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## *DESCRIPTION OF PACKAGE STYLES*

STANDARD PACKAGE: Pictured on the cover. Model numbers will be per Table I (eg: SP-101)

OPEN CHASSIS UNIT: Model numbers is Table I will be preceded by the letter "O" (eg: OSP-101). Open chassis units are similar to the picture on the cover, but are furnished without a face plate, lower end plate and back plate. The "Speed Adjust" potentiometer, fuses and fuse blocks are furnished loose for customer installation.

SYSTEMS-TYPE UNIT: Model numbers in Table I will be preceded by the letter "S" (eg: SSP-101). These units are normally supplied pre-mounted on a panel and pre-wired to various options as a part of a "Spartan II System." They are "bare" with no enclosing plates furnished. Numerous parts of this manual such as installation and wiring instructions do not apply to Systems Type Spartan II Units. The manual is included however as a reference for servicing and adjustment purposes. See separately furnished drawings for installation instructions.

## 1. DESCRIPTION

The SPARTAN II Drive System consists of a SPARTAN II solid state regulated power unit, a Polyspede shunt-wound DC motor, and option boxes (if selected) to provide such auxiliary functions as reversing, dynamic braking and jogging.

The power unit is a highly developed regulator system capable of maintaining motor speed precisely at any given level within the advertised speed range of the control. Two internal regulators are provided. The primary regulator maintains speed constant at a selected value until the motor load (torque) exceeds a preset value, normally 150% of rated motor torque. As this occurs, the second regulator assumes control and allows speed to drop but holds motor torque constant at the preset limiting value. If the motor load continues to increase, as would be the case if the driven machine had jammed, the torque limit is capable of holding this preset value of torque down to locked-rotor or zero speed condition. Thus, the control has two modes of operation; a constant speed (normal) mode and a constant torque (overload) mode. Operation is smooth and stable in both modes.

In the normal constant speed mode, the control holds motor speed constant at a selected value, determined by the setting of the "Speed Adjust" knob, by

regulating armature voltage. Load changes are compensated for by an "IR" compensation circuit which senses any increase in armature current and raises armature voltage to compensate for the increased voltage drop in the motor armature. This circuit thus controls the regulation (speed change) due to load changes. With proper adjustment of the "IR" circuit, no-load to full-load regulation of less than +/- 1% of base speed can be readily achieved with little or no sacrifice of stability.

All components used in the regulators are temperature compensated and shift of speed setting due to changes in temperature within the control housing is negligible. Also, the setting of the torque limit point is insensitive to temperature changes and the regulators are not affected by changes in line voltage within the specified range of allowable input voltages.

The SPARTAN II family covers 1/6 to 2 horsepower per Table I. Controls of a given voltage rating are identical except for connection of the sensing resistor. Table I gives sensing resistor connections for various models. Field conversion of controls with a given voltage rating from one horsepower to another is accomplished by reconnecting the sensing resistor and changing the model tag per Table I.

The drive motor and the SPARTAN II unit are protected against overloads by the excellent SPARTAN II torque limit. In addition, the SPARTAN II unit is protected against damage due to accidental wiring shorts or grounds by fast-acting rectifier-protection type fuses inserted in the AC input lines. The fuses are located behind the face plate (enclosed models) or furnished loose for user connection (open chassis models).

| WARNING |
| --- |
| If fuse replacement becomes necessary, use only the specified fuses. The use of substitute fuses may void control warranty. |

TABLE 1

| MODEL | CONTROL VOLTAGE | CONTROL HORSEPOWER | FUSE TYPE | R71 CONNECTION (DIAGRAM #) |
| --- | --- | --- | --- | --- |
| SP-16, SP-25 | 115 | 1/6 or 1/4 | A | 1 |
| SP-33, SP-50 | 115 | 1/3 or 1/2 | A | 2 |
| SP-75, SP-100 | 115 | 3/4 or 1 | A | 3 |
| SP-34, SP-51 | 230 | 1/3 or 1/2 | B | 1 |
| SP-76, SP-101 | 230 | 3/4 or 1 | B | 2 |
| SP-150, SP-200 | 230 | 1 1/2 or 2 | B | 3 |

Fuse type A: Shawmut A13 x25 or Intl Rectifier SF13 x 25
Fuse type B: Shawmut A25 x 25 or Intl Rectifier SF25 x 25

SENSING RESISTOR (R71) CONNECTIONS

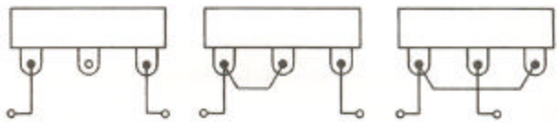


DIAGRAM #1
.2 ohms

DIAGRAM #2
.1 ohms

DIAGRAM #3
.05 ohms

Table II gives technical specifications of the control unit and matched Polyspede motor.

Section 12 gives user application information for specific applications such as contactor operation, reversing and external torque programming.

**TABLE II**

**SPECIFICATION**

| | |
|---|---|
| CONTROL UNIT | |
| Input Voltage (single phase) ……. | 115VAC ± 10 volts(115V. models)<br>230 VAC ± 20 volts(230V. models) |
| Input Frequency ……... | 50 /60 Hz |
| Output Voltage to Armature…….. ….. | 0-90 VDC (0 -180 VDC on 230V. models) |
| Output Voltage to Field ..……. | 100 VDC (200 VDC 230V .models) |
| Speed Range ……. | 0 – 100% |
| Speed Range for Specified Regulation …… | 100:1 |
| Regulation ……..……. | Adjustable to ± 1% of base speed |
| Stability of Speed Setting: | |
| Temp. Coefficient (Typ.)[1]…… …. | ±.05% of base speed per °C |
| Line voltage Coefficient (Typ.)[2]……... | ±.05% of base speed per volt change<br>(± .025% for 230V. models) |
| Speed Dial Characteristics ……... | Linear |
| Linear Acceleration Time: | |
| (0 – 90% of final speed) ……... | 0.5 to 15 sec. variable |
| Torque Limit Adjustment Range…….. | 75 to 200% rated torque |
| External Adjustment Points Available, Linear…. | |
| Maximum Ambient Temp…….. …… | 40° C |
| External Signal Capability ……... | See Polyspede Application Bulletins |
| MOTOR, 115V, DRIVES, 1800 RPM OR 2400 RPM | |
| Armature Voltage…… | 90 volts, unfiltered, rectified |
| Field Voltage ……... | 100 volts, unfiltered, rectified |
| Ambient Temperature…….. | 40° C max |
| Speed Range ……... | 20:1 at rated torque |
| Speed Stability | |
| Temp . Coefficient (Typ)[3] ……..... | +0.1% of base speed per ° C |
| Field Voltage Coefficient (Typ)…….…. | - 0.2% of base speed per volt change |
| Service Factor…… | 1.0 |

TABLE II

SPECIFICATIONS (Continued)

| | |
|---|---|
| Short-Term Overload Capacity…….. | 150% rated torque |
| MOTOR, 230V, DRIVES, 1800 RPM OR 2400 RPM | |
| Armature Voltage……. | 180 volts, unfiltered, rectified |
| Field Voltage …….. | 200 volts, unfiltered, rectified |
| Ambient Temperature…….. | 40° C max |
| Speed Range …… | 20:1 at rated torque |
| Speed Stability | |
| Temp . Coefficient (Typ)[3] …… | + 0.1% of base speed per ° C |
| Field Voltage Coefficient (Typ)4…….. | - 0.1% of base speed per volt change |
| Service Factor……. | 1.0 |
| Short-Term Overload Capacity…….. | 150% |

NOTES:

1. Temperature of motor held constant, ambient temperature of control varied
2. Field voltage to motor supplied by separate source, line voltage to control unit varied
3. Temperature of control unit held constant, temperature of motor varied.
4. Voltage input to control unit held constant, motor field voltage varied(from separate source)
5. Quantities marked “Typ.” will vary from unit to unit.

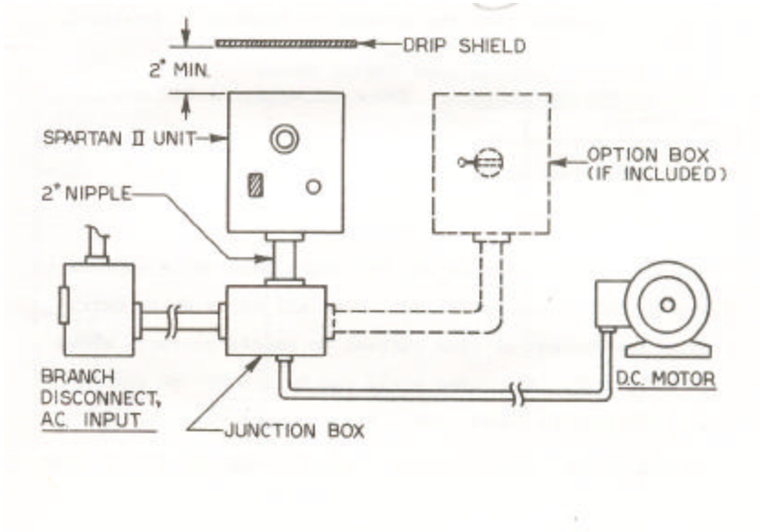
## 2. INSPECTION

Check for shipping damage. If damage is found, report it to the carrier immediately. Do not attempt to operate the drive if visible damage to the circuit boards or any electronic component exists.

## 3. INSTALLATION

### 3.1 MOUNTING

Mount and install standard unit as shown below. (Does not apply to OSP and SSP models)



INSTALLATION NOTES

(1) Wiring will be easier if the "2" nipple is installed and if wiring is connected to the SPARTAN II terminal blocks before mounting the control unit. Remove face plate and lower end plate. Install nipple and wiring as described in 3.2.

(2) Do not block ventilation holes in top and bottom plates.

(3) Drip shield is to guard against chips and liquid spills.

(4) Install in area where ambient temperature is 40° C (104° F) or lower.

(5) Assure that the SPARTAN II housing is grounded.

## 3.2 WIRING PROCEDURE - (Does not apply to SSP models)

Remove the four screws which attach the face plate to allow access for wiring the unit.

Select the schematic on the following page which applies to the control being installed. Size all wires which carry armature current or line current to handle currents shown in Table III. All other wires may be #18 AWG or smaller as permitted by local code. All connections to 52 TB should be made with flexible stranded wire, no larger than #18AWG to avoid damage to the circuit board due to strain. Lug wires and be sure nothing shorts to the chassis or shorts between terminals.

Clearly identify the branch-circuit disconnect; this disconnect must carry the currents shown in Table III, but should have a fuse or trip rating not greater than 30 amperes. If the distribution system which feeds the disconnect is of greater capacity than 120KVA, or if power factor correction capacitors are used, install an isolation transformer (sized at roughly 2 ½ KVA per horsepower) immediately ahead of the branch disconnect.

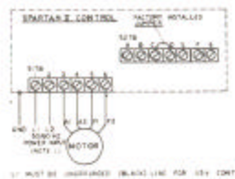
TABLE III

CURRENT RATINGS FOR WIRE SIZING

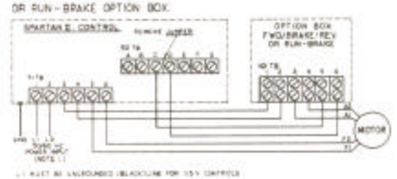
| INPUT VOLTAGE | HORSEPOWER | RMS AMPERES |
|---|---|---|
| 115 VAC | 1/6 | 3 |
| 115 VAC | 1/4 | 5 |
| 115 VAC | 1/3 | 6 |
| 115 VAC | 1/2 | 9 |
| 115 VAC | 3/4 | 14 |
| 115 VAC | 1 | 18 |
| 230VAC | 1/3 | 3 |
| 230VAC | 1/2 | 5 |
| 230VAC | 3/4 | 6 |
| 230VAC | 1 | 9 |
| 230VAC | 1½ | 14 |
| 230VAC | 2 | 18 |

## 3.3 CONNECTIONS DIAGRAMS - ENCLOSED CONTROLS

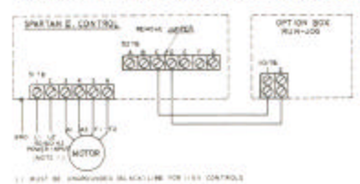
### 3.3.1. BASIC CONTROL, EXTERNAL CONNECTIONS.




### 3.3.2. BASIC CONTROL, CONNECTIONS TO FORWARD-BRAKE-REVERSE OR RUN-BRAKE OPTION BOX.

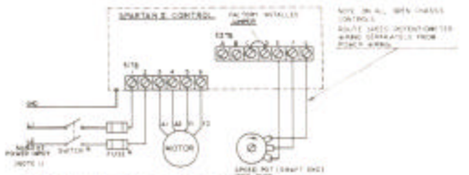



### 3.3.3. BASIC CONTROL, CONNECTIONS TO RUN-JOG OPTION BOX.

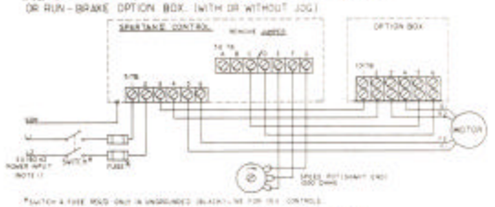



## 3.4 CONNECTION DIAGRAMS - OPEN CHASSIS CONTROLS.

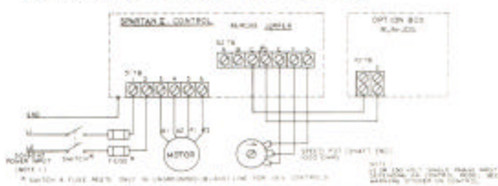
### 3.4.1. BASIC CONTROL, EXTERNAL CONNECTIONS.




### 3.4.2. BASIC CONTROL, CONNECTION TO FORWARD - BRAKE - REVERSE OR RUN - BRAKE OPTION BOX. (WITH OR WITHOUT JOG)




### 3.4.3. BASIC CONTROL CONNECTIONS TO RUN-JOG OPTION BOX.

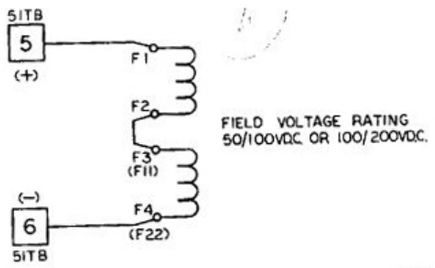


NOTICE

Motor field lead designation F1and F2 in the external connection diagrams on the facing page and in the schematics on Pages 40 & 41 are for reference only. Some DC motors are provided with dual voltage field windings connectable for high or low voltage. The field voltage supplied by the Polyspede SPARTAN II control is as follows:

| | | |
|---|---|---|
| 115VAC Input | - | 100VDC Field |
| 230VAC Input | - | 200VDC Field |

Typical dual voltage field winding connection is as follows:




Refer to the motor wiring information plate and connect field windings for the proper voltage. Note also that some motors have permanent magnet fields in which case no connections are made to Terminals 51TB-5 and 51 TB-6.

## 4. INITIAL TURN- ON PROCEDURE

Re-check all wiring. Accidental grounds on any of the motor leads or speed potentiometer wires (open chassis controls) may damage the unit when power is applied. Inspect for pinched wires. The face plate should be in place; if loose support it so that no terminals on the face plate can short to the chassis. Assure that service is of correct voltage as indicated by warning tags attached to the SPARTAN II unit.

Turn speed potentiometer to zero. Turn power on at the branch disconnect and at the SPARTAN II switch. Slowly advance the speed potentiometer while observing motor. If motor rotation is incorrect, turn power off at the branch disconnect and reverse the A1 and A2 connections in the motor conduit box.

The face plate light labeled “Fuse” is used to indicate blown fuses. The light burns in normal operation but does not burn if fuses are blown.

Check for satisfactory operation throughout the speed range.

If instability (hunting) is observed, reduce the setting of the “IR” trim potentiometer as described in the following section.

Also. if zero-speed creep is observed, or if maximum speed is higher than desired, or if acceleration time is not as desired, adjust the control as described in the following section. If initial operation is satisfactory, no readjustment is

necessary.

5. ADJUSTMENTS:

Five internal adjustments are provided.

a) Minimum speed ("MIN")
b) Maximum speed ("MAX")
c) IR (load) compensation ("IR")
d) Torque limit ("TORQ")
e) Acceleration ("ACC")

The functions of these adjustments are described in Table IV

All adjustments, except "IR", are preset at the factory. A "typical" test motor is utilized. The "Max" and "Torque" adjustments do not depend on individual motor characteristics and therefore should be correct as received. The "IR" and "Min" adjustments, however, are somewhat dependent on characteristics of the particular motor used, and should therefore be made by the user when the drive is installed. Job-site adjustment of "IR" is necessary to achieve specified regulation. The adjustments are permanent; periodic readjustment is not necessary.

Perform adjustments in per Table IV and in the order listed in Table IV. The adjustments are completely independent of each other except as noted below:

a) "IR" has a slight effect on "Min", but "Min" does not affect "IR"

b) "Min" has a slight effect on "Max"

Thus performing adjustments in the order listed in Table IV eliminates any necessity for repeating a calibration operation.

Note that torque limit ("Torque") is independent of the other adjustments. Since this is basically a protective adjustment, preset at the factory, it should not be re-adjusted except to decrease the limit point.

## 5.1 ADJUSTMENT PROCEDURE

a) Turn power off at branch disconnect.

b) Remove four screws that fasten face plate and fold face plate forward to expose the adjustment trim pots.
c) Turn power on and proceed with the adjustment as per Table IV.

CAUTION: The circuit board and components are "hot" with respect to control enclosure and face plate components. Wrap screwdriver shaft with electrical tape to avoid accidental shorts. Do not let screwdriver blade slip and short circuit board components. Support face plate as necessary during adjustments. Also face plate components are "hot" – do not allow terminals to touch control housing.

ADJUSTMENT NOTES

TABLE IV

ADJUSTMENTS

| ADJUSTMENT NAME | DESCRIPTION OF FUNCTIONS NOTES | ADJUSTMENT OF PROCEDURE |
|---|---|---|
| "IR" | Sets the load regulation (%slowdown of motor as shaft load is changed from zero to full rated load).<br><br>If load slowdown is of no concern, rotate "IR" trim pot fully counter clockwise. | <u>Approximate Method</u><br>a) Set speed control knob for 20% speed.<br>b) Rotate "IR" trim pot clockwise until motor begins to hunt.<br>c) Back off "IR" trim pot counterclockwise until hunting stops.<br>d) Back off "IR" trim pot1/3 rd of the span between this setting and zero setting. This method usually results in slight over compensation.<br><br><u>Exact method:</u><br>a) Turn drive power off and connect a DC ammeter in series with the A1 motor lead between motor and control. Do **not** use clamp-on meter.<br>b) Set speed control knob for 20% speed.<br>c) Turn drive power on. With motor shaft loaded as lightly as feasible, read motor speed with a strobe light or a tachometer.<br>d) Load the motor shaft until ammeter reads rated motor current [see nameplate]. Read motor speed with strobe light or tachometer.<br>e) If motor speed decreased as motor was loaded, adjust the "IR" trim pot and repeat (c) and (d) until little or no speed decrease is noted.<br>f) In performing (d) and (e), be sure motor is not loaded heavily enough to cause torque limiting to occur.<br>g) Remove ammeter and reconnect A1 motor lead. Recheck control at very low speed for cogging. |
| "MIN" | Sets the zero calibration of the speed control knob.<br><br>Clockwise rotation of "MIN" trim pot increases speed. | a) Set speed control knob to zero.<br><br>b) Rotate the "MIN" trim pot clockwise until motor starts to rotate.<br>c) Decrease the "MIN" trim pot setting until motor rotation stops. |

| | | |
|---|---|---|
| "MAX" | Calibrates the speed at which motor turns when speed control knob is set at 100%. Clockwise rotation of the "MAX" trim pot increases maximum motor speed. | a) Turn drive power off.<br>b) Connect a DC voltmeter between A1 and A2 motor leads at the motor.<br>c) Set meter scale so that rated armature voltage (90 volts or 180 volts as noted on motor name-plate) may be read.<br>d) Turn power on. Turn speed control knob to 100% setting..<br>e) Adjust "MAX" trim pot until meter reads nameplate rated voltage (90 volts or 180 volts).<br><br>NOTE: If desired, a tachometer or strobe light may be used in lieu of the DC voltmeter. Proceed as described above, except adjust "MAX" trim pot until tachometer or strobe light indicates that motor is turning at base speed. |
| "TORQ" | **(**Torque Limit**).** Sets the maximum torque that can be obtained from the motor, and the maximum armature current that the control unit will deliver. Torque adjustment is preset at the factory for 150% to 200% of rated motor torque (current) depending on motor horsepower. Clockwise rotation of the "TORQUE" trim pot increases the torque that the motor will deliver. | a) Turn power off.<br>b) Connect a DC ammeter (not a clamp-on type) in series with the A1 motor lead between motor and control unit.<br>c) Turn power on.<br>d) Set speed control knob for low speed (e.g. 10% setting).<br>e) Apply friction braking to the motor shaft until motor stalls out. Caution**:** Watch ammeter to assure that control is limiting current.<br>f) Stall current should read roughly 150% of rated armature current (see motor nameplate).<br>g) If current is too high, rotate the "TORQUE" trim pot counterclockwise to decrease. |
| "ACC" | Acceleration adjustment sets time for motor to reach set speed. | Adjust to desired acceleration time. C.W. rotation increases time. |

## 6. OPERATION (Does not apply to model SSP controls)

### 6.1 BASIC CONTROL

If the control system does not include an option box (forward -brake-reverse-,run-brake, or run-jog), the motor is started simply by pressing the on-off switch to the "on" position. Turning this switch off remove all power from the control and from the motor. There is no need to return the speed control knob to zero when re-starting the drive. The control unit contains a linear acceleration unit variable from .5 to 15 seconds. When the control is turned off at the on-off switch, wait at least 2 seconds for the controlled acceleration circuit to reset before again pressing the switch on. The speed control dial is linear; that is, 50% setting of the dial commands 50% maximum motor speed.

### 6.2 CONTROL WITH RUN-JOG OPTION BOX

Operation of this control is identical to that of the basic control, except that a spring-loaded run-jog switch is provided for turning the control on and off rapidly. This switch may be pulsed on and off as rapidly as the operator can activate it with no adverse effects in the control. When this switch is in the "run" position the control and motor operate normally as described under "Basic Control". The switch has a centre-off position. In this position power is left on

the control and on the motor field, but drive will not run. The switch is spring-loaded in the "jog" position and returns to the center-off position when released and the motor coasts to zero speed. In the "jog" position the control also runs precisely as it would in the 'run" mode, and if the "jog" switch is held down, the motor will accelerate to the speed set on the speed control knob. The switch maybe left in the center-off position indefinitely with the main power switch still in the "on" position. If the drive is left unattended, however, it may be advisable to turn the control "on-off" switch off.

## 6.3 CONTROL WITH RUN-BRAKE OPTION BOX

This option box contains a braking resistor and a run brake switch. In the "run" position, operation is as described under "Basic Control". When the switch is activated to the "brake" position, the motor brakes rapidly to a stop. In the "brake" position, electrical power remains on the control and on the motor field. The control system may thus be shut down by leaving the run-brake switch in the "brake" position. It is permissible to leave the control system unattended in the "brake" mode with the control unit "off-on" switch on. CAUTION: The main power switch must be turned off if any part of the system requires servicing.

## 6.4 CONTROL WITH FORWARD-BRAKE-REVERSE OPTIONBOX

Operation of this system is identical to that of the "run-brake" system except that the switch in the option box has a third position, "reverse", which reverses motor rotation. The switch has a mechanical delay in the center "brake" position which prevents an operator from switching rapidly from "forward" to "reverse". For relatively low inertia loads, this delay is long enough to allow the motor to brake to a stop before the switch is reversed. If the motor is connected to a high inertia load, however, the braking time may be longer than the mechanical delay which the switch forces. In this case the operator should watch the motor to assure it has stopped before attempting to reverse motor rotation. Otherwise, the fuses may blow. The comments of the previous section concerning leaving the control "on" in the "brake" mode apply.

## 6.5 OPERATORS NOTE

SPARTAN II control units (except for the open chassis types) will have a light labeled "overload" or "fuse" on the face plate. This light burns if control is operating normally. If power is on and light is not burning, it is probable that a fuse has blown and that the control requires service.

# 7. TROUBLE SHOOTING

## 7.1 TROUBLE SHOOTING TABLE

The majority of major malfunctions which might be encountered may be stated simply as:

a. Motor does not run
b. Motor runs only at full speed or over speed.
c. System blows fuses or breakers repeatedly
d. Motor operation unstable

Table V tabulates these malfunctions, probable causes, and actions required for testing. If fuse blowing is the problem, read Table V and then start the checkout procedure of Section 7.1.1 (115 volt controls) or 7.1.2 (230 volt controls).

> WARNING: Dangerous voltages are present in the controls housing and at the motor terminals. Only personnel familiar with electrical test procedures, test equipment and safety precautions should attempt these tests. Do not allow switch terminals, fuse block terminals or pot terminals to touch control housing.

Before starting tests which require disassembly of the SPARTAN II unit, read Paragraph 7.2. “General Test Procedures”, and observe caution notes therein.

### 7.1.1 TROUBLE SHOOTING PROCEDURE: 115 VOLT CONTROLS

If fuses blow, a light bulb checkout procedure may be used without danger of damaging the control and without excessive fuse blowing during checkout. Proceed as follows:

a) Turn power off at the service disconnect ahead of the control.

b) Connect a 120 volt 100 watt incandescent light bulb in series with the underground AC input line (L1)

c) Replace control fuse if it is blown.

d) Disconnect A1, A2, and field wires at the motor. Insulate wire ends.

e) Turn power on; turn the control "on-off" switch "on". Bulb should not burn at any setting of the speed control pot. If bulb burns, either the SPARTAN II control is defective or external wiring to the control contains a fault.

f) If the bulb burned in step (e), turn all power off and disconnect all external wiring to 51TB and 52 TB except for the two AC input lines. With bulb still inserted in series with AC line as in step (b), turn power on and turn control "on-off" switch "on". If bulb still burns, the SPARTAN II unit is defective and requires servicing. Proceed per section 7.2, 7.3 and 7.4. If bulb does not burn, start reconnecting all external wires one at a time until the wire is located which causes bulb to burn. Repair or replace all defective wiring.

g) If no faults are located in the preceding steps, leave light bulb connected as in the preceding steps and reconnect A1 and A2 wires at the motor. Leave field wires disconnected and insulated. Set speed control pot at zero and turn on all power. Light should not burn. Increase speed setting to 20%. Lamp brilliance should increase smoothly to nearly full brilliance. [Note - lamp flicker and erratic brilliance may be observed at settings above 15% or 20%; this is normal.]

h) Repeat step (g) with motor field wires connected. Results should be similar except that the bulb will burn at about 1/2 brilliance with speed control set at zero (due to motor field current) and will increase to nearly full brilliance at a 15% or 20% setting of the speed pot.

i) If operation is normal in all preceding steps, remove light bulb and reconnect all wiring for normal operation.

j) If occasional fuse blowing occurs, an intermittent short or ground is indicated. Inspect motor leads and motor brush pigtails for possible faults. Inspect SPARTAN II unit for loose foreign objects (washers, nuts, wire clippings, etc.). Test all external wiring.

### 7.1.2 TROUBLE SHOOTING PROCEDURE, 230 VOLT CONTROLS

If fuses blow a light bulb checkout procedure may be used without danger of damaging the control and without excessive fuse blowing during checkout. Proceed as follows:

Perform all of the steps used in checkout of 115 volt controls (section 7.1.1) except with the following changes:

(a) Use two 115 volt 100 watt light bulbs connected in series in each of the two AC input lines (a total of four bulbs). This is necessary since both lines may be "hot" in a 230 volt service and either line may be susceptible to faults to ground.

(b) Results should be the same as in the preceding section (7.1.1) except that bulb brilliance will be less than that described for 115 volt controls because of the number of bulbs used.

TABLE V

TROUBLE SHOOTING PROCEDURE

| MALFUNTION | PROBABLE CAUSE | ACTION |
|---|---|---|
| a) Motor does not run | a) AC input to control not present. | Routine test |
| | b) Fuse blown | Remove fuse, heck with ohmmeter |
| | c) Terminals C and D of 52TB not shorted (must be shorted to run). If control has an option box, option box switch must be in "Forward", "Reverse", or "Run" position to operate motor. Option box switches apply the short. If option box is not present, short is applied on 52TB. | Turn power off and test (with ohmmeter) between C and D on 52TB for zero ohms |
| | d) Armature circuit of motor open | Check wiring to motor; test motor per 7.4.1.3 |
| | e) Motor jammed mechanically | Rotate motor shaft manually. to check |
| | f) Sensing resistor (R71) in control unit open or connections loose. | Check R71. Normal resistance is less than 1ohm. Check for loose connections. |
| | g) Speed Pot open or incorrectly connected | Disconnect wires from speed pot at 52TB, E, F, and G. Check pot per 7.4.2. Reconnect. |
| | h) Problem on circuit board1498 | Test board per 7.4.4 |
| b)Motor runs at full speed or over-speed | a) Motor field open | Check wiring to motor field. Check motor per 7.4.1.2 |
| | b) Field voltage to motor absent or low | With system running, check voltage between motor leads F1 and F2. Should be 100V DC (200V DC in 230 volt units). If low, check AC line voltage and rectifiers in control unit per 7.4.3. |
| | c) Faulty SCR in control unit | Test SCR' s per 7.4.3 . |

| | | |
|---|---|---|
| | d) Speed pot faulty or incorrectly connected | Test speed pot per 7.4.2 |
| | e) Problem on circuit board 1498 | Remove circuit board 1498. If motor stops, test board per 7.4.4.If motor still runs, problem is not on circuit board. |
| c) System blows fuses or breaker repeatedly. | a) Incorrect AC input voltage. | Routine test. Compare AC input voltage against warning stickers in control. |
| | b) Incorrect connections between motor and control. | Routine test. Compare with connections diagrams in back of manual. |
| | c) Accidental short between terminals on control unit or option box. | Routine test and visual inspection. |
| | d) Motor overloaded. (Note – If fuses blow immediately at turn-on, use procedure of page 22 or page 23.) | Disconnect load from motor shaft and re-test. Alternate: Place DC ammeter (not clamp-on type) in series with A1 lead at motor and note current, compare with motor nameplate. |
| | e)Motor faulty. | Disconnect all leads from motor and test control per 7.1.1 or 7.1.2 (steps a-e). If bulbs do not burn, test motor per 7.4.1 |
| | f) Motor locked mechanically. | Rotate motor shaft manually. |
| | g) Shorted rectifier or SCR in control unit. | Test per 7.4.3.1. |
| | h) Shorted wiring in control unit. | Routine test and visual inspection. |
| d) Motor operation unstable (hunting or bumping.) | a) “IR” trim pot set too high. | Rotate “IR” trim pot counterclockwise (RF. -5.1) and re-test. |
| | b) Yellow jumper on board 1498 not in place. (Doesn’t apply to tach-feedback systems or systems that use external filtering.) | See fig.2. TP-D and TP-C must be shorted by plug-in jumper (except in the indicated applications). Install jumper if absent. |

## 7.2 GENERAL TESTING PROCEDURE

### 7.2.1 Precautions to be observed

7.2.1.1 – Use a Simpson Model 260 Multimeter (or equivalent) for making the tests, unless otherwise indicated. When an ohmmeter is called for in test procedures, use one of the ohms scales on the Model 260 Multimeter. Do not use electronic type voltmeters which require plugging into AC power.

7.2.1.2 – All test points on both the motor and the control unit are electrically "hot" with respect to control housing, to motor frame, and to conduit ground. Be extremely careful not to short any of these points to housing or frame.

7.2.1.3 – When testing voltages inside the control unit, use small diameter probes insulated except for a very small tip area, or "minigator" clips with insulating sleeves.

7.2.1.4 – Be sure electrical power is off when making continuity or resistance checks.

7.2.1.5 – Unless otherwise noted, always disconnect the motor from the control unit when making motor tests per 7.4.1

## 7.3 DISASSEMBLY

Except on open chassis controls, parts of the control housing must be removed to gain access to test points. Proceed as follows if removal is called for.

7.3.1 Face Plate Removal – Turn power off at branch disconnect ahead of control unit. Remove four screws that attach face plate. Allow face plate to swing forward it will be held in place by the wire bundle. Support face plate as necessary.

7.3.2 Removal of Circuit Board 1498 – Remove four screws which attach upper end plate. Remove upper end plate. Slide circuit board upward and out of control housing. Always tilt face plate out first (7.3.1).

7.3.3 Removal of Lower Cover Plate – This plate covers the exposed studs of the rectifiers and SCR' s. Remove upper end plate per 7.3.2. Slide lower cover plate upward and out of control enclosure.

## 7.4 SPECIFIC TEST PROCEDURE

7.4.1 Motor Tests – Turn power off at branch disconnect for all motor tests. Disconnect and indentify all wiring to motor at the motor.

7.4.1.1 Shorts to Frame - Using a Megger set for 400 volt test potential, check leakage resistance between the A1, A2, motor field leads and the motor frame. 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.

7.4.1.2 Open or Shorted Field - Check resistance between the motor field leads. Resistance should be between 100 and 600 ohms. depending on motor size.

7.4.1.3 Open Armature - Check resistance between the A1 and A2 motor leads. (ohmmeter, RX1 scale). Resistance should be low (less than 10 ohms). Rotate armature slowly, while observing the ohmmeter. A high resistance reading at any point in a revolution is a trouble indication. Armature "opens" are usually the result of bad brushes, burned commutator segments, or severed wires.

7.4.2 Speed Pot Test

7.4.2.1 Inspect for Proper Connection The wiper (center terminal) of the speed pot must terminate on 52TB, Lug F. The outer terminals of the pot terminates on Lugs E and G. If control works, but speed pot works "backwards", the connections to Lugs E and G are reversed.

7.4.2.2 - Test Speed pot for Fault – Disconnect power to control. Disconnect the three speed pot wires at Terminals E, F and G of 52TB. Identify wires for proper reconnection. Read resistance between outer two terminals of pot on ohmmeter. Resistance should be 1000 ohms +/- 10%. Read resistance between center terminal of pot and an outer terminal. As pot shaft is rotated, resistance should vary smoothly from near zero to 1000 ohms (or the reverse). Jumpy readings indicate a faulty pot. Repeat with ohmmeter connected between the other outside terminal and the center terminals (wiper). Reconnect wires to Terminals E, F and G of 52TB after tests.

7.4.3 Power Cube Tests (Diode & SCR Checks)

7.4.3.1 Tests for Faulty Diodes and SCR's – All power semiconductors devices (diodes and SCR's) are located in the power cube. Simple tests with an ohmmeter cannot conclusively show that an SCR or rectifier is good, but shorted or open rectifiers and shorted SCR's can be detected .

Fold face plate out per 7.3.1 (enclosed controls) and remove circuit board per 7.3.2. Disconnect A1, A2 and motor field leads at the motor. Use a Simpson Model 260 multimeter set on the RX100 scale; polarity switch should be "+DC". Connect the meter leads to position #1 as shown in Fig 1. Meter should read a high resistance equal to or near full scale. Reverse meter leads and repeat. This reading should also be high. Repeat on the other SCR.

Connect meter leads per Fig. 1 for test #3. Meter should read a high resistance, near full scale. Reverse meter leads and repeat. Meter should now read a low resistance, on the order of 500 ohms, but not zero. Repeat as for test #3 on test #'s 4 thru 7. Tests #4 and #5 will check the remaining 2 diodes in the power cube and tests #6 and #7 will respectively check field diodes D51 and D52. Note that D51 and D52 are mounted on the output printed circuit board (E1446) and are not easily accessible directly on the board. These diodes can be measured by connecting to the terminal as indicated on 52TB. Test as showing Fig. 1. Be sure that all fuses are good and that printed circuit conductors leading to D51 and D52 are intact.

If any of the readings which should be "high" fall as low as the readings described as "low" in the preceding paragraph, the device is faulty. If a diode does not have a "low" reading in one direction per the preceding paragraph, the rectified is "open".

If results on <u>all</u> rectifiers are the reverse of those descried ("high" and "low" readings reversed) and if a multimeter other than the one specified was used, the meter is probably a "reverse polarity" type on "ohms" ranges and the rectifiers are probably not faulty.

7.4.4 Circuit Board Tests (Board E1498) – Swing face plate outward per 7.3.1. Turn power on. Observe all precautions given in 7.2. Set up speed pot per Fig. 2 and make voltage measurements as shown in Fig. 2.

7.4.4.1 Interpretation of Readings – (Refer also to functions schematic of board given in Fig 3)

(a) If reading (8) is as shown but reading (2) is zero, the board is faulty (R33 open or D6 or C9 shorted).

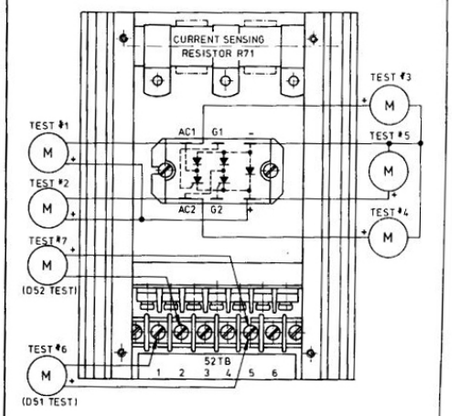
(b) If reading (6) is as shown but (5) is zero or some small value, IC-1 may be at fault or ACC pot open; or C5, Q1, or Q4 shorted.

(c) If reading (4) is as shown but reading (6) is not, either speed pot or wring leading to speed pot is faulty.

(d) Reading (3) and (5) should be nearly identical. If reading (5) is as specified but (3) is high or low, check board to be sure jumper 2 (Fig 2) is correctly in place and not loose.

(e) If jumper 2 is correct and if reading (3) is high and the motor runs overspeed, but stops when the board is removed, the board is faulty.

FIG. 1.
DIODE & POWER CUBE TESTS




METER (M): SIMPSON MODEL 260 MULTIMETER SET ON THE "RX100" SCALE, "+DC POLARITY."

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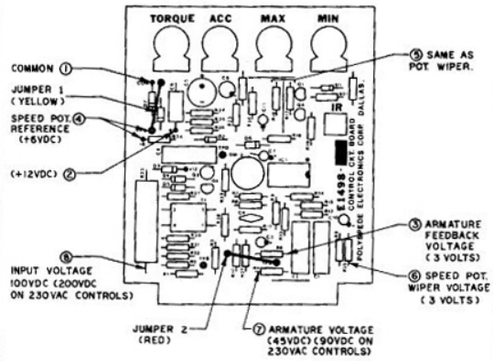
FIG. 2
TROUBLE SHOOTING TEST POINTS
ON BOARD E1498




NOTE:
JUMPER 1 SHOWN IN INTERNAL TORQUE LIMIT MODE.
JUMPER 2 SHOWN IN ARMATURE FEEDBACK MODE.

MEASUREMENTS MADE WITH SPEED POT SET AT 50%.

USE SIMPSON MODEL 260 MULTIMETER OR EQUIVALENT.

NEGATIVE LEAD OF METER CONNECTED TO POINT (1) FOR ALL MEASUREMENTS.

VOLTAGES APPROXIMATE - 10% DEVIATION IS NOT A TROUBLE INDICATION.

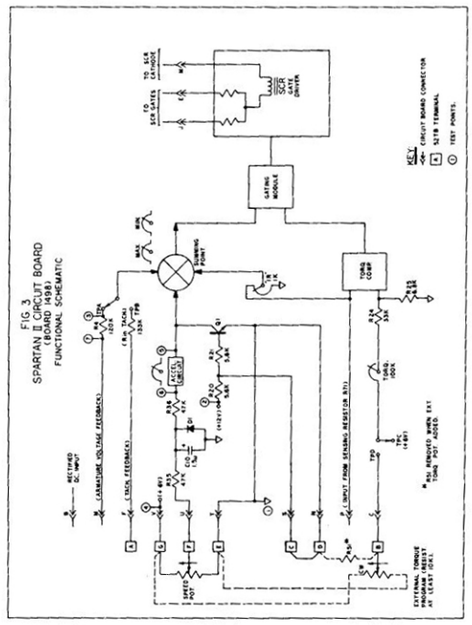


FIG. 3
SPARTAN II CIRCUIT BOARD
FUNCTIONAL SCHEMATIC
KEY
CIRCUIT BOARD CONNECTOR
SLTB TERMINAL
TEST POINTS
GATING MODULE
TONE CODE
SPEED POT
SCR GATE DRIVER

## 8. REPAIR

Repair service for all types of repair is available at the factory. For on-site repairs, proceed as follows. Use rosin core solder only.

### 8.1 MOTOR REPAIR

Motor repairs, other than routine brush replacement, should be referred to a reputable motor repair shop, or the motor should be returned to the factory for repair.

### 8.2 ROUTINE REPAIRS ON CONTROL

Replacement of the speed pot, fuses, switches, power cube, and replacement of the plug-in circuit board can be handled by any qualified serviceman experienced in repair of electronic equipment. Use Polyspede replacement parts.

### 8.3 REPLACEMENT OF POWER CUBE

Only experienced repair personnel should attempt field replacement. Use Polyspede replacement parts and proceed as follows:

8.3.1 Turn power off at the branch circuit disconnect. Remove faceplate per 7.3.1 (enclosed controls). Remove circuit board per section 7.3.2.Remove the 6 fast-on lugs that are connected to the top six tabs on the power cube. Wiggle the tabs from side to side while pulling in a direction perpendicular to the mounting surface.

8.3.2 After completing step 8.3.1, the power cube is easily removed by removing the 2 mounting screws on either side of the cube. Before installing a new power cube, apply a

thin coating of Dow Corning #4 silicon grease or equivalent to the base plate of the power cube. A thin layer should also be applied to the cleaned area of the heatsink on which the power cube will be mounted. Mount the power cube the baseplate with the crews and hardware removed at the beginning of this step. (The AC terminals of the power cube must be on the left side after mounting if the control is viewed in the normal mounting configuration with resistor R71 on top).

Once the power cube is securely tightened in place, reconnect the fast-on lugs, replace the E1498 control board, and replace the faceplate.

The control should be restarted by following the turn-on procedure as given is section 7.1.1 (115V controls) or 7.1.2 (230V controls).

## 8.4 CIRCUIT BOARD REPAIRS

Circuit board repair should not be attempted in the field. Replace the circuit board as an assembly and return the faulty board to the factory for repair. Circuit boards damaged by attempts at field repair are not covered under warranty. Credit cannot be allowed on board assemblies in which the board itself is damaged.

NOTES

## 8.5 SPARTAN II REPAIR PARTS

### 115 VOLT CONTROLS

| DESCRIPTION | SCHEMATIC DESIGNATION | IDENTIFICATION NUMBER | NOTES |
|---|---|---|---|
| On-off switch | S91 | | Specify “115V” |
| *Fuse | | A13 x 25 or SF13 x 25 | |
| *Speed Pot | Pot 91 | 1000 ohms | |
| | | | |
| *Power cube (2 SCR, 3 Diode bridge configuration) | | M252512FV | |
| *Field Rectifier | D51,D52 | | |
| Sensing resistor | R71 | | |
| Face Plate assembly, wired | | B1205-000 | Wired assembly Specify “115V” |
| *Circuit board assembly | | E1498-01 | Includes all components mounted & wired |
| Input-output circuit board assembly | | B1203-010 | Includes all components mounted & wired Specify “115V” |
| Heat sink assembly | | B1207-010 | Includes all components mounted & wired Specify “115V” |

Specify control voltage and type (SPARTAN II) on order. If parts are for repair of a specific control, specify serial number and model number.

*Parts recommended for customer stocking

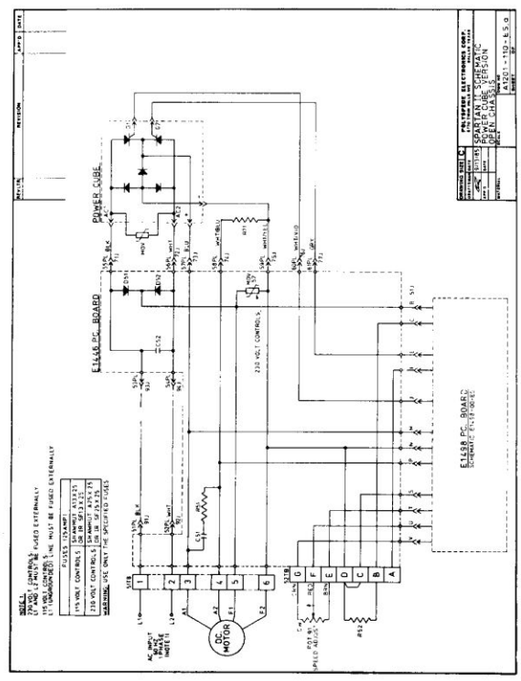
## 8.6 SPARTAN II REPAIR PARTS

230 VOLT CONTROLS

| DESCRIPTION | SCHEMATIC DESIGNATION | IDENTIFICATION NUMBER | NOTES |
|---|---|---|---|
| On-off switch | S91 | | Specify “230V” |
| *Fuse | | A13 x 25 or SF13 x 25 | |
| *Speed Pot | Pot 91 | 1000 ohms | |
| Speed pot knob | | | |
| *Power cube (2 SCR, 3 diode bridge configuration) | | M252512FV | |
| *Field Rectifier | D51,D52 | | |
| Sensing resistor | R71 | | |
| Face Plate assembly wired | | B1205-000 | Wired assembly Specify “230V” |
| *Circuit board assembly | | E1498-02 | Includes all components mounted & wired |
| Input-output circuit board assembly | | B1203-010 | Includes all components mounted & wired Specify “230V” |
| Heat sink assembly | | B1207-010 | Includes all components mounted & wired Specify “230”V |

Specify control voltage and type (SPARTAN II) on order. If parts are for repair of a specific control, specify serial number and model number.

*Parts recommended for customer stocking

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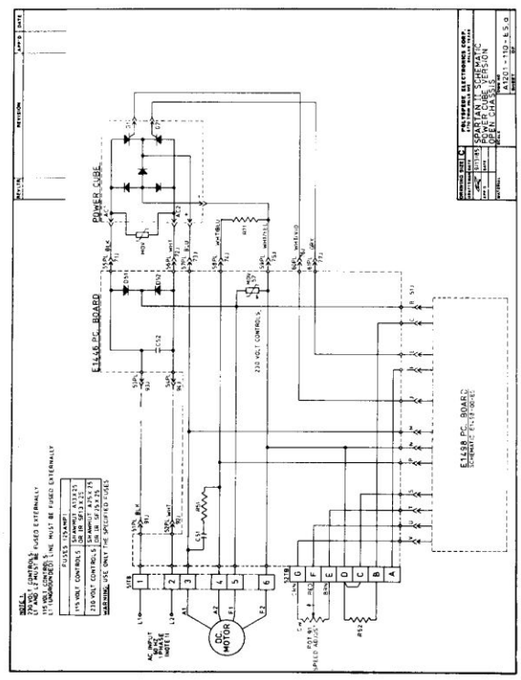


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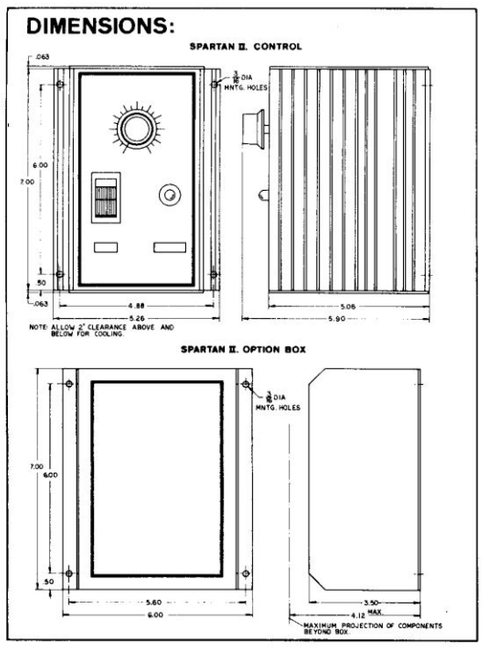
DIMENSIONS:
SPARTAN II. CONTROL
.063
3/16 DIA
MNTG. HOLES
6.00
7.00
.50
.063
4.88
5.26
5.05
5.90
NOTE: ALLOW 2" CLEARANCE ABOVE AND BELOW FOR COOLING.
SPARTAN II. OPTION BOX
3/16 DIA
MNTG. HOLES
7.00
6.00
.50
5.60
6.00
3.50
4.12 MAX.
MAXIMUM PROJECTION OF COMPONENTS BEYOND BOX.



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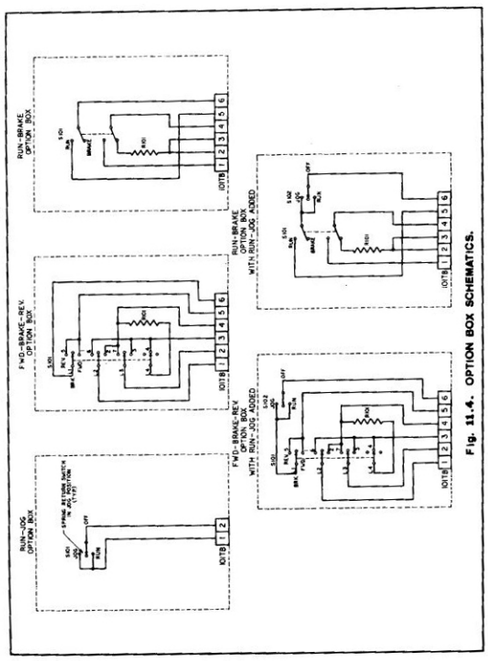



Fig. 11.4. OPTION BOX SCHEMATICS.

## 9. PERIODIC MAINTENANCE

Blow dust accumulation off of the control unit periodically with an air hose. Inspect motor brushes and determine the replacement intervals required by the particular application. Motor bearings are pre-lubricated for long life operation without regreasing.

## 10 SYSTEM FLEXIBILITY

The SPARTAN II drive was designed as a basic building block which can be incorporated into relatively complex systems, including automated processes. Several unique features of the control unit are not described in this basic manual, but are covered in supplementary application bulletins. See also section 12.0 herein.

## 11. SCHEMATICS AND TECHNICAL DESCRIPTION

Schematics included in this section are for references use and for use in servicing the control.

### 11.5 CIRCUIT DESCRIPTION (Refer to Functional Schematic (Fig. 3).

A regulated +6 volts DC is applied to the speed potentiometer. The voltage on the wiper is applied via an acceleration circuit to a summing point. IR compensation and speed feedback voltages are also summed at this point. The amplified difference voltage at the output of the summing point is applied to the gating module.

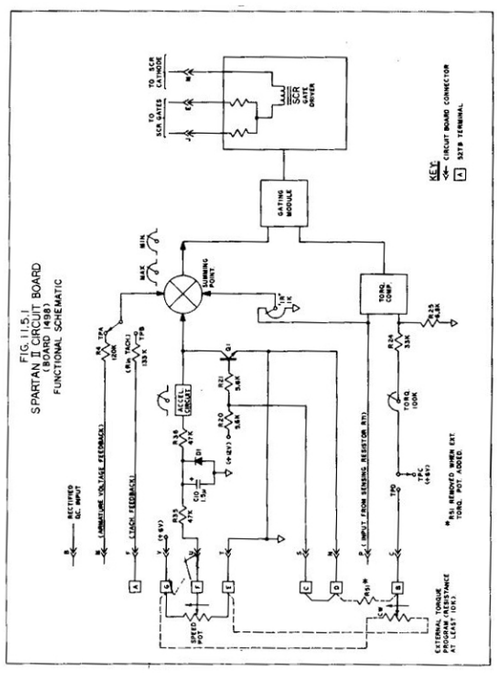


FIG. 1.1.5.1
SPARTAN II CIRCUIT BOARD
(BOARD 1498)
FUNCTIONAL SCHEMATIC
RECTIFIED DC INPUT
ARMATURE VOLTAGE FEEDBACK
TACH FEEDBACK
SPEED POT
ACCEL CIRCUIT
MAX
MIN
SUMMING POINT
GATING MODULE
TO SCR CATHODE
TO SCR GATES
LA555 SCR GATE DRIVER
TORQ COMP
TORQ POT 100K
TPO
I INPUT FROM SENSING RESISTOR R31
EXTERNAL JUMPER PROGRAM (RESISTANCE AT LEAST 10K)
*R34 REMOVED WHEN EXT TORQ. POT ADDED
KEY
CIRCUIT BOARD CONNECTOR
A 5370 TERMINAL

Provided that load conditions are such that the torque comparator section is not active, the amplified difference voltage from the speed summing point is transmitted through the gating module to the SCR gate driver.

The gate driver generates a pulse of such a phase as to adjust the armature voltage to a value which will maintain a null at the summing point.

Functionally, the SCR gate driver is a voltage controlled phase shift generator.

If armature current rises to a level such that the voltage from the sensing resistor R71, applied to the torque comparator, exceeds a fixed value set by the torque limit pot, the torque comparator takes control of the gating module. The unit is now under torque control. When this condition exists, the load current is held at a constant value and if the load is further increased, armature current will stay fixed but the speed will drop. In torque limit, the speed may drop to zero while still maintaining the same armature current. Therefore, even if the motor locks, current is limited to the preset value, and so the motor is protected.

Acceleration is controlled by a linear integrator creating a linearly rising voltage, the final value of which is set by the speed pot setting and whose slope is controlled by the setting of the acceleration pot.

The “min” pot introduces a voltage into a summing point in the speed control line in order to set zero speed or some minimum speed condition desired. It may also be used to determine motor starting point relative to an external control voltage or current. External torque control may be provided by either a torque control voltage scaled to a maximum of 6 volts or by an external 10K pot connected to the internal 6V supply.

Tachometer voltage feedback may be used instead of armature voltage feedback. Circuit values are adjusted to accommodate tachometer with output voltages of 45 to 50 volts per 1000 rpm. Values other than this may be accommodated but require a component change on the board.

Transistor Q1, if allowed to conduct, forces the speed input to the zero volts level. Q1 is kept in a nonconducting state by a shorting jumper which forces the base of Q1 to zero volts. Removal of this jumper biases the transistor to saturation and thus inhibits the speed signal voltage.

In systems with braking, reversing and jogging operations the jumper is replaced by a switch which opens during braking, and between cycles during jogging, to effectively force a zero peed command. For normal operations Q1 must be held "off" by presence of the jumper or a switch closure.

## 12. APPLICATION DATA

In addition to the switch-operated reversing, braking and jogging option boxes described elsewhere in this manual, Polyspede offers custom-designed "SPARTAN II Systems" which consists of a standard SPARTAN II motor control unit mounted on a panel with various options, eg: contactors, external signal transducer, linear acceleration unit, special enclosures, etc. SPARTAN II systems can be designed to meet practically any user requirement. Polyspede recommends the use of these factory-designed systems. The following application data is provided, however, to aid knowledgeable users in designing their own motor control system utilizing a basic SPARTAN II unit.

> NOTE: Polyspede's warranty covers the SPARTAN II unit and (for the case of custom-designed SPARTAN II systems) all factory-supplied accessories provided external connections to such systems are per factory specification. The following information is advisory only. Warranty on

the control unit is not extended to cover damage to the SPARTAN II control unit caused by improper use in user-designed system.

## 12.1 CONTACTOR-OPERATED DRIVES

In certain applications it may be necessary to start SPARTAN II motor control system with a use's contactor. The contactor may be used to make and break the two AC lines, or it may break the two armature lines A1 and A2.

IMPORTANT

If the contactor is connected to make and break the DC lines (A1 and A2 ), a third set of normally open contactor contacts must be provided and connected to short 52TB terminal C to 52B terminal D. The factory-installed permanent jumper between these two terminals must be removed. (See connection diagrams, Sections 3.3 & 3.4 on page 10). The third set of contacts should be an auxiliary set with gold contact surfaces and having preferably a wiping action since the circuit between terminals C and D is low signal level. Opening of the circuit between terminals C and D instantaneously resets the controlled acceleration circuit and prepares it for a "soft start" when the contactor is again activated.

If the contactor is connected to make and break the AC input lines, the connections to 52TB terminals C and D are not necessary. In this case, however,

it is necessary to allow two seconds to elapse between contactor activations to allow the controlled acceleration circuit to “bleed down” and reset. (Rapid jogging not permitted) Failure to reset the controlled acceleration circuit may cause fuses to blow on the next start-up cycle.

## 12.2 CONTACTOR REVERSING

External contactors or manually operated switches maybe used to reverse motor rotation. This is accomplished by physically reversing the external connections between 51TB terminals 3 and 4, and the A1 and A2 lines to the motor. In designing a reversing setup the following conditions must be met:

a) The contactors (or switches) must be electrically or mechanically interlocked such that forward and reverse contactors cannot be activated simultaneously. Simultaneous operation would short out the control output and cause fuses to blow.

b) Auxiliary contacts must be provided on both the forward and reverse contactors such that 52TB terminals C and D are shorted when either contactor is activated, but opened when neither contactor is activated (controlled acceleration reset). For further explanation of the operation of the “reset” circuit, refer to section 12.1 “Contactor-Operated Drives”.

c) The motor must be allowed to stop rotation before it is reversed. Reversing electrical power to a rotating motor ("plugging" the motor) causes high inrush currents which may damage the control unit, cause fuse blowing, or cause motor commutator damage. In custom-designed SPARTAN II systems, Polyspede provides an anti-plugging relay which senses CEMF due to motor rotation and electrically prohibits activation of any contactor until motor rotation ceases.

## 12.3 BRAKING

In a contactor reversed system it may be desirable to provide braking to cause rapid stopping of the motor and therefore to allow quicker reversing. If a power resistor (5 ohms 75 watts in 115 volt system or 10 ohms 75 watts in 230 volt systems) is connected across the motor armature leads (A1 and A2) after the control has been disconnected from the SPARTAN II unit by contactor release, the motor will act as a generator and brake to a stop. (Larger wattage resistors will be required for high-inertia loads or frequent stops and starts.) The braking resistor must be removed from the circuit before power is re-applied.

## 12.4 JOGGING

If rapid starts and stops are required, do not use the "On-Off" switch. Stop the drive by removing the jumper between 52TB terminals C and D, and start the drive by reapplying the jumper. See Fig. 3.4.3 and Fig. 11.4 pg.-43 for schematic. Read section 6.2. See also note in Para 12.1 concerning contact surfaces.

## 12.5 EXTERNAL TORQUE LIMIT ADJUSTMENT

The internal "torque" adjustment trim pot is a calibration adjustment trim pot used to preset torque. If it is desirable to add an externally adjusted torque pot proceed as follows:

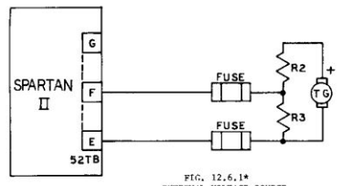
a) Remove 1500 ohm ½ watt resistor connected between 52TB terminals B and D (if present)

b) Connect a 10K ohm potentiometer between 52TB terminals G, E and B as shown in Fig 12.6.3.

c) clockwise adjustment of the 10K pot will adjust torque output from 0 to 150% of rated torque. If 0 to 100% rated torque is desired, the external pot should be set fully clockwise and the internal trim pot set for 100% torque. The yellow jumper on the E1498 will have to be moved from TPC to TPD to make the external torque limit functional.

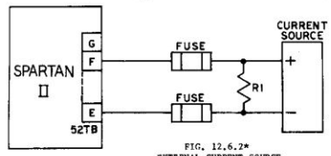
d) Use good quality totally enclosed potentiometers since shorting of the potentiometer leads to earth ground will cause fuse blowing and possible control damage.

EXTERNAL SIGNAL PROGRAMMING




Size R2 & R3 so that maximum voltage developed across R3 is 6 volts. Tachometer Signal Isolated From AC lines and earth ground.(See section 12.6.1 for more details)

FIG. 12.6.1*
EXTERNAL VOLTAGE SOURCE
(Typical Tachometer Follower Circuit)

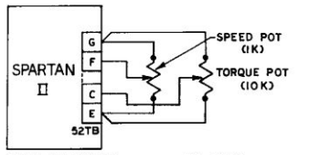



R1 (½ Watt, 1%)

For 10-50 ma-120 OHM
For 4-20 ma-300 OHM
For 1-5 ma-1200 OHM

(Current source isolated from AC lines and earth ground. See section 12.6.1 for more details.)

FIG. 12.6.2*
EXTERNAL CURRENT SOURCE
(Process Instrument)




Fuses: 3AG ½ amp. (Fast Blow)

Connect yellow jumper to TPD if connected to TPC

FIG. 12.6.3
EXTERNAL TORQUE LIMIT

## 12.6 EXTERNAL SIGNAL PROGRAMMING

### 12.6.1 Speed

The Spartan II control unit can be programmed by an external voltage signal taken from a DC tachometer or other DC voltage source, or can be programmed from an external current signal as typically obtained from a process instrument controller. Basically, any DC voltage which meets the requirements a outlined following and which varies from zero to six volts may be applied between 52TB terminals E and F to vary speed from 0 to 100%. Speed will vary directly and linearly with the applied voltage. Also, the control will not "load" the signal source since the Spartan II control input impedance at terminal F of 52TB is high (typically greater than 100K ohms). The following procedure and guidelines must be followed to insure satisfactory operation.

a) Disconnect the 3 speed potentiometer wires from 52TB terminals E, F, and G.

b) Connect the external signal source to 52TB through a transducer circuit as given per Fogure12.6.1 or 12.6.2

c) If the external signal is not isolated from the AC input lines of the control or earth ground, one of the following two requirements must be fulfilled before reapplying power and operating the control.

    1) Use an isolation transformer (preferable as electronically shielded type) to power the AC input of the Spartan II.

2) Use a signal isolator circuit board between the transducer output and the input to the Spartan II control. (The appropriate isolation board depending on external signal level is available from Polyspede. Contact the Polyspede Electronics factory or Polyspede representative for more details.)

d) If using an external 1-5ma, 4-20ma, or 10-50 ma current source, the "Min" adjustment in the Spartan II will have to be reset so that the low end current levels (1, 4, or 10ma) will set zero motor speed. The fuses are used to protect against destructive current incase of accidental grounding.

12.6.2 Torque

An external signal may be used to program torque. A voltage of six volts will give that torque preset by the internal torque pot .If a larger value of programming voltage is available, it must be scaled down by a voltage divider so that the maximum voltage available on terminals B of 52TB is six volts.

A voltage variation of from zero to 6 volts between terminals B and D of 52TB (positive on B) will give a torque variation of from zero to that value preset by the internal torque control.

The yellow jumper on the 1498 circuit board will have to be moved from TPC to TPD to utilize external torque programming feature.

## 12.7 TACHOMETER FEEDBACK

The SPARTAN II control unit may be connected to utilize tachometer feedback rather than armature feedback if higher precision in speed control is desired.

To accommodate tach feedback the following procedure should be followed:

a) Change the red jumper form TPA to TPB.

b) Set IR pot to zero (fully counter clockwise)

c) Connect tachometer leads with positive lead to terminal A and negative lead to terminal D on 52TB. IF the drive system is connected for reversing, the tachometer leads must be reversed when motor rotation is reversed so that terminal A is always positive.

d) When in operating condition, readjust “max” pot for desired maximum speed. If an AC tach is used a full wave bridge rectifier should be used with the positive bridge connection going to terminal A and negative to terminal D on 52TB.

NOTE: Circuit constant are designed for a tach voltage of 45-50 volts per 1000 rpm. If tach voltage varies radically from this, the factory would have to be consulted for circuit board modifications.

## 12.8 OPERATION IN ENCLOSURE

The Spartan II unit is designed for use at full rated power in open areas with air temperatures of 40 C (104 F) or lower. If the Spartan II unit is mounted inside a non-ventilated enclosure (Nema 12 or Nema 4) and operated at maximum 10 amp DC output (1 HP at 115 VAC, or 2HP at 230 volts). It is likely that the air temperature inside the enclosure will exceed 40 C and the unit will over heat. Operation in enclosure may, however, be accomplished as follows:

Fan Cooling - Add a small fan inside the enclosure to move air across the fins of the Spartan II unit. This increased cooling efficiency will allow operation in air temperatures up to 60 C (140 F) which will cover most cases. A ROTRON "muffin" fan (50 to 100 cfm) or PAMOTOR series 4500 are sufficient.

Situations in Which Fan May Be Omitted - If the enclosure is large and contains no other components which generate significant heat, or if room temperatures are exceptionally low (e.g. always 78 F) or if the average load on the Spartan II unit is small (e.g under ½ HP applications), the fan may be omitted. Maximum case temperature of 90 C as measured on the gold aluminum case directly adjacent to the power cube can be used as the determining factor. (Other critical maximum temperatures next to capacitors, IC's, etc. correlate to this temperature.) When in doubt, use the fan.

### 12.8.1 Engineering Data

Maximum permissible case temperature (on the gold housing underneath where the power cube is mounted) is 90 C. This temperature coincides approximately with the maximum permissible temperature that can exist under these conditions next to the temperature sensitive components such as electrolytic capacitors, integrated circuits, etc. For estimating purposes, when the Spartan II is mounted in an enclosure, assume that the Spartan II case temperature adjacent to the power cube will rise 40 C above enclosure air temperature in 1 HP, 115 VAC controls, or in 2HP, 230VAC controls. For these two cases, internal power dissipation is 37 watts and 38 watts respectively.