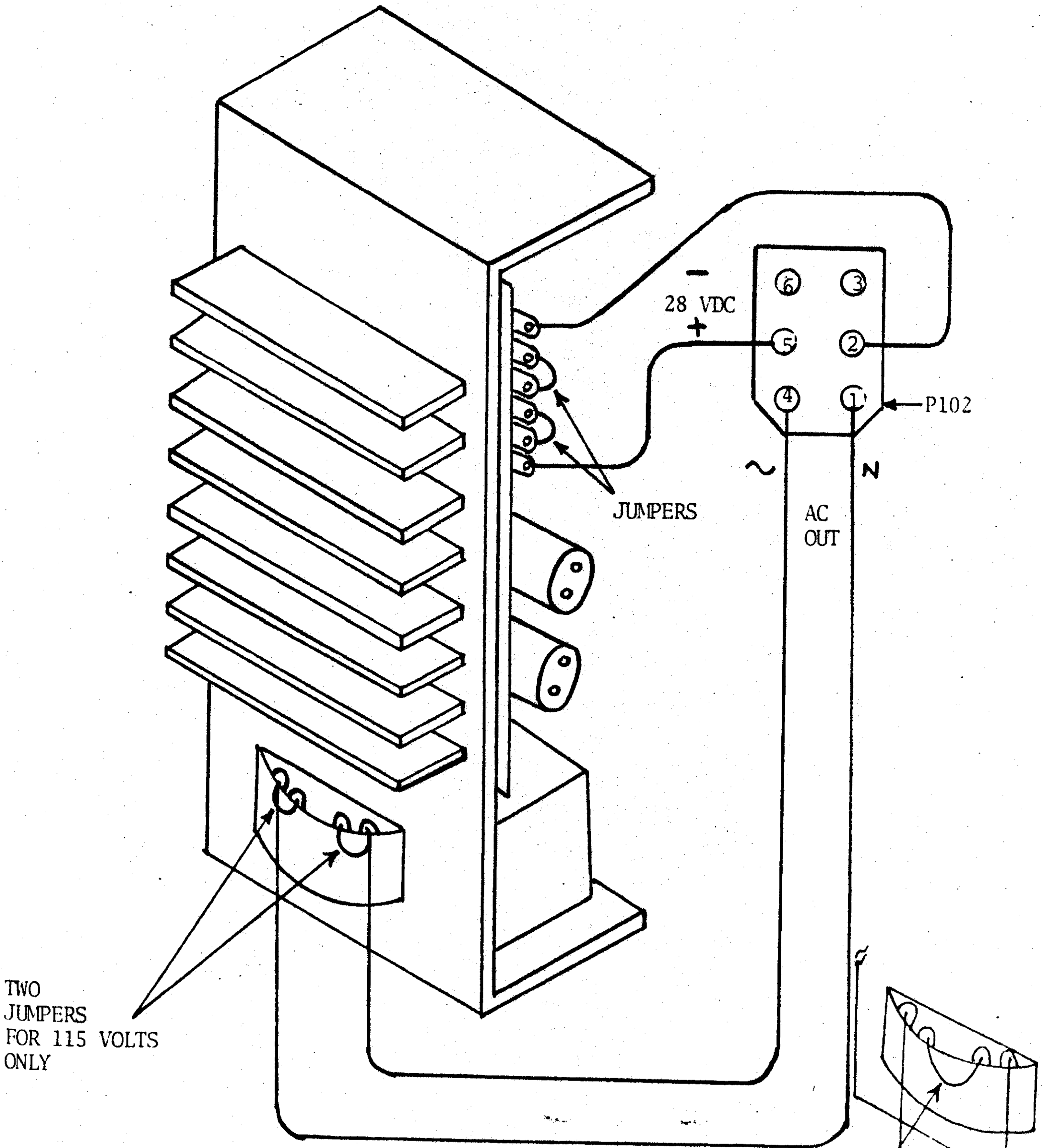
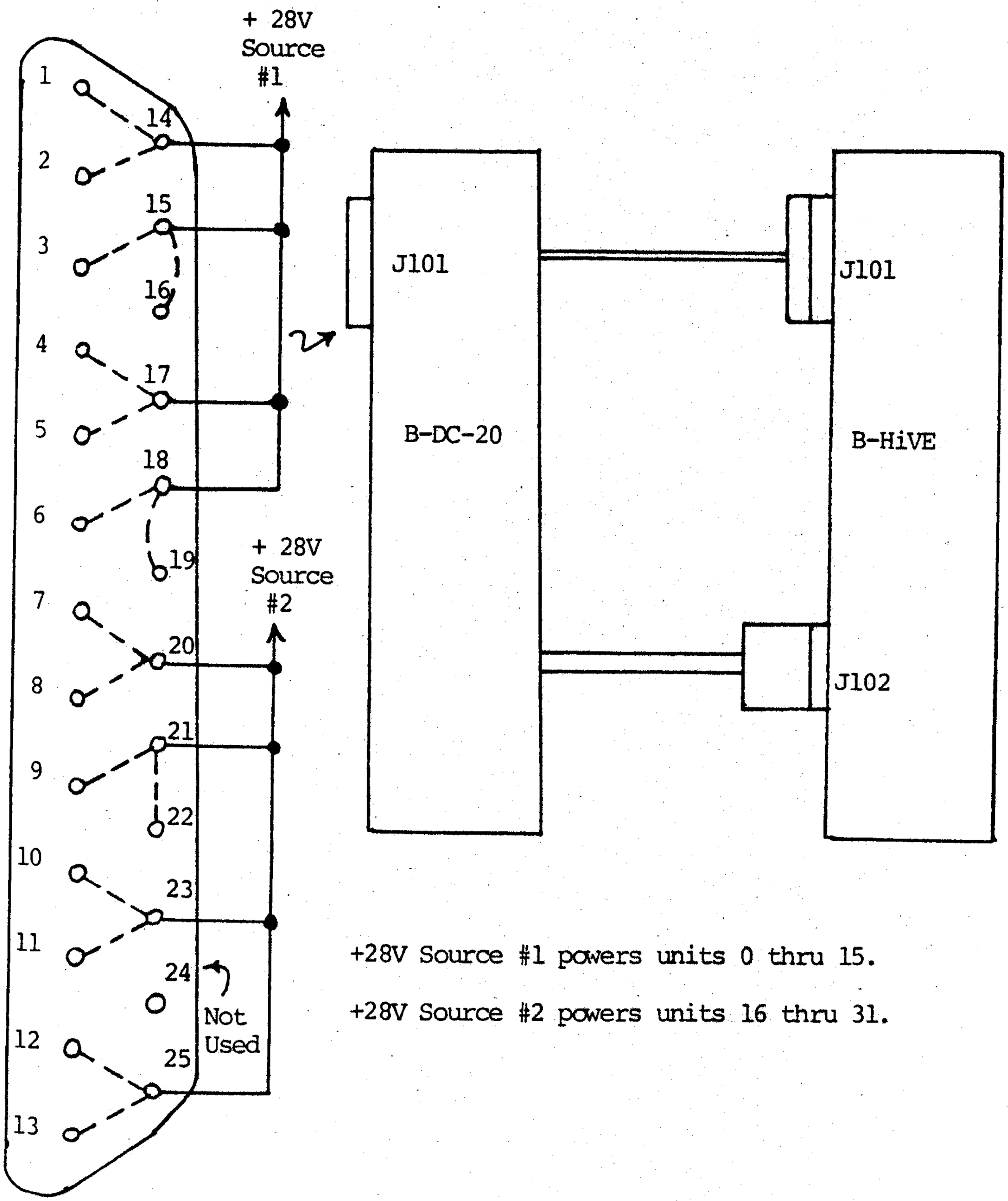


FIGURE [illegible] B-DC-10 SERIES
P-102 PLUG WIRING TO EXTERNAL
+28 VDC POWER SUPPLY
B-HiVE MAINFRAMES S/N [illegible]



B-DC-10 SERIES
FIGURE 5: P102 PLUG WIRING TO EXTERNAL +28 VDC POWER SUPPLY FOR B-HiVE MAINFRAMES S/N 026-UP



+28V Source #1 powers units 0 thru 15.

+28V Source #2 powers units 16 thru 31.

FIGURE 6: B-DC-20 SERIES INSTALLATION
WITH SPLIT INTERLOCK WIRING

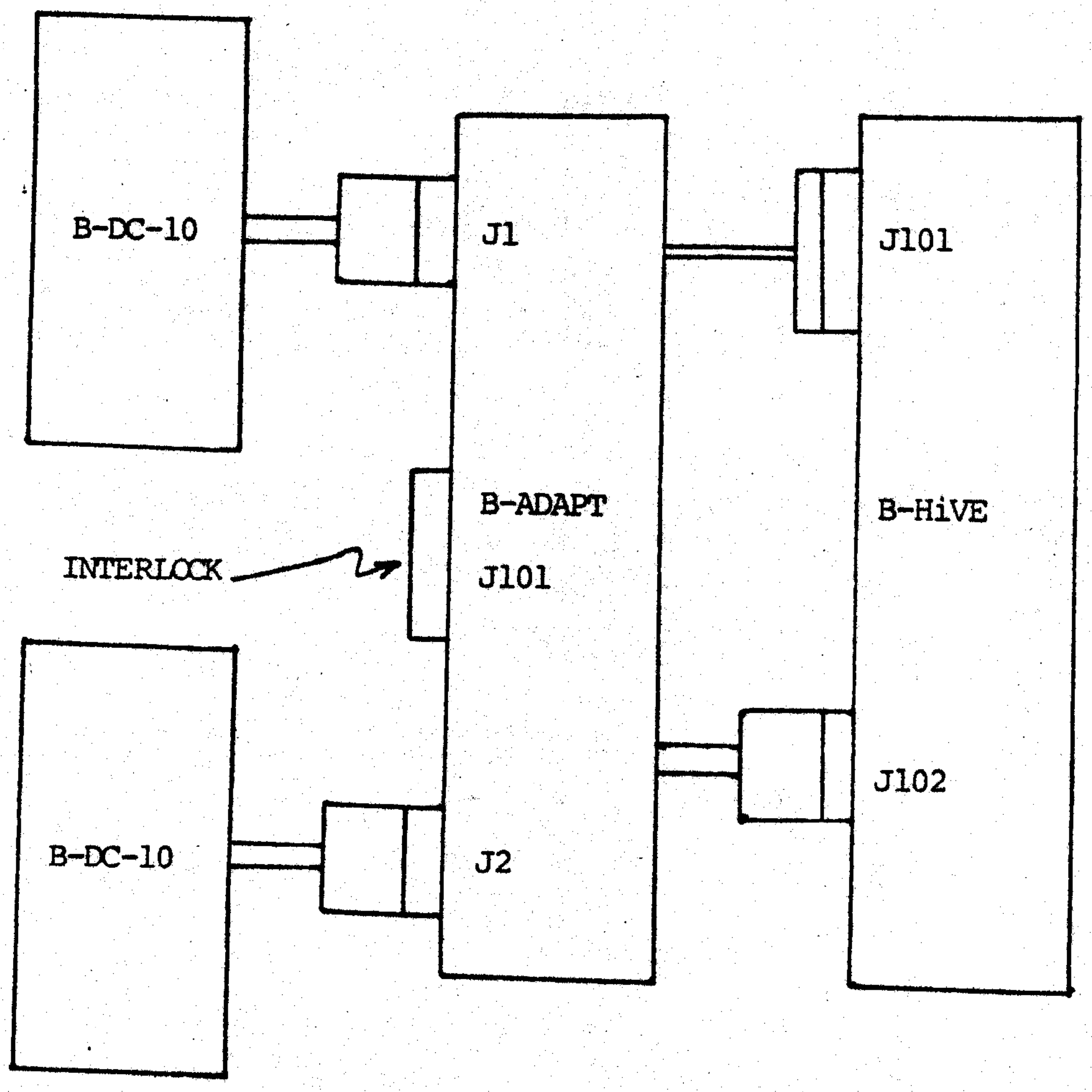


FIGURE 7: DUAL B-DC-10 SERIES INSTALLATION USING DUAL SUPPLY ADAPTER. INTERLOCK WIRING IS SAME AS IN FIGURE 6.

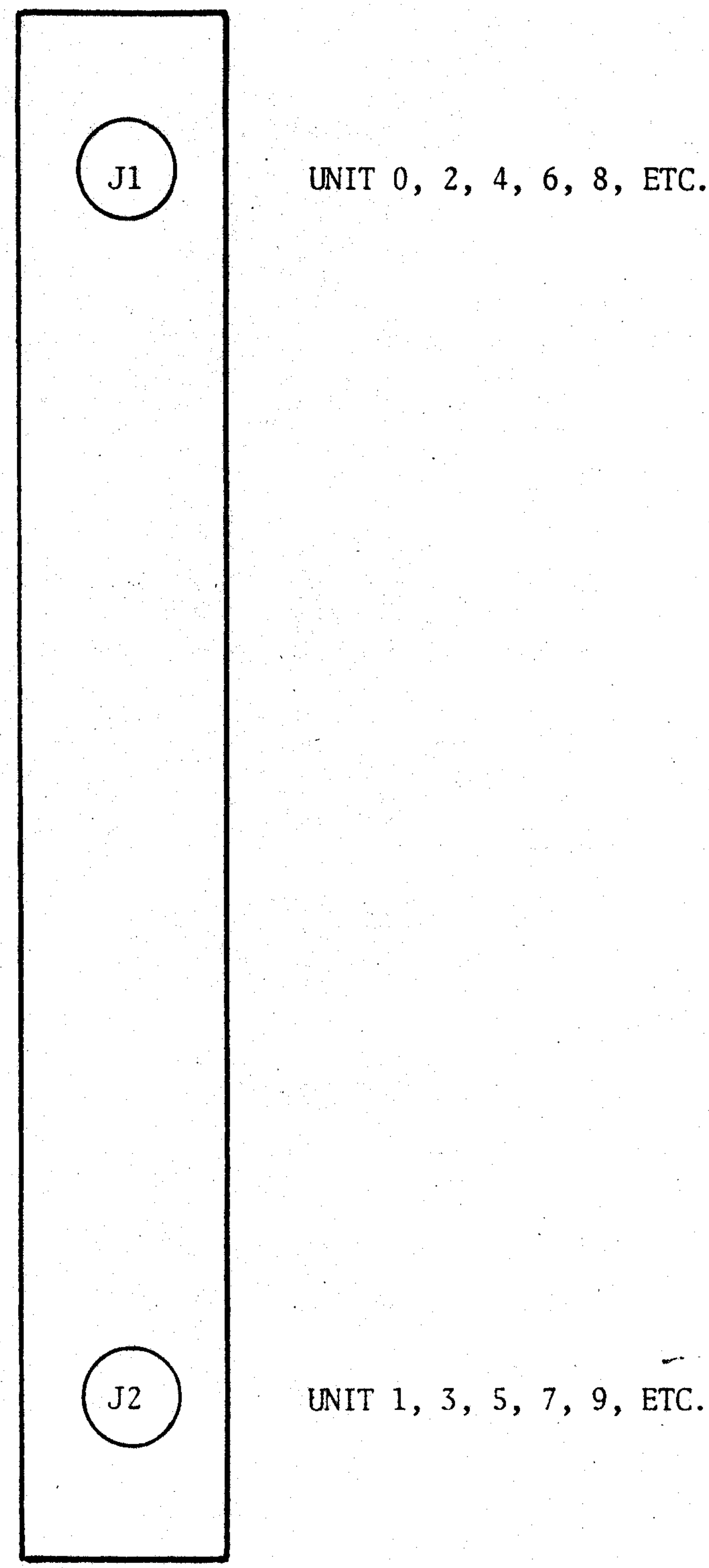


FIGURE 8: UNIT ASSIGNMENTS
AT MODULE CONNECTORS

OPERATION

3.1 INTRODUCTION

This section provides operating information for a BERTAN ASSOCIATES, INC. B-HiVE equipped with any combination of B-MOD and/or B-PAC plug-ins.

Operating directions contained herein are given intuitive clarity by careful choice of mnemonics. ("I" stands for Initialization, "S" stands for Status, etc.) Any command sequence that can be implemented at the front panel can also be implemented by remote control using a data terminal or a remote computer. However, there are some commands which by virtue of their scope and power, exceed front panel capability and are only applicable to remote control by data terminal or computer. In either case, controls are designed to be user-friendly.

3.2 MONITOR AND CONTROL

The Preparation for Use instructions of Section 2.3 must be completed before proceeding with the instructions of this section. Section 3.2.1 defines front panel read-outs. Section 3.2.2 defines Local Control. Section 3.2.3. defines Remote Control. Section 3.2.4 gives actual operating instructions.

It is suggested that the following sequence of front panel keystrokes be executed (with a data terminal connected to the RS232C connector) to obtain a display of B-HiVE status. The user need not be concerned with the meanings of each operation at this time, but it will be helpful in acquiring intuitive understanding of the B-HiVE command structure.

Place the IEEE488-LOCAL-RS232C toggle switch in RS232C. Connect a data terminal set for 9600 BAUD (standard ASCII character set, half-duplex, two stop bits, seven data bits and no parity) to the 25-pin connector on the front panel. Turn the AC power switch on.

Depress the following keys in order to obtain a CRT display of B-HiVE status with initialization:

[F] [2] [CR] [F] [0] [CR]

A typical status dump thereby obtained is shown below. A status dump may be obtained at any time using just [F] [0] [CR] which may be useful in examining the results of programming experiments on the part of the user.

FIGURE 9: TYPICAL STATUS DUMP

UNIT	TYPE	VSET	VTRU	ITRU	VLIM	ILIM	OVLD	TRIP
04	205A-20	05.00	05.00	0.012	21.00	1.050	NO	NO
05	205A-20	15.00	00.00	0.000	21.00	1.050	NO	YES
10	B3N	3.000	2.998	0.000	3.150	3.150	NO	NO
11	B3N	3.000	3.002	0.012	3.150	3.150	NO	NO
12	B3P	2.950	2.953	0.000	3.150	3.150	NO	NO
13	B3P	0.500	0.499	0.003	3.150	3.150	NO	NO
16	205A-50	10.00	10.00	00.00	52.50	00.31	NO	NO
17	205A-50	50.00	00.00	00.00	52.50	00.31	NO	YES

3.2.1 FRONT PANEL READOUTS

3.2.1.1 Numberical Fields

The front panel readout is divided into two fields. The first field is the two left most digits used to identify the unit addressed or entry to the Function Call (FC) Mode. All commands and queries are applicable to the last address(es) selected. Legitimate addresses are 00 through 32 for all outputs simultaneously.

When the address field is ready to accept an address (after the [U] for Unit key has been pushed) a prompr (·) will appear at the lower right of the field. The next two numbers entered will be displayed in the field and will indicate the unit addressed. Depressing the period key • will complete the addressing of one unit. (See 3.2.4.1 for complete addressing information).

The second field is the right most 4 digits. These digits are used to display unit type, output readings (voltage or current), voltage setting, limit settings (voltage or current) and function numbers. A polarity indication is displayed only during unit identification.

This field will also display an error message (Er) whenever an incorrect command sequence occurs or if an unacceptable command is entered, followed by code number to identify which kind of error has been made. (Section 3.2.5).

See Figure 10 on next page.

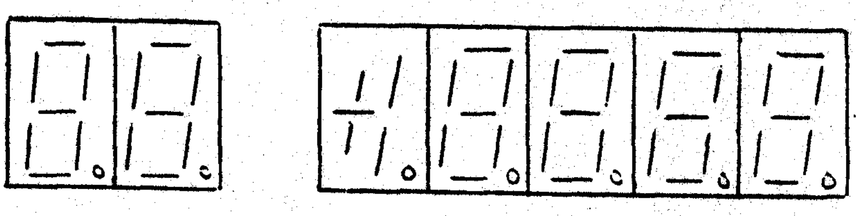


Figure 10. Front Panel Numerical Fields

3.2.1.2 LED Indicators

Individual LED indicators are located at the computer front panel. These identify the data displayed in the fields (see 3.2.1.1) and indicate the interlock and overload status of the B-HiVE.

The top LED indicators located just to the right of the data display define the units of the data. When numerical data is displayed, one (and only one) of these indicators is lit.

3.2.1.2.1 kV LED

The "kV" LED indicates that the number displayed in the data field is a voltage value to be read in kilovolts. It may be lit simultaneously with one of the three descriptive indicators.

3.2.1.2.2 mA LED

The "mA" LED indicates that the number displayed in the data field is a current value to be read in milli-amperes. It may be lit simultaneously with one of the three descriptive indicators.

3.2.1.2.3 Descriptive Indicators TYPE, SET, TRUE

The three descriptive indicators, "TYPE", "SET", AND "TRUE" define the meaning of a displayed voltage or current. The "TYPE" LED is lit when the displayed voltage is identifying the type of module that has just been addressed. The "TYPE" and "kV" LEDS become lit upon the conclusion of an address entry, when the B-HiVE identifies the type of module present at the address.

The "SET" LED identifies that the voltage displayed in the data field is a set or command value. It becomes lit after an EV (enter voltage) command is given. When the "SET" and "kV" LEDS are lit, the number keys can be used to enter a new set value of voltage for the address shown. The addressed power supply will not receive the new set value as a command until the [EX] (execute) key is pressed concluding the EV command entry sequence.

The "TRUE" LED identifies that the data displayed is a reading of the output voltage (if the "kV" LED is also lit) or of the output current (if the "mA" LED is also lit).

If one of the"kV" or "mA" LEDS is lit and none of the three descriptive LEDS is lit then the value displayed in the data field is a limit value protecting the particular high voltage power supply addressed.

3.2.1.2.4 Status Indicators INTERLOCK, GLOBAL OVERLOAD, LOCAL OVERLOAD.

The three status LEDS define the system and module operational status. The "INTERLOCK" LED defines the condition of the external optically isolated interlock input. When it is lit it indicates that the appropriate TTL logic level signal has been applied. When it is not lit the high voltage cannot be turned on. (See 2.3.2.1).

The "GLOBAL OVERLOAD" LED indicates when any or all of the up to 32 high voltage supplies has incurred an "overload" condition. The "LOCAL OVERLOAD" LED indicates that the <u>addressed</u> high voltage power supply has incurred an "overload". The term "overload" should not be cause for concern in itself. It is indicative of protective software activity within the B-HiVE and can be ignored during initial B-HiVE set-up. (See section 2.3.5)

3.2.2 Local Control

There are twenty keys on the computer front control panel. These keys are used only during the local control commands to the computer to control the module performance and the monitoring of each output. The mainframe must be placed in local control mode for front panel operation.

Figure 11

Keypad nomenclature is arranged as follows:

U	E	1	2	3
V	A	4	5	6
L	F	7	8	9
,	=	.	0	EX

U = Unit
E = Enter
V = Voltage
A = Amperage
L = Limit
F = Function
EX = Execute

The number keys 0 thru 9, the comma [,] the equals sign [=] and the period [.] are used in entry sequences.

3.2.2.1 NUMBER KEYS [0] thru [9]

The number keys are used for all numerical command or data entries. They are used for unit addressing, voltage settings, voltage and current limit settings and function command number entries.

3.2.2.2 EXECUTE KEY [EX]

The execute key is used to conclude entry sequences.

3.2.2.3 UNIT KEY [U]

The unit key is used for address selection. (Section 3.2.4.1).

3.2.2.4 ENTER KEY [E]

The enter key is used for voltage output settings. (Section 3.2.4.2

3.2.2.5 VOLTAGE KEY V

The voltage key is used for voltage output settings, voltage limit settings and voltmeter readings. (Sections 3.2.4.2, 3.2.4.3 and 3.2.4.5.1).

3.2.2.6 AMPERAGE KEY [A]

The amperage key is used for current limit settings and ammeter readings. (Section 3.2.4.4 and 3.2.4.5.2).

3.2.2.7 LIMIT KEY [L]

The limit key is used for voltage limit and current limit settings. (Section 3.2.4.3 and 3.2.4.4.)

3.2.2.8 FUNCTION KEY [F]

The function key is used in selection of function - calls. (Section 3.2.4.6)

3.2.2.9 COMMA KEY [,]

The comma key is used as a command delimiter.

3.2.2.10 EQUALS KEY [=]

The equals key is used as a command delimiter.

3.2.2.11 PERIOD KEY [.]

The period key is used as a command delimiter.

3.2.2.12 OFF PUSHBUTTON [OFF]

The off pushbutton removes 28 volt power from all B-MODs/B-PACs. (It is assumed that the external 28 volt power supply is B-HiVE controlled per Figures 3 thru 7). An internal pilot light is lit when 28 volt power is off. This pushbutton is always effective.

3.2.2.13 ON PUSHBUTTON [ON]

The on pushbutton applies 28 volt power to all B-MODs/B-PACs. (It is assumed that the external 28 volt power supply is B-HiVE controlled per Figures 3 thru 7). An internal pilot light is lit when 28 volt power is on. This pushbutton is not effective unless and until all safety interlock requirements have been met.

3.2.2.15 AC (ON-OFF)

This is the main AC power switch.

3.2.2.16 REMOTE-LOCAL (IEEE 488, LOCAL, RS232C)

This three-position toggle switch selects which method of B-HiVE control is in use.

3.2.3 REMOTE CONTROL

3.2.3.1 RS232C and 20mA TTY (Also see 3.2.3.3 CAMAC and 3.2.3.4 IEEE 488)

For remote control with RS232C or 20mA TTY, the following protocol and preparatory set-up are applicable:

Protocol = 7 data bits (ASCII), no parity and one stop bit for 150, 300, 600, 1200, 2400, 4800 or 9600 BAUD; two stop bits for 110 BAUD. B-HiVE received-data storage is one byte. (See Intel Corp. data sheet on part number 8251A for further info.) B-HiVEs are factory set to RS232C and 9600 BAUD. This may be changed by switch adjustments on the ADSIOT card in accordance with the following tables (See Figure 12, page 3-8).

In each of the following sections, command execution is done with carriage return [CR].

3.2.3.1 REMOTE - LOCAL EQUIVALENTS

Each of the nineteen keypad keys described in 3.2.2.1 thru 3.2.2.11 correspond directly to the identically marked keys on the keyboard of a standard data terminal. (The execute key of 3.2.2.2 corresponds to the carriage return key of the data terminal keyboard). All of the functions of Local Control are preserved.

3.2.3.2.1 HIGH VOLTAGE OFF [X] [CR]

The keyboard letter "X" is used to remove 28 volt power.

This is functionally equivalent to [OFF] in 3.2.2.12 (see).

3.2.3.2.2 HIGH VOLTAGE ON [H] [CR]

The keyboard letter "H" is used to apply 28 volt power.

This is functionally equivalent to [ON] in 3.2.2.13 (see).

The following functions are available thru a data terminal for entry, and for CRT display where applicable. They are of greater power and scope than can be accomodated in any relatively limited front panel control and LED display.

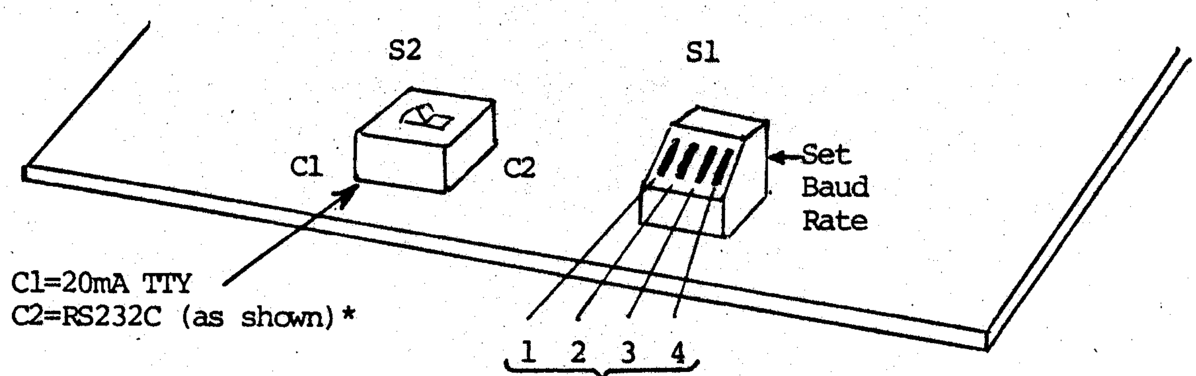
3.2.3.2.3 STATUS [S] [CR]

The keyboard letter "S" is used in system status examination of all units.

3.2.3.2.4 STATUS, BOTTOM [S] [B] [CR]

Figure 12

RS232C and 20mA TTY Set-up Requirements



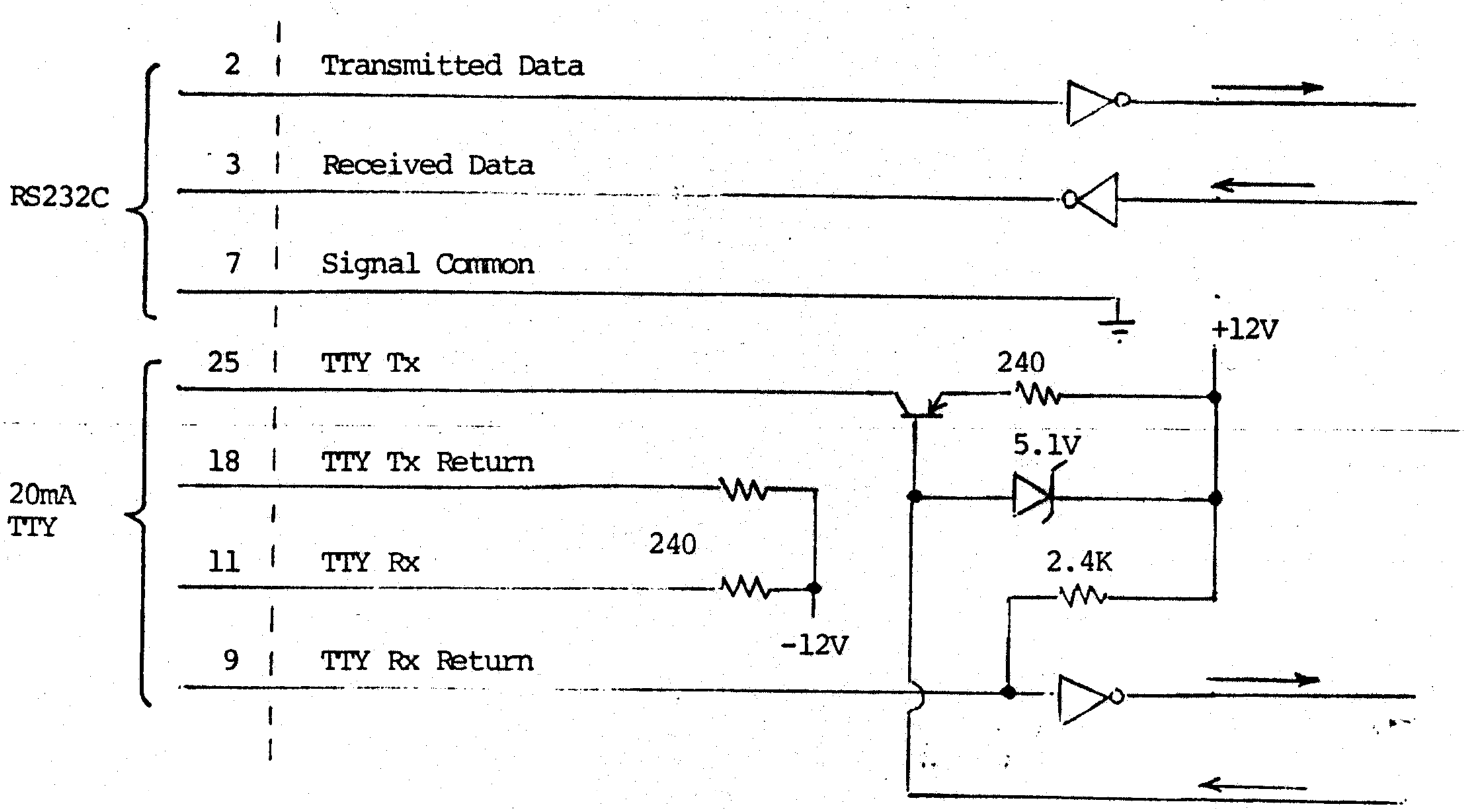
Baud Rate	S1 Settings 1	2	3	4
9600*	Ø	1	1	1
4800	Ø	1	1	Ø
2400	Ø	1	Ø	1
1200	Ø	1	Ø	Ø
600	Ø	Ø	1	1
300	Ø	Ø	1	Ø
150	Ø	Ø	Ø	1
110	Ø	Ø	Ø	Ø

1=UP (Away from pc board).

Ø=DOWN (Toward pc board).

Note: S1 baud rate setting is only read once by the B-COMP at the moment of AC power application.

* Factory Settings



3.2.3.2.5 STATUS, TOP [S] [T] [CR]

The keyboard letter "T" is used with "S" in status examination of the top numbered units (16 thru 31).

3.2.3.2.6 STATUS, UNITS [S] [U] [CR]

The keyboard letter "U" is used with "S" in status examination of contiguously numbered units, called "groups". (See 3.2.4.1.3.)

3.2.3.2.7 INITIALIZATION [I] [CR]

The keyboard letter "I" is used to establish a starting point or "initialized" state as follows:

All units are programmed to zero volts.
All units are tripped.
All limit values are set to default numbers per Table 1.

(See 3.2.4.6.3 for [F] [2] [EX] and [F] [2] [CR].)

Table 1. VLIM and ILIM Default Values

B-MODS	VLIM	ILIM
B3P, B3N	3.150	3.150
B7.5P,B7.5N	7.875	1.050
MWPC B-PACS		
1739P,N,X	7.875	0.525
1755P,N,X	5.250	0.525
1792P,N,X	10.50	0.525

A default value is the number of kV or mA assigned to each VLIM and ILIM by the B-COMP computer unless some other lesser number is chosen by the user. (See 3.2.4.3 and 3.2.4.4).

205A B-PACS	VLIM	ILIM
-01	1.050	31.50
-03	3.150	10.50
-05	5.250	5.250
-10	10.50	2.625
-20	21.00	1.050
-30	31.50	0.525
-50	52.50	00.31

210 B-PACS	VLIM	ILIM
-01	1.050	236.25*
-03	3.150	78.75*
-05	5.250	42.00
-10	10.50	15.75
-20	21.00	7.350
-30	31.50	4.725
-50	52.50	2.625

* For 210-01 and 210-03 only, the displayed values of ILIM and ITRU are one tenth of the actual values of ILIM and ITRU. This is the result of a number-processing limitation in the B-COMP. Values of ILIM and may be taken at face value for all other B-PACs and alll B-MODs.

Figure 13. Typical Status Dump (Also see Figure 9, page 3-2).

UNIT	TYPE	VSET	VTRU	ITRU	VLIM	ILIM	OVLD	TRIP
04	205A-20	05.00	05.00	0.012	21.00	1.050	NO	NO
05	205A-20	15.00	00.00	0.000	21.00	1.050	NO	YES
10	B3N	3.000	2.998	0.000	3.150	3.150	NO	NO
11	B3N	3.000	3.002	0.012	3.150	3.150	NO	NO
12	B3P	2.950	2.953	0.000	3.150	3.150	NO	NO
13	B3P	0.500	0.499	0.003	3.150	3.150	NO	NO
16	205A-50	10.00	10.00	00.00	52.50	00.31	NO	NO
17	205A-50	50.00	00.00	00.00	52.50	00.31	NO	YES

Units 4 and 5 are a 205A-20 B-PAC, one output set to 5kV the other set to 15kV. Unit 4 is not tripped and its volmeter reads back 5kV. Unit 5 is tripped and its voltmeter reads back zero.

Units 10 and 11 are a B3P B-MOD, one output set to 2.95kV, the other set to 500 volts. Neither unit is tripped, so true-voltage readings of 2.953kV and 499 volts are obtained.

Units 16 and 17 are a 205A-50 B-PAC, one output set to 10KV, the other set to 50kV. Unit 16 is not tripped and its voltmeter reads back 10kV. Unit 17 is tripped and its voltmeter reads back zero.

All other slots or unit positions are vacant.

3.2.3.2.8 RECALL [R] [CR]

The keyboard letter "R" is used after an AC power interruption to recall previously stored data.

(See 3.2.4.6.4 for [F] [3] [EX] and [F] [3] [CR].

In normal operation, data on voltage settings, limit values, trip status etc. is stored in RAM within B-MODs, B-PACs, the ADSIOT, etc. An image of these stored values is stored in the CMOS RAM. Should an AC power interruption occur, data stored in RAM will be lost, but the data stored in the CMOS RAM is preserved by battery back-up. When AC power is restored, the processor initializes the system to ensure user safety and hardware protection. The user may then issue a recall command to bring the preserved data out of the CMOS RAM and back to the locations it occupied before the power interruption, or the user might choose to discard the preserved data, issue [I] [CR] or [F] [2] [EX] and go on to other programming. The recall function gives the user both options.

Status-readout information taken after re-application of interrupted AC power, but prior to issuance of recall or initialization commands, is to be interpreted as follows:

1) UNIT numbers and TYPE signatures are as they were before AC power interruption.

2) VSET numbers show what voltage settings <u>were</u> in effect before the AC power interruption. <u>Actual</u> settings will be at zero volts so that you, the user, can decide if you still want the same voltage settings you had before. If so, your issuance of recall commands will put all B-MOD/B-PAC voltage settings back to their VSET-illustrated values. If not, you should initialize the system and go on to new programming.

3) VTRU, ITRU, VLIM and ILIM numbers are valid.

4) OVLD will be NO if no overload existed prior to the AC power interruption. If OVLD is YES before the interruption, it will stay YES even after the issue of the recall command. It is a reminder that something had caused an OVLD response before, even though TRIP may be put to NO by the recall command as stated below. OVLD can only be cleared to NO by initialization, or a new VSET entry.

5) TRIP status is valid. The units will all be tripped for the sake of safety after an AC power interruption. The recall command will untrip only those units that were not tripped before the interruption. Those that were tripped before the interruption will stay tripped. (See 4 above).

The 28 volt power will <u>not</u> automatically be restored by recall commands. For safety's sake, it is necessary to issue [H] [CR] or press the [ON] button, as appropriate, to restore the 28 volts.

Fast trip detectors are automatically enabled after a power interruption. They must be deliberately disabled using [F] [7] [EX] or [F] [7] [CR] (See 3.2.4.6.8.) if fast trip detection is not wanted.

3.2.3.3. CAMAC

B-HiVE operation in CAMAC (ANSI/IEEE-583) systems is accomplished using the following adapter:

Model 3340 - D1B
Communications Interface

by

Kinetic Systems Corporation
11 Maryknoll Drive
Lockport, Illinois 60441

Phone: (815) 838-0005

Telex: 910 638-2831

Kinetic Systems International S. A.
3 Tavernay
1218 Geneva, Switzerland

Phone: (022) 98 44 45

Telex: 289 622 KSI CH

Required interconnections and 3340-D1B switch settings are shown in Figure 14 and Table 2.

All of the features and capabilities of the B-HiVE RS232C mode are retained.

Care should be taken not to exceed the byte storage capacities of the B-COMP (See 3.2.3.1) or the Interface, with or without First-In-First-Out (FIFO) storage.

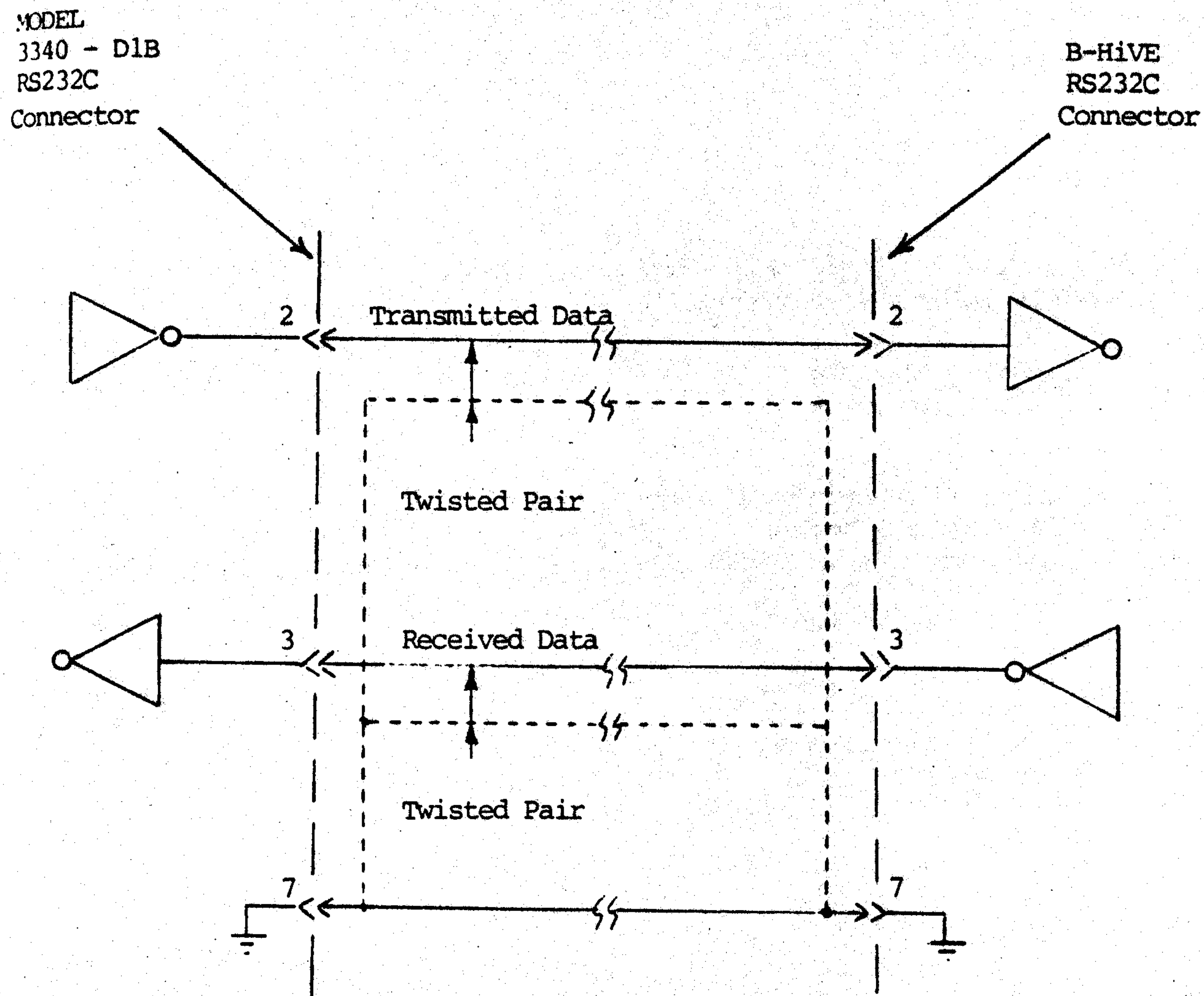


FIGURE 14.

Interconnection of B-HiVE and CAMAC Interface

TABLE 2: CAMAC INTERFACE

SWITCH SETTINGS

BAUD RATE	S1 AND S2 A	B	C	D
110	Ø	1	Ø	Ø
150	Ø	Ø	1	Ø
300	1	Ø	1	Ø
600	Ø	1	1	Ø
1200	1	1	1	Ø
2400	Ø	1	Ø	1
4800	Ø	Ø	1	1
9600*	Ø	1	1	1

* Matches B-HiVe factory setting of 9600 Baud.

CONTROL SIGNALS	S5 POSITIONS AND SETTINGS
Odd/Even Parity	EPS = Don't care
7 Bits per Character	NB2 = 1 and NB1 = Ø
Number of stop bits	TSB = Ø (except 110 baud, TSB = 1
No parity	NP = 1
Input/Output Signal	RS232C = Ø, TTL = 1, 20mA = 1

S3 and S4 are not B-HiVE related.

3.2.3.4 IEEE 488 General Purpose Interface Bus (GPIB)

The BERTAN B488 interface is optional. When used, it is installed in the B-COMP and makes interface via a front panel connector. GPIB software is required. See Appendix A1, IEEE-488 programming example.
With the interface installed the B-HiVE can receive commands from a controller on the GPIB and send the results of voltage and current measurements.

3.2.3.4.1 COMMAND STRUCTURE

The interface will accept and execute all commands that are allowable when the B-HiVE is operated via its RS232C interface. Results of the execution of a command are displayed on the B-HiVE front panel and transmitted from the RS232C interface. Connection of a printer to the RS232C interface allows the generation of hardcopy of the operation of the system.

Only two commands from the GPIB controller cause the B-HiVE to send data back to the controller. These commands V and A cause a voltage or current measurement respectively, of the output of a previously addressed single unit. When addressed as a talker the B-HiVE will transmit to the controller the results of the last voltage or current measurement taken. The form of the results transmitted on the GPIB are:

$$\begin{Bmatrix} N \\ T \end{Bmatrix} \begin{Bmatrix} + \\ - \end{Bmatrix} X.XXX \begin{Bmatrix} K \\ M \end{Bmatrix} \downarrow \qquad \downarrow = \text{Carriage Return and End of Instruction}$$

where only one of the symbols in each bracket is transmitted. The message consists of a header:

N : unit operating normally
or T : unit tripped because of an overload

(Fast trip detection will <u>not</u> show "T". User take note!)

a sign

\+ : positive output
or − : negative output

a four digit and decimal point value field,
and a suffix

K : kilovolts
or M : milliamps

3.2.3.4.2 INSTALLATION

The primary talker and listener address must be set on the interface PC card via the address DIP switch. Switch positions 5 thru 1 provide the five bit device address, with position 1 the least significant bit. A switch in the ON position corresponds to a 0. The GPIB cable is plugged into J1 of the interface card. The interface card is placed in the card case (card pull down) and the female GPIB cable connected to the front panel.

3.2.3.4.3 OPERATION

To receive commands from the GPIB the B-HiVE's LOCAL/RS232C switch must be in the RS232C position. * The GPIB controller must address the B-HiVE with it's MLA (My Listen Address). The controller can then send device specific commands to the B-HiVE as data. The command format is identical to that for commands sent via the RS232C interface. All characters are sent as 7 bit ASCII with the 8th bit, parity, ignored. Letters of the alphabet are sent in upper case.

Only two commands, V and A, cause data to be sent back to the GPIB controller. For example, to make a voltage measurement the following sequence of operations are required:

The GPIB controller-

a. Sends the universal unlisten command, UNL
b. Addresses B-HiVE as listener, MLA
c. Addresses itself as talker, MTA
d. Sends B-HiVE voltage measurement command, UXX.V
e. Sends universal unlisten command, UNL
f. Addresses itself as listener, MLA
g. Addresses B-HiVE as talker, MTA

The B-HiVE will then transmit the results of the measurement with the format shown in section 3.2.3.4.1. EOI is sent by the B-HiVE when it sends the carriage return. Note: To have the B-HiVE send the same message again (i.e. repeat the transmission of a result) the B-HiVe must be unaddressed and then readdressed.

See Appendix A1 for a programming example using IEEE-488.

* Do not use "IEEE 488" position on B-HiVE front panel.

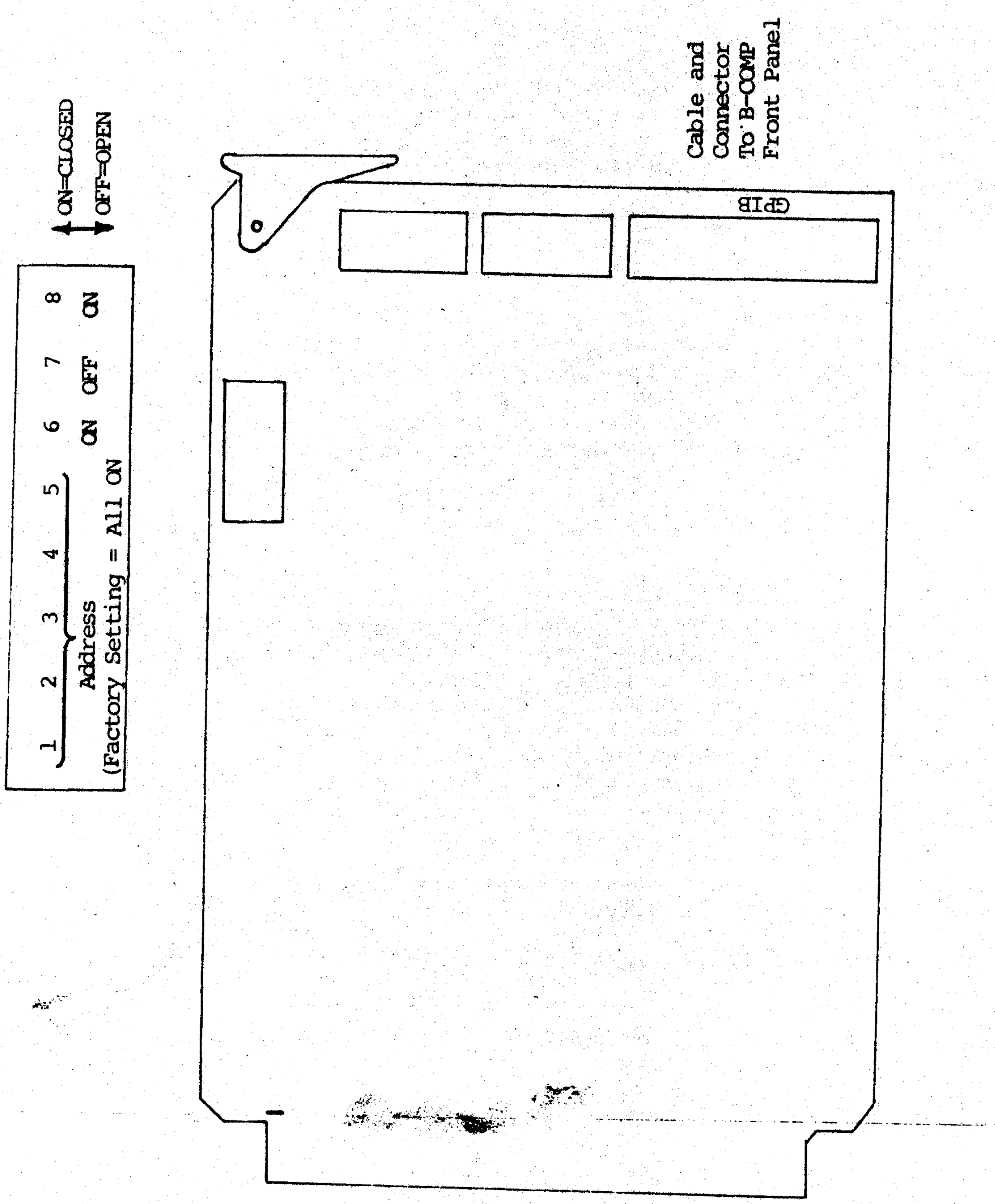


Figure 15. B488 Switch Settings For IEEE-488

3.2.4 OPERATING INSTRUCTIONS

The following operating instructions are given in terms of their required keystrokes and push-button depressions for both front panel local control and for remote control using a data terminal or external computer.

Please review Sections 3.2.2 and 3.2.3 for keystroke defintions.

Examples:

1) UØ1.EV3.Ø5 EX means address unit number one, enter a voltage output setting of 3.05 kV and execute. The keystroke sequence would be:
[U] [0] [1] [·] [E] [V] [3] [·] [0] [5] [EX] on the front panel.

2) U32.EV1.93 CR H CR means address all units simultaneously (32 is the GLOBAL address), enter a common voltage output setting of 1.93 kV, execute and turn on the 28 volt power for making the high voltage. The keystroke sequence would be:
[U] [3] [2] [·] [E] [V] [1] [·] [9] [3] [CR] [H] [CR] on a data terminal.

(Note CR means carriage return)

or [U] [3] [2] [·] [E] [V] [1] [·] [9] [3] [EX] [ON] on the front panel

In the following, execute EX and carriage return CR may be used interchangeably. Individual kay strokes are designated by mnemonics in boxes only if clarity is aided.

3.2.4.1 UNIT ADDRESSING

3.2.4.1.1 SINGLE UNIT ADDRESSING

UNaNb. where NaNb is a two digit decimal number from zero thru 31.

Examples: 1) UØ5. addresses Unit 5
2) U22. addresses Unit 22
3) U7. addresses Unit 7 and it is understood that Na = zero

The unit number and maximum programmable output voltage are displayed. The TYPE LED will be lit on the front panel.

3.2.4.1.2 GLOBAL ADDRESSING

U32. addresses all units simultaneously. The global address unit number (32) and the maximum programmable output voltage of the lowest full-scale-voltage unit will be displayed.

Example: B3P @ Units 4,5
B7.5N @ Units 22, 23
B-PAC 205A-20P @ Units 30, 31
U32. will display Unit number 32 and a 3.00 kV voltage range.

The TYPE LED will be lit on the front panel

3.2.4.1.3 GROUP ADDRESSING

UNaNb, UNcNd. where NaNb and NcNd are two digit decimal numbers from zero thru 31 and NaNb NcNd.

Examples: 1) U1Ø, U25. addresses Units 10 thru 25 simultaneously.

2) UØ3, U18. addresses Units 3 thru 18 simultaneously.

The unit number NcNd and the maximum programmable output voltage of the lowest full-scale-voltage unit within the group will be displayed on the front panel. A remote data terminal will display both unit numbers bracketing the group and the same programmable voltage number. The TYPE LED will be lit on the front panel.

3.2.4.1.4 ADVANCEMENT ADDRESSING

Delimiter , will advance the unit address to the next-highest-number present in the system.

Examples:

Assume: B3P @ Units Ø,1
B3P @ Units 2,3
B3N @ Units 7,8
B7.5P @ Units 19,21

1) Assume Unit Ø is addressed as a single unit with UØ. Then:

With , B-HiVE address is advanced to Unit 1
With , B-HiVE address is advanced to Unit 2
With , B-HiVE address is advanced to Unit 3
With , B-HiVE address is advanced to Unit 7
With , B-HiVE address is advanced to Unit 8
With , B-HiVE address is advanced to Unit 19
With , B-HiVE address is advanced to Unit 21
With , B-HiVE address is advanced to Unit Ø

Since there are no units above 21, the address advancement re-cycles back to the lowest numbered unit. Vacant unit numbers are ignored.

2) Assume Units 2 thru 7 are addressed as a group, with U2, U7. Then a series of commands are issued to change limits, voltage settings, to read status or whatever.

With , B-HiVE address is moved to the next highest number or Unit 8.

3.2.4.2 OUTPUT VOLTAGE PROGRAMMING

After unit addressing per Section 3.2.4.1, output voltages are programmable within the limits of Section 3.2.4.3 using the following sequences:

3.2.4.2.1 DIRECT ENTRY OF VOLTAGE OUTPUT SETTING

EV will cause a display of the output voltage setting already in effect for the addressed unit(s).* This is then followed by entry of the first digit of the integral number of kilovolts, the second digit of the integral number of kilovolts (if ten kV or greater only), a decimal point, and the digits for the fractional part of a kilovolt desired, if any. EX on the front panel or carriage return on a remote data terminal completes the direct entry of the output voltage program for the addressed unit(s).

*If the already entered value need not be changed, command execution with EX or CR will leave the already entered setting undisturbed.

Examples:

1) Programming Unit 13 to 2000 volts:

U13.	EV 2.	EX	on the front panel
U13.	EV 2.	CR	on a data terminal.
Single Unit Addressing	Entering Desired voltage	Command Execution	

2) Programming all units to 500 volts:

U32.	EV 0.5	EX	on the front pantl.
U32.	EV 0.5	CR	on a data terminal
Global Addressing	Entering desired voltage	Command execution	

3) Programming Units 4 thru 27 to 7370 volts:

U4, U27.	EV 7.37	EX	on the front panel.
U4, U27.	EV 7.37	CR	on a data terminal.
Group Addressing	Entering desired voltage	Command execution	

4) Assuming a plug-in at Units 30, 31 and vacancy at Units 28, 29, then after the sequence of Example 3 above:

Programming the next advanced unit to 5842 volts:

,	EV 5.842	EX	on the front panel
,	EV 5.842	CR	on a data terminal
Address advancement to Unit 30	Entering desired voltage	Command execution	

Notes re. the above examples:

1) When entering the desired voltage, the integer part of the number of kilovolts must be entered, even if zero as in Example 2.

2) When entering the desired voltage, the decimal point must be entered, even if the entry is a whole number of kilovolts as in Example 1.

3) Entry of a desired voltage of zero will "trip" the addressed unit's output drive circuit. No output energy can then be delivered to either a normal or a malfunctioning load. Entry of any non-zero desired voltage will "untrip" or restore energy delivery capability. (See Sections 3.2.4.6.5 and 3.2.4.6.6).

4) Entry of a desired voltage greater than the limit value assigned to the addressed unit(s) will be rejected with an error message ERØ5. See Section (3.2.5.6). The original voltage setting will remain undisturbed.

3.2.4.2.2 INDIRECT ENTRY OF VOLTAGE OUTPUT SETTING TO ZERO

The I CR command (direct system initialization will) automatically program all units to zero volts output. (See Section 3.2.4.6.3).

3.2.4.3 VOLTAGE LIMIT PROGRAMMING

After unit addressing per Section 3.2.4.1 applicable voltage ranges are programmably restrictable using the following sequences:

3.2.4.3.1 DIRECT ENTRY OF VOLTAGE LIMIT

LV will cause a display of the voltage limit setting in kV already in effect for the addressed unit(s).* This is then followed by entry of the first digit of the integral number of kilovolts, the second digit of the integral number of kilovolts (if ten kV or greater only), a decimal point, and the digits for the fractional part of a kilovolt desired, if any. EX on the front panel or carriage return on a remote data terminal completes the direct entry of the voltage limit program for the addressed unit(s).

* If the already entered value need not be changed, command execution with EX or CR will leave the already entered setting undisturbed.

Examples:

1) Limiting Unit 21 to 1500 volts:

U21.	LV 1.5	EX on the front panel.
U21.	LV 1.5	CR on a data terminal.
Single unit Addressing	Entering limit voltage	Command execution

2) Limiting all units to 200 volts:

U32.	LV 0.2	EX on the front panel
U32.	LV 0.2	CR on a data terminal
Global Addressing	Entering limit voltage	Command Execution

3) Limiting Units 10 thru 15 to 3200 volts:

U10, U15.	LV 3.2	EX on the front panel
U10, U15.	LV 3.2	CR on a data terminal
Group Addressing	Entering limit voltage	Command Execution

4) Assuming a plug-in at Units 16, 17, then after the sequence of Example 3 above:

Limiting the next-advanced unit to 5000 volts:

,	LV 5.	EX on the front panel
,	LV 5.	CR on a data terminal
Address advancement to Unit 18	Entering limit voltage	Command Execution

Notes re. the above examples:

1) When entering the limit voltage, the integer part of the number must be entered, even if zero as in Example 2.

2) When entering the limit voltage, the decimal point must be entered, even if the entry is a whole number of kilovolts as in Example 4.

3) Each type of B-MOD/B-PAC is assigned a maximum value of limit voltage. This is called a "default" value. Entry of a limit voltage greater than the default value assigned to the addressed unit(s) will be rejected with an error message ERØ5. (See Section 3.2.5.6). The original limit voltage setting will remain undisturbed.

3.2.4.3.2 INDIRECT ENTRY OF VOLTAGE LIMIT

The I CR command (direct system initialization) will automatically program all units to their respective assigned values of default limit voltage. (See Section 3.2.3.2.7).

The F 2 EX on the front panel or the F 2 CR on a data terminal (indirect system initialization) will automatically program all units to their respective assigned values of default limit voltage. (See Section 3.2.4.6.3).

4) Assuming a plug-in at Units 20, 21, then after the sequence of Example 3 above:

Limiting the next advanced unit to 15.1 mA:

Address advancement to Unit 20	Entering limit current	Command Execution
,	LA 15.1	EX on the front panel
,	LA 15.1	CR on a data terminal

Notes re. the above examples:

1) When entering the limit current, the integer part of the number must be entered, even if zero as in Example 3.

2) When entering the limit current, the decimal point must be entered, even if the entry is a whole number of mA as in Example 2.

3) Each type of B-MOD/B-PAC is assigned a maximum value of limit current. This is called a "default" value. Entry of a limit current greater than the default value assigned to the addressed unit(s) will be rejected with an error message ERØ5. (See Section 3.2.5.6). The original limit current setting will remain undisturbed.

3.2.4.4.2 INDIRECT ENTRY OF CURRENT LIMIT

The I CR command (direct system initialization) will automatically program all units to their repsective assigned values of default limit current. (See Section 3.2.3.2.7).

The F 2 EX on the front panel or the F 2 CR on a data terminal (indirect system initialization) will automatically program all units to their respective assigned valves of default limit current. (See Section 3.2.4.6.3).

3.2.4.5 MEASUREMENTS

3.2.4.5.1 VOLTAGE MEASUREMENTS

The single command V produces a display of the internal voltmeter reading(s) for the unit(s) addressed per Section 3.2.4.1.

Examples:

1) U14. V will display the unit number and voltage measurement for Unit 14. Pressing V again updates the display, which may be done at any time.

2) U8, U13. V will sequentially display the unit numbers and corresponding voltage measurements for Units 8 thru 13. Pressing V again updates the display, which may be done at any time.

3.2.4.4 CURRENT LIMIT PROGRAMMING

After unit addressing per Section 3.2.4.1, applicable output load-current ranges are programmably restrictable using the following sequences:

3.2.4.4.1 DIRECT ENTRY OF CURRENT LIMIT

LA will cause a display of the current limit setting in mA already in effect for the addressed unit(s).* This is then followed by entry of the first digit of the integral number of mA, the second digit of the integral number of mA (if ten mA or greater only), a decimal point, and the digits for the fractional part of a milliamp desired, if any. EX on the front panel or carriage return on a remote data terminal completes the direct entry of the current limit program for the addressed unit(s).

* If the already entered value need not be changed, command execution with EX or CR will leave the already entered setting undisturbed.

Examples:

1) Limiting Unit 17 to 1.84 mA:

U17.	LA 1.84	EX on the front panel
U17.	LA 1.84	CR on a data terminal
Single Unit addressing	Entering Limit current	Command Execution

2) Limiting all units to 3mA:

U32.	LA 3.	EX on the front panel
U32.	LA 3.	CR on a data terminal
Global addressing	Entering limit current	Command Execution

3) Limiting Units 8 thru 19 to 0.15 mA:

U8, U19	LA 0.15	EX on the front panel
U8, U19	LA 0.15	CR on a data terminal
Group addressing	Entering limit current	Command Execution

3) Status readouts per Sections 3.2.3.2.3 thru 3.2.3.2.6 contain voltage measurements under the heading VTRU.

3.2.4.5.2 CURRENT MEASUREMENTS

The single Command A produces a display of the internal ammeter reading(s) for the unit(s) addressed per Section 3.2.4.1.

Examples:

1) UØ. A will display the unit number and current measurement for Unit Zero. Pressing A again updates the display, which may be done at any time.

2) U32. A will display all of the unit numbers and their corresponding current measurements. Pressing A again updates the display, which may be done at any time.

3) Status readouts per Sections 3.2.3.2.3 thru 3.2.3.2.6 contain current measurements under the heading ITRU.

3.2.4.6 FUNCTION-CALL PROGRAMMING

A set of user-callable functions is provided for specific purposes as shown below:

3.2.4.6.1 FUNCTION ZERO = STATUS DUMP

F O EX on the front panel

F O CR on data terminal

Commands a status dump to be outputted. It is functionally identical to S CR of 3.2.3.2.3.

3.2.4.6.2 FUNCTION ONE = RAMP SLOPE SET

F 1 = NaNb EX on the front panel

F 1 = NaNb CR on a data terminal

Where NaNb is a two-digit decimal number between zero and sixty. Commands the rate-of-rise of high voltage outputs that will be subsequently programmed. NaNb is the number of seconds in which those high voltage outputs will rise by one kilovolt. Issuing F1=Ø EX sets NaNb=zero for which no ramping occurs.

Caution: The use of Function one locks out further commands following entry of a voltage output command until the defined ramping is completed. In Example 2 below, a ramp rate of 60 seconds per kilovolt and a voltage entry of 50 kV multiply out to a delay of 3000 seconds or 50 minutes! Be <u>very</u> careful that your chosen products of ramp rate times voltage setting do not give longer delay times than you are prepared to cope with! With F1 ≠ zero, the entry of a voltage command will lock out any further commands until ramp completion.

Ramping is accomplished in steps of one volt in time increments as small as one millisecond (F1=1 second per kV) to as large as 60 milliseconds (F=60 seconds per kV). Time interval accuracy is impacted by processor-speed limitations. Timing errors may or may not be significant in your case. The following table compares nominal versus measured delay times to ramp completion for some specific cases as a guide to the user. (Also see examples).

Mainframe Loading

U4,5 = 205A-20 B-PAC
U10,11 = B3N
U16,17 = 205A-50 B-PAC
U22,23 = B3P

ADDRESSED UNITS	F1 = NaNb	VOLTAGE SETTING	NOMINAL TIME	MEASURED TIME (APPROX)	% ERROR
UØ4.	60 sec/kV	3kV	180 sec	182 sec	1/90 = 1.11%
U10.	30 sec/kV	3kV	90 sec	93 sec	3/90 = 3.33%
U16.	50 sec/kV	1kV	50 sec	52 sec	2/50 = 4%
U22.	25 sec/kV	1.4kV	35 sec	38 sec	3/35 = 8.57%
UØ4,U11.	60 sec/kV	3kV	180 sec	197 sec	17/180 = 9.44%
U16.	10 sec/kV	5kV	50 sec	57 sec	7/50 = 14%
U32.	60 sec/kV	3kV	180 sec	225 sec	45/180 = 25%
UØ4.	1 sec/kV	3kV	3 sec	7 sec	4/3 = 133%
U16.	1 sec/kV	50kV	50 sec	124 sec	74/50 = 148%

Examples:

1) F 1 = 0 1 EX
or F 1 = 1 EX
on the front panel

F 1 = 0 1 CR
or F 1 = 1 CR
on a data terminal

In these sequences, NaNb = 1 second per kV.

U10. EV3. EX on the front panel
U10. EV3. CR on a data terminal

Programming to 3kV at a ramp rate of one second per kV will take 3 seconds.

U17. EV50. EX on the front panel
U17. EV50. CR on a data terminal

Programming to 50kV at a ramp rate of one second per kV will take 50 seconds.

2) F 1 = 6 0 EX on the front panel
F 1 = 6 0 CR on a data terminal

In these sequences, Na Nb = 60 seconds per kV.

U11. EV3. EX on the front panel
U11. EV3. CR on a data terminal

Programming to 3kV at a ramp rate of 60 seconds per kV will take 180 seconds.

U18. EV50. EX on the front panel
U18. EV50 CR on a data terminal

Programming to 50kV at a ramp rate of 60 seconds per kV will take 3000 seconds = 50 minutes.

3.2.4.6.3 FUNCTION TWO = INITIALIZATION

F 2 EX on the front panel
F 2 CR on a data terminal

Commands initializaiton of the B-HiVE system. It is functionally identical to I CR of 3.2.3.2.7 (See)

3.2.4.6.4 FUNCTION THREE = RECALL

F 3 EX on the front panel
F 3 CR on a data terminal

Commands a recall of previously stored data after an AC power interruption. It is functionally identical to R CR of 3.2.3.2.8. (See)

3.2.4.6.5 FUNCTION FOUR = TRIP

F 4 EX on the front panel
F 4 CR on a data terminal

Commands the "tripping" or output-shutdown(s) of the unit(s) last addressed.

3.2.4.6.6 FUNCTION FIVE = UNTRIP

F 5 EX on the front panel
F 5 CR on a data terminal

Commands the "untripping" or output-restoration(s) of the unit(s) last addressed.

3.2.4.6.7 FUNCTION SIX = ENABLE FAST TRIP

F 6 EX on the front panel
F 6 CR on a data terminal

Commands the enabling of protective arc-detection circuitry. Detection of an arc causes shutdown, i. e. tripping, to avoid driving destructive energy to a malfunctioning load. This command applies only to the unit(s) last addressed.

3.2.4.6.8 FUNCTION SEVEN = DISABLE FAST TRIP

F 7 EX on the front panel
F 7 CR on a data terminal

.mmands the disabling of arc-detection circuitry. In this case, high voltage ill continue to be delivered in the presence of arcing. This command applies nly to the unit(s) last addressed.

3.2.4.6.9 FUNCTION EIGHT = LOG STATUS

(Requires use of Calendar-Clock circuit card. See 1.2.3.5.)

F 8 = Na Nb EX on the front panel
F 8 = Na Nb CR on a data terminal

.mmands periodic outputting or dumping of complete B-HiVE status per Sections .2.3.2.3 and 3.2.4.6.1 at intervals of T seconds.

a Nb is a two digit decimal number. T=10* Na Nb seconds except if Na Nb = zero. or zero, periodic logging is halted.

.xamples:

1) Command logging of status dumps at ten second intervals:

F 8 = 0 1 EX on the front panel
F 8 = 0 1 CR on a data terminal

2) Command logging of status dumps at 600 sec. or 10 minute intervals:

F 8 = 6 0 EX on the front panel
F 8 = 6 0 CR on a data terminal

3) Command periodc logging of status to halt:

F 8 = EX or F 8 = 0 EX on the front panel
F 8 = CR or F 8 = 0 CR on a data terminal

3.2.4.6.10 FUNCTION NINE

F 9 EX on the front panel
F 9 CR on the data terminal

.o assignment for this command.

.OTE: Functions ten thru sixteen are only applicable with the optional Calendar-Clock circuit card. (See 1.2.3.5).

3.2.4.6.11 FUNCTION TEN = SET YEAR

F 1 0 = Na Nb EX on the front panel
F 1 0 = Na Nb CR on a data terminal

.ters the calendar year into memory for later calendar-clock entry using . 1 6 EX or F 1 6 CR. Na Nb is a two digit decimal number corresponding . year i. e. Na Nb = 82 for 1982, Na Nb = 83 for 1983, etc.

3.2.4.6.12 FUNCTION ELEVEN = SET MONTH

F 1 1 = Na Nb EX on the front panel
F 1 1 = Na Nb CR on a data terminal

Enters the calendar month into memory for later calendar-clock entry using F 1 6 EX or F 1 6 CR. Na Nb is a two digit decimal number corresponding to month. Na Nb = 1 for January, Na Nb = 7 for July, Na Nb = 11 for November, etc.

3.2.4.6.13 FUNCTION TWELVE = SET DAY OF MONTH

F 1 2 = Na Nb EX on the front panel
F 1 2 = Na Nb CR on a data terminal

Enters the calendar day into memory for later calendar-clock entry using F 1 6 EX or F 1 6 CR. Na Nb is a two digit decimal number corresponding to day. Na Nb = 15 for Feb. 15th, Sept. 15th, etc.

3.2.4.6.14 FUNCTION THIRTEEN = SET DAY OF WEEK

F 1 3 = Na EX on the front panel
F 1 3 = Na CR on a data terminal

Enters number Na into memory for later calendar-clock entry using F 1 6 EX or F 1 6 CR. Na is a single digit number corresponding to the day of the week. Na = 1 for Sunday, Na = 2 for Monday, etc.

3.2.4.6.15 FUNCTION FOURTEEN = SET HOUR

F 1 4 = Na Nb EX on the front panel
F 1 4 = Na Nb CR on a data terminal

Enters a number Na Nb into memory for later calendar-clock entry using F 1 6 EX or F 1 6 CR. Na Nb is a two digit decimal number corresponding to the hour-of-the-day on a 24-hour clock basis. Na Nb = 3 for 3 AM, Na Nb = 18 for 6 PM, etc.

3.2.4.6.16 FUNCTION FIFTEEN = SET MINUTE

F 1 5 = Na Nb EX on the front panel
F 1 5 = Na Nb CR on a data terminal

Enters a number Na Nb into memory for later calendar-clock entry using F 1 6 EX or F 1 6 CR. Na Nb is a two digit decimal number corresponding to the minute-of-the-hour. Na Nb = 15 for 01:15 hours (1:15 AM), for 22:15 hours (10:15 PM), etc.

3.2.4.6.17 FUNCTION SIXTEEN = START CLOCK

F 1 6 EX on the front panel
F 1 6 CR on a data terminal

Enters all of the information previously stored in memory by functions F10 thru F15 into the calendar-clock. See 3.2.4.6.11 thru 3.2.4.6.16)

Example:

Setting the calendar-clock to 12:30:00 PM, Wednesday, June 23, 1982:

F 1 0 = 8 2 EX	or	F 1 0 = 8 2 CR	Set 1982
F 1 1 = 6 EX	or	F 1 1 = 6 CR	Set June
F 1 2 = 2 3 EX	or	F 1 2 = 2 3 CR	Set 23rd
F 1 3 = 4 EX	or	F 1 3 = 4 CR	Set Wednesday
F 1 4 = 1 2 EX	or	F 1 4 = 1 2 CR	Set 12 hours
F 1 5 = 3 0 EX	or	F 1 5 = 3 0 CR	Set 30 minutes

Enter F 1 6 and stop <u>entering</u>!

At precisely 12:30:00 PM on Wednesday, June 23, 1982 press EX or CR to correctly set the calendar-clock.

FIGURE 16. TYPICAL HARD-COPY OF STATUS DUMP USING CALENDAR-CLOCK CIRCUIT CARD

*F0

82/01/14 16:19:07

UNIT	TYPE	VSET	VTRU	ITRU	VLIM	ILIM	OVLD	TRIP
04	205A-20	05.00	05.00	0.012	21.00	1.050	NO	NO
05	205A-20	15.00	00.00	0.000	21.00	1.050	NO	YES
10	B3N	3.000	2.998	0.000	3.150	3.150	NO	NO
11	B3N	3.000	3.002	0.012	3.150	3.150	NO	NO
12	B3P	2.950	2.953	0.000	3.150	3.150	NO	NO
13	B3P	0.500	0.499	0.003	3.150	3.150	NO	NO
16	205A-50	10.00	10.00	00.00	52.50	00.31	NO	NO
17	205A-50	50.00	00.00	00.00	52.50	00.31	NO	YES

On January 14, 1982 at 16 hrs. 19 min. 7 sec., this status dump was taken:

Units 4 and 5 are a 205A-20 B-PAC, one output set to 5kV the other set to 15kV. Unit 4 is not tripped and its voltmeter reads back 5kV. Unit 5 is tripped and its voltmeter reads back zero.

Units 10 and 11 are a B3N B-MOD, both outputs set to 3kV. Neither unit is tripped, so true-voltage readings of 2.998kV and 3.002kV are obtained.

Units 12 and 13 are a B3P B-MOD, one output set to 2.95kV the other set to 500 volts. Neither unit is tripped, so true-voltage readings of 2.953kV and 499 volts are obtained.

Units 16 and 17 are 205A-50 B-PAC, one output set to 10kV, the other set to 50kV. Unit 16 is not tripped and its voltmeter reads back 10kV. Unit 17 is tripped and its voltmeter reads back zero.

All other slots or unit positions are vacant.

3.2.5 ERROR MESSAGES

Incorrect command entry sequences will be rejected by the B-COMP and will result in the display of the appropriate error message via the RS232C port.

3.2.5.1 ERROR ZERO = INVALID COMMAND SEQUENCE

Invalid command sequences will be automatically rejected by the B-COMP. The front panel will display Er00 and a remote data terminal will display ERØØ.

3.2.5.1.1 USE IN COMMAND ESCAPE

It is possible to escape from inadvertant entry of valid but unwanted commands by using deliberate invalid sequences.

Inadvertant entry of I, H or X (any of which when executed materially changes the system status) can be escaped from by further entry of any B-COMP recognized character to produce an invalid command sequence (I followed by I, I followed by X, X followed by H, etc.) No action will be taken on the entered commands except for issuance of the error message.

3.2.5.2 ERROR ONE = INVALID UNIT NUMBER

Valid unit numbers are within the range of zero to 32. Entry of a two-digit unit number greater than 32 will be rejected with a front panel of Er01 and a remote data terminal display of ERØ1.

Appendix

A1. IEEE 488 Programming Example

A simple IEEE 488 system is shown in Figure A1. The controller is a model 1720A by John Fluke Mfg. Co., Inc. The data terminal and the line printer are standard.

The B-HiVE is controllable from either the 1720A or the data terminal, so the user should be careful not to issue commands from them simultaneously. A second line printer could be used in place of the data terminal for hard copy logging of B-HiVE activity.

Figure A2 is a sample program written in BASIC for the 1720A. It illustrates a few programming possiblities using string manipulation. Some changes might be necessary for transfer to another type computer. Note in line 800 the expression CHR$(44). Character-string number forty-four is the comma (see any ASCII chart), but the 1720A will not accept a "comma" as part of a string to be transmitted on the IEEE 488 bus. No other seemingly odd programming requirements have been discovered as of this writing, but the user may take a caveat from this example.

The illustrated program gives B-HiVE control via IEEE 488 as follows:

1) The 1720A requests user entry of a B-HiVE command to be entered via the 1720A keyboard.
2) After entry, the 1720A sends and the B-HiVE receives and acts upon the command. The 1720A displays the issued command on its own CRT plus appropriate remarks for the user's reference.
3) The 1720A then requests the next user entry of a B-HiVE command.

Figure A3 is a hard copy log taken from KB1 of the 1720A.

GPIB software is required within the B-HiVE for use with the BERTAN B-488 board. The GPIB or the non-GPIB software is installed at the factory depending on the presence or absence of the B-488 option. Retrofit of the B-488 into an existing non-GPIB B-HiVE also requires software retrofit. Consult factory for details.

Figure A1: Sample Configuration for B-HiVE Control Via IEEE488 Using Fluke 1720A Controller.

(See attached sample program in Fluke BASIC and operation log.)

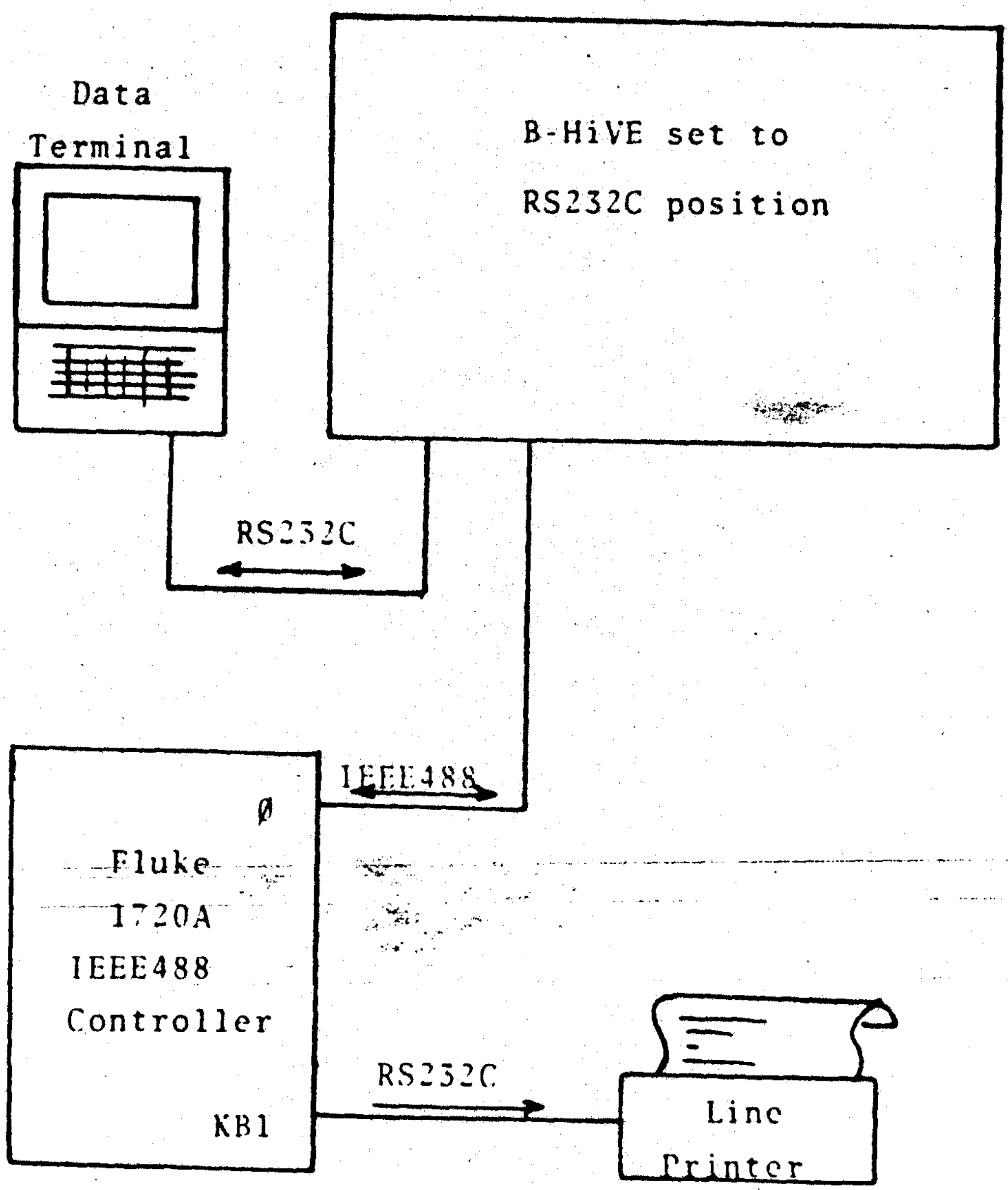


Figure A3. Sample Hard Copy Log from 1720A.

```
ENTER B-HIVE COMMAND?
*U32.  GLOBAL ADDRESS

ENTER B-HIVE COMMAND?
*EV2. = VOLTAGE ENTRY

ENTER B-HIVE COMMAND?
*S GLOBAL STATUS DISPLAY OUTPUTTED VIA B-HIVE RS232C.

ENTER B-HIVE COMMAND?
*GROUP WHAT IS THE FIRST UNIT? U9
WHAT IS THE LAST UNIT? U17
GROUP ADDRESS = U9,U17.

ENTER B-HIVE COMMAND?
*LV2.95 = LIMIT ENTRY

ENTER B-HIVE COMMAND?
*SU STATUS OF UNITS LAST ADDRESSED OUTPUTTED VIA B-HIVE RS232C.

ENTER B-HIVE COMMAND?
*I B-HIVE HAS BEEN INITIALIZED.

ENTER B-HIVE COMMAND?
*LV2.496 = LIMIT ENTRY

ENTER B-HIVE COMMAND?
*EV2.1 = VOLTAGE ENTRY

ENTER B-HIVE COMMAND?
*H

ENTER B-HIVE COMMAND?
*S GLOBAL STATUS DISPLAY OUTPUTTED VIA B-HIVE RS232C.

ENTER B-HIVE COMMAND?
*X

ENTER B-HIVE COMMAND?
```

A2. B-PAC and 205A/210 Matched-Set Calibration Procedure

Procedure for obtaining matched-set performance between 205A/210 B-PAC's and 205A/210 high voltage supplies.

Factory adjustments of 205A/210 supplies and B-PAC's provide complete interchangeability of identical models of each for operation with BERTAN specified accuracies. Enhanced accuracy is possible if a particular 205A/210 is to be controlled by a particular B-PAC. The following steps produce matched-set performance for optimized accuracy.

Note: If the 205A/210, which has been matched to a particular B-PAC output, is moved to the other output of any other B-PAC, the matched-set accuracy will be lost. Furthermore, the B-PAC output of the former matched-set should either be re-calibrated for matched-set performance with another high voltage supply of the same model, or be re-calibrated for the original complete interchangeability.

1. Remove all B-MCD's and B-PAC's from the main frame. Install the B-PAC to be adjusted in the Unit 30, 31 slot (nearest slot to the rear panel connectors).

2. Connect a B-PAC interface cable between J1 of the B-PAC (or J2) and the remote control connector on the rear of the 205A/210.

3. Terminate the 205A/210 high voltage properly to avoid possible arc-over at the maximum voltage (which will be applied).

4. Place the 205A/210 into local control mode with the switch on the 205A/210 rear panel. Apply AC power to the B-HiVE and to the 205A/210.

5. Using the B-HiVE front panel, issue the commands: F2 EX U3Ø.

   or

   Using a remote data terminal via RS232C, issue the commands = F2 CR U3Ø.

Note: Unit 30 refers to B-PAC output J1. Use U31 for B-PAC output J2.

6. Use the 205A/210 front panel controls to program for full-scale output voltage. This will be referred to herein as VSET.

7. Repeatedly issue B-HiVE command V to obtain values of VTRU and adjust R104 (for J1) or R204 (for J2) to make VTRU equal to VSET above.

8. Use the 205A/210 controls to program for zero output voltage. Place the 205A/210 in remote control mode using the switch on the 205A/210 rear panel.

9. Using the B-HiVE front panel, issue the following commands:

   U 3Ø. EV N_1N_2. EX (for J1)

   U 31. EV N_1N_2. EX (for J2)

   OR

   Using a remote data terminal via RS232C issue the following commands:

   U3Ø. EV N_1N_2. CR (for J1)

   U31. EV N_1N_2. CR (for J2)

   N_1N_2 is the two digit decimal value of full-scale 205A/210 output voltage = VSET.