1. INTRODUCTION

CONGRATULATIONS on your 3 phase HP Series 6 SCR control purchase. You have purchased a state of the art DC motor control that has a very wide range of industrial system uses. Although small in size, approx. 14" x 14" but slightly larger overall on controls that use a fan for cooling, the control is available up thru 40HP at 460 volts input. This compact size is made possible through the use of isolated base mounted power cubes in the 6 SCR power section. In addition, dynamic braking, when supplied, is accomplished through Solid State techniques, not the usual DC armature loop contacts. This enables even those controls (BHP Series) that do not have an armature contactor to be capable of being supplied with the optional dynamic braking package. Your control has been designed to give many years of trouble –free performance.

2. GENERAL FEATURES

The HP Series is a family of open chassis three phase controls that have tremendous flexibility due to the modular building blocks concept used in designing and building this series of controls. The control can be essentially custom designed for the applications through the usage of the many predesigned options. The HP Series of controls are broken down into three major categories:

a) The BHP Series b) The FHP Series c) The RHP Series

The differences between these major groups is explained in Section 3. The features that are common to all groups are discussed in the following paragraphs.

The HP Series control in its simplest form (BHP type control) consists of the following four basic building blocks: 1) The Power Board, b) The Command Board, c) The Field Supply and RC Snubber Board, and d) The 6 SCR Armature Output Power Bridge.

2.1 The Power Board (E1537 PC Board)

The power board generates the necessary 12 volt power supplied for proper operation of the control. The power supplies are generated through the use of (3) single phase transformers connected in a delta primary configuration. Since the HP Series of controls has an isolated signal common due to armature voltage and armature current feedback isolators, it is necessary to generate both ± 12V "Hot" power supplies. The three
circuit board transformers also feed the digital ramp generators for detection of the sine wave zero crossing. All HP Series controls use a voltage to frequency converter and 3 electronic decade counters to implement digital firing control. Digital firing eliminates the need for adjustment potentiometers to balance the three phase firing. (The firing point is dictated by a 0 to -6 volt firing signal from the E1537 command board.) The output from the firing circuitry is amplified by Darlington

power transistors, Q5 to Q10, and then the signal to fire is sent through pulse transformers T6 to T11 to the gates of the SCRs.

In addition to the power supplies and gate firing circuitry, the E1537 "Power Board" contains the differential input armature voltage signal isolator, the armature current signal isolator, the instantaneous overcurrent trip detector and dynamic braking circuitry. It is because of the armature voltage and armature current signal isolators that the signal common of the control is not electrically hot in respect to the AC input lines. This enables the signal common to be connected to earth ground if required.

2.2 The Command Board (E1538 PC Board)

The command board dictates the actual firing point of the SCR's. This board is tied in to the Power Board by means of connector J203. Two control loops operating independently, in parallel, continuously monitor the Speed and Torque of the DC motor. Normally, the Torque loop stands idly by on the side monitoring the current while the speed loop controls the firing to maintain the speed as set by the speed potentiometer. When motor currents exceed the maximum amount permitted as set by the "Torque Limit" potentiometer (adjustable from 0 to 200%), the torque loop assumes command of the SCR firing. Speed will drop as required, even all the way to zero if necessary, in order to keep the armature current from exceeding the maximum permissible set value. When the load on the motor is relieved, the speed loop will again take charge and the motor will return to the proper speed as set at the speed input terminal (201TB-13).

This board also contains the Accel/Decel circuitry that dictates the rate at which motor speed will change for an input speed change. Lastly, this board also contains the logic that will not permit the drive to start if conditions are not right or will shut the control off if an abnormal condition is sensed. A Phase Loss and Low Line detector and an Instantaneous Overcurrent Trip detector (IOT) will automatically shut down the control and will give an indication of this problem by means of an LED. Anti-Plug circuitry locks out the drive from running in either direction until zero speed is reached.

2.3 The Field Supply and RC Snubber Board (E1539 PC Board)

This circuit board furnishes the proper field voltage. In addition, RC snubbers which are mounted on this board are connected between anode and cathode of the SCR's to protect against dv/dt (misfiring problems).

2.4 6 SCR Power Bridge

The power section contains (6) SCR's wired in a 3 phase full wave bridge connection. This power section consists of (3) power modules. Each module contains (2) SCR's. (A fourth power module is supplied with the control when the control is equipped with dynamic braking.)

3. DRIVE CONFIGURATIONS

As mentioned earlier, there are three major groups of HP Series controls. The three major groups are: BHP, FHP, and RHP. These terms are explained following. It is important that they be understood because these terms will be often mentioned throughout the remainder of this manual.

3.1 BHP - Basic HP Control

BHP is a unidirectional control without an armature disconnect contactor. With this control, the motor is always connected to the output of the power bridge. In this configuration of control, power to the motor is cut off by inhibiting the firing circuit from firing the SCR's.

3.2 FHP – Forward HP Control

FHP is a unidirectional control with an armature disconnect contactor (FCON). The motor is only connected to the control when actually running. Contactor electronic timing networks are provided in the control such that the contactors physically disengage the motor from the bridge only after the SCR's have stopped firing. This eliminates arcing in the contactors.

3.3 RHP - Reversing HP Control

RHP is a bi-directional reversing control with forward (FCON) and reverse (RCON) contactors. Dynamic braking is a standard feature on all RHP units. The output from the 6 SCR power section is unidirectional, but by wiring the RCON reversing contactor in the opposite sense from FCON, the forward contactor, the voltage to the armature of the motor can be reversed. This will enable the motor to run in two directions. Because of contactor electronic timing circuits, contactor arcing is minimized in a similar fashion as explained for FHP controls.

4. DESCRIPTION

4.1 Nameplate Explanation

The nameplate is the primary identifier for factory service, replacement, and reorder purposes. Complete identification is normally provided by the model number and the option codes listed in the block below the "Family" block. However, if the notation "SPEC" follows the model number, the number in the "MOS" block is also required. The "Part No." block is for insertion of a user part number, if applicable. For further explanation of the entries, refer to the illustration below and Tables 1, 2, & 3.

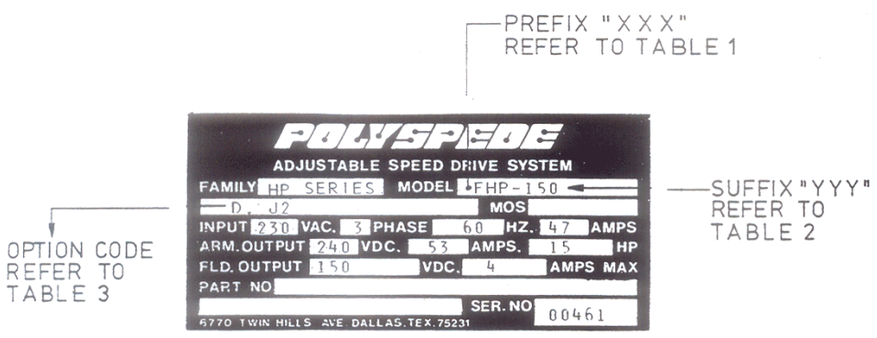


FIGURE 1
SAMPLE NAMEPLATE

TABLE 1
CONTROL "XXX" PREFIX LETTERS WITH DESCRIPTION

MODEL NO. PREFIX "XXX"	DESCRIPTION OF DRIVES
BHP	BASIC SYSTEMS CONTROL, UNIDIRECTIONAL, WITHOUT AN ARMATURE CONTACTOR
FHP	FORWARD SYSTEMS CONTROL, UNIDIRECTIONAL, WITH ONE FORWARD CONTACTOR
RHP	REVERSING SYSTEMS CONTROL, BI-DIRECTIONAL, FORWARD AND REVERSING CONTACTORS AND DYNAMIC BRAKING

TABLE 2
CONTROL "YYY" SUFFIX NUMBERS WITH ELECTRICAL SPECIFICATIONS

MODEL NO. SUFFIX "YYY"	INPUT		ARMATURE OUTPUT			*FIELD OUTPUT	
	VAC (RMS)	AMPS (RMS)	VDC	AMPS DC	HP	VDC	AMPS DC (MAX)
-15	230	5	240	6	1 1/2	150	4
-20	230	7	240	8.0	2	150	4
-30	230	12	240	13	3	150	4
-50	230	17	240	18	5	150	4
-75	230	26	240	28	7 1/2	150	4
-100	230	34	240	37	10	150	4
-150	230	47	240	53	15	150	4
-200	230	62	240	70	20	150	4
-31	460	5.5	500	6.5	3	300	4
-51	460	8.5	500	8.9	5	300	4
-76	460	12	500	13	7 1/2	300	4
-101	460	17	500	18	10	300	4
-151	460	23	500	26	15	300	4
-201	460	31	500	35	20	300	4
-251	460	38	500	43	25	300	4
-301	460	44	500	50	30	300	4
-401	460	56	500	65	40	300	4

* - AN OPTIONAL 240V FIELD SUPPLY IS AVAILABLE ON 230 VOLT CONTROLS

TABLE 3
STANDARD OPTIONS AND MODIFICATIONS

STANDARD OPTION & MODIFICATIONS		OPTION CODE	CORRESPONDING MANUAL SECT.	CIRCUIT BD SUPPLIED W/ OPTION
Solid State Dynamic Braking		D	9.1	Modify E1537
Field Econimizing		FE	9.8	Modify E1539
External Signal Follower	1-5MA	SF1	9.12	E1542-022
	4-20MA	SF2	9.12	E1542-023
	10-50MA	SF3	9.12	E1542-024
	0-6V	SF4	9.12	E1542-011
	0-10V	SF4	9.12	E1542-011
Armature Voltage Follower	0-90V	VF1	9.13	E1543-06
	0-180V	VF1	9.13	E1543-06
	0-240V	VF1	9.13	E1543-06
	0-500V	VF2	9.13	E1543-07
Tachometer Follower (Max input)	6-20VDC	TF1	9.13	E1543-01
	20-65VDC	TF2	9.13	E1543-02
	65-200VDC	TF3	9.13	E1543-03
	25-75VAC	TF2	9.13	E1543-02
	75-230VAC	TF3	9.13	E1543-03
Tachometer Feedback	1750RPM (non-rev)	T2	9.4	Modify E1538
	2400RPM (non-rev)	T3	9.4	Modify E1538
50V/1000 Tach	1750RPM (reversing)	TR2	9.4	Modify E1538
	2400RPM (reversing)	TR3	9.4	Modify E1538
External Torque Programming		ETP	9.5	Modify E1538
Auto Reversing (RHP controls only)		AR	9.6	Modify E1538
Jog Speed		J2	9.3	E1534-02
Preset Speeds		PS0	9.2	E1532-07
		PS3	9.2	E1532-31
		PS4	9.2	E1532-40
		PS6	9.2	E1532-61
		PS7	9.2	E1532-70
Inverse Timed Shutdown		ITS	9.10	E1541-00

TABLE 3 (CON'T)

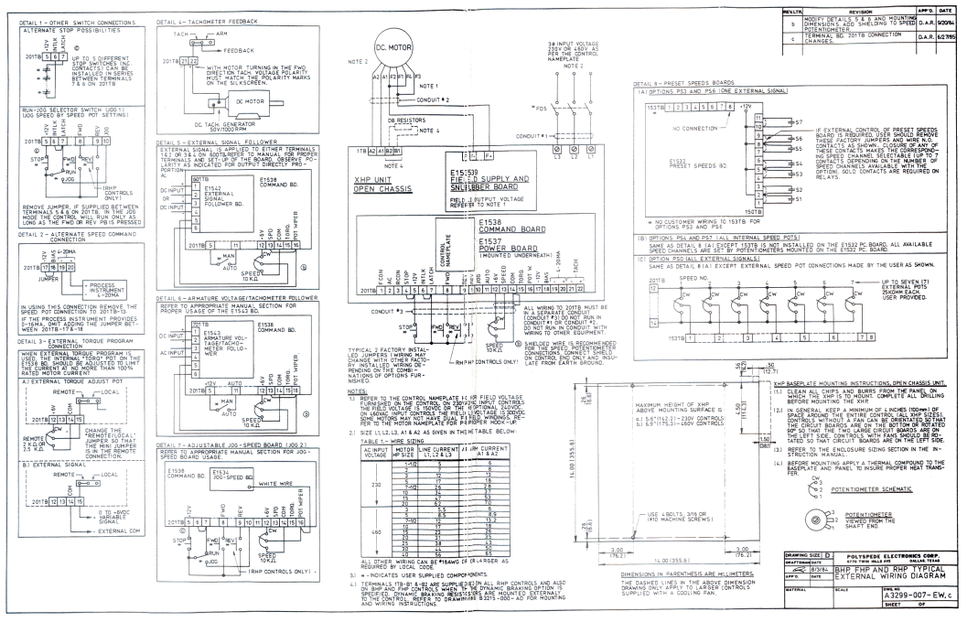
STANDARD OPTION & MODIFICATIONS	OPTION CODE	CORRESPONDING MANUAL SECT.	CIRCUIT BD SUPPLIED W/ OPTION
Field Loss 150VFLD Protection 240VFLD 300VFLD	FL1 FL2 FL3	9.11 9.11 9.11	E1540-01 E1540-02 E1540-03
Change to 50Hz	"50" typed in Hz block	9.7	Modify E1537
Change to 240V Field (230V cont. only)	"240" typed in "FLD" block	9.9	Supply E1539-02 Bd

Note : Some options are mutually exclusive of other options, and some options are not compatible with all control models. Refer to appropriate section in manual for details on each option.

4.2 HP SERIES SPECIFICATIONS (ALL MODELS)

Input Voltage (three phase) ……..	230 VAC ± 20 volts (230V models) 460VAC ± 40 volts (460V models)
Input Frequency.....……..	60 Hz (50 Hz optional)
Output voltage:	
a) To armature (rectified & unfiltered)……	0-240VDC (230V models) 0-500VDC (460V models)
b) To field (rectified & unfiltered)……	150VDC (230V models) (240VDC field optional) or 300VDC (460V models) unregulated, 4 amps max
Maximum ambient temperature, SC unit mounted in proper size sealed enclosure (see Section 6)……	40C
Maximum allowable temperature of air in user's cabinet	
a) With in-cabinet fan ……	65C
b) With no cabinet fan ……	55C (below uppermost HP unit in multiple control enclosures)

Overload capability for 1 minute…….	150% of rated current
Load regulation for 95% load change:	
a) With armature feedback ……..	adjustable to ± 1% of base speed
b) With tachometer feedback …….	± .1% of base speed typical
Line regulation (speed change for ± 20VAC line voltage change in 230V models and for ± 40VAC change in 460V models):	
a) Any motor and tachometer feedback……..	± .1% of base speed
b) Shunt field motor and armature feedback…..	± 2 to 8% of set speed (depends on motor)
Speed change with temperature, 25C, to max operating temperature:	
a) Due to control unit ……..	Typically less than 1% of base speed
b) Due to motor or tachometer…….	Varies with motor or tachometer design and tach mounting method
Speed range …….	0 to 100%
Speed range for specified regulation ……	20 :1
Speed program voltage (voltage on lug 13 with respect to lug 14 of 100TB) to produce zero to100% speed …….	0 to +6VDC
Torque program voltage (voltage on lug 15 with respect to lug 14 of 100 TB) to produce zero to preset max torque limit ……	0 to +6VDC
Acceleration & deceleration times……. (zero to 100% base speed)	Linear .6 to 28 seconds independently adjustable
Torque limit…… (% of rated motor current)	Approx. 75 to 150% adjustable


DETAIL 1 – OTHER SWITCH CONNECTIONS
ALTERNATE STOP POSSIBILITIES
UP TO 5 DIFFERENT START SWITCHES (NO CONTACTS) MAY BE INSTALLED IN SERIES BETWEEN TERMINALS 7 & 8 ON 2017B
RUN-JOG SELECTOR SWITCH (JOG = 1 JOG SPEED BY SPEED POT SETTING)
REMOVE JUMPER IF SUPPLIED BETWEEN TERMINALS 5 & 6 ON 2017B. IN THE JOG MODE THE CONTROL WILL RUN ONLY AS LONG AS THE FWD OR REV PB IS PRESSED
DETAIL 2 – ALTERNATE SPEED COMMAND CONNECTION
IN USING THIS CONNECTION REMOVE THE JUMPER BETWEEN TERMINALS 10 AND 11 OF 2017B.
IF THE PROCESS INSTRUMENT PROVIDES 0–10VDC, REMOVE THE JUMPER BETWEEN 2017B–17 & –18
DETAIL 3 – EXTERNAL TORQUE PROGRAM CONNECTION
WHEN EXTERNAL TORQUE PROGRAM IS USED, THE INTERNAL TORQ POT ON THE E1538 BD. SHOULD BE ADJUSTED TO LIMIT MOTOR CURRENT TO NOT MORE THAN 100% RATED MOTOR CURRENT.
A) EXTERNAL TORQUE ADJUST POT
CHANGE THE "REMOTE/LOCAL" JUMPER SO THAT THE MINI JUMPER IS ON THE "REMOTE" CONNECTION.
B) EXTERNAL SIGNAL
0 TO +8VDC VARIABLE SIGNAL
DETAIL 4 – TACHOMETER FEEDBACK
WITH MOTOR TURNING IN THE FWD DIRECTION TACH VOLTAGE POLARITY MUST MATCH THE POLARITY MARKS ON THE SILKSCREEN.
DC TACH. GENERATOR 50V/1000RPM
DETAIL 5 – EXTERNAL SIGNAL FOLLOWER
EXTERNAL SIGNAL IS APPLIED TO EITHER TERMINALS 1 & 3 OR 3 & 4 ON 2007B.REFER TO MANUAL FOR PROPER TERMINALS AND SETUP OF THE BOARD. OBSERVE POLARITY AS INDICATED FOR OUTPUT DIRECTLY PROPORTIONAL TO
DC INPUT
OR
DC INPUT
AC INPUT
E1543 EXTERNAL SIGNAL FOLLOWER BD.
E1534 COMMAND BD.
SPEED 10 KΩ
DETAIL 6 – ARMATURE VOLTAGE/TACHOMETER FOLLOWER
REFER TO APPROPRIATE MANUAL SECTION FOR PROPER USAGE OF THE E1543 BD.
AC INPUT
E1543 ARMATURE VOLTAGE/TACHOMETER FOLLOWER BD.
E1538 COMMAND BD.
SPEED 10 KΩ
DETAIL 7 – ADJUSTABLE JOG–SPEED BOARD (JOG 2)
REFER TO APPROPRIATE MANUAL SECTION FOR JOG–SPEED BOARD USAGE
E1538 COMMAND BD.
E1534 JOG–SPEED BD.
WHITE WIRE
SPEED 10 KΩ
(RHP CONTROLS ONLY)
DC MOTOR
NOTE 2
NOTE 1
CONDUIT #2
OR RESISTORS
NOTE 4
NOTE 4
XHP UNIT OPEN CHASSIS
E1533 SCR SUPPLY AND SNUBBER BOARD
FIELD OUTPUT VOLTAGE REFER TO NOTE 1
E1538 COMMAND BOARD
E1537 POWER BOARD
(MOUNTED UNDERNEATH)
CONDUIT #3
CONDUIT #1
3Φ INPUT VOLTAGE 230V OR 460V AS REQUIRED BY CONTROL NAMEPLATE
NOTE 1
* FDS
ALL WIRING TO 2017B MUST BE ROUTED THROUGH CONDUIT #3 (DO NOT RUN IN CONDUIT #1 OR CONDUIT #2). DO NOT RUN CONDUIT WITH WIRING TO OTHER EQUIPMENT.
SHIELDED WIRE IS RECOMMENDED FOR ALL SPEED POT CONNECTIONS. CONNECT SHIELD ON CONTROL END ONLY AND INSULATE FROM EARTH GROUND.
TYPICAL 7 FACTORY INSTALLED OPTIONS SHOWN. USAGE WITH OTHER FACTORY INSTALLED WIRING OR REWIRING OF THE COMBINATIONS OF OPTIONS FURNISHED.
NOTES:
1) REFER TO THE CONTROL NAMEPLATE IF AC FIELD VOLTAGE THROUGH 3Φ SCR CONTROL OR SINGLE PHASE INPUT CONTROL. RECTIFIED VOLTAGE IS 100VDC OR 170V IF OPTIONAL 230VDC.
2) USE ON LINE INPUT CONTROLS THE FIELD VOLTAGE IS 200VDC. SOME MOTORS MAY NOT HAVE DUAL FIELD WINDINGS. REFER TO THE MOTOR NAMEPLATE FOR PROPER HOOK-UP.
2.1 SIZE L1,L2,L3, AT & A2 AS GIVEN IN THE METABLE BELOW:
TABLE I – WIRE SIZING
AC INPUT VOLTAGE | MOTOR HP SIZE | LINE CURRENT L1,L2 & L3 | J3 JUMPER CURRENT AT & A2
230 | 1–HP | 5 | 6
230 | 2 | 10 | 12
230 | 3 | 15 | 18
230 | 5 | 25 | 30
230 | 7½ | 35 | 42
230 | 10 | 45 | 54
230 | 15 | 67 | 80
230 | 20 | 82 | 98
460 | 1 | 2.5 | 3
460 | 2 | 5.5 | 6.6
460 | 3 | 8 | 9.6
460 | 5 | 12 | 14.4
460 | 7½ | 17 | 20
460 | 10 | 23 | 28
460 | 15 | 33 | 40
460 | 20 | 38 | 46
460 | 25 | 46 | 55
460 | 30 | 54 | 65
460 | 40 | 68 | 82
460 | 50 | 82 | 98
ALL OTHER WIRING CAN BE #16AWG OR LARGER AS REQUIRED BY LOCAL CODE.
3) ▪ – INDICATES USER SUPPLIED COMPONENTS.
4) TERMINALS 1TB–BY & –B1 ARE SUPPLIED ON ALL RHP CONTROLS AND ALSO ON 3HP AND 7½HP CONTROLS WHEN TH DYNAMIC BRAKING OPTION IS SPECIFIED. DYNAMIC BRAKING RESISTORS ARE MOUNTED EXTERNAL TO THE CONTROL. REFER TO DRAWING # 3215–000–AD FOR MOUNTING AND WIRING INSTRUCTIONS.
DETAIL 8 – PRESET SPEEDS BOARDS
(A) OPTIONS P03 AND P04 (ONE EXTERNAL SIGNAL)
NO CONNECTION
E1532 PRESET SPEEDS BD.
IF EXTERNAL CONTROL OR PRESET SPEEDS BOARD IS REQUIRED, USER SHOULD REMOVE THESE FACTORY JUMPERS AND WIRE N.O. CONTACTS AS SHOWN. CLOSING ONE OF CONTACTS AS TO MAKE YOUR COMMAND. ONLY ONE SPEED CHANNEL SELECTABLE (UP TO 7 CONTACTS) DEPENDING ON THE NUMBER OF SPEED CHANNELS AVAILABLE WITH THE OPTION. GOLD CONTACTS ARE REQUIRED ON RELAYS.
= NO CUSTOMER WIRING TO 1537B FOR OPTIONS P03 AND P04
(B) OPTIONS P05 AND P07 (ALL INTERNAL SPEED POTS)
SAME AS DETAIL 8 (A) EXCEPT 1537B IS NOT INSTALLED ON THE E1532 PC BOARD. ALL AVAILABLE SPEED CHANNELS ARE SET BY POTENTIOMETERS MOUNTED ON THE E1532 PC BOARD.
(C) OPTION P02 (ALL EXTERNAL SIGNALS)
SAME AS DETAIL 8 (A) EXCEPT EXTERNAL SPEED POT CONNECTIONS MADE BY THE USER AS SHOWN.
SPEED NO.
UP TO SEVEN (7) EXTERNAL POTS 2%OHM EACH. USER PROVIDED.
MAXIMUM HEIGHT OF XHP ABOVE MOUNTING SURFACE IS:
1) 5.5"(13.3) – 230V CONTROLS
2) 6.8"(17.3) – 460V CONTROLS
USE 4 BOLTS, 3/8 OR M10 MACHINE SCREWS)
DIMENSIONS IN PARENTHESIS ARE MILLIMETERS.
THE DASHED LINES IN THE ABOVE DIMENSION DRAWING ONLY APPLY TO LARGER CONTROLS SUPPLIED WITH A COOLING FAN.
XHP BASEPLATE MOUNTING INSTRUCTIONS, OPEN CHASSIS UNIT.
(1.) CLEAN ALL CHIPS AND BURRS FROM THE PANEL ON WHICH THE XHP IS MOUNTED. COMPLETE ALL DRILLING BEFORE MOUNTING THE XHP.
(2.) IN GENERAL, KEEP A MINIMUM OF 4 INCHES (100mm) OF SPACE AROUND THE ENTIRE CONTROL. FOR SIZE1 CONTROLS WITHOUT A FAN CAN BE OBERTATED SO THAT THE CIRCUIT BOARDS ARE ON THE RIGHT SIDE. FOR SIZE2 THE CIRCUIT BOARDS ARE ON THE LEFT SIDE. CONTROLS WITH FANS SHOULD BE MOUNTED SO THAT CIRCUIT BOARDS ARE ON THE LEFT SIDE.
(3.) REFER TO THE ENCLOSURE SIZING SECTION IN THE INSTRUCTION MANUAL.
(4.) BEFORE MOUNTING APPLY A THERMAL COMPOUND TO THE BASEPLATE AND PANEL TO INSURE PROPER HEAT TRANSFER.
POTENTIOMETER SCHEMATIC
POTENTIOMETER VIEWED FROM THE SHAFT END
REVISIONS
REV.LTR. | REVISION | APP'D. | DATE
1 | MODIFY DETAIL 1 & 7 PANEL MOUNTING DIMENSIONS ADD SHIELDING TO SPEED POTENTIOMETER | D.A.R. | 9/20/94
C | TERMINAL BD. 2017B CONNECTION CHANGES | D.A.R. | 6/2/95
DRAWING SIZE: D
MANUFACTURED BY: POLYSPEDE ELECTRONICS CORP. DALLAS, TEXAS
DRAWN: 8/2/94
APP'D.
DATE
MATERIAL
SCALE
XHP, FHP AND RHP TYPICAL EXTERNAL WIRING DIAGRAM
DWG.NO. A3299-007-EW, C
SHEET OF

Mounting centers, all models ……	8" x 13.5" (sym.) (4 holes, 7/32" diam)
a)1 1/2 HP thru 10 HP - 230V models ……	14.0"H x 14.0"W x 5.6"D
b) 15 HP & 20 HP – 230V models ……..	14.6H x 15.5"W x 5.6" D
c) 3HP thru 25 HP – 460V models ……..	14.0"H x 14.0"W x 6.9"D
d) 30HP & 40HP - 460V models…….	14.6"H x 15.5"W x 6.9"D

5. FUSES

WARNING

FUSES 1FU, 2FU, & 3FU IN HP UNITS ARE FAST ACTING RECTIFIER PROTECTION FUSES AND MUST NOT BE REPLACED WITH AN UNAPPROVED SUBSTITUTE. IF FUSE REPLACEMENT BECOMES NECESSARY, REPLACE ONLY WITH APPROPRIATE FUSES SPECIFIED IN TABLE 4.

TABLE 4
FUSE vs HP SPECIFICATIONS

CONTROL HP RATING	FUSES 1FU,2FU, & 3FU
1 1/2 thru 15HP (230V models) 3 thru 30HP (460V models)	INTERNATIONAL RECTIFIER SF50P70 or CHASE SHAWMUT A50P70 or BUSSMANN FWH70
20HP (230V) 40HP (460V)	INTERNATIONAL RECTIFIER SF50P100 or CHASE SHAWMUT A50P100 or BUSSMANN FWH100

6. ENCLOSURE SELECTION AND PLACEMENT

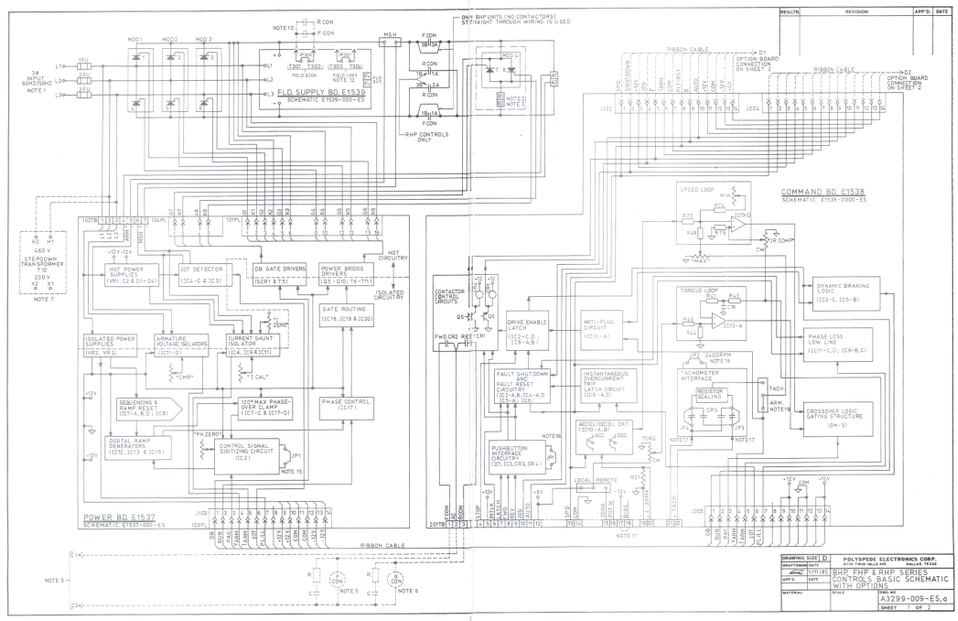
This section is intended as an aid to the customer in appropriately selecting a proper box size for mounting the HP Series controls. (Polyspede does offer as an option the HP Series controls mounted in an enclosure.)

The open chassis HP Series control can be mounted in the following suitable enclosures: Nema 1, Nema 12, or Nema 4. These enclosures are available from numerous manufacturers. Several HP units may be mounted in the same enclosure or the HP unit may be mounted in the same enclosure with other equipment. If mounted in an enclosure with other equipment or with other HP units, all notes on Drawing A3299-007-EW concerning routing and separation of wiring must be observed.

The enclosure selected must be of adequate size and design so that the temperature at critical points inside the enclosure does not rise above acceptable limits under worst case operating conditions.

A) Max air temp around circuit boards …… …….70C
B) Max power cube or power module base plate temp… ..95C

Table 5 gives box size guidelines when mounting one control by itself in a sealed Nema 4 or Nema 12 enclosure. The table assumes the maximum ambient temperature outside the enclosure is 40C and there are no other heat generating elements in the box. The box size for a Nema 1 enclosure can be considerably smaller in many cases because through the use of fans and/or louvers, the box can be ventilated to the surrounding environment. In addition, the table will point out if an additional internal cabinet fan is required for circulation of the air in the enclosure. The additional fan should have a 100CFM or higher rating.


FLD SUPPLY BD E1532
SCHEMATIC E1539-0000-ES
COMMAND BD E1538
SCHEMATIC E1539-0000-ES
POWER BD E1537
SCHEMATIC E1539-0000-ES
RIBBON CABLE
POLYSPEED ELECTRONICS CORP.
BHP PHP E RHP SERIES
CONTROLS BASIC SCHEMATIC
WITH OPTIONS
A3299-009-ES,a

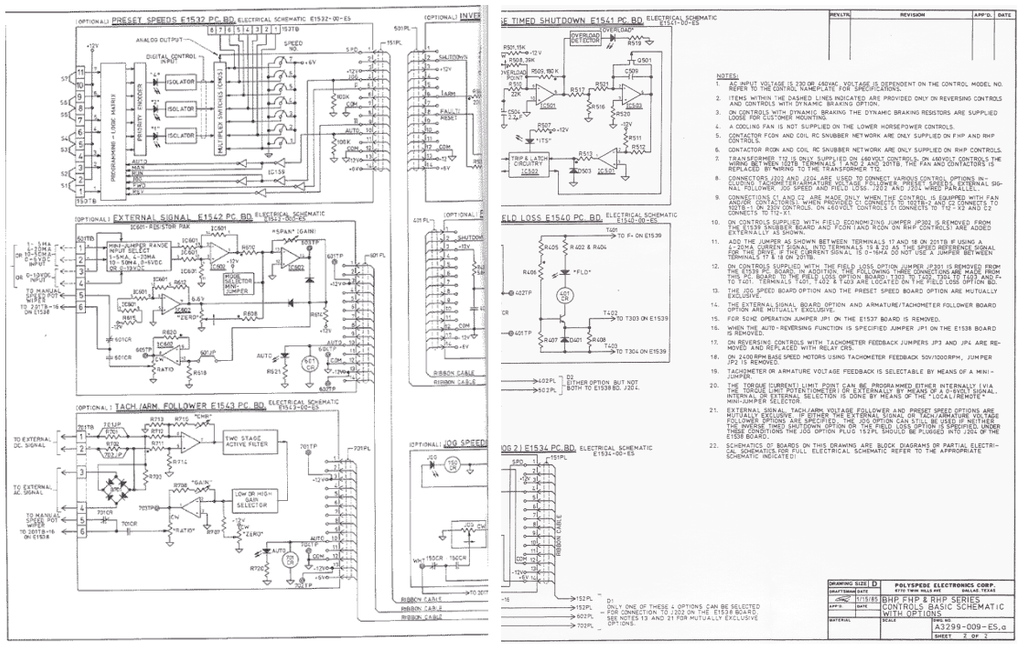

PRESET SPEEDS E1532 PC BD. ELECTRICAL SCHEMATIC E1532-00-ES
EXTERNAL SIGNAL E1542 PC BD. ELECTRICAL SCHEMATIC E1542-00-ES
TACH/ARM FOLLOWER E1543 PC BD. ELECTRICAL SCHEMATIC E1543-00-ES
E TIMED SHUTDOWN E1541 PC BD. ELECTRICAL SCHEMATIC E1541-00-ES
FLD LOSS E1540 PC BD. ELECTRICAL SCHEMATIC E1540-00-ES
OG 2 E1534 PC BD. ELECTRICAL SCHEMATIC E1534-00-ES
REVISION
APP'D.
DATE
NOTES:
1. AC INPUT VOLTAGE IS 230 OR 460VAC. VOLTAGE IS DEPENDENT ON THE CONTROL MODEL NO. REFER TO THE CONTROL NAMEPLATE FOR SPECIFICATIONS.
2. ITEMS WITHIN THE DASHED LINES INDICATED ARE PROVIDED ONLY ON REVERSING CONTROLS AND CONTROLS WITH DYNAMIC BRAKING OPTION.
3. ON CONTROLS WITH DYNAMIC BRAKING THE DYNAMIC BRAKING RESISTORS ARE SUPPLIED LOOSE FOR CUSTOMER MOUNTING.
4. A COOLING FAN IS NOT SUPPLIED ON THE LOWER HORSEPOWER CONTROLS.
5. CONTACTOR FCON AND COIL RC SNUBBER NETWORK ARE ONLY SUPPLIED ON FHP AND RHP CONTROLS.
6. CONTACTOR RCON AND COIL RC SNUBBER NETWORK ARE ONLY SUPPLIED ON RHP CONTROLS.
7. TRANSFORMER T10 IS ONLY SUPPLIED ON 460VOLT CONTROLS. ON 460VOLT CONTROLS THE WIRING BETWEEN TB1TB TERMINALS 1 AND 2 AND 201TB, THE FAN AND CONTACTORS IS REPLACED BY WIRING TO THE TRANSFORMER T10.
8. CONNECTORS J202 AND J204 ARE USED TO CONNECT VARIOUS CONTROL OPTIONS IN-CLUDING TACHOMETER/ARMATURE VOLTAGE FOLLOWER, PRESET SPEED, EXTERNAL SIG-NAL FOLLOWER, JOG SPEED AND FIELD LOSS. J202 AND J204 WIRED PARALLEL.
9. CONNECTIONS C1 AND C2 ARE MADE ONLY WHEN THE CONTROL IS EQUIPED WITH FAN AND/OR CONTACTOR(S). WHEN PROVIDED C1 CONNECTS TO 115TB-7 AND C2 CONNECTS TO 115TB-8. ON 460VOLT CONTROLS C1 CONNECTS TO T12-X2 AND C2 CONNECTS TO T12-X1.
10. ON CONTROLS SUPPLIED WITH FIELD ECONOMIZING JUMPER JP302 IS REMOVED FROM THE E1538 SNUBBER BOARD AND FCON (AND RCON ON RHP CONTROLS) ARE ADDED EXTERNALLY AS SHOWN.
11. ADD THE JUMPER AS SHOWN BETWEEN TERMINALS 17 AND 18 ON 201TB IF USING A 4-20MA CURRENT SIGNAL INTO TERMINALS 18 & 22 AS THE SPEED REFERENCE SIGNAL FOR THE DRIVE. IF THE CURRENT SIGNAL IS 0-10MA DO NOT USE A JUMPER BETWEEN TERMINALS 17 AND 18 ON 201TB.
12. ON CONTROLS SUPPLIED WITH THE FIELD LOSS OPTION JUMPER JP391 IS REMOVED FROM THE E1538 BOARD. IN ADDITION, THE FOLLOWING WIRE CONNECTIONS ARE MADE FROM THE E1538 BOARD TO THE FIELD LOSS OPTION BOARD: TERMINAL T401 TO T403, T402 TO T401. TERMINALS T401, T402 & T403 ARE LOCATED ON THE FIELD LOSS OPTION BD.
13. THE JOG SPEED BOARD OPTION AND THE PRESET SPEED BOARD OPTION ARE MUTUALLY EXCLUSIVE.
14. THE EXTERNAL SIGNAL BOARD OPTION AND ARMATURE/TACHOMETER FOLLOWER BOARD OPTION ARE MUTUALLY EXCLUSIVE.
15. FOR 50HZ OPERATION JUMPER JP1 ON THE E1537 BOARD IS REMOVED.
16. WHEN THE AUTO-REVERSING FUNCTION IS SPECIFIED JUMPER JP1 ON THE E1538 BOARD IS REMOVED.
17. ON REVERSING CONTROLS WITH TACHOMETER FEEDBACK JUMPERS JP3 AND JP4 ARE RE-MOVED AND REPLACED WITH RELAY CR5.
18. ON 2400 RPM BASE SPEED MOTORS USING TACHOMETER FEEDBACK 50V/1000RPM, JUMPER JP2 IS REMOVED.
19. TACHOMETER OR ARMATURE VOLTAGE FEEDBACK IS SELECTABLE BY MEANS OF A MINI-JUMPER.
20. THE TORQUE (CURRENT) LIMIT POINT CAN BE PROGRAMMED EITHER INTERNALLY (VIA POTENTIOMETER) OR EXTERNALLY BY MEANS OF A 0-10VDC SIGNAL. INTERNAL OR EXTERNAL SELECTION IS DONE BY MEANS OF THE "LOCAL/REMOTE" MINI-JUMPER SELECTOR.
21. EXTERNAL SIGNAL, TACH/ARM VOLTAGE FOLLOWER AND PRESET SPEED OPTIONS ARE MUTUALLY EXCLUSIVE. IF EITHER THE EXTERNAL SIGNAL OR TACH/ARMATURE VOLTAGE FOLLOWER OPTIONS ARE SPECIFIED, THE JOG OPTION CAN STILL BE USED IF NEITHER THE INVERSE TIMED SHUTDOWN OPTION OR THE FIELD LOSS OPTION IS SPECIFIED. UNDER THESE CONDITIONS THE JOG OPTION PLUG 152PL SHOULD BE PLUGGED INTO J204 OF THE E1538 BOARD.
22. SCHEMATICS OF BOARDS ON THIS DRAWING ARE BLOCK DIAGRAMS OR PARTIAL ELECTRI-CAL SCHEMATICS FOR FULL ELECTRICAL SCHEMATIC REFER TO THE APPROPRIATE SCHEMATIC INDICATED!
D1 ONLY ONE OF THESE 4 OPTIONS CAN BE SELECTED FOR CONNECTION TO J202 ON THE E1538 BOARD. SEE NOTES 13 AND 21 FOR MUTUALLY EXCLUSIVE OPTIONS.
D2 EITHER OPTION BUT NOT BOTH TO E1538 BD. J204.
DRAWING SIZE D
POLYSPEDE ELECTRONICS CORP.
DALLAS, TEXAS
11/13/85
BHP FHP & RHP SERIES CONTROLS BASIC SCHEMATIC WITH OPTIONS
A3299-009-ES.a
SHEET 2 OF 2

TABLE 5
ENCLOSURE BOX SIZE TABULATION
(Control is mounted on an enclosure sub-panel)

HP	INPUT VAC	RECOMMENDED ENCLOSURE SIZE H x W x D	ADDITIONAL CABINET FAN
1 1/2	230	24" x 20" x 8"	NO
2	230	24" x 20" x 8"	NO
3	230	24" x 20" x 8"	NO
5	230	24" x 20" x 8"	NO
7 1/2	230	24" x 20" x 8"	NO
10	230	30" x 24" x 8"	NO
15	230	30" x 24" x 8"	YES
20	230	36" x 30" x 8"	YES
3	460	24" x 20" x 8"	NO
5	460	24" x 20" x 8"	NO
7 1/2	460	24" x 20" x 8"	NO
10	460	24" x 20" x 8"	NO
15	460	24" x 20" x 8"	NO
20	460	30" x 24" x 8"	NO
25	460	30" x 24" x 8"	NO
30	460	30" x 24" x 8"	YES
40	460	36" x 30" x 8"	YES

The following figure is the recommended manner in which to mount the HP series control in order to get the maximum cooling efficiency. In addition, the approximate location of the cabinet internal fan, when required as given in Table 5, is shown in Figure 2.

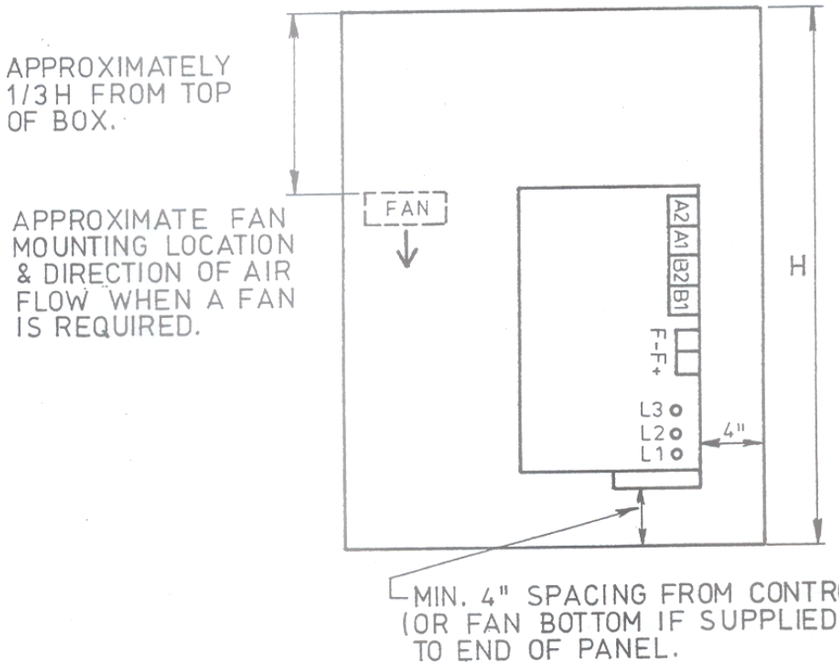


FIGURE 2

APPROXIMATE CONTROL MOUNTING POSITION IN AN ENCLOSURE

7. ADJUSTMENTS

Before leaving the factory, all HP controls are thoroughly tested to verify proper control performance. There are many adjustments in the control that are factory preset and need not be readjusted in the field. However, there are some adjustments that are temporarily set at the factory and may have to be readjusted somewhat in the field. After the factory and field adjustments are made, these adjustments are permanent and periodic readjustment is not necessary.

7.1 Adjustments on the E1537 PC Board

This section is applicable to all HP series controls.

The E1537 has 4 adjustment potentiometers. These potentiometers are: "CMR", "I ZERO", "I CAL", and "PHASE (ANGLE)ZERO". All four of these adjustments are factory adjustments and should not have to be reset in the field. The following explanation of each potentiometer is provided mainly for informational purposes.

A) "CMR" – (Common Mode Rejection)

This potentiometer equalizes the armature voltage differential op amp isolator gains. This in turn minimizes the common mode noise passed on to the output (IC11-D pin 14) of the differential op amp. This potentiometer is factory preset and should not need to be adjusted.

B) "I ZERO" – (Current Zero)

This potentiometer adjusts for zero at the output of the current signal isolator circuit, IC11 –C pin 8 in respect to the Iso common, with zero current flowing in the armature of the motor. This adjustment is factory preset and should not have to be readjusted.

C) "I CAL" - (Current Calibrate)

This potentiometer is adjusted so that at rated armature motor current, the output (IC11-C pin 8) of the armature current signal isolator circuit in respect to the Iso common is 1 volt. This potentiometer has been factory preset and should not have to be readjusted.

D) "PHASE (ANGLE) ZERO"

This potentiometer is adjusted so that with zero speed reference and with the "Min Speed" potentiometer (located on E1538 board) set to 25% of full rotation, the SCR's are just on the verge of firing. (Increasing the "Min" setting will cause armature voltage to appear.) This potentiometer has been factory preset and should not have to be readjusted.

7.2 Adjustments on the E1538 PC Board

The E1538 board contains several potentiometers. Many of these potentiometers can only have their final settings made in the field. All potentiometers have been checked at the factory as to their proper operation and a temporary setting has been made on the potentiometers following:

A) "ACC" - (Acceleration Time)
This potentiometer controls the rate of change in speed for a step

input in speed reference voltage. The acceleration time is adjustable from approximately .6 to 28 seconds in going from zero to top speed. (Zero to top speed corresponds to a zero to 6 volt speed reference.) The "Accel" potentiometer is normally set at the factory to its approximate mid point of rotation. This gives a 10 to 15 second acceleration time in going from zero to top speed. For longer acceleration time, turn the "Accel" potentiometer clockwise. For shorter acceleration time, turn this potentiometer counterclockwise.

B) "DEC" – (Deceleration Time)

This potentiometer controls the rate of change in speed for a step input decrease in speed reference voltage. The deceleration time is also adjustable from approximately .6 to 28 seconds in going from top to zero speed. The "Decel" potentiometer is normally set at the factory to its approximate midpoint of rotation. This gives a 10 to 15 second deceleration time in going from top to zero speed. For longer deceleration time, turn the "Decel" potentiometer clockwise. For shorter deceleration time, turn the potentiometer counterclockwise. (The deceleration time set must be longer than the coast down time of the motor to be effective.)

C) "IR" – (IR Speed Droop Compensation)

This adjustment controls load regulation (the amount of slowdown that occurs when the motor is loaded) when armature voltage feedback is utilized. Incorrect setting of the "IR" potentiometer will cause drive instability. Adjust the "IR" potentiometer as follows:

1. Tachometer Feedback Systems: Set the "IR" potentiometer fully counterclockwise.
2. Armature Voltage Feedback Systems: This includes all systems in which the "Tach/Arm" switch is left in the "Arm" position. Two methods of setting "IR" are given below. Select the method which is most convenient.

   a) Machine Loading Method - In this method, the speed of the motor being driven by the HP Series control should be monitored. Run at a slow speed and record the speed of the motor when unloaded. Now load the motor that is being driven by the HP Series control. (For example, if the machine driven is a conveyor, place a weight on the conveyor.) If the machine slows down when it is loaded, adjust the "IR" potentiometer clockwise and repeat the test. The "IR" potentiometer setting is correct when little or no slow down occurs as the machine is loaded. CAUTION - The machine should not speed up when it is loaded. If it does, the "IR" potentiometer is set too far clockwise. Too high an "IR" setting can cause drive instability at certain speeds and loading conditions.

b) Instability Method – If the machine loading method is impractical, operate the machine and turn the "IR" potentiometer clockwise until instability occurs. Turn the "IR" potentiometer slowly counterclockwise just until operation is again smooth. Turn the "IR" a little further counterclockwise (about 20% of the setting). This method gives the approximately correct setting.

D) "TORQUE LIMIT" – (Torque Limit)

This potentiometer adjusts the maximum amount of current that the motor can pull. The "Torque limit" potentiometer is capable of adjusting for a maximum current draw of 0 to 200% of rated current. Normally, unless specified differently when ordered, current limit is adjusted to limit current at 150% of rated current.

E) "MIN" – (Minimum Speed)

The "Min" speed potentiometer should be adjusted with the external reference (at 201TB-13 in respect to 201TB-14 common) set to zero volts. Rotate the "Min" potentiometer from the counterclockwise direction until the motor starts to rotate. Decrease the "Min" potentiometer slowly until the motor rotation stops.

F) "MAX" – (Maximum Speed)

The "Max" speed potentiometer calibrates the speed at which the motor will turn when full speed reference (+6VDC) is applied to the control. Normally, with maximum speed reference, the armature voltage is adjusted for 240VDC on 230V controls and 500VDC on 460V controls. The armature voltage maximum can be set for a lower voltage level as required by the application. (The armature voltage should be measured at terminals A1 and A2 of 1TB.)

There is a slight interaction between the "Max" and "Min" speed adjustments. Therefore, after setting the "Min" speed and then the "Max" speed, check the "Min" speed setting with the speed reference at zero. Readjust if necessary.

7.3 Adjustments on the E1534 PC Board
Adjustable Jog Speed Board – (Option J2)

This board has only one adjustment. This is the "Jog" speed potentiometer. On the standard "Jog" speed assembly (Option J2), the "Jog" speed is adjustable from 0 to 100% of base speed. At the factory, the "Jog" potentiometer is set at 10% of base speed and may be readjusted by the user to any desired speed. Clockwise rotation of the "Jog" potentiometer increases the jog speed.

7.4 Adjustments on the E1532 PC Board – Preset Speeds Board (Options PS0, PS3, PS4, PS6, or PS7)

Unless additional documentation is furnished with the control indicating special factory modifications on the E1532 board, all internal speed pots are capable of adjusting from 0 to 100% of base speed. At the factory, all internal speed potentiometers on the Preset Speeds Board are set fully counterclockwise to zero speed. In the field, adjustments must be made by the user to obtain the desired speeds. Clockwise rotation of a preset speed pot increases the related speed. (For information on usage, refer to the section "Guidelines for Programming Preset Speeds Option" at the back of this manual.)

7.5 Adjustments on the E1541 PC Board Inverse Timed Shutdown – (Option ITS)

There is one adjustment potentiometer on this option. The adjustment is made at the factory and should not have to be readjusted in the field. The "Overload" potentiometer is adjusted so that the inverse timing circuit is activated when 100% rated motor current is reached. A 1 volt "IARM" signal is present at the dotted end of R504 when the motor is pulling 100% rated current.

7.6 Adjustments on the E1543 PC Board – Armature Voltage / Tachometer Follower – (Options VF1, VF2, TF1, TF2, & TF3)

The E1543 board has four adjustment potentiometers and one gain set-up mini-jumper. The "CMR" potentiometer is factory set to maximize common mode voltage rejection. This potentiometer should not have to be readjusted. The "Zero", "Gain" and "Ratio" potentiometers are customer adjustments. The proper adjustment procedures are explained in the paragraphs below. Before proceeding with these three adjustments, initially set the ""Gain Select" jumper 703JP in the low gain mode. Adjustments should be made with the control not operating in any run mode.

A) "Zero" and "Gain" Adjustments

Temporarily put the "gain" potentiometer in the mid-range of its rotation. With zero input volts, adjust the "Zero" potentiometers for zero voltage between 703TP and 704TP. Set for maximum input voltage between terminals 1 & 2 or 3 & 4, and adjust the "Gain" potentiometer for six volts, between 703TP and 704TP. If it is not possible to set for six volts, repeat this step from the beginning with the "Gain Select" jumper in the "High" gain position. This completes the normal set-up of these two potentiometers. (If it is desired to have an offset voltage at the output when there is zero input, reduce the input voltage to zero and adjust for the desired offset at the output.)

B) "Ratio Adjustment"

After calibrating for a 0 to +6VDC output level at 703TP in respect to 704TP (Com), the "Ratio" potentiometer can be adjusted as required to set for the desired output voltage of the E1543 board when operating in the "Auto" mode. In many cases, this potentiometer will be left fully clockwise.

7.7 Adjustments on the E1542 PC Board – External Signal Follower Board – (Options SF1, SF2, SF3, and SF4)

There are 3 adjustment potentiometers, "Zero", "Span" (Cal), and "Ratio" on this PC board. In addition, there are two mini-jumper selectors to select the proper "Input Range" and "Mode". Initially set the "Ratio" potentiometer fully clockwise and the "Zero" potentiometer fully counterclockwise. Follow the procedures outlined below in adjusting the "Span" and "Zero" potentiometers.

7.7.1 "Span" and "Zero" Adjustments (Output directly proportional to input)

Before beginning these adjustments, the two mini-jumpers, designated "Input Range" and "Mode", should be checked as to their proper position. The following set-up assumes that the output voltage is to be directly proportional to the input. If this option is being used so that the output is inversely proportional to the input, refer to Step 7.7.2

Before making the "Span" and "Zero" adjustments, verify that the "Input Range" and "Mode" mini-jumpers are in the proper position. For options SF1, SF2, or SF3, the "Input Range" mini-jumper should be in the 1-5MA, 4-20MA, or 10-50MA range respectively. With these 3 options, the "Mode" mini-jumper should be in the "Normal" position. The current source should be connected to 601TB-1 & -2 so that the current enters terminal 1. For option SF4, both mini-jumpers should be in the "Volts" position. The external signal is connected to either terminals 1 & 2 of 601TB for a 0 to 6 volt input or terminals 3 & 4 of 601TB for a 0 to 10 volt input. The signal polarity should be such that either terminal 1 is positive in respect to terminal 2 or terminal 3 is positive in respect to terminal 4.

Connect a meter between test points 605TP and 604TP. Apply minimum external signal at the input terminals. Adjust the "Zero" potentiometers slowly from the fully counterclockwise direction just until zero volts is read between these two terminals. Supply maximum external signal at the input terminals. Adjust the "Span" (Cal) potentiometer for 6 volts between 603TP in respect to 604TP.

The "Ratio" potentiometer is many cases will be left fully clockwise but may be turned down as required for proper tracking.

This option is also supplied with a "Man/Auto" relay. This relay is energized when +12 volts is applied to 201TB-11. In the "Auto" mode, an "Auto" LED is also illuminated. Control speed in the "Auto" mode is programmed by the external signal. In the "Manual" mode, the speed is programmed by the voltage from the wiper of the "Manual" speed potentiometer.

7.7.2 "Span" and "Zero" Adjustments
(Output voltage inversely proportional to input)

Before making the "Span" and "Zero" adjustments, verify that the "Input Range" and "Mode" mini-jumpers are in the proper position. For options SF1, SF2, or SF3, the "Input Range" mini-jumper should be in the 1-5MA, 4-20MA, or 10-50MA range respectively. With these three options, the "Mode" mini-jumper should be in the "Inverse" position. For option SF4, the "Input Range" mini-jumper should be in the "Volts" position. The "Mode" mini-jumper should be in the "Inverse" position. The external signals need to be opposite polarity-wise from what they were in Step 7.7.1. On options SF1, SF2, and SF3, the external current should enter at terminal 2 and exit from terminal 1. On option SF4, terminal 2 should be positive in respect to terminal 1 for a 0 to 6 volt signal input or terminal 4 positive in respect to terminal 3 for a 0 to 10 volt input.

Connect a meter between test points 605TP (+ lead) and 604TP (- lead). Temporarily turn the "Span" potentiometer to mid-range and set for maximum input signal. Adjust the "Zero" potentiometer slowly from the counterclockwise end until zero volts is read on the meter. Reduce the input signal to minimum. Adjust the "Span" potentiometer for 6 volts at these test points.

The "Ratio" potentiometer in many cases will be left fully clockwise, but may be turned down as required for proper tracking.

This option is also supplied with a "Man/Auto" relay. This relay is energized when +12 volts is applied to 201TB-11. In the "Auto" mode, an "Auto" LED is also illuminated. Control speed in the "Auto" mode is programmed by the voltage from the wiper of the "Manual" speed potentiometer.

8. SET-UP JUMPERS ON THE E1538 PC BOARD

There are two mini-plug jumpers on the E1538 board. They are: the "Remote/Local" plug and the "Tach/Arm" plug. The "Remote/Local" plug decides whether the torque limit setting is programmed from an external (Remote) 0 to 6 volt signal or an internal (Local) 6 volt power supply. The "Tach/Arm" selector decides whether tachometer or armature voltage feedback is used in the drive.

8.1 "Remote /Local" Mini-Jumper

Standard controls (all series) are shipped with the "Remote/Local" mini-jumper set to the "Local" position. In this position, the "Torque Limit" setting is adjusted by means of the "Torque Limit" potentiometer mounted on the PC board. When the control is equipped with the External Torque Program option, option "ETP", the jumper is in the "Remote" position. (With the E1538 board oriented so that terminal strip 201TB is on the bottom edge when viewing the board, the "Remote" mode is selected when the left and center pins are jumpered together. The "Local" mode is selected when the right and center pins are connected.)

8.2 "Tach/Arm" Mini-Jumper

The "Tach/Arm" mini-jumper selector decides whether tachometer or armature voltage feedback is used in the drive. All standard drives use armature voltage feedback. Therefore, the mini-jumper will normally be in the "Arm" position.

If the control is supplied with one of the tachometer feedback options (T2, T3, TR2, or TR3), the "Tach/Arm" jumper must be moved to the "Tach" position. The standard tach feedback options will work with either a 1750 or 2400 RPM motor using a 50V/1000 Tach. When using a 2400 RPM motor on a non-reversing drive (BHP or FHP control), jumper JP2 must be clipped from the board. In addition, when using a 2400 RPM motor on a reversing drive (RHP control), jumper JP4 must also be removed. (Note: If the drive was initially adjusted with the "Tach/Arm" selector in the "Arm" position and the jumper is changed to the "Tach" position, the "Max" and "Min" adjustments on the board will in most cases have to be readjusted. Refer to Section 7.2 for proper adjustment procedures on the "Max" and "Min" potentiometers.)

9. STANDARD OPTIONS AND MODIFICATIONS

Options and modifications described in this section have been predesigned for the HP series of controls. Addition of these options does not change the overall dimensions of the control.

9.1 Dynamic Braking – (Option DB)

This is a factory installed option. Dynamic braking is accomplished by permitting the motor to act as a generator and dump its energy into resistors placed across the armature of the motor. Since a solid state technique with SCR's is used in order to do the dynamic braking, this option can also be supplied on BHP series controls that do not have an armature contactor. (Dynamic braking is a standard feature on all RHP (reversing) controls.)

All controls that are furnished with dynamic braking are also equipped with an anti-plug circuit. Once the control begins dynamic braking, the anti-plug circuit inhibits any "Fwd" or "Rev" command until the dynamic braking cycle is completed. As a general rule, the frequency of stops or reversals should be limited to no more than one per minute with the load inertia reflected back to the motor shaft no larger than the motor armature inertia. On large inertial loads and/or more frequent stopping times, consult the Polyspede factory. The dynamic braking resistors are supplied loose for mounting external to the control.

Table 6 is a tabulation of the dynamic braking resistors used in the different HP models. Dynamic braking is an option on BHP and FHP controls but is standard on RHP controls. (For external mounting, refer to BHP, FHP, and RHP Controls, Dynamic Braking Resistors, Customer Assembling, Mounting, and Wiring Instructions, B3215-000-AD)

MODEL NO SUFFIX BHP, FHP, & RHP CONTROLS	AC CONTROL VOLTAGE	CONTROL HP	DYNAMIC BRAKING RESISTORS	COMMENTS ON HOOK-UP
-15	230	1 1/2	(1) 20 OHM 135W	
-20	230	2	(1) 20 OHM 135W	
-30	230	3	(1) 9 OHM 135W	
-50	230	5	(1) 9 OHM 135W	
-75	230	7 1/2	(2) 9 OHM 135W	wired in parallel
-100	230	10	(2) 9 OHM 135W	wired in parallel
-150	230	15	(2) 5 OHM 185W	wired in parallel
-200	230	20	(2) 1 OHM 300W	wired in series
-31	460	3	(2) 20 OHM 135W	wired in series
-51	460	5	(1) 20 OHM 135W (1) 10 OHM 135W	wired in series
-76	460	7 1/2	(2) 10 OHM 135W	wired in series
-101	460	10	(1) 10 OHM 185W (1) 5 OHM 185W	wired in series
-151	460	15	(2) 5 OHM 240W	wired in series
-201	460	20	(3)2.5 OHM 240W	wired in series
-251	460	25	(3)2.5 OHM 240W	wired in series
-301	460	30	(4) 5 OHM 240W	(2) 5 OHM res. in series wired in parallel with (2) 5 OHM res. in series
-401	460	40	(4) 1 OHM 300W	wired in series

TABLE 6
CONTROL MODEL NUMBERS AND REQUIRED DB RESISTORS

9.2 Preset Speeds – (Options PS0, PS3, PS4, PS6, PS7)

This option is a factory or field installed option. There are five variations of this option, depending on the application requirements. (Refer to Table 7.)

TABLE 7
PRESET SPEED OPTIONS

OPTION	DESCRIPTION	PC ASS'Y
PS0	7 speeds set by remote pots or external signals	E1532-07
PS3	4 speeds, 3 set by internal pots, and 1 controlled by external signal	E1532-31
PS4	4 internal speed pots	E1532-40
PS6	7 speeds, 6 set by internal pots, and 1 controlled by external signal	E1532-61
PS7	7 internal speed pots	E1532-70

All seven speed channels are available with PS0, PS6, or PS7 options. Only four speed channels are available with PS3 or PS4 options. Options PS0, PS3, and PS6, which are designed to accommodate external signals, have an eight place terminal block, 153TB, installed on the E1532 PC board. Terminal board 153TB is not on the E1532 board on options PS4 and PS7.

This option basically enables the user to program the system so that different preset speed-program voltages are automatically selected during different modes of operation. The speed program voltages are set between zero and +6 volts DC with respect to COM (201TB-14 on the E1530 PC board). Each speed channel is selected through four-input AND logic. The preset voltage corresponding to the selected speed channel is transmitted directly to the control circuitry on the E1507 PC board. At any instance, the voltage programming the speed of the motor can be measured at 201TB-13 (SPD), with respect to 201TB-14 (COM), on the E1538 PC board. This option can be programmed by one of the following methods:

METHOD 1 consists of removing terminal block jumpers from 150TB and replacing them with maintained normally open remote switches. Gold contacts are required if relays are used. Positions for wiring these switches are clearly marked as S1, S2, S3, etc. on the silkscreen of the E1532 PC board. For example, closure of the switch wired in position marked S1 enables speed number 1 to be selected. In this case, the motor speed is controlled by setting of speed pot number 1 or external signal number 1 (as in the case of PS0).

METHOD 2 consists of programming the E1532 PC board so that conditions to select a certain speed channel are set by operator commands; namely "AUTO" or "MAN", "RUN" or "JOG", and "FWD" or "REV". Each speed channel has an eleven place programming strip designated to it. Operator command functions are clearly marked on the silkscreen. Refer to Figure 7.

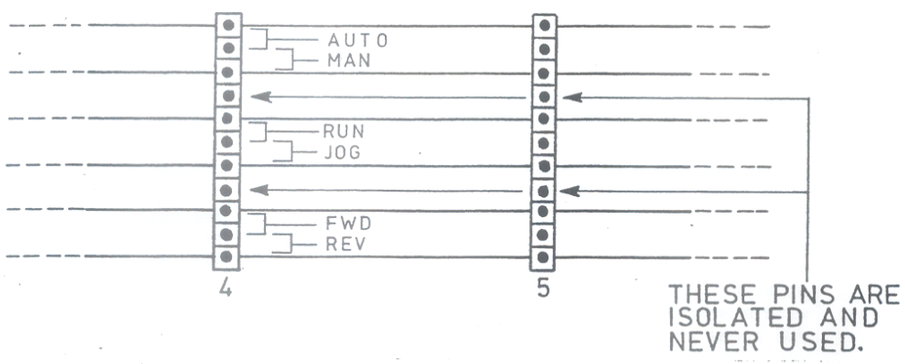


FIGURE 7 : PROGRAMMING STRIPS

Conditions for selecting a speed channel are set by placing program plugs over appropriate pairs of pins on the designated programming strip. In other words, each strip is functionally equivalent to three independent SP3T switches. Ten program plugs are furnished with each preset speeds option. Additional program plugs are available from Polyspede Electronics and can be ordered separately if necessary (Berg Part No. 65474-001). Any operator command not exclusively picked up by placing the plugs is ignored by the "AND" logic; i.e., logic inputs not pinned down by the program plugs are automatically always "HI" and pulled up to +12 volts. In order for method 2 to be workable, the terminal board jumpers placed on 150TB should be left in place.

METHOD 3 is a combination of Methods 1 & 2. Conditions set by operator commands and the closure of switches wired to 150TB determine whether a certain speed channel is enabled.

There is another feature of this circuitry that deserves mentioning at this point. If during any mode of operation of the system conditions set up by any of the three methods described above enables two or more speed channels simultaneously, then the output will be selected by the speed channel designated by the highest number. For example, if conditions prevail to enable both speed channels number 3 and 7 simultaneously, then speed number 7 will be selected at the output. This feature could be used to simplify programming if the application permits.

The E1532 PC board has three LED indicators marked "1", "2", and "4". The LED's indicate the BCD (binary coded decimal) designation number of the selected speed channel. The LED marked "4" represents the most significant bit and the LED marked "1" represents the least significant bit. For example, say the LED's marked "4" and "1" are in the ON state and the one marked "2" is in the OFF state. This indicates that speed channel number 5 is selected. In other words, the sum of the numbers represented by the LED's in the ON state indicates the selected speed channel number.

For further guidelines on programming the E1532 PC board, refer to the Appendix.

9.3 Adjustable Jog Speed (Option J2)

This is a factory or field installed option and is available on all three drive configurations; BHP, FHP, and RHP. It is compatible with all other standard options except Preset Speeds. This option consists of an E1534 PC board assembly mounted on the command PC board, E1538 with snap-on nylon standoffs. The jog speed board assembly includes a JOG speed potentiometer, and a relay with LED indicator, and is linked with a ribbon cable to the E1538 PC board. The potentiometer adjusts Jog speed from 0-100% of base speed. Unless specified otherwise, the Jog speed potentiometer is set at the factory at 10% of full scale. When +12 volts is applied to 201TB-10, the LED lights, and the relay is activated. The activated relay disconnects any other speed input and feeds the JOG command to the SCR drive. Refer to external wiring diagram A3299-007-EW for use of the "RUN-JOG" selector switch (not supplied with control unless specified).The JOG command is accomplished if the RUN-JOG is in the Jog position and the FORWARD (or REVERSE) switch is held activated.

The "Adjustable Jog Speed" option can be used in conjunction with the "External Signal Follower" or the "Armature Voltage/ Tachometer Follower" option. However, the "JOG" command always overrides the "AUTO" or "MANUAL" commands.

9.4 Tachometer Feedback (Options T2, T3, TR2, & TR3)

Using Tachometer Feedback improves load regulation to ±0.1% of base speed and minimizes speed change due to motor heating and line voltage variations. There are four standard variations of this option. Refer to Table 6 for matching option code vs. application. "Tachometer Feedback" option requires a simple modification which can be performed at the factory or in the field. However, the motor base speed must be known before the control can be modified correctly. The modification to the HP unit includes replacement of the armature voltage feedback with tachometer feedback and provision for the correct tachometer scaling network, but it does not include the required motor-mounted tachometer generator. A motor-mounted DC tachometer generator with an appropriate 50 volts per 1000 RPM output must be specified separately.

This option when supplied with RHP (reversing) units also includes the addition of a circuit board mounted tachometer reversing relay. For other motor / tachometer combinations, consult the Polyspede factory.

TABLE 8
TACHOMETER FEEDBACK OPTIONS

OPTION CODE	APPLICABLE TO THE FOLLOWING CONTROL GROUPS	MOTOR BASE SPEED	FACTORY MODIFICATIONS	
			JUMPERS CLIPPED ON E1538 PC BOARD	OTHER MODS ON E1538 PC BOARD
T2	BHP OR FHP	1750 RPM	NONE	NONE
T3	BHP OR FHP	2400 RPM	JP2	NONE
TR2	RHP	1750 RPM	JP3, JP4	RELAY CR5 ADDED
TR3	RHP	2400 RPM	JP2, JP3, JP4	RELAY CR5 ADDED

9.5 External Torque Program – (Option ETP)

This option is a simple modification that can be done in the field or at the factory. This modification is accomplished by moving the "Remote/Local" mini-jumper from the "Local" position to the "Remote" position. A voltage of +6 volts at 201TB-15 in respect to 201TB-14 on the E1538 board will permit the same max current (torque) as preset by the internal "Torque Limit" potentiometer on the E1530 board. If a larger value of programming voltage is available, it must be scaled down so that the maximum voltage that appears at 201TB-15 in respect to 201TB-14 (COM) is +6 volts. A zero to +6 volts voltage variation between terminals 15 & 14 on 201TB will vary the maximum torque (current) capability from zero to that value preset by the internal "Torque Limit" potentiometer. Normally the internal torque pot is set to limit the current at 150% of rated current. However, in some external torque program applications, it may be required that the control be run at torque limit for prolonged lengths of time. In this case, the user should adjust the internal "Torque Limit" potentiometer to limit the torque (current) to 100% of rated current when +6VDC is applied between terminals 201TB-15 in respect to common 201TB-14. Refer to drawing A3299-007-EW for directions on wiring the external potentiometer.

9.6 Auto-Reversing – (Option AR)

This option is applicable to RHP (reversing) units only. It is compatible with all other standard options. It requires a simple modification which

can be implemented at the factory or in the field. The modification consists of removing jumper JP1 from the E1538 board and changing the identification "dash number" or assembly number on the E1538 PC board assembly. (The second digit in the 4 digit "dash number" changes from a "0" to "1".) With this modification, the motor will reverse if the applicable operator "Forward" or "Reverse" pushbutton of switch is momentarily activated. (Note: Without this modification, the operator must first allow the motor to "stop" before a reversal command is registered, or the operator must hold the pushbutton or switch actuated until the motor stops before a reversal can occur. This modification simplifies certain limit switch applications on reversing machines, but is not recommended in cases where it might introduce operator hazard.)

9.7 Change to 50Hz Operation (Option)

When it is necessary to operate on a 50 Hz line, the control must be modified with the 50Hz operation option. This modification, which again can be performed in the field or at the factory, consists of clipping jumper JP1 on the E1537 board. The 1st digit of the 3 digit dash number after E1537 on the power board changes from a "0" to a "1". It may also be necessary to readjust the "Phase Zero" potentiometer. Refer to the adjustments section (Section 7.1 on the E1537 board) for proper adjustment of the "Phase Zero" potentiometer.

9.8 Field Economy (Option FE)

This option is only available on FHP & RHP controls. With this option, the field voltage is reduced whenever the drive is stopped and the armature contactor drops out. By reducing the field voltage when not running, energy is saved.

9.9 240 Volt Field Supply (Option)

This option is only available on 230 volt controls. The standard field voltage for 230 volt controls is 150VDC. Some older vintage motors having 240VDC armatures may require a 240VDC field supply. If control is purchased for use on an existing motor, check motor nameplate before ordering.

9.10 Inverse Timed Shutdown (Option ITS)

This is a factory or field installed option and is available on all three drive configurations: BHP,FHP & RHP. It is compatible with all other standard options except the Field Loss Option. This option consists of the E1541 PC board assembly that mounts in the upper right hand corner of the E1538 board by using snap-on nylon standoffs. A plug connects to socket J204 on the E1538 board.

This option continuously monitors the armature current and causes the control to shut down after a timed interval if the armature current

persistently stays above rated current. The amount of time before shutdown is inversely related to the amount of the overload. With the motor pulling 150% of rated current, it will take approximately 1 minute before the control is shutdown. At 125% of rated current, it will take 2 minutes before shutdown. At 112.5%, it would take approximately 4 minutes. Each reduction by 1/2 of the amount of overload will double the amount of time before shutdown.

This option is supplied with one adjustment potentiometer and two LED indicators. The potentiometer, "Overload Point", adjusts the motor point at which this circuit is activated. Normally, this potentiometer is factory set so that the circuit is activated at current levels exceeding 100% of rated armature current. The "Overload Timing" is "On" when the timing circuit is activated. The "ITS" LED will light when the control has timed out and control shuts down. This fault indictor is automatically reset when a start function, either "Forward" or "Reverse", is activated.

9.11 Field Loss Option – (Options FL1, FL2 and FL3)

This is a factory or field installed option and is available on all three drive configurations: BHP, FHP, or RHP. This option is compatible with all other standard options except the "Inverse Timed Shutdown" option which when supplied uses the same board space as the "Field Loss Option" board. This option consists of the E1541 PC board assembly that mounts in the upper right hand corner of the E1538 board by using snap-on nylon standoffs. A ribbon cable plug connects to socket J204 on the E1538 board, and three wires connect by means of fast-on tabs to the Field Supply Board.

The purpose of this option is to sense field current. If field current goes to zero, this option will cause the control to shut down. The "FLD" (field) LED indicator will also extinguish. The control cannot be restarted until this condition is rectified and field current is reestablished in the motor.

9.12 External Signal – (Options SF1, SF2, SF3, & SF4)

This is a factory or field installable option that is available for use on BHP, FHP, or RHP controls. This option is compatible with all other options except "Preset Speeds" and "Armature Voltage/Tachometer Follower". This option can take any of the following inputs: 0-6 volts, 0-10 volts, 1-5MA, 4-20MA, or 10-50MA. The "External Signal Follower Option" mounts in the upper left hand corner of the E1538 board. A ribbon cable plug connects to socket J202 on the E1538 board.

There are three adjustments on this option. They are: "Zero", "Span", and "Ratio". The "Ratio" potentiometer is normally set fully clockwise but may be used to trim down the follower signal if desired. The "Zero" and "Span" potentiometers work in conjunction with one another to adjust for the minimum to maximum output levels for respective minimum to maximum input levels. The board has the capability of adjusting for an

output directly or inversely proportional to the input. The circuitry can also be biased at a DC level up to 25% of the maximum output for a zero input signal.

All variations of this option utilize a "Man/Auto" relay. When +12V is applied from 201TB-5 to 201TB-11, the "Man/Auto" relay on this board is energized. In addition, the "Auto" LED on the E1542 board will light. In the manual mode, the "Man/Auto" relay is de-energized and the control speed is programmed by the "Manual Speed" potentiometer wiper connected to 601TB-5. Refer to drawings E1542-000-ES, A3299-007-EW, and A3299-009-ES in the Appendix for more details on inputs and outputs to this board. The output of the External Signal board can be measured at 601TB-6 in respect to control common at 201TB-14.

(This option should not be used if the external signal is connected to 230 or 460 volts in respect to earth ground.)

9.13 Armature Voltage/Tachometer Follower (Options VF1, VF2, TF1, TF2, or TF3)

The "Armature Voltage/Tachometer Follower" is a factory or field installed option. It is compatible with all other options except "Preset Speeds" or "External Signal Follower" option. This option uses an E1543 PC board assembly that mounts on top and on the left side of the E1538 PC board. A ribbon cable plug connects the option with the E1538 board. There are 5 assembly variations to this option. The user should consult Option Table 3 to pick out the proper option to use depending on the signal to be followed. When using one of these tachometer follower options, TF1, TF2, or TF3, the tachometer signal used must be isolated from the AC input lines. On the "Armature Voltage Follower" options, VF1 or VF2, the armature voltage signal is not required to be line isolated. DC line isolated voltages and armature voltages are wired to 701TB terminals 1 & 2. (Terminal 1 of 701TB is positive.) AC line isolated tachometer signals are wired to terminals 3 & 4. Connections should be made to only one set of input terminals for any given application.

There are four adjustment potentiometers on this option. They are "CMR", "Zero", "Gain", and "Ratio". The "CMR" potentiometer on the input differential amplifier stage is adjusted to maximize the common mode noise rejection. The "Gain" potentiometer adjusts for a maximum of 6 volts at the final output stage for maximum voltage input. The "Zero" potentiometer adjusts for any offset in the output stage with zero input signal. The "Zero" potentiometer can also be used to adjust for a fixed offset (up to 15% of rated voltage) in the output. The "Ratio" potentiometer is normally set fully clockwise, but may be trimmed down by the user if desired to lower tracking speed.

10. MOTOR SELECTION

Polyspede offers matched motor-control combinations which eliminate the necessity of the user considering the following guidelines when selecting a motor. However, the following precautions must be taken by those who want to mate the HP Series control to an existing motor.

The capabilities of a DC motor operated from a rectified 3 phase alternating-current supply differs somewhat from that of the same motor operated from a direct current source. The DC motor selected to be used with the HP series controls must be rated appropriately for three phase full-wave (6 pulse) SCR drives. DC motors for use with SCR drives are readily available from many motor manufacturers. The user must verify that the motor in question is proper for use on full-wave rectified AC power. Horsepower rating, armature voltage, field voltage, and armature current specified on the motor nameplate should match those specified on the control nameplate. For motors with multiple field voltages, be careful to wire the field for the voltage as specified on the control.

11. INSPECTION

Check for shipping damage. If damage is found, report it to the carrier immediately. DO NOT attempt to operate the drive system if visible damage to the circuit board or other component exists.

12. INSTALLATION OF CONTROL

12.1 Mounting

Follow the requirements for enclosure sizing and drive orientation as given in Section 6. Refer to drawing A3299-007-EW for mounting details. Follow the external wiring requirements as given on this drawing.

Drill the 4 holes for mounting the HP control to the enclosure panel. The use of tapped holes is preferable to facilitate servicing without the necessity of panel removal. Deburr all holes. WARNING: Drill and tap all required holes in the panel, punch all required conduit entry holes in the cabinet, and blow or vacuum all metal chips or shavings from the cabinet before mounting the HP panel. Before mounting, apply a thermal compound to the control baseplate and enclosure panel to insure proper heat transfer. Caution must always be used whenever drilling into the cabinet to make sure metallic pieces do not fall into any portion of the HP control.

13. WIRING PROCEDURE

Use one of the following external wiring diagrams for connecting the control unit:

A) A3299-007-EW (located in the back of this manual) for all standard open chassis HP units or for HP units which have been factory mounted in an enclosure with no additional circuitry, and no additional terminal blocks.

B) In addition to (A), if one of the four standard remote operator stations are supplied, refer to drawing A3299-008-EW for proper wiring connections.

C) A customer special wiring diagram will be furnished in addition to these drawings if the standard control has been altered by the addition of other equipment to make the external connections incompatible with those shown on the standard drawings. A special customer drawing will begin with the letter "M" and a number following that matches the Polyspede customer order number.

Wire the control per the applicable drawing(s) and observe all instructions on these related drawings as to the proper wire size and separations of various wire runs. All terminal blocks on the HP unit are of the wire-clamp type which do not require wire lugging.

14 PROTECTIVE SHUTDOWN CIRCUITS

The HP control includes as standard features (2) protective shutdown circuits. If a fault condition activates one of the protective circuits, the drive immediately shuts down and the motor coasts to a stop. The appropriate fault indicating LED will remain "ON" to indicate cause of the shutdown. The fault indicators go "OFF" automatically when the HP control is restarted after a fault shutdown. The two protective shutdown circuits operate as explained following. Both indicators are on the E1538 Command Board.

14.1 "IOT"

This circuit is the electronic "Instantaneous Overcurrent Trip" circuit. The circuit is activated any time the motor armature current peaks exceed approximately 260% of rated motor current.

14.2 "LOW LINE"

Any time the AC input voltage of any of the three phases drops below approximately 168VAC on 230V controls or 336VAC on 460V inputs, the controls will automatically shut down.

15. OTHER LED INDICATORS

On each HP series control, there are several other LED's that indicate the status of the drive when it is actually running. These are explained following along with the "Anti-Plug" indicator which is activated when a start function, either "Fwd" or "Rev", is activated and the drive is not ready to be started. The following LED indicators are located on the E1538 Command Board :

15.1 "FWD" – (Forward)

This LED is "On" whenever the control is operating and the forward direction has been selected. (On non-reversing drives, only the forward direction can be selected.)

15.2 "REV" -(Reverse)

This LED is "On" whenever the control is operating and the reverse direction has been selected. (This LED is only supplied on reversing controls.)

15.3 "SPEED REG" – (Speed Regulation)

This LED is "On" whenever the control is in operation and the speed error amplifier is in control of the SCR phase angle firing.

15.4 "TORQUE LIMIT" – (Torque (Current) Limit)

This LED is "On" whenever the control is in operation and the torque error amplifier is in control of the SCR phase angle firing.

15.5 "OVERDRIVE"

Whenever the output of the gating module (GM-5) exceeds the positive 6 volt supply, this LED indicates that an overdrive (possible overspeed) condition exists. (It is not necessary to exceed 6 volts from the output of the gating structure to be able to apply rated armature voltage at 150% rated motor current.)

15.6 "DRIVE ENABLED"

Whenever the control is operating, this LED is activated.

15.7 "ANTI-PLUG"

Whenever the motor is dynamic braking to a stop or coasting to a stop and either the "Fwd" or "Rev" pushbutton is being activated, this LED is "On". If the control is supplied with the automatic reversing option,

"AR", and either the "Fwd" or "Rev" PB is activated, this LED will go "On" until zero speed is reached even if the pushbutton actuation is released.

16. REMOTE OPERATOR STATIONS (OPTIONAL)

There are 4 standard Nema 12 remote operator stations that have been specifically designed for use with the HP series control. These 4 operator stations have been designated by the model number ROC-1, ROC-2, ROC-3, and ROC-4. These 4 operator stations are described briefly following:

16.1 Remote OCS#1 – Model No. ROC-1

This Nema 12 operator station can be used on BHP and FHP controls that do not use the "External Signal Follower" option and "Armature Voltage/Tachometer Follower" options. The operators supplied on this station are Stop, Start, Run/Jog, and a single turn speed adjust potentiometer.

16.2 Remote OCS#2 – Model No. ROC-2

This Nema 12 operator is designed for use on BHP and FHP controls that use the "External Signal Follower" or the "Armature Voltage/Tachometer Follower" option. Operators are the same as for the ROC-1 station except for the addition of a "Man/Auto" toggle switch.

16.3 Remote OCS#3 – Model No. ROC-3

This Nema 12 operator station is for use on RHP controls that do not use the "External Signal Follower" and "Armature Voltage/Tachometer Follower" options. The operators supplied on this station are : Stop, Start, Run/Jog, Fwd/Rev, and a single turn speed adjust potentiometer.

16.4 Remote OCS#4 – Model No. ROC-4

This Nema 12 operator station is for use on RHP controls that use either "External Signal Follower" or "Armature Voltage/Tachometer Follower" options. The operators supplied on this station are identical to the operators on ROC-3 except for the addition of a "Man/Auto" toggle switch.

17. CHANGING CONTROL HORSEPOWER SIZE

There are at least 30 distinct models to the HP Series of controls. These 30 models can be subdivided down into 7 major groups. Within each group and between some groups control horsepower can be changed by substituting the appropriate shunt link. (In addition, if the control had dynamic braking , the dynamic braking resistors would

have to change accordingly as required for the new horsepower size.) The rules for changing horsepower within a group number are given below. Refer to Table 9 for identification of what group a specific control is in. The following is an explanation of how the horsepower sizes can change within and between groups.

1. Group #1 – Any control within this group can be changed to any other horsepower size within this group.

2. Group #2 – The 15HP, 230V controls within this group can be down rated for use as any control in Group #1.

3 Group #3 – The 20HP, 230V controls within this group can be downrated for use as any control within Group #1 or # 2.

4. Group #4 – Any control within this group can be changed to any other horsepower size within this group.

5 Group #5 – The FHP and BHP, 25HP, 460V controls can be downrated for use as any horsepower in Group#4.

6. Group #6 – The 30HP, 460V controls can be downrated for use as any horsepower in Groups #4 and #5.

7. Group #7 – The 40HP, 460V controls can be downrated for use as any horsepower in Groups #4, #5, and #6.

To change horsepower sizes properly, it is necessary to do the following three things:

1. Change the current shunt. Refer to Section 17.1 for proper details on changing the shunt.

2. Change the dynamic braking resistors on those controls so equipped. Refer to Section 17.2 for specific details.

3. Change the nameplate information on the HP unit and fill in the Field Modification drawing at the back of this manual. Refer to Section 17.3.

TABLE 9
HORSEPOWER SIZE CONVERSION TABLE

GROUP#	SHUNT RATING (AMPS)	HP SIZE	INPUT VOLTS	MODEL NO. SUFFIX *	INPUT AMPS (RMS)	ARM OUTPUT AMPS	PROPER DB RESISTORS **
#1	6	1 1/2	230	-15	5	6	(1) 20 OHM 135W
	8.5	2	230	-20	7	8	(1) 20 OHM 135W
	13	3	230	-30	12	13	(1) 9 OHM 135W
	18	5	230	-50	17	18	(1) 9 OHM 135W
	28	7.5	230	-75	26	28	(2) 9 OHM 135W
	37	10	230	-100	34	37	(2) 9 OHM 135W
#2	53	15	230	-150	47	53	(2) 5 OHM 185W
#3	70	20	230	-200	62	70	(2) 1 OHM 300W
#4	6	3	460	-31	5.5	6.5	(2) 20 OHM 135W
	8.5	5	460	-51	8.5	8.9	(1) 20 OHM 135W (1) 10 OHM 135W
	13	7.5	460	-76	12	13.2	(2) 10 OHM 135W
	18	10	460	-101	17	18	(1) 10 OHM 185W (1) 5 OHM 185W
	28	15	460	-151	23	26	(2) 5 OHM 240W
	37	20	460	-201	31	35	(3) 2.5 OHM 240W
	43	25	460	BHP-251 ONLY !	38	43	(3) 2.5 OHM 240W
#5	43	25	460	FHP-251 RHP-251	38	43	(3) 2.5 OHM 240W
#6	53	30	460	-301	44	50	(4) 5 OHM 240W
#7	70	40	460	-401	56	65	(4) 1 OHM 300W

* - Applies to BHP, FHP, & RHP controls unless otherwise specified.

** - Refer to Table 6 in Section 9.1 for proper dynamic braking resistor hook-up.

17.1 Change Current Shunt ("MSH")

The shunt links are identified by a current rating number scribed into one end of the barrel lugs. Select from Table 9 the appropriate shunt link for the new horsepower size. Replace the existing link with the new link. Refer to Figure 8 for proper mounting sequence of the new link. It is mandatory that all washers, lugs, and hardware items be replaced in their original order to insure proper operation.

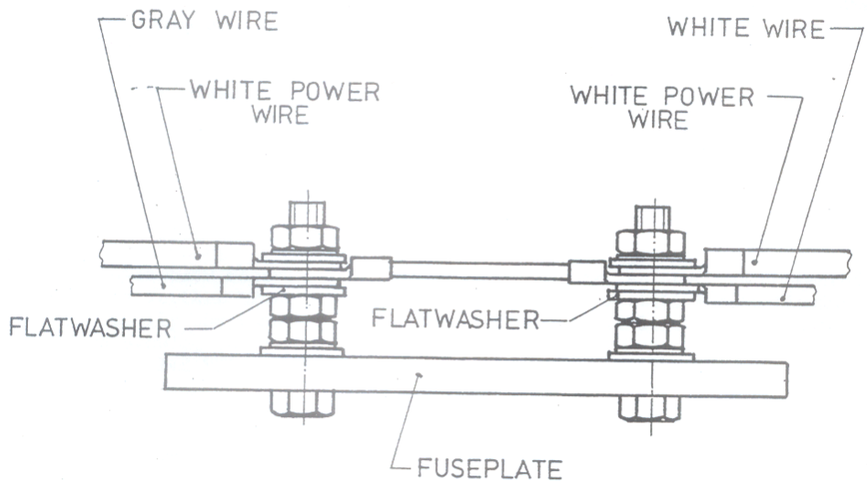


FIGURE 8
Details for Mounting Shunt Link

17.2 Change Dynamic Braking Resistor

This section is applicable only to all RHP units that come equipped with the dynamic braking feature and BHP and FHP controls that are supplied with option "D". If a control that has dynamic braking has its horsepower changed, then it is mandatory that the dynamic braking resistor for the new HP rating be matched appropriately as given in Table 9.

17.3 Change Nameplate Information on HP Unit

After the horsepower change has been made, it is necessary to change the contents of four information blocks on the HP unit to agree with the listing in Table 9 for the new horsepower size. This must be done to insure delivery of an exact or at least equivalent replacement part if repair or replacement of the HP control becomes necessary. This may be done by preparing four small white paper strips with correct information typed on them and sticking the strips over the appropriate nameplate blocks with clear Scotch tape or other equivalent means. Note that for the block marked "Model" the alphabetical prefix (BHP, FHP, or RHP) remains unchanged, only the numerical suffix needs to be changed. At this point, the "Field Modification Form" must be completed to be mailed to the factory. This form is located at the back of this manual.

18. TROUBLE SHOOTING AN HP UNIT

Procedures contained in this section are intended to assist the user in identifying whether a problem is due to the DC motor, the HP Control unit, or to external wiring to the HP unit. Procedures for locating faulty circuit boards and modules are also given. Identify the problem area by using the procedures contained in this section. If the problem is in the HP control, either replace the entire unit or repair it by replacing the faulty sub-assembly as specified in the sections following.

18.1 Occasional Fuse Blowing

Occasional fuse blowing can be caused by intermittent shorts to ground in the DC motor or in the motor wiring. Check motor connections especially those in the motor conduit box. Blow carbon dust out of the motor using an air hose. Inspect all wiring including motor brush pigtails. Check motor per Section 19.

Occasional fuse blowing can also be caused by power failures and voltage input transients. This type of fault must be corrected in the power distribution system. Look for wire clippings, loose washers, etc., around the fuses and SCR modules.

18.2 Repetitive Fuse Blowing

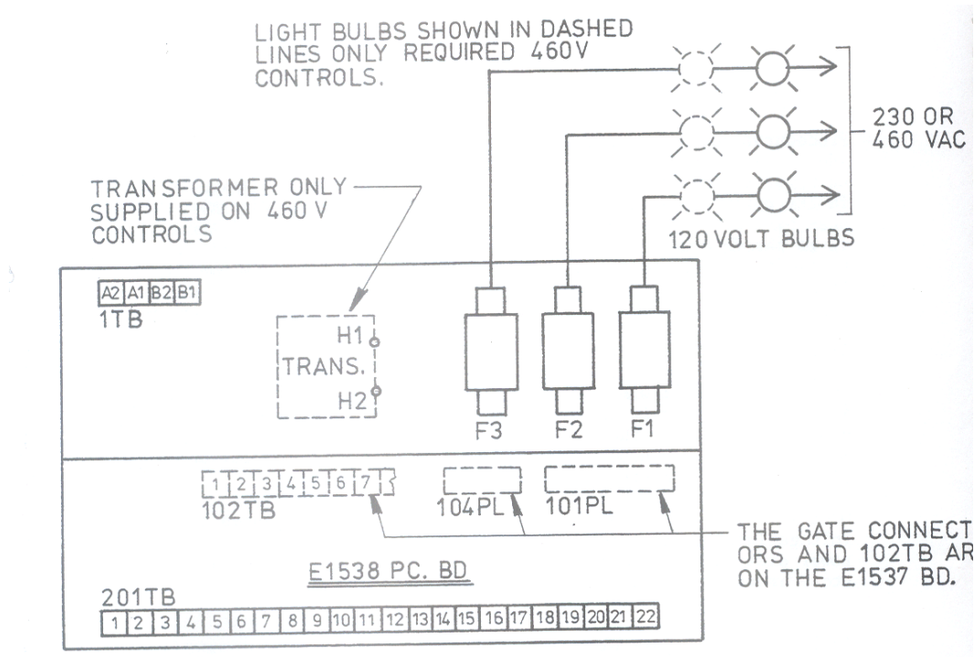
If fuses blow repetitively, the problem must be isolated and corrected before further trouble-shooting can be done. Repetitive fuse blowing is usually the result of the same problems as are listed for occasional fuse blowing but may also be due to a faulty HP control circuit board or a failed SCR module.

WARNING

DO NOT REPLACE FUSES WITH UNAPPROVED SUBSTITUTES. INCORRECT FUSES WILL ALSO BLOW, BUT WILL PROBABLY ALLOW FAILURE OF AN SCR MODULE OR OTHER COMPONENTS BEFORE BLOWING. REPAIR COST WILL BE INCREASED AND WARRANTY MAY BE VOIDED. SEE SECTION 5 FOR APPROVED FUSE TYPES.

18.3 Procedure if Fuses 1FU, 2FU, or 3FU Blow

1) Turn power off at the AC disconnect. Connect light bulbs in series with the AC lines as shown in Figure 9. Disconnect the motor armature (A1, A2), field (F+, F-), and dynamic braking (B2, B1) leads, if equipped. Replace 1FU, 2FU, and 3FU if blown. Disconnect the SCR gate connectors to plugs 104PL and 101PL on the E1537 board. Remove and tape up the wires going to 102TB-1, 2, & 3. In addition, on 460V controls, remove the wires going to transformer T12.



ISOLATING CAUSE OF MAIN FUSE BLOWING!

FIGURE 9

2) Be sure no loose wires are touching ground or any circuit components. Turn power on at the AC disconnect. None of the lights should illuminate. If the lights do come on, proceed to Step 3. If none of the lights come on, proceed to Step 5.

3) Turn power off and remove the three #18 gauge wires (brown, red, and orange) that connect to L1, L2, and L3 on the E1539 board. Reapply power and check to see whether any of the bulbs burn. If the bulbs do not light, the problem is a defective E1539 field supply & snubber board. Replace this board and rewire to the load side of fuses 1FU, 2FU, & 3FU. Reapply AC power and the bulbs should not light. Proceed to Step 5 for further testing. If the bulbs came on even when the connections to L1, L2, and L3 on the board were not made, the problem is probably defective power cubes. Proceed to Step 4.

4) If the previous steps have been followed in sequence, the only things that still remain connected to the control are the power cubes. The module wiring should be inspected for shorts. Look for nuts, washers, or wire

clippings wedged between bus bars. Check to see if the barrels of any of the connectors are inadvertently touching an adjacent connection or bus bar. If this is not the case, there are probably two or more defective SCR modules. Remove SCR modules #1, #2, & #3 and bench test per Section 18.4 to locate the faulty modules. Replace the faulty modules. Proceed to Step 6. If none of the lights come on, there still may be a defective power cube. Proceed to Section 5, for further testing.

5) In this step, the power modules will also be checked to see if they are shorted. With power off temporarily, jumper A1 to A2. In addition, on FHP & RHP controls jumper the FCON contacts. (Refer to drawing A3299-009-ES.) Jumper A2 to the load side of 1FU temporarily. Reapply AC power. If any of the bulbs do not light, modules 2 and 3 are probably OK. If bulbs in series with lines L1 and L3 light, power module #3 is bad. If bulbs light in series with lines L2 and L3, both modules #2 and #3 are bad. Shut off power and move the jumper from the load side of 1FU to the load side of 2FU. Reapply power. If the bulbs now light in series with line L1, module #1 is defective. Remove power and replace the defective modules. The only module that has now not been checked is Module #4. This module is supplied on all RHP controls and other controls. (BHP & FHP) furnished with the dynamic braking option.

6) (This step only applies to those controls that use dynamic braking.) Turn off power and perform the following steps to get an indication of whether or not power module #4 is defective. It is assumed in this step that power modules #1, #2, & #3 are not defective, or, if defective, have already been replaced.

The following conditions should be present to make this test. (Remove power before performing the following.)

a) Remove the jumpers between B1 & B2 and A1 & A2.
b) If working on an FHP or RHP control, temporarily jumper the FCON contacts.
c) Jumper the load side of 1FU to terminal A1. Jumper the load side of 3FU to terminal A2.

Apply power with the above conditions. The bulbs should not light. If they do light, make sure that the connections to L1, L2, & L3 of the E1539 board and the wires to 201TB-1, 2, & 3 are not connected. [If this is the case and the gate connections (sockets to 101PL and 104PL) are removed going to the SCR's, power modules 1, 2, and/or 3 are still probably defective.] Repeat steps 4 and 5 above to find the cause of the problem. If the bulbs do not light, remove AC power. Jumper B1 & B2. Reapply AC power. If the bulbs now light, power module #4 is defective. Replace if this is found to be the case. If in doubt whether the module is good, bench test per Section 18.4. This completes the power modules check-out.

7) Turn power off. Remove the light bulbs in series with the AC lines and connect the AC lines directly to the inputs of fuse. 1FU, 2FU, & 3FU on the HP control. Reconnect the L1, L2, & L3 connections to the E1539 PC board, if not already connected. In addition, reconnect all wires to 102TB

terminals 1, 2, & 3. Reconnect the gate connectors to 104PL and 101PL on the E1538 board. Remove any temporary jumpers added in previous steps from the FCON contacts on FHP & RHP controls.

8) Perform the following test only after correcting any problems which caused bulbs to burn in the previous steps.

Turn power off. Disconnect motor armature and field leads if not already disconnected from the HP control. Connect light bulbs in the armature circuit as shown in Figure 10. Be sure that all fuses are good. Turn power on and start the HP control. Vary the speed command from zero to maximum. Brightness of the bulbs should vary from zero to maximum. (Maximum armature voltage will be approximately 240VDC on 230VAC controls and 500VDC on 460VAC controls.)

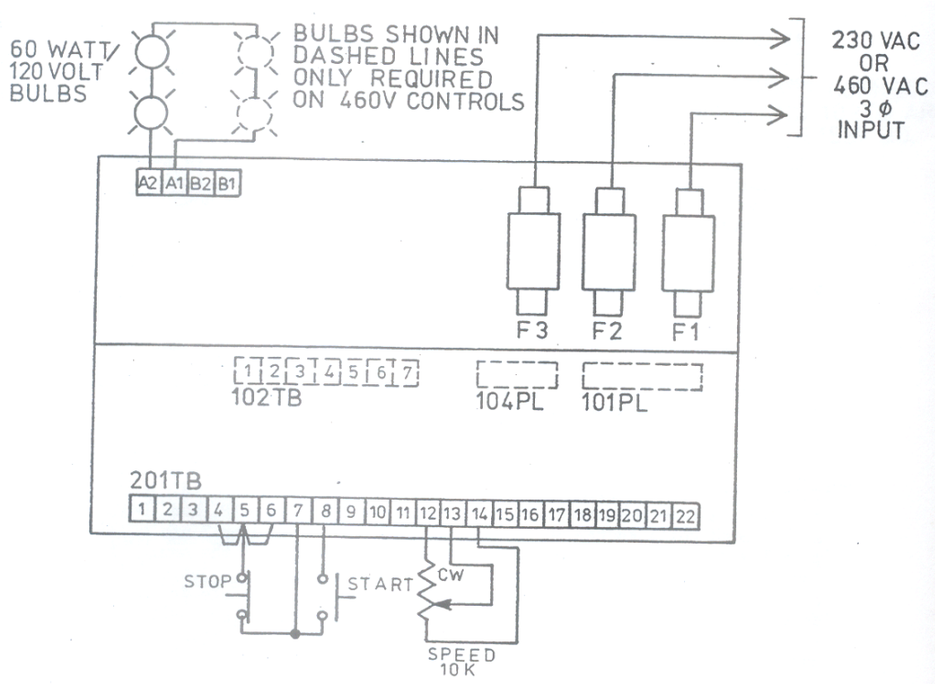


FIGURE 10
Checking Circuit Boards

9) If the bulbs do not light as indicated in Step 8, the problem is a defective E1537 and/or E1538 board. The next few steps will try and isolate which board is defective.

10) If the bulbs did not burn in Step 8, measure the voltage across R59 on the E1537 PC board. When the control is working normally, this voltage will vary from 0 to somewhat less than 6 volts in going from minimum to maximum bulb brightness (armature voltage). Energize the control. (If the drive has a contactor, the contactor should come in.) Increase the speed pot from zero to maximum. If the voltage across R59 does not go to approximately 6 volts with the speed pot fully clockwise, make the following checks.

a) Measure the "Speed Input" voltage 201TB-13 in respect to 201TB-14. This voltage should vary from 0 to +6 volts. If the voltage does not vary from zero, check to see that the speed potentiometer is wired correctly, and that the +6 volts is present at 201TB-12 in respect to 201TB-14. Also check that the +12 volts (201TB-5) and -12 volts (201TB-17) power supplies are present. If the +12V and -12V power supplies are missing, make sure that plugs 103PL and 203PL are properly in place in sockets J103 and J203 on the E1537 and E1538 boards. The +12 and -12 volts can be measured on E1537 board. Check to see if these voltages are on the tubular test point terminals on the E1537 board. If not, replace the E1537 board. If the +12 volts and -12 volts power supplies are present but the +6V supply on 201TB-12 of the E1538 board is missing, the E1538 board is probably defective. Replace this board.

b) If the control is started and +6 volts is measured across R59 and there is no armature output, the problem is probably a defective E1537 board. Replace this PC board.

11) After replacing the E1537 and/or E1538 boards, it will probably be necessary to make some adjustments to these boards. Refer to Sections 7.1 & 7.2 for this purpose. As ballpark settings, the adjustments on the replacement board can be put in the same relative position as on the board being replaced. (This assumes, of course, that the original adjustments have not been tampered with.)

18.4 Bench Testing of SCR Modules

SCR modules may be tested for voltage breakdown or shorted SCR's as shown in Figure 11. One of the bus bars used in the HP control may be used to jumper the terminals shown. Threads in the modules are metric. Use only the screws furnished with the power cube to make connections. Use adequate safety precautions to prevent a shock hazard. Test on an insulated pad to avoid accidental grounds. None of the light bulbs should burn. If lights burn, the module is faulty and requires replacement.

Also test all modules as shown in Figure 12 to detect open cathode leads in the module. Use a multimeter to measure. Readings generally will fall

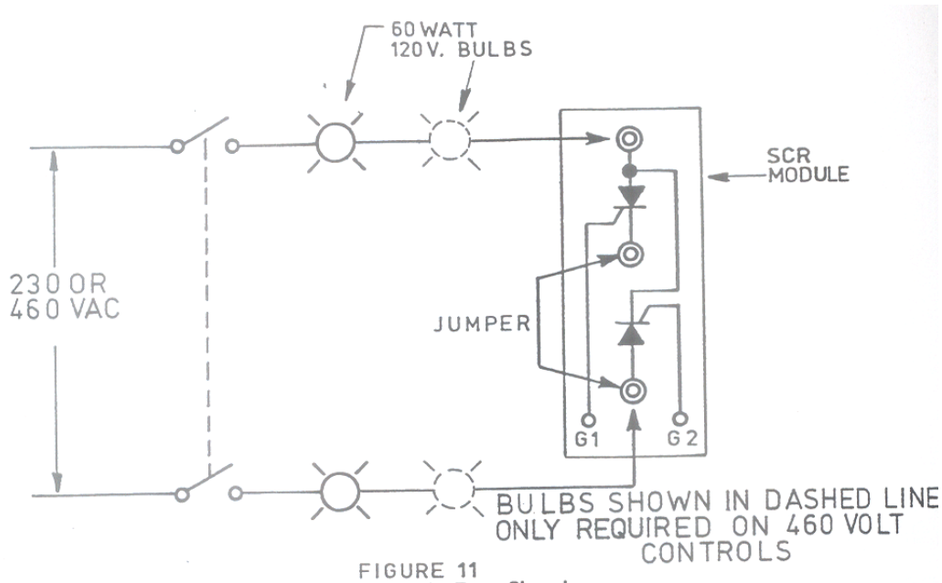


FIGURE 11
Module Test For Shorts

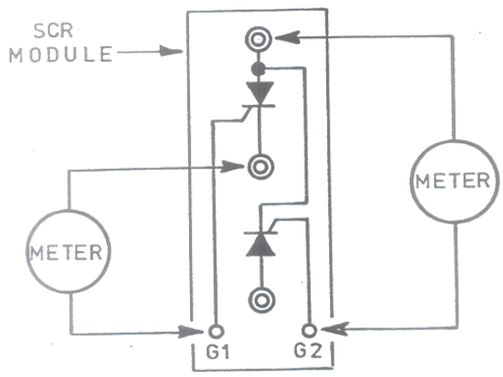


FIGURE 12
Module Test For Open Cathode

in the 10 to 150 ohms range. Readings much higher than 200 indicate an open cathode lead in the module. Also check the 3.9 ohm gate resistors, R13, R15, R17, R19, R21, & R23. In cases with problems with the power modules, these resistors will often open.

Before installing new modules or re-installing the old modules, examine gate pins G1 & G2. These pins should be free of potting compound and other contamination all the way to the bottom of the pin well. Scrape off any foreign material with a small screwdriver.

18.5 Procedure if Motor Does Not Run

1) If a fault indicator LED, such as IOT or Low Line, is "On", pressing the Start (Forward or Reverse) pushbutton should get things started. If pressing the Forward or Reverse pushbutton does not clear the fault, the fault may still be present. This would be the case if the unit tripped out on low line and the low line condition was still present when the Start function was pressed. Note that if a Forward or Reverse command is activated while the motor is still rotating, the Anti-Plug LED will light, but the motor will not start until zero speed is reached. (On RHP controls with "Automatic Reversing", the Anti-plug LED is on whenever the control is stopped and the motor is dynamic braking to a stop.)

2) If the drive has been started and the "Drive Enabled" and "Speed Reg" LED's are "On", but the motor will not run, check the speed command voltage at 201TB-13 in respect to 201TB-14. This voltage should be +6 volts DC for a full speed command. If this voltage is absent and the voltage at terminal 201TB-12 in respect to common is 6 volts, the problem could be in the external wiring or the speed potentiometer may be defective.

3) If the drive has been started and the "Drive Enabled" and "Torque Limit" LED's are "On", the motor may be jammed. Verify, if possible, with power, with power off to see if the motor shaft is jammed. If the motor is not jammed and is not overloaded, check the torque command voltage between 201TB-15 in respect to 201TB-14. This voltage should measure +6VDC to command maximum torque. Check to make sure that the "Torque Limit" potentiometer on the board is still set to the factory setting. Typically this potentiometer is set to limit current at 150% of rated current. This corresponds to a setting of approximately 75% of full rotation on this potentiometer when 6 volts DC is across the potentiometer.

4) If all appears normal in the preceding steps but the motor still will not run, start the HP control, and set for full speed command. Measure the voltage at the dotted end of R78 in respect to common (201TB-14) on the E1538 board. Voltage should be fairly close to +6 volts. The armature voltage between A1 and A2 should be close to a maximum. If voltage in both areas is near zero and all previous steps have checked OK, the problem is the E1538 board. This board should be replaced.

18.6 Procedure if Motor Overspeeds

The most probable causes of this malfunction are loss of speed feedback signal, speed command voltage excessively high, motor field voltage low, or motor field wired improperly.

1) Check the speed command voltage between terminals 201TB-13 in respect to 201TB-14. This voltage should be in the 0 to 6 volt DC range. If an external signal is being used to control speed and operation is normal, except maximum speed is slightly higher than desired, readjust the "Max" potentiometer per Section 7.2.

2) Check armature feedback signal path as follows. (If the HP control uses tachometer feedback, go to Step 3.) Be sure that the "Tach/Arm" mini-jumper selector on the E1538 board is in the "Arm" position. This is accomplished when the middle and right end pins of this 3 pin jumper strip are connected together by means of a small mini-jumper. Check to see that the two 18 gauge wires that go to the armature terminal strip, 1TB terminals A1 & A2, have not come loose and that the lug screws are not seated on wire insulation. Also, check that the wires from 1TB-A1 & A2 to 102TB terminals 4 and 5 have not been switched. Terminal 1TB-A1 must be wired to 102TB-4 and terminal 1TB-A2 must be wired to 102TB-5. Also make sure that the wires to 102TB are not clamped on their insulation.

3) Check tachometer feedback signals as follows. (If the HP control does not use tachometer feedback, skip this step and proceed to Step 4.) Problems may be due to tachometer shaft looseness in coupling, tachometer wires reversed or loose, wrong tachometer volts/1000, or intermittent "Tach/Arm" mini-jumper connections. The most common faults are mechanical problems in the tachometer coupling.

Move the "Tach/Arm" mini-jumper selector on the E1538 board to the "ARM" position and recheck the control. (Armature voltage feedback is operational when the middle and right end pins are jumpered together by means of the mini-jumper. Tachometer feedback is operational when the left and centre pins are jumpered together.) If operation is satisfactory in the "Arm" position, the problem is in the tachometer or tachometer wiring. Turn power off and clean the jumper pins. If the small mini-jumper is in question, replace the mini-jumper and set up for "Tach" feedback. If the system has operated satisfactorily in the past, the problem is probably due to slipping in the tach coupling. Tighten all set screws in the coupling and inspect for mechanical damage due to misalignment. If the system has not been operated before, verify that the polarity of tachometer voltage is correct. Terminal 201TB-22 must be positive in respect to 201TB-21 in the "FWD" mode. If the system does not operate correctly with the "Tach/Arm" switch set to the "Arm" position, perform the tests in Step 2 to locate the problem.

4) Measure the field voltage output of the HP unit at terminals F- and F+ of the E1539 Field Supply and Snubber board. Compare the measured voltage with the field voltage rating on the motor nameplate. Also check

for correct connection of the motor field wires. Incorrect field voltage will cause overspeed only in systems using armature voltage feedback. (Incorrect connections to the motor can cause motor and/or control damage.)

18.7 Procedure: Unstable Operation

The following is a check list of possible causes and cures for unstable operation:

1) "IR Comp" potentiometer set too far clockwise. Readjust "IR Comp" per Section 7.2. Note : "IR Comp" potentiometer must be fully counterclockwise when using tachometer feedback.

2) Tachometer shaft slipping or wobbling (tach feedback systems only). This problem can be checked by connecting the "Tach/Arm" mini-jumper selector for the "Arm" position. If operation is smooth, problem is in the tachometer and/or coupling.

3) Motor series field wired in backwards. Motors with a series field (S1 and S2) must be wired properly so that the series field aids the shunt field. Refer to motor wiring diagram on motor for proper connections. On RHP reversing controls, the series field cannot be used since in one direction or another, the series field would be wired in backwards. If omission of the series compensating field does not result in stable operation, this motor cannot be used.

18.8 Power Supply Voltage Checks

All but one of the power supply voltages that are used on either the E1537 or E1538 PC boards are generated on the E1537 PC board. The voltages are supplied to the E1538 board thru the ribbon cable connector that connects J103 to J203. In addition, a +6 volt power supply is generated on the E1538 board for use as the speed potentiometer reference voltage.

The following voltages can be read from the E1538 201TB terminal strip:

a) 201TB-5 in respect to 201TB-14 - +12±.6V
b) 201TB-17 in respect to 201TB-14 - -12 ±.6V
c) 201TB-12 in respect to 201TB-14 - +6V±.3V

The remainder of the power supply voltages must be checked on the E1537 PC board. These other voltages are measured on tubular terminals on the E1537 board. To get to the E1537 board, remove the upper right and left hand corner screws that hold the E1538 board in place. This will permit the E1538 to fold down 90 degrees revealing the E1537 PC board below.

The remaining voltages to be checked on the bottom board are:

a) HOT +12V in respect to HotCom - +12V ± .6V
b) HOT -12V in respect to HotCom - -12V ±. .6V

If the +6 volt is missing but all other voltages are present disconnect the wires going to 201TB-12. Remeasure the voltage at 201TB-12 in respect to 201TB-14. If the +6 volts now appears at this terminal, something external is loading down the control. Check the external wiring. If the +6 volts does not appear, the E1538 board is defective and needs to be replaced.

If the Hot +12 volt and/or Hot -12 volt power supply is missing, the problem is probably in the E1537 PC board. If the Iso +12 volt and/or -12 volt power supply is gone, shut off power and temporarily remove the plugs and ribbon cable connecting J203 and J103. Now measure the isolated +12 volts and -12 volts at the appropriate silkscreened tubular terminals on the E1537 board. If the voltages are now normal, either the E1538 or connecting cables are defective. Check for shorts or open conductors in the ribbon cable. If none can be located, replace the E1538 PC board.

19. TROUBLE SHOOTING, MOTOR

The following tests will be helpful in pinpointing possible motor problems. Before making any tests, turn power off and disconnect the armature and field leads from the control.

a) Shorts to the Frame - Using a megger set for 400 volt test potential, check leakage resistance from motor frame to the A1 and A2 leads and to motor field leads. Readings of less than 10,000 ohms indicate possible problems. A dead short indicates need for immediate repair. Checks for dead shorts may be made with an ohmmeter or a continuity tester if a megger is not available. Retest while rotating armature by hand.

b) Open or shorted Field - Check resistance between motor field leads. Resistance should not be less than approximately 50 (100) ohms or greater than 500 (1000) ohms for fields connected for 150 (300) VDC operation.

c) Open Armature - An ohmmeter between A1 and A2 should indicate a resistance of less than 10 ohms. Rotate the motor shaft very slowly while observing the ohmmeter. Because of the residual magnetism in shunt field motors or the field in permanent magnet motors, a CEMF will be produced by rotating. This will cause the ohmmeter readings to change during rotation. Therefore, after moving the shaft a small amount, stop and check the resistance reading. A high resistance reading at any position of the motor shaft when it is stopped is a trouble indication. Armature opens are usually the result of bad brushes, burned commutator segments, or severed wires.

20. MAINTENANCE

20.1 Control Maintenance

The HP control requires no maintenance in normal installations. If installed in dusty locations, blow off dust periodically with an air hose. If installed in ventilated cabinets, change cabinet filters regularly.

20.2 Motor Maintenance

Inspect motor brushes regularly. Polyspede recommends replacement when brushes are worn to one third of original length or at regularly scheduled intervals.

Motor brush life is related to motor speed, loading, cycling rate, ambient temperature, and other variables not controlled by Polyspede. Therefore, only guidelines can be given concerning inspection intervals. Experience has shown that each application has its own wear rate. Removal of the brushes after each three months of operation during the first year will give an indication of the specific wear rate. After three sets of brushes have been used, remove the motor armature for checking by a competent motor repair shop for possible commutator refacing.

Armature bearings are sealed and require no additional lubrication. Replacement should be performed by a reputable service shop if bearings become noisy.

Occasional cleaning of motor vent holes or removal of fan guard to remove dust accumulation from fans is the only additional maintenance required.

21 SPEED REDUCER MAINTENANCE

a) Reducers are shipped without lubricant. Fill reducer with specified lubricant before start up. (see tags on reducer or refer to manufacturer's manual).

b) Use type and grade oil specified on the gear reducer nameplate. Keep in mind proper viscosities for various temperatures.

c) Keep oil at proper level.

d) Drain, flush, and refill reduction unit after initial run-in period.

e) Replace shaft seals at first sign of leakage not only to avoid damage due to loss of lubricant, but also to eliminate the possible entrance of contaminants into housing.

f) If detailed instructions for assembly and disassembly of a particular unit are required, contact the speed reducer manufacturer for this information.

g) If the drive is connected by a coupling which requires lubricating, the coupling should be checked on start-up and semi-annually.

APPENDIX

GUIDELINES FOR PROGRAMMING PRESET SPEEDS OPTION

The Preset Speeds option for the HP Series has been designed with flexibility in mind. There are multitudes of applications for which this option can be used. Therefore, it is impossible to provide a hard and fast procedure to program this option for every upcoming application. The intent of the following steps and examples is to guide a programmer so that he may easily, with some trial and error, come with an appropriate scheme for his particular application. Bear in mind that two people working on the same application may come up with different results, both of which may be correct. It is definitely helpful, for a first-time programmer, to have an HP unit on hand while going through the following steps, and to have read through the description of this option in the HP Series manual. (Section 9.2)

Step 1: Determine the total number of different speeds that an HP unit will be subjected to during different modes of operation. For example, suppose there are four speeds required. Three speeds are programmed by PC board mounted pots and one by an external signal. For this particular example, the requirements could be satisfied by option PS3. But, say PS6, which has seven speed channels, was ordered. This leaves three extra speed channels to be moved out of the way.

Step 2: Disarm extra speed channels, if any, by removing the appropriate terminal block jumpers on 150TB. Refer to A3299-009-ES.

Our hypothetical example requires access to an external signal. Therefore, speed channel No. 7 must be used. But any three of the other channels, No. 1, through No. 6 may be disarmed.

Step 3: Now let us take a look at what causes a particular speed channel to be selected. Refer to Figure A.

In order for a speed channel to be selected, all four inputs of its corresponding "AND" gate must be Hi at +12VDC with respect to 201TB-14 (ISO COM). The status of the first three inputs of each "AND" gate is determined by the placement of program jumpers on the PROGRAMMING STRIP, while the status of the fourth input is determined by the wiring on terminal block 150TB on the E1532 PC board.

If a program jumper is placed in the "AUTO" position, then a Hi signal is applied at input No. 1 of the "AND" gate, whenever a +12VDC(with respect to 201TB-14) is applied at terminal 201TB-11 (AUTO) on the E1538 PC board. Refer to Detail 6 on external wiring diagram A3299-007-EW. But if the program jumper is in the "MAN" (manual) position, then input No. 1 is Hi when +12VDC is not applied at 201TB-11. Again, if the program jumper is neither in the "AUTO" nor "MAN" position for any particular gate, then the input No.1 for that gate is Hi regardless of the status of 201TB-11. In other words, there are three conditions for input No. 1 of each gate; "AUTO"

"MAN", and "none". Likewise there are three conditions for each of the inputs No. 2, No.3, and No.4. Refer to Table A for characteristics.

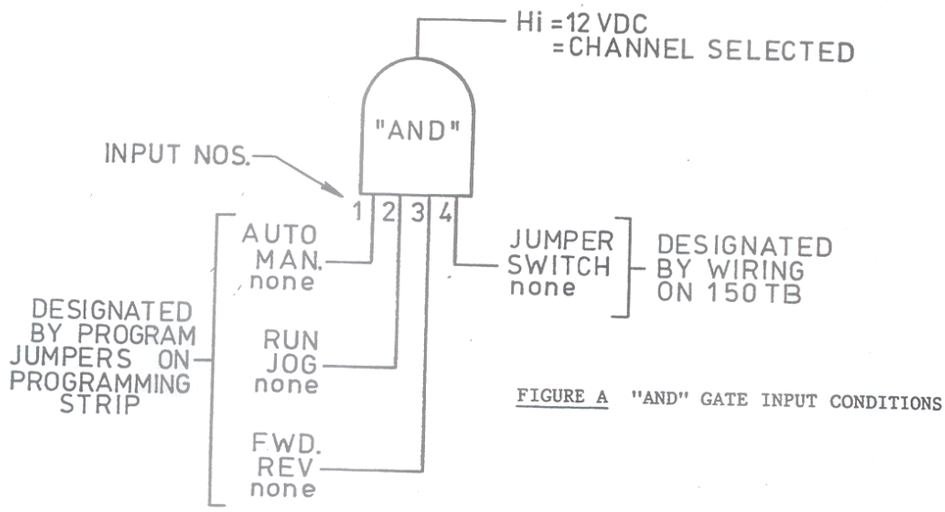


FIGURE A "AND" GATE INPUT CONDITIONS

FIGURE A
"AND" GATE INPUT CONDITIONS

TABLE A
"PROGRAM CONDITIONS vs. DRIVE CONTROL CHARACTERISTICS"

INPUT NO.	PROGRAM CONDITIONS PLACED	CHARACTERISTICS
*1	AUTO	Hi if and only if +12VDC is applied at 201TB-11
	MAN	Hi if and only if +12VDC is not applied at 201TB-11
	none	Hi regardless of the status of 201TB-11
*2	RUN	Hi if and only if +12VDC is not applied at 201TB-10
	JOG	Hi if and only if +12VDC is applied at 201TB-10
	none	Hi regardless of the status of 201TB-10
*3	FWD	Hi if and only if FWD command is activated, i.e., FWD LED on E1538 PC board is ON
	REV	Hi if and only if REV command is activated, i.e., REV LED on E1538 PC board is ON
	none	Hi regardless of the status of the FWD or REV circuits
**4	JUMPER	Hi always
	SWITCH	Hi if and only if contacts are closed. Refer to A3299-007-EW, detail 8(A).
	none	Lo always. Handy method of disarming a speed channel completely.

* Input No. 1, 2, and 3 are programmed by placement of program jumpers over appropriate pins on the programming strip.

** Input No. 4 is programmed by proper connections on terminal block 150TB. Refer to Detail 8(A) on drawing A3299-007-EW external wiring diagram. Note : If this connection is left open, the input is LO, unlike the characteristic for input Nos. 1, 2, and 3.

All four inputs of the "AND" gate must be Hi simultaneously before the output can be Hi, otherwise the gate output will be Lo and its corresponding speed channel will be inhibited. If operator conditions and programming is such that outputs of more than one gate is Hi, then the speed program voltage

(zero to +6VDC) will be selected by that speed channel which is designated by the highest number.

Step 4 : Now begin to program by filling out the worksheet given below. If this is your first time, use a pencil, because there may be some erasing before you are finally satisfied. Read through the following example for helpful hints.

ROUGH WORKSHEET

"AND" GATE INPUT NO.	SPEED CHANNEL NO.						
	1	2	3	4	5	6	7
1							
2							
3							
4							

Example : Let us continue with our hypothetical example that was mentioned in the beginning steps of this guideline. Suppose we are still working with option PS6 which is capable of seven speeds; six set by PC board mounted pots and one using a signal external to this PC board. Again, we hypothetically allocate speed channels to the functions as given below.

Speed channel No.1 is enabled anytime the "Run-Jog" operator is the "Jog" mode, regardless of other operator situations.

Speed channel No.2 is enabled when the control is in the "Man" mode, i.e., the "Auto-Manual" operator is in the "Man" mode, the "Run-Jog" operator is in the "Run" mode, and the "Fwd" command is enabled.

Speed channel No.3 is enabled whenever the control is in the "Run" mode and "Rev" command is enabled, regardless of whether it is in "Auto" or "Man" mode. But remember we still want speed channel No.1 to take over when the control is reversing in the "Jog" mode.

Speed channel No. 7 is enabled when the "Run/Jog" operator is in the "Run" mode, the "Auto-Manual" operator is in the "Auto" mode, and the "Fwd" command is enabled.

Speed channels No. 4, No. 5, and No.6 should be disarmed by removing the appropriate jumpers on terminal block 150TB. Refer to drawing A3299-007-EW.

For the example described above with option PS6, the worksheet turns out to

be as follows :

SAMPLE WORKSHEET #1

"AND" GATE INPUT NO.	SPEED CHANNEL NO.						
	1	2	3	4	5	6	7
1	none	MAN	none	none	none	none	AUTO
2	JOG	RUN	RUN	none	none	none	RUN
3	none	FWD	REV	none	none	none	FWD
4	JUMPER	JUMPER	JUMPER	none	none	none	JUMPER

The same example could be done using a PS3 option instead of PS6, and the worksheet would turn out as follows:

SAMPLE WORKSHEET #2

"AND" GATE INPUT NO.	SPEED CHANNEL NO.						
	1	2	3	4	5	6	7
1	none	MAN	none	AUTO			
2	JOG	RUN	RUN	RUN			
3	none	FWD	REV	FWD			
4	JUMPER	JUMPER	JUMPER	JUMPER			

Step 5: HP units that are equipped with the "Preset Speeds" options have the nameplate mounted above the E1532 PC board with four nylon spacers. Remove this nameplate by snapping off the spacers from the E1532 PC board. This will expose an entire array of programming strips. Start programming the unit by placing program jumpers on these terminal strips and/or arranging jumpers and switches on the terminal block 150TB. Use the plan that was devised on the Rough Worksheet in Step 4.

Step 6: Turn power on and put the control through trial runs. Verify that each designated speed channel gets selected when its programmed

conditions are met. The LED's display in BCD (binary coded decimal) the speed channel number that is selected at the output. If the results are satisfactory as expected, move on to Step 7. But if the results are not satisfactory then the possible problems and solutions are given below.

a) Certain designated speed channels do not get selected. Probable cause is a missing jumper on 150TB.

b) Wrong channel gets selected. If you take a closer look at the program conditions that have been set, you will probably fine that more than one channel is eligible to be selected simultaneously, but the channel with the highest designation number gets the priority.

c) Unused channel gets selected. Probably because the appropriate jumper on terminal block 150TB has not been removed.

d) If it is found that the preset signal of two or more speed channels will be set identically, more speed channels than necessary have probably been used. By proper programming, it is possible to reduce all the speed channels with identical speed settings to just one speed channel. For example, if "Jog-Fwd" and "Jog-Rev" channels were programmed and it was found that the speed settings on both these channels were always identical, then these channels can be reduced to just one speed channel. ("Jog") by leaving the program jumper off the "Fwd" & "Rev" positions.

Step 7: After verifying that the programming is correct and the system changes speeds appropriately, then the Final Worksheet should be filled out and saved for future reference.

FINAL WORKSHEET

"AND" GATE INPUT NO.	SPEED CHANNEL NO.						
	1	2	3	4	5	6	7
1							
2							
3							
4							

Step 8: Write or type the information from the Final Worksheet on 3/8" x 1 1/4" labels. Stick these labels in their appropriate blocks on the E1532 PC board, so that the program information for each channel falls next to

the speed pot for that channel. Figure B is an example for Sample Worksheet #1 of Step 4.

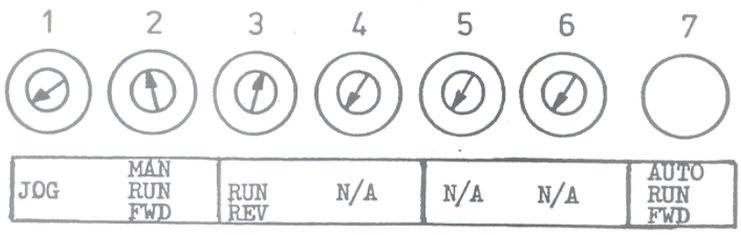


FIGURE B
Sample of Information typed on Potentiometer Identification Labels

This helps the operator to associate the speed setting with the program conditions for each channel. Figure C gives examples of notations on the labels for the case where external control switches are wired to terminal block 150TB.

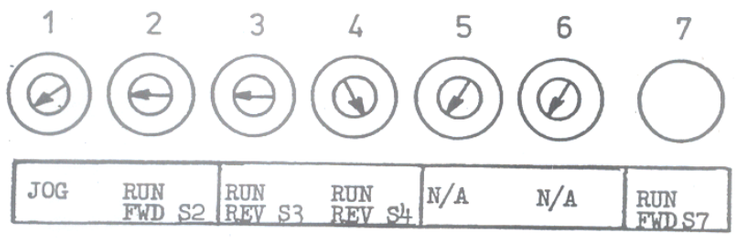
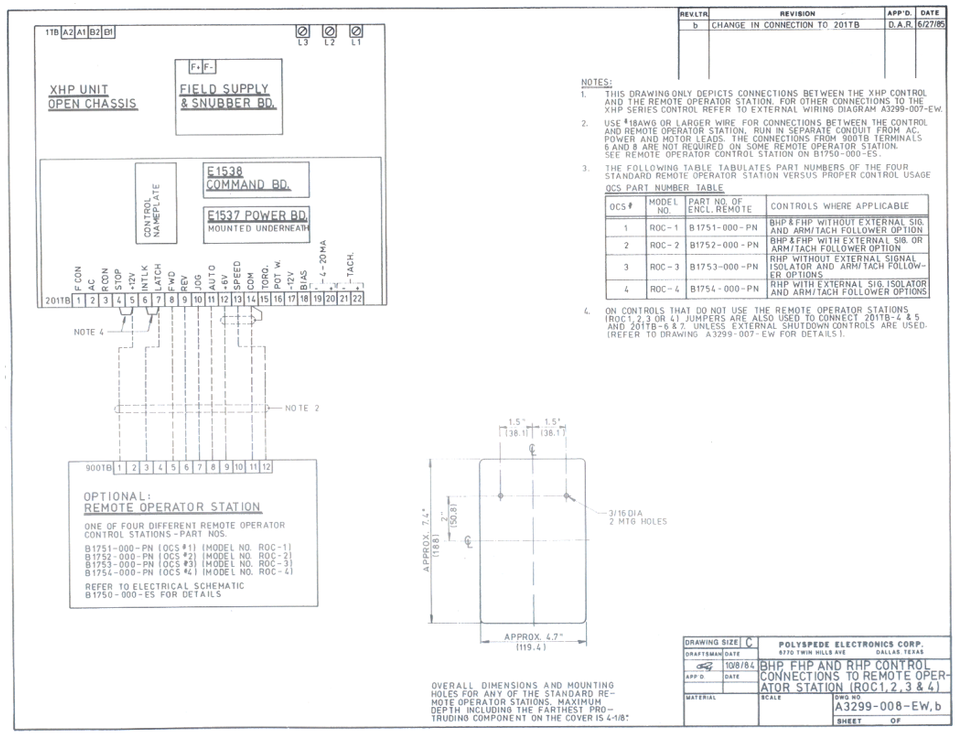


FIGURE C
Sample of Information typed on Potentiometer Identification Labels

Step 9: The nameplate is the only convenient means of identifying a HP unit accurately. Therefore, the last but not the least step is to replace the nameplate back on the E1532 PC board to avoid losing it.



REVLTR	REVISION	APP'D.	DATE
b	CHANGE IN CONNECTION TO 201TB	D.A.R.	6/27/85

NOTES:

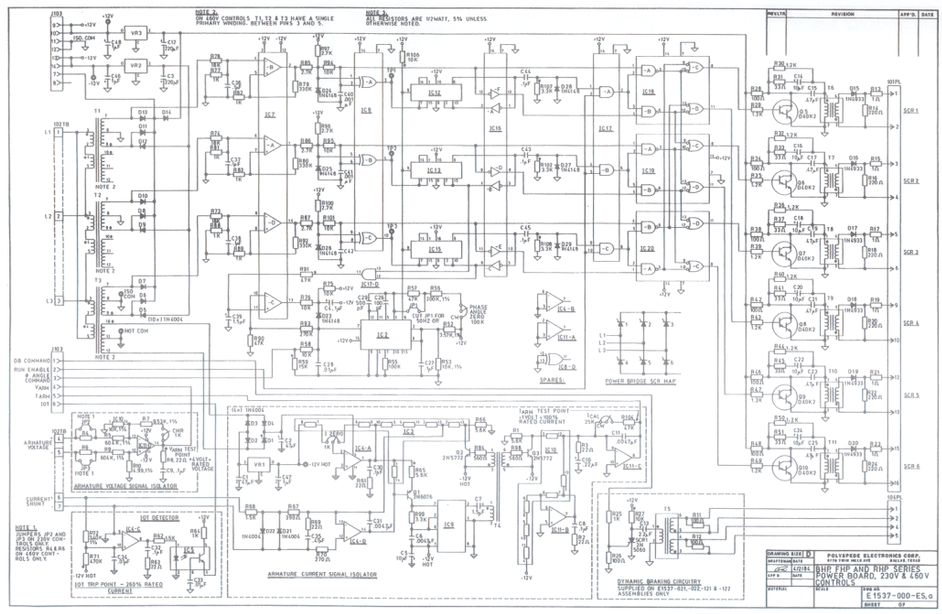
1. THIS DRAWING ONLY DEPICTS CONNECTIONS BETWEEN THE XHP CONTROL AND THE REMOTE OPERATOR STATION. FOR OTHER CONNECTIONS TO THE XHP SERIES CONTROL REFER TO EXTERNAL WIRING DIAGRAM A3299-007-EW.
2. USE #18AWG OR LARGER WIRE FOR CONNECTIONS BETWEEN THE CONTROL AND REMOTE OPERATOR STATION. RUN IN SEPARATE CONDUIT FROM AC. POWER AND MOTOR LEADS. THE CONNECTIONS FROM 900TB TERMINALS 6 AND 8 ARE NOT REQUIRED ON SOME REMOTE OPERATOR STATION. SEE REMOTE OPERATOR CONTROL STATION ON B1750-000-ES.
3. THE FOLLOWING TABLE TABULATES PART NUMBERS OF THE FOUR STANDARD REMOTE OPERATOR STATION VERSUS PROPER CONTROL USAGE

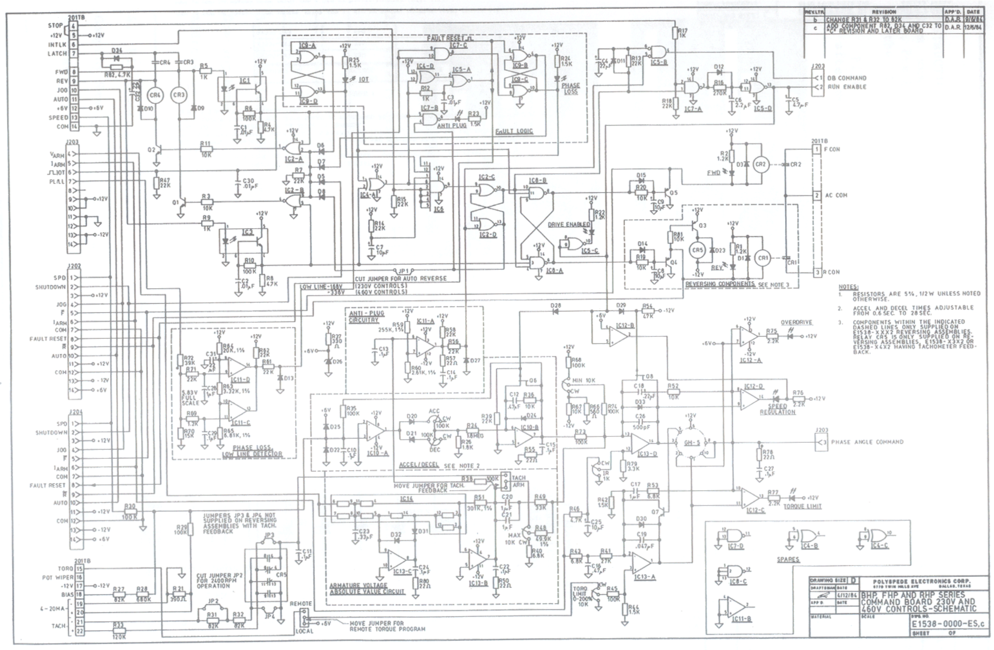
OCS PART NUMBER TABLE

OCS #	MODEL NO.	PART NO. OF ENCL. REMOTE	CONTROLS WHERE APPLICABLE
1	ROC-1	B1751-000-PN	BHP & FHP WITHOUT EXTERNAL SIG. AND ARM/TACH FOLLOWER OPTION
2	ROC-2	B1752-000-PN	BHP & FHP WITH EXTERNAL SIG. OR ARM/TACH FOLLOWER OPTION
3	ROC-3	B1753-000-PN	RHP WITHOUT EXTERNAL SIGNAL ISOLATOR AND ARM/TACH FOLLOWER OPTIONS
4	ROC-4	B1754-000-PN	RHP WITH EXTERNAL SIG. ISOLATOR AND ARM/TACH FOLLOWER OPTIONS

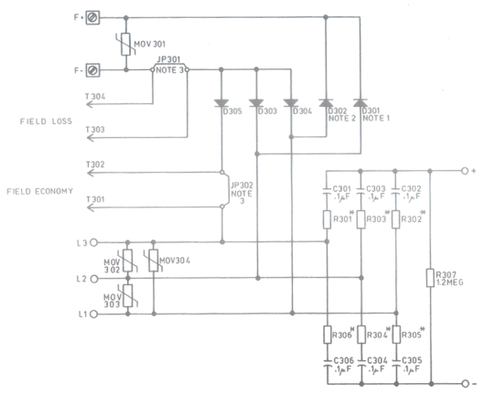
4. ON CONTROLS THAT DO NOT USE THE REMOTE OPERATOR STATIONS (ROC1,2,3 OR 4) JUMPERS ARE ALSO USED TO CONNECT 201TB-4 & 5 AND 201TB-6 & 7, UNLESS EXTERNAL SHUTDOWN CONTROLS ARE USED. (REFER TO DRAWING A3299-007-EW FOR DETAILS).

DRAWING SIZE C	POLYSPEDE ELECTRONICS CORP. 8370 TWIN HILLS AVE DALLAS, TEXAS	
DRAFTSMAN DATE: 10/8/84	BHP FHP AND RHP CONTROL CONNECTIONS TO REMOTE OPERATOR STATION (ROC1,2,3 & 4)	
APP'D DATE		
MATERIAL	SCALE	DWG NO A3299-008-EW, b
		SHEET OF


NOTE 2.
ON 460V CONTROLS T1, T2 & T3 HAVE A SINGLE PRIMARY WINDING. BETWEEN PINS 3 AND 5.
NOTE 3.
ALL RESISTORS ARE 1/2WATT, 5% UNLESS OTHERWISE NOTED.
REVISION
APP'D.
DATE
ARMATURE VOLTAGE SIGNAL ISOLATOR
ARMATURE CURRENT SIGNAL ISOLATOR
DYNAMIC BRAKING CIRCUITRY
SUPPLIED ON EX537-021-002-121 & -122 ASSEMBLIES ONLY
SPARES:
POWER BRIDGE SCR MAP
POLYPHASE ELECTRONICS CORP.
BHP, FHP AND RHP SERIES
POWER BOARD, 230V & 460V
CONTROLS
E1537-000-ES,a


PHASE ANGLE COMMAND
TORQUE LIMIT
SPARES
DRAWING SIZE D
POLYSPEDE ELECTRONICS CORP.
DALLAS, TEXAS
4/12/84
BHP, FHP AND RHP SERIES
COMMAND BOARD 230V AND
460V CONTROLS-SCHEMATIC
E1538-0000-ES,c

REVLTR	REVISION	APP'D.	DATE
b	ADD MOV302 – MOV304	D.A.R.	5/5/84



* – RESISTORS R301 THRU R306 – 47 OHMS 230V CONTROLS.
50 OHMS 460 V CONTROLS.

NOTES :
1. DIODE D301 IS ONLY PROVIDED ON THE -XY2 ASSEMBLIES.
2. DIODE D302 IS ONLY PROVIDED ON THE -XY2 ASSEMBLIES. ON THE -XY1 AND -XY3 ASSEMBLIES DIODE D302 IS REPLACED WITH A JUMPER.
3. QUICK CONNECT TERMINALS T301, T302, T303, & T304 ARE PROVIDED TO ALLOW ADDING FIELD ECONOMIZING OR FIELD LOSS OPTIONS. WHEN FIELD ECONOMIZING IS PROVIDED, JUMPER JP302 IS REMOVED. WHEN FIELD LOSS IS PROVIDED, JUMPER JP301 IS REMOVED.
4. THE ASSEMBLY NUMBER OF THE E1539 BOARD IS SPECIFIED BY 3 NUMBERS FOLLOWING THE E1539 DESIGNATION. TABLE 1 TABULATES THE VALIDATIONS.

TABLE 1

ASSEMBLY NO.	AC INPUT VOLTAGE	DC FIELD VOLTAGE
E1539-XY1	230	150
E1539-XY2	230	240
E1539-XY3	460	300

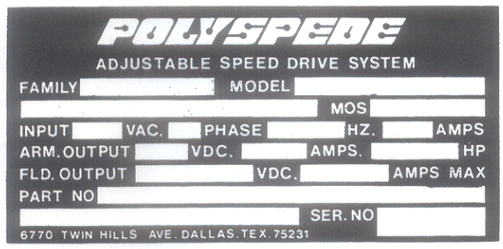
"X" IS "0" ON BOARDS WITH JUMPER JP302 AND IS "1" ON BOARDS WITHOUT JP302 (FIELD ECONOMY OPTION)
"Y" IS "0" ON BOARDS WITH JP301 AND A "1" ON BOARDS WITHOUT JP301 (FIELD LOSS OPTION)

DRAWING SIZE C		POLYSPEDE ELECTRONICS CORP. 6770 TWIN HILLS AVE DALLAS, TEXAS
DRAFTSMAN	DATE	
	5/1/84	BOARD, PC, FIELD SUPPLY & SNUBBER, XHP SERIES-ALL MODELS - SCHEMATIC
APP'D.	DATE	
MATERIAL	SCALE	DWG NO. E1539-000-ES b

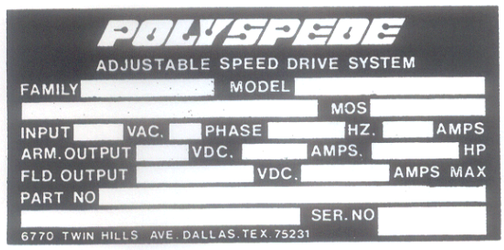
FIELD MODIFICATION FORM

INSTRUCTIONS: When an HP unit is subjected to modification in the field, this form must be completed in detail and mailed to Polyspede Electronics, P.O. Box 822720 Dallas, Texas, 75238. Mail the form to the attention of the "Test Department."

1. Fill in all blocks completely for both (a) before modification and (b) after modification.



(a) Nameplate Information Before Modification



(b) Nameplate Information After Modification

2. Briefly describe the modification. _____

_____

_____

_____

3. Name (of person making the modification) _____

Company Name _____ Phone: ( ) _____

Address _____

_____

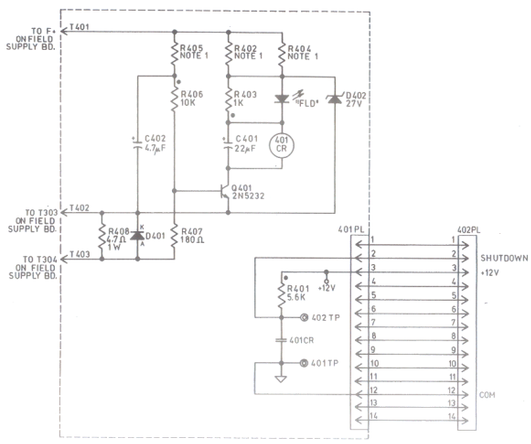
4. Final Location:

Company Name _____ Phone: ( ) _____

Address _____

_____

REV.LTR.	REVISION	APP'D.	DATE
b	R408 WAS 3.9 OHM	D.A.R.	6/27/85
c	DELETE R404 AND CHANGE R402 FROM 18K 2WATT TO 10K 12WATT ON E1540-01 ASSEMBLIES	D.A.R.	12/1/88



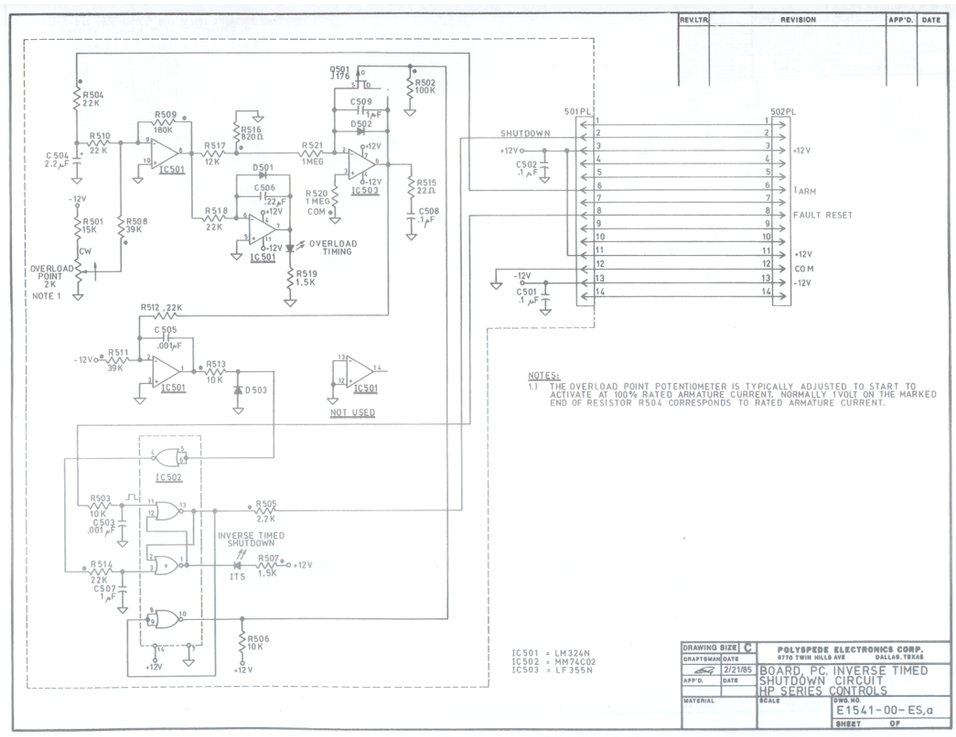
NOTES:

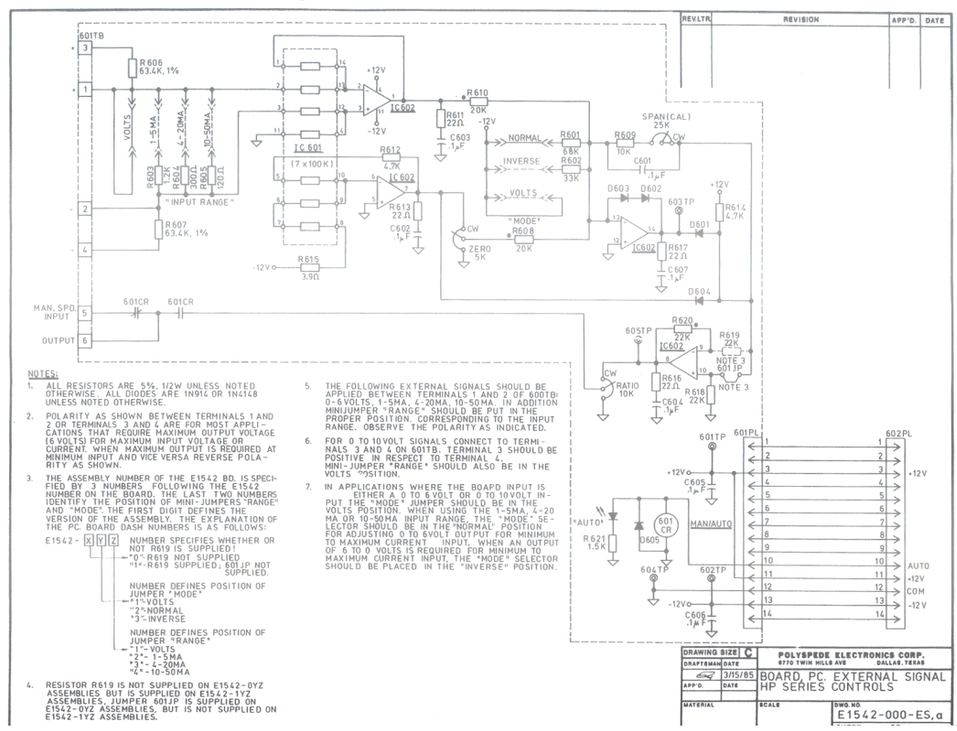
1. RESISTOR VALUES R402, & R405 CHANGE AS A FUNCTION OF ASSEMBLY. REFER TO TABLE 1 FOR TABULATION OF VALUES.
2. THE LED IS LIT WHEN 100MA OR GREATER FIELD CURRENT IS DETECTED.
3. REFER TO TABLE 1 FOR TABULATION OF AC CONTROL VOLTAGE VS. DC FIELD VOLTAGE OUTPUT.

TABLE 1

ASSEMBLY NO.	AC CONTROL VOLTAGE	DC FIELD VOLTAGE OF CONTROL	R405	R402	R404
E1540-01	230 VAC	150 VDC	150K, 1W	10K, 12W	
E1540-02	230 VAC	240 VDC	270K, 1W	20K, 12W	—
E1540-03	460 VAC	300 VDC	270K, 1W	22.5K, 12W	—

DRAWING SIZE C	POLYSPEDE ELECTRONICS CORP. 8770 THIN HILLS AVE DALLAS, TEXAS	
DRAFTSMAN DATE		
2/20/85	BOARD, PC, FIELD LOSS OPTION FOR ALL HP SERIES CONTROLS	
APP'D. DATE		
MATERIAL	SCALE	DWG NO. E1540-00-ES, c
		SHEET OF


REV.LTR
REVISION
APP'D.
DATE
Q501
J176
R502
100K
R504
22K
R509
180K
R516
820Ω
C509
.1μF
D502
R510
12K
C504
2.2μF
IC501
R517
12K
R521
1MEG
+12V
IC503
-12V
R515
22Ω
C508
.1μF
D501
C506
.22μF
R520
1 MEG
COM
R518
22K
IC501
OVERLOAD
TIMING
R519
1.5K
-12V
R501
15K
R508
39K
CW
OVERLOAD
POINT
2K
NOTE 1
R512 ,22K
C505
.001μF
-12V
R511
39K
R513
10K
IC501
D503
IC501
NOT USED
IC502
R503
10K
C503
.001μF
R505
2.2K
INVERSE TIMED
SHUTDOWN
R514
22K
C507
1μF
ITS
R507
1.5K
+12V
R506
10K
+12V
+12V
501PL
SHUTDOWN
C502
.1μF
C501
.1μF
-12V
502PL
+12V
I ARM
FAULT RESET
+12V
COM
-12V
NOTES:
1.) THE OVERLOAD POINT POTENTIOMETER IS TYPICALLY ADJUSTED TO START TO ACTIVATE AT 100% RATED ARMATURE CURRENT. NORMALLY 1VOLT ON THE MARKED END OF RESISTOR R504 CORRESPONDS TO RATED ARMATURE CURRENT.
IC501 = LM324N
IC502 = MM74C02
IC503 = LF355N
DRAWING SIZE C
DRAFTSMAN
DATE
2/21/85
APP'D.
DATE
MATERIAL
SCALE
POLYSPEDE ELECTRONICS CORP.
8770 TWIN HILLS AVE DALLAS, TEXAS
BOARD, PC. INVERSE TIMED
SHUTDOWN CIRCUIT
HP SERIES CONTROLS
DWG NO.
E1541-00-ES,a
SHEET OF


REV.LTR.
REVISION
APP'D.
DATE
601TB
R606 63.4K, 1%
VOLTS
1-5MA
4-20MA
10-50MA
R603 1.3K
R604 680Ω
R605 300Ω
R606 120Ω
"INPUT RANGE"
R607 63.4K, 1%
IC 601
(7 x 100 K)
+12V
-12V
IC602
R610 20K
R611 22Ω
C603 1μF
R612 4.7K
R613 22Ω
C602 .1μF
R615 3.9Ω
NORMAL
INVERSE
VOLTS
"MODE"
R608 20K
CW
ZERO 5K
R601 68K
R602 33K
SPAN(CAL) 25K
R609 10K
C601 1μF
D603
D602
D601
D604
603TP
R614 4.7K
R617 22Ω
C607 1μF
MAN. SPD. INPUT
OUTPUT
601CR
601CR
605TP
R620 22K
R619 22K
R616 22Ω
C604 1μF
R618 22K
NOTE 3
601JP
RATIO 10K
601TP
601PL
602PL
+12V
C605 .1μF
"AUTO"
R621 1.5K
D605
601 CR
MAN/AUTO
604TP
602TP
C606 .1μF
AUTO
COM
NOTES:
1. ALL RESISTORS ARE 5% 1/2W UNLESS NOTED OTHERWISE. ALL DIODES ARE 1N914 OR 1N4148 UNLESS NOTED OTHERWISE.
2. POLARITY AS SHOWN BETWEEN TERMINALS 1 AND 2 OR TERMINALS 3 AND 4 ARE FOR MOST APPLICATIONS THAT REQUIRE MAXIMUM OUTPUT VOLTAGE (6 VOLTS) FOR MAXIMUM INPUT VOLTAGE OR CURRENT. WHEN MAXIMUM OUTPUT IS REQUIRED AT MINIMUM INPUT AND VICE VERSA REVERSE POLARITY AS SHOWN.
3. THE ASSEMBLY NUMBER OF THE E1542 BD. IS SPECIFIED BY 3 NUMBERS FOLLOWING THE E1542 NUMBER ON THE BOARD. THE LAST TWO NUMBERS IDENTIFY THE POSITION OF MINI-JUMPERS "RANGE" AND "MODE" THE FIRST DIGIT DEFINES THE VERSION OF THE ASSEMBLY. THE EXPLANATION OF THE PC. BOARD DASH NUMBERS IS AS FOLLOWS:
E1542 - X Y Z
NUMBER SPECIFIES WHETHER OR NOT R619 IS SUPPLIED!
"0"-R619 NOT SUPPLIED
"1"-R619 SUPPLIED; 601JP NOT SUPPLIED.
NUMBER DEFINES POSITION OF JUMPER "MODE"
"1"-VOLTS
"2"-NORMAL
"3"-INVERSE
NUMBER DEFINES POSITION OF JUMPER "RANGE"
"1"-VOLTS
"2"- 1-5MA
"3"- 4-20MA
"4"-10-50MA
4. RESISTOR R619 IS NOT SUPPLIED ON E1542-0YZ ASSEMBLIES BUT IS SUPPLIED ON E1542-1YZ ASSEMBLIES. JUMPER 601JP IS SUPPLIED ON E1542-0YZ ASSEMBLIES, BUT IS NOT SUPPLIED ON E1542-1YZ ASSEMBLIES.
5. THE FOLLOWING EXTERNAL SIGNALS SHOULD BE APPLIED BETWEEN TERMINALS 1 AND 2 OF 600TB: 0-6VOLTS, 1-5MA, 4-20MA, 10-50MA. IN ADDITION MINIJUMPER "RANGE" SHOULD BE PUT IN THE PROPER POSITION, CORRESPONDING TO THE INPUT RANGE. OBSERVE THE POLARITY AS INDICATED.
6. FOR 0 TO 10 VOLT SIGNALS CONNECT TO TERMINALS 3 AND 4 ON 601TB. TERMINAL 3 SHOULD BE POSITIVE IN RESPECT TO TERMINAL 4. MINI-JUMPER "RANGE" SHOULD ALSO BE IN THE VOLTS POSITION.
7. IN APPLICATIONS WHERE THE BOARD INPUT IS EITHER A 0 TO 6 VOLT OR 0 TO 10 VOLT INPUT THE "MODE" JUMPER SHOULD BE IN THE VOLTS POSITION. WHEN USING THE 1-5MA, 4-20 MA OR 10-50MA INPUT RANGE, THE "MODE" SELECTOR SHOULD BE IN THE "NORMAL" POSITION FOR ADJUSTING 0 TO 6 VOLT OUTPUT FOR MINIMUM TO MAXIMUM CURRENT INPUT. WHEN AN OUTPUT OF 6 TO 0 VOLTS IS REQUIRED FOR MINIMUM TO MAXIMUM CURRENT INPUT, THE "MODE" SELECTOR SHOULD BE PLACED IN THE "INVERSE" POSITION.
DRAWING SIZE C
DRAFTSMAN DATE
3/15/85
APP'D. DATE
MATERIAL
SCALE
POLYSPEDE ELECTRONICS CORP.
6770 TWIN HILLS AVE DALLAS, TEXAS
BOARD, PC. EXTERNAL SIGNAL HP SERIES CONTROLS
DWG. NO.
E1542-000-ES,a

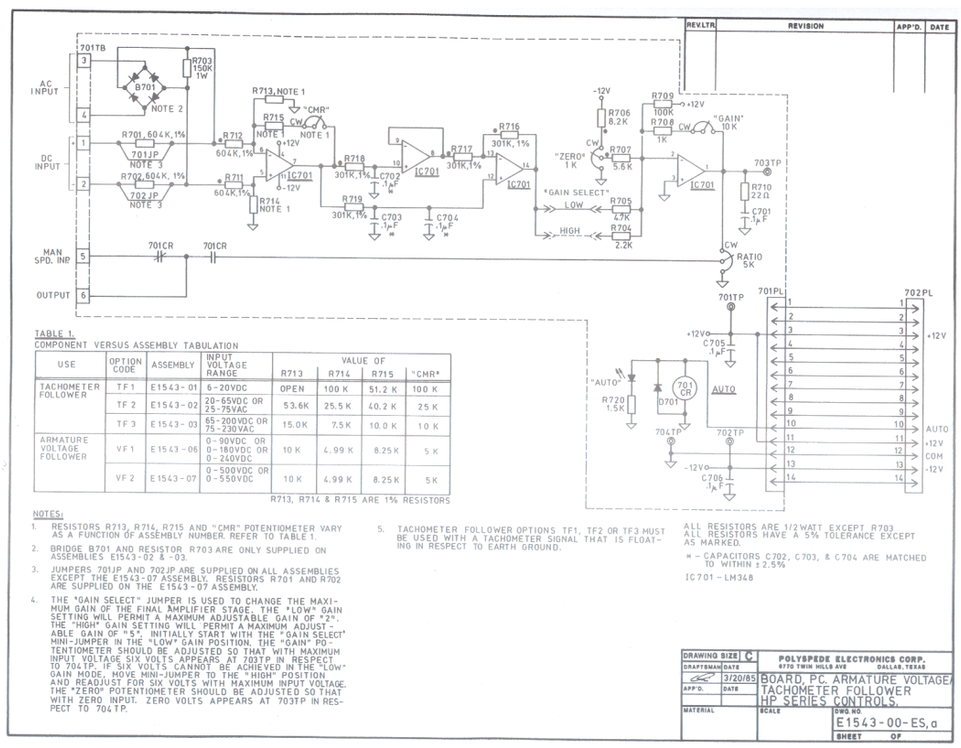


TABLE 1.
COMPONENT VERSUS ASSEMBLY TABULATION

USE	OPTION CODE	ASSEMBLY	INPUT VOLTAGE RANGE	VALUE OF R713	R714	R715	"CMR"
TACHOMETER FOLLOWER	TF 1	E1543-01	6-20VDC	OPEN	100 K	51.2 K	100 K
	TF 2	E1543-02	20-65VDC OR 25-75VAC	53.6K	25.5 K	40.2 K	25 K
	TF 3	E1543-03	55-200VDC OR 75-230VAC	15.0K	7.5 K	10.0 K	10 K
ARMATURE VOLTAGE FOLLOWER	VF 1	E1543-06	0-90VDC OR 0-180VDC OR 0-240VDC	10 K	4.99 K	8.25K	5 K
	VF 2	E1543-07	0-500VDC OR 0-550VDC	10 K	4.99 K	8.25K	5K

R713, R714 & R715 ARE 1% RESISTORS

NOTES:

1. RESISTORS R713, R714, R715 AND "CMR" POTENTIOMETER VARY AS A FUNCTION OF ASSEMBLY NUMBER. REFER TO TABLE 1.
2. BRIDGE B701 AND RESISTOR R703 ARE ONLY SUPPLIED ON ASSEMBLIES E1543-02 & -03.
3. JUMPERS 701JP AND 702JP ARE SUPPLIED ON ALL ASSEMBLIES EXCEPT THE E1543-07 ASSEMBLY. RESISTORS R701 AND R702 ARE SUPPLIED ON THE E1543-07 ASSEMBLY.
4. THE "GAIN SELECT" JUMPER IS USED TO CHANGE THE MAXIMUM GAIN OF THE FINAL AMPLIFIER STAGE. THE "LOW" GAIN SETTING WILL PERMIT A MAXIMUM ADJUSTABLE GAIN OF "2". THE "HIGH" GAIN SETTING WILL PERMIT A MAXIMUM ADJUSTABLE GAIN OF "5". INITIALLY START WITH THE "GAIN SELECT" MINI-JUMPER IN THE "LOW" GAIN POSITION. THE "GAIN" POTENTIOMETER SHOULD BE ADJUSTED SO THAT WITH MAXIMUM INPUT VOLTAGE SIX VOLTS APPEARS AT 703TP IN RESPECT TO 704TP. IF SIX VOLTS CANNOT BE ACHIEVED IN THE "LOW" GAIN MODE, MOVE MINI-JUMPER TO THE "HIGH" POSITION AND READJUST FOR SIX VOLTS WITH MAXIMUM INPUT VOLTAGE. THE "ZERO" POTENTIOMETER SHOULD BE ADJUSTED SO THAT WITH ZERO INPUT, ZERO VOLTS APPEARS AT 703TP IN RESPECT TO 704TP.
5. TACHOMETER FOLLOWER OPTIONS TF1, TF2 OR TF3 MUST BE USED WITH A TACHOMETER SIGNAL THAT IS FLOATING IN RESPECT TO EARTH GROUND.

ALL RESISTORS ARE 1/2 WATT EXCEPT R703.
ALL RESISTORS HAVE A 5% TOLERANCE EXCEPT AS MARKED.
* - CAPACITORS C702, C703, & C704 ARE MATCHED TO WITHIN ± 2.5%
IC701 - LM348

DRAWING SIZE	C	POLYSPEDE ELECTRONICS CORP. 6770 TWIN HILLS AVE DALLAS, TEXAS
DRAFTSMAN	DATE	BOARD, PC, ARMATURE VOLTAGE/ TACHOMETER FOLLOWER HP SERIES CONTROLS.
	3/20/85	
APP'D.	DATE	
MATERIAL		SCALE
		DWG. NO. E1543-00-ES, a
		SHEET OF