WARRANTY (FHP PARAJUST)

Parametrics, a unit of Barry Wright Corp., the manufacturer, warrants that for a period of twenty-four (24) months from date of shipment by the manufacturer or 24 months from Parametrics receipt of Warranty Registration card, not to exceed 30 months from date of shipment, it will repair, or at its option, replace any new apparatus which proves defective in material or workmanship, or which does not conform to applicable drawings and specifications approved by the manufacturer. All repairs and replacements shall be F.O.B. factory. All claims must be made in writing to the manufacturer.

In no event and under no circumstances shall manufacturer be liable for (a) damages in shipment; (b) failures or damages due to misuse, abuse, improper installation or abnormal conditions of temperature, dirt or corrosives; (c) failures due to operation, intentional or otherwise, above rated capacities, and (d) non-authorized expenses for removal, inspection, transportation, repair or rework. Nor shall manufacturer ever be liable for consequential and incidental damages, or in any amount greater than the purchase price of this apparatus.

This warranty is in LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING (BUT NOT LIMITED TO) ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE TERMS OF THIS WARRANTY CONSTITUTE ANY BUYER'S AND/OR USER'S SOLE AND EXCLUSIVE REMEDY, AND ARE IN LIEU OF ANY RIGHT TO RECOVER FOR NEGLIGENCE, BREACH OF WARRANTY, STRICT TORT LIABILITY OR UPON ANY OTHER THEORY. Any legal proceedings arising out of the sale or use of this apparatus must be commenced within eighteen (18) months of the date of shipment.

RETURNED GOODS—No goods will be accepted for return unless there is prior written authorization by the home office. In all cases, transportation charges must be prepaid.

INTERPRETATION—There are no conditions or understandings whatsoever, verbal or otherwise, except as written herein and this statement contains the complete and exclusive agreement between the buyer and manufacturer. No waiver, alterations or modification of any of the provisions hereof shall be binding upon the manufacturer unless made in writing and signed by a duly authorized officer of the manufacturer.

Parametrics™

INSTRUCTION MANUAL

IM6007

FHP ParaJust®

MODEL
6007

FHP
ParaJust®
NOW WITH
2 YR. WARRANTY
See SM6006
for details

IMPORTANT: READ ENTIRE MANUAL PRIOR TO CONNECTING AND OPERATING EQUIPMENT!

WARNING: DANGEROUS VOLTAGES, WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL, EXIST WHENEVER POWER IS ON OR HAS BEEN APPLIED TO THE PARAJUST CONTROLLER!

Be sure to read all warnings and procedures prior to doing any wiring, troubleshooting or any other work on the ParaJust Controller.

DANGER: VOLTAGES ACROSS CHARGED CAPACITORS CAN BE IN EXCESS OF 280VDC!

IM6007B
Effective: 2/14/83
Supersedes: 10/15/81

WARNING

DANGEROUS VOLTAGES

BE SURE THAT THE LARGE FILTER CAPACITOR INSIDE THE PARAJUST® CONTROL IS FULLY DISCHARGED BEFORE DOING ANY WIRING, TROUBLESHOOTING OR ANY OTHER WORK INSIDE THE CONTROLLER!!

This capacitor is normally discharged automatically when the input power is removed from the controller. To assure that this capacitor is discharged, always test with a DC voltmeter (500 VDC scale), before working inside the controller. If no reading is shown on the voltmeter, reduce the scale and test again.

If the automatic discharge circuitry has not discharged the capacitor, carefully discharge it through a resistor rated 50 ohms minimum and 50 watts minimum. **BE SURE THAT THE INPUT POWER IS OFF!** Do not hold the resistor with bare hands since the resistor will get hot when discharging. Be sure to repair the automatic discharge circuitry before reapplying input power to the control.

DANGER

VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL!

Therefore good electrical practices, applicable electrical codes and the contents of this manual must be followed.

1.0 RECEIVING

1.1 INSPECTION

Inspect for shipping damage upon receiving your FHP ParaJust controller. If any shipping damage is found, report it to the carrier immediately. Remove the cover from the controller and check inside for any visual damage. DO NOT ATTEMPT TO OPERATE THE FHP PARAJUST CONTROLLER IF ANY VISUAL DAMAGE EXISTS! Check all the mounting hardware for tightness. Check all connectors for proper seating in their sockets.

1.2 STORAGE

After the initial inspection, you may repack and store the FHP ParaJust in a clean dry location until you are ready for use. **DO NOT** store this equipment in any area where the ambient temperature will rise above 60° C or drop below −20° C. DO NOT store this equipment in areas of high condensation or corrosive atmostpheres. Proper storage is necessary to insure satisfactory start-up and performance.

If the FHP ParaJust is to be stored for periods of two years or more, refer to section 5.1 of the start-up procedure and perform this procedure at two year intervals.

2.0 GENERAL INFORMATION

Electronic Shear Pin module P# 100308

2.1 SPECIFICATIONS

2.1.1 INPUT POWER

Single Phase, 230 VAC*, +10% −5%, 50/60 HZ.

*208 VAC input power operation is available. Refer to paragraph 7.6.

2.1.2 OUTPUT POWER

Three-Phase, 0 to 60 HZ* with voltage proportional to frequency for constant torque.

*Frequencies above 60 HZ are available. Refer to paragraph 7.1.

2.1.3 OUTPUT CURRENT RATING

The full load continuous current rating is 3 amps RMS. The intermittent current rating is 4.5 amps RMS. The controller may be operated up to the intermittent current rating for up to two minutes out of thirty minutes. The Electronic shear pin circuit will trip at the intermittent rating.

2.1.4 AMBIENT TEMPERATURE

Operating 32° F (0° C) to 104° F (40° C)

Storage −4° F (−20° C) to 140° F (60° C)

2.1.5 FREQUENCY STABILITY

The output frequency does not vary with load nor with input frequency variations. Reference Table 1 for variation figures.

	+10% –5% INPUT VOLTAGE CHANGE	PER DEGREE C AMBIENT TEMPERATURE CHANGE (1 HOUR WARMUP)
PERCENT OF OUTPUT FREQUENCY CHANGE	1.75%	.035%

Above figures are expressed in percent of Maximum Frequency.

TABLE 1

2.1.6 INPUT FUSES

Replace with BUSS ABC-10 or LITTLEFUSE 3AB-10 fuses.

2.1.7 CONTROL VOLTAGES

0 to 10 VDC for speed control.

6 VDC for start/stop control.

2.2 STANDARD FEATURES

2.2.1 SPEED CONTROL

The output frequency may be controlled by a 5000 ohm 2 watt potentiometer or an isolated 0 to 10 volt DC analog signal.

2.2.2 START/STOP CONTROL

The FHP ParaJust controller may be started and stopped by using momentary start and stop pushbuttons or by using an external switch or relay contact.

2.2.3 INDICATING LIGHTS

POWER ON INDICATOR – Located on the front panel or remote, the Power On indicator will illuminate whenever the input power is applied.

SHEAR PIN INDICATOR – Located on the front panel or remote, the Shear Pin indicator will illuminate whenever an overload or protective circuit trips.

2.2.4 INTERNAL ADJUSTMENTS

ACCEL/DECEL TIME – Adjustable from 1.5 to 15 seconds linear.*

BOOST – For starting torque adjustments.

Volts/Hertz – For use with multiple motors and for motor current savings.

*Optional Accel/Decel times are available. Refer to paragraph 7.2.

**Refer to paragraph 7.3 for internal adjustments on the optional Automatic Reversing Control Module.

2.3 PROTECTIVE CIRCUITS

The FHP ParaJust controller has a trip circuit called Electronic Shear Pin. The Electronic Shear Pin will trip due to any one of the following:

a. Input voltage drops below 200 VAC.
b. Output current to the motor exceeds 150% of the controls continuous current rating. Reference paragraph 2.1.3.
c. Regenerative current from the motor exceeds 150% of the controls continuous current rating. Reference paragraph 2.1.3.
d. The output bus voltage exceeds the rated voltage of the control.
e. A phase-to-phase short occurs at the motor output terminals.
f. Power outages of longer than two or three cycles of AC input power.

3.0 MECHANICAL INSTALLATION

3.1 ENCLOSED FHP PARAJUST CONTROLLER

The standard FHP ParaJust controller with or without operators devices in the cover is suitable for use in normal industrial atmospheres including temperatures of 32° to 104° F and relative humidities of 0 to 95%.

Do not mount the FHP ParaJust controller in direct sunlight or on any hot surfaces. The control should be mounted vertically. Mounting dimensions may be found on page 43 of this manual.

3.2 CHASSIS CONTROLLER

The FHP ParaJust controller may be mounted in a customer enclosure or in a clean dry location with ambient temperatures of 32° to 104° F. The bottom of the chassis must be in intimate

contact with a metal surface which has sufficient size to provide heat dissipation. Heat sinking compound such as Dow Corning 340 MUST BE USED between the controller and the mounting surface.

If any other heat generating equipment is to share a cabinet with the FHP ParaJust controller, care must be taken to insure ample outside surface area for proper heat dissipation to protect your controller from overheating.

Chassis dimensions may be found on page 43 of this manual.

4.0 ELECTRICAL INSTALLATION

4.1 INPUT POWER

The FHP ParaJust controller operates from single phase 230 VAC input power connected to TB2 the input power terminal block. (Reference Figure 1.) (For 208 VAC operation, refer to paragraph 7.6.) A ground terminal is located on TB2 for an earth ground connection.

The FHP ParaJust controller is designed to perform properly with voltages from 218 VAC to 253 VAC. Voltages ranging from 218 to 208 VAC will reduce the output voltage to the motor, thus affecting torque when the controller is run above 85% speed. Operation below 85% speed will not be affected.

When the input voltage drops below 205 VAC, the Electronic Shear Pin circuit will shut off the control. **Voltages above 253 VAC should be avoided or component failure may result.**

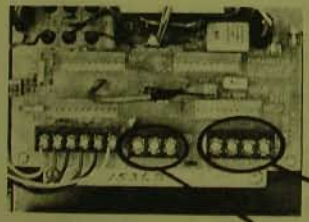


FIGURE 1

4.1.1 POWER OUTAGE

Power outages of two or three cycles will not affect the operation of the FHP ParaJust controller. Outages of longer than two or three cycles will trip the Electronic Shear Pin circuit. Reference paragraph 6.3.

4.1.2 INPUT WIRING

The input wiring should be a minimum of 14 AWG. The normal input current under full load is 4 AMPS.

4.1.3 DISCONNECT DEVICES

To meet the National Electrical Code, a disconnect device must be furnished in the input power line. This device should be rated for the normal input current listed in paragraph 4.1.2. NEITHER THE INPUT DISCONNECT DEVICE NOR ANY OTHER INPUT POWER CONTROLLER SHOULD BE USED TO START AND STOP THE FHP PARAJUST CONTROLLER. Only the 6 volt control relay provided in the control should be used for start and stop control.

4.2 ISOLATION TRANSFORMERS

The FHP ParaJust controller requires 230 VAC single phase input power. It can be operated from 460 or 575 Volt AC power by inserting a transformer between the input power line and the controller input. This transformer will reduce the voltage to the correct value. If an isolation transformer is used, it will not only reduce the voltage but it will also protect the controller from ground faults in the motor wiring.

ISOLATION TRANSFORMERS ARE STRONGLY RECOMMENDED when the FHP ParaJust controller is used with motors located in high moisture or wash-down installations. Suggested transformer ratings for the FHP ParaJust controller are shown in Table 2.

DRIVEN MOTOR HP	TRANSFORMER KVA	PARAMETRICS P/N FOR 240/480 V POWER	PARAMETRICS P/N FOR 600 V POWER	NON-ISOLATING BOOST TRANSFORMER
1/4	1/2	680201	680202	680215
1/2	1	680208	680209	680215
3/4	1.5	680211	680212	680215

TABLE 2

Each ParaJust controller must operate from a separate isolation transformer in order to eliminate phase-to-ground faults as a potential failure. These are the most common type of motor faults.

When isolation transformers are used, none of the secondary leads (the leads on the controller side of the transformer) should be grounded or earthed. This includes not grounding the center tap of single phase isolation transformers.

Standard single phase distribution transformers are used. They may be purchased locally for an economical installation.

4.3 OUTPUT POWER

WARNING: ALTHOUGH NO PHASE TO PHASE OUTPUT VOLTAGE EXISTS WHEN THE FHP PARAJUST CONTROLLER IS STOPPED, THERE IS A CONSTANT POTENTIAL OF 230 VAC ABOVE GROUND AS LONG AS INPUT POWER IS APPLIED!!

4.3.1 CONTROLLER OUTPUT

For the output rating refer to paragraph 2.1.3. Output voltage is proportional to output frequency, zero volts at zero frequency and 230 volts at 60 HZ. Wire size should be chosen according to local codes for motor size and for the distance between the control and the motor. Motor frame should be grounded to the controller ground lugs. Connect motor leads to TB3. Ref. Figure 1.

4.3.2 LIGHT LOAD OPERATION

The FHP ParaJust controller can be operated at any load from zero amps to rated amps. The FHP ParaJust controller may also be operated without a motor connected to TB3. This feature is for your convenience during start-up and in troubleshooting.

4.3.3 STARTERS OR CONTACTORS

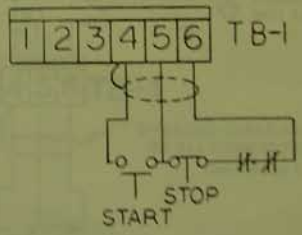
A motor starter or contactor is not necessary in most FHP ParaJust controller applications. If a motor starter, contactor or disconnect device is installed in the controller output, it may NOT be opened or closed while the controller is running. Opening such a device while it's running may cause damage

to ParaJust controller components. Closing it may trip the Electronic Shear Pin circuit.

Starter or contactor coils must be operated from plant power. Do not use the variable frequency output of the FHP ParaJust controller as a source of control power. These coils will chatter at low frequencies and overheat at high frequencies when operated from the variable output of the controller.

4.3.4 MOTOR OVERLOAD PROTECTION

Heat is the enemy of motor life. The motor must be protected from overheating by the user. Internal motor overheat protectors are recommended. Check with the motor supplier or a rewind shop for the use of overheat protectors with your motor. Motor thermal overload relays such as Allen Bradley bulletin 815, Cutler Hammer catalog C300 or Square D bulletin 9065 may be used for motor overload protection. Because these devices measure motor amps and ambient temperature, they are not as accurate as a device which measures actual motor temperature. Reference Figure 2 for connection of motor overload devices to the FHP ParaJust controller's start/stop circuitry.



Additional Stop Circuits
FIGURE 2

4.3.5 MULTIPLE MOTORS

The FHP ParaJust controller may be used with multiple motors providing that the SUM of their FULL LOAD nameplate current does not exceed the controller's FULL LOAD rating and they all start when the controller is started. Each motor should have its own overload protection.

4.4 OPERATOR'S CONTROLS

IMPORTANT: ALL WIRING TO TB1 CONTROL CIRCUIT MUST BE KEPT FREE OF ELECTRICAL "NOISE." CONTROL WIRING MUST BE SHIELDED AND MUST NOT BE RUN IN THE SAME CONDUIT OR RACEWAY WITH ANY POWER WIRING. REFERENCE PARAGRAPH 4.4.5 FOR INSTALLATION OF SHIELDED CABLE.

4.4.1 SPEED CONTROL

The speed of the motor is controlled by varying the output frequency and voltage of the FHP ParaJust controller. The FHP ParaJust controller output frequency is proportional to the setting of a 5000 ohm 2 watt potentiometer. This may be bought locally or ordered through your Parametrics distributor if not supplied with your FHP ParaJust controller. This potentiometer should be wired to terminals 1, 2 and 3 of the control terminal strip TB1. Refer to Figures 3 and 4. Potentiometers other than 5000 ohm 2 watt should not be used.

The output frequency may be controlled from an isolated external 0 to 10 VDC analog signal furnished by the customer (zero volts equals zero frequency). Apply this external voltage source between terminals 4 and 2 of TB1, terminal 4 being negative and terminal 2 being positive.

An optional Isolated Signal Interface Kit is available from Parametrics which will allow the output frequency to be controlled in proportion to signals of 1 - 5, 4 - 20, 10 - 50 MA DC or DC voltages other than 0 - 10 VDC.

4.4.2 START-STOP CONTROL

A ParaJust controller is normally started with a momentary normally open start contact and stopped with a momentary

normally closed stop contact, wired to terminals 4, 5 and 6 of TB1 as shown in Figures 3 and 4. This "3 wire control" design means your ParaJust controller will not automatically re-start upon application of power after a power outage, or for any other interruption of input power. This feature reduces the risk of damage or injury from instant start.

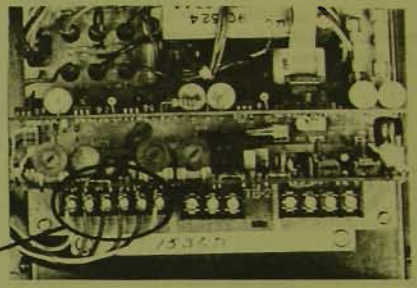
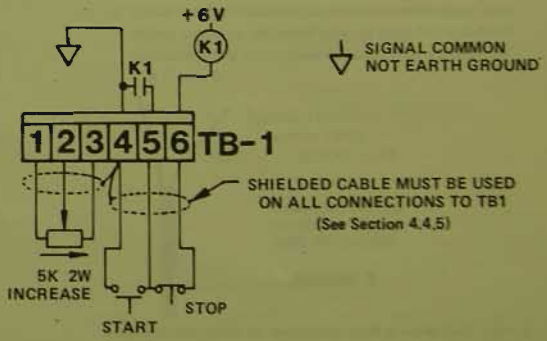


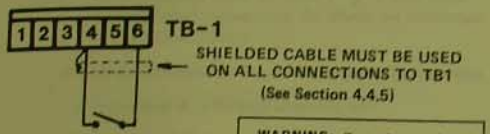
FIGURE 3



Control Connections
FIGURE 4

4.4.3 TWO-WIRE START-STOP CONTROL

If the application calls for starting and stopping from an external source (a switch or a relay contact) two-wire starting and stopping may be used. For the reasons stated in Section 4.4.2, this method is not recommended without installing a control interlocking device. This device will prevent immediate starting after a power outage which could result in damage or injury. Reference Figures 3 and 5 for two-wire stop-start connection.



WARNING: Two wire start/stop control may allow the ParaJust controller to restart upon application of input power after an outage!

Two Wire Start-Stop Control
FIGURE 5

4.4.4 ADDITIONAL STOP CIRCUITS

If additional stop circuits such as thermal overload relay contacts, motor thermal protector contacts, etc., are desired, they may be wired into the controller's control circuit as shown in Figure 2. The contacts should be normally closed. Wire the additional contacts in series with the normally closed stop switch or contact. Shielded wire must be used.

4.4.5 SHIELDED WIRE/ELECTRICAL NOISE

ALL CONNECTIONS MADE TO TB1 MUST BE MADE WITH SHIELDED WIRES TO MINIMIZE THE EFFECT OF ELECTRICAL NOISE ON THE FHP PARAJUST CONTROLLER'S CIRCUITRY.

4.4.5.1 The following Beldon shielded cables or equivalent are recommended:

a. Trade Number 8771 "Beldfoil," 3-conductor, size 22 may be used for speed control and start/stop circuits.

b. Trade Number 8761 "Beldfoil," 2-conductor, size 22 may be used for speed control and start/stop circuits. Shields should be connected to the FHP ParaJust controller TB1 terminal 4.

4.4.5.2 Note that Figures 4 and 5 illustrate shielded wiring used for speed control and start/stop circuits and that the shields are connected to terminal 4.

4.4.5.3 NO OTHER CONNECTION OF THE SHIELD SHOULD BE MADE.

Shields are connected at the FHP ParaJust controller end only. Be sure that shields do not and cannot touch any other conductive surface.

4.4.5.4 **Cable Installation Procedure ParaJust Controller**

a. Cut outside insulation back to desired length. Be sure to leave wire long enough to make easy connections to control terminal block without excess wire hanging free.

b. Unwrap foil from conductors. Cut foil even with outer insulation.

c. Carefully insulate shielded lead using insulating tubing, electrical tape, etc. Do not insulate complete length. Leave approximately ½" exposed at the loose end for electrical connection.

d. Cover outside insulation at the termination point with shrink tubing or electrical tape, to keep foil stub from contacting any conductive surface. Wire should look like Figure 6.

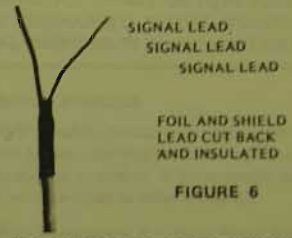


FIGURE 6

e. Strip insulation on remaining control wires back approximately ¼" and carefully crimp a fork tongue connector. Screw the fork tongue connector to the correct point. Be sure of a tight connection.

NOTE: Due to the low level signals and the small size of the cable, a careful crimp made to the proper fork tongue connector is highly recommended.

f. For speed potentiometer, speed signal, system speed signal (output), and two and three wire stop-start controls, connect the shield lead to Pin 4 of TB1 on the control terminal block.

NOTE: Do not confuse signal common (▽) with earth ground (⏚) connections. All shields are connected to signal common only.

4.4.5.5 **Cable Installation Procedure, Remote Operator End**

a. Follow Step A of ParaJust controller end.

b. Cut the shield foil and the shield lead back even with the outside insulation and further insulate with electrical tape or shrink tubing. No connection of shield is to be made at the operator's station end.

c. Cover the outside insulation, shield foil, and shield lead at termination point. Shield must not touch anything conductive at the operator's device end. Shielded cable should now look like Figure 7.

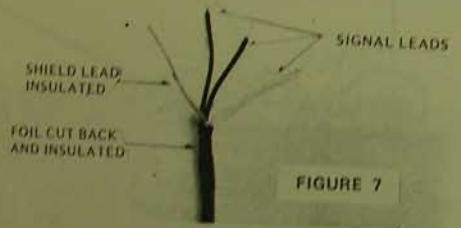


FIGURE 7

d. Apply appropriate terminal to signal leads and connect to the operator's device end.

5.0 START-UP PROCEDURE

IMPORTANT: BE SURE TO FOLLOW ALL SAFETY PRECAUTIONS, ALL WARNINGS AND FOLLOW THIS ENTIRE PROCEDURE STEP BY STEP TO ENSURE A SUCCESSFUL START-UP!

SAFETY PRECAUTIONS

1) VOLTAGE LEVELS ON THIS CONTROL CAN BE GREATER THAN 280 VDC, WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! THEREFORE GOOD ELECTRICAL PRACTICES, APPLICABLE ELECTRICAL CODES AND THE CONTENTS OF THIS MANUAL MUST BE FOLLOWED!

2) THIS CONTROLLER SHOULD BE INSTALLED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL, FAMILIAR WITH HIGH VOLTAGE WIRING AND ELECTRICAL HAZARDS!

3) BE ABSOLUTELY SURE THAT THE INPUT POWER DISCONNECT IS IN THE OFF POSITION WHEN CONNECTING AND SERVICING THIS EQUIPMENT!

4) BE SURE TO WEAR SAFETY GLASSES AT ALL TIMES!

5) AFTER THE INPUT POWER HAS BEEN REMOVED FROM THE CONTROL, ALWAYS USE A DC VOLTMETER ON THE OUTPUT CAPACITOR TO BE SURE THAT IT IS FULLY DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS IN THIS CONTROL!!

5.1 PROLONGED STORAGE

If the FHP ParaJust controller has been stored for a period of two years or more, perform the following steps before proceeding with the start-up procedure. If the controller has not been stored for two years, proceed directly to step 5.2.

5.1.1 Refer to paragraph 4.1, Input Power Wiring. Connect the input power wires to TB2 as shown in Figure 1. Be sure that the plant power is within the specification stated in paragraph 2.1.1.

5.1.2 Refer to paragraph 4.4. Make control connections to TB1. Set the speed control fully counter clockwise (zero speed). Apply plant power to the input. Check to see that the Power On light is ON.

5.1.3 Start the control and slowly turn the speed potentiometer clockwise. With the speed potentiometer fully clockwise, allow the control to remain ON for a minimum of eight (8) hours. This will recondition the Electrolytic capacitors. The FHP ParaJust controller may now be stored for an additional two (2) years.

5.2 START-UP

5.2.1 Check for the following setting on the control module. Reference Figure 8.

5.2.1.1 ACCEL/DECEL at 12 o'clock

5.2.1.2 VOLTS/HERTZ preset

5.2.1.3 BOOST at 12 o'clock

5.2.1.4 PARAMIZER™ Jumper W1 in place

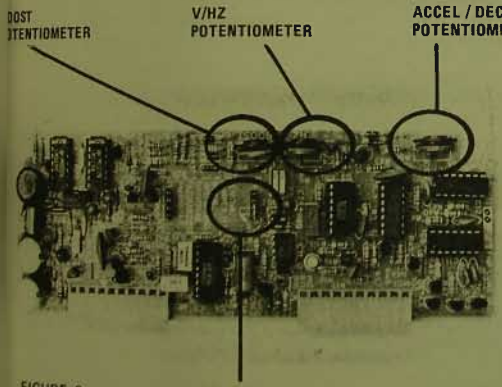


FIGURE 8

5.2.2 Refer to paragraph 4.4, Operator's Controls. Make the appropriate control connections to TB1 and TB4 if reversing option is installed, as shown in the wiring diagrams.

5.2.3 Refer to paragraph 4.1, Input Power Wiring. Connect the input power to TB2 as described in paragraph 4.1. Be sure that the plant power is within the specification described in paragraph 2.1.1.

5.2.4 Set the speed control signal or speed potentiometer to zero speed. Set the start/stop circuitry to the stop position.

5.2.5 Apply power to the input. Check to see that the Power On LED is illuminated. If the 'Power On' LED does not light, refer to section 10.1.

WARNING: In the following steps, voltage will be present with sufficient stored energy to cause serious injury or be fatal! EXTREME CAUTION is recommended at all times!

5.2.6 Using a DC voltmeter, check for +10 VDC from terminal 4 to terminal 3 of TB1. Terminal 4 is negative. If +10 VDC is not measured, refer to section 10.3.

5.2.7 With the speed potentiometer set for zero speed, push the 'Start' button. Relay K1 should pick and remain energized. If you can hear K1 pick, push the 'Stop' button and K1 should drop out. Once it has been determined that the control is receiving power, proceed to paragraph 5.2.8. If K1 does not pick or if it does not remain energized, refer to section 10.4.

5.2.8 Press the start button once again. Slowly rotate the speed potentiometer clockwise. Using an AC voltmeter on the 500 VAC scale, test across terminals 1 and 2 of TB3. With the speed potentiometer on the maximum setting (fully clockwise) the voltmeter should show that approximately 230 VAC is present. This measurement may be less due to the accuracy of the meter, the V/HZ adjustment, and the use of the Paramizer option. At this time, terminals 1 and 3 of TB3 and terminals 2 and 3 of TB3 should also be measured for 230 VAC.

If no voltage is measured, or if the readings across the terminals differ greatly, refer to section 10.5, 10.6 or 10.7.

5.2.9 Run the speed potentiometer to zero speed and press the stop button.

DISCONNECT THE INPUT POWER FROM THE INPUT!

WARNING: Allow 60 seconds for the filter capacitor to discharge, after input power is removed, before doing any work on the FHP ParaJust controller. Always test across the capacitor with a DC voltmeter to be sure it is fully discharged. Start with at least a 500 VDC scale. If no reading is shown, step down one scale; continue to reduce the scale until no voltage is measured on the lowest scale.

5.2.10 Refer to paragraph 4.3. Connect the motor leads to TB3 as described in section 4.3.

BE SURE NO PHASE-TO-PHASE OR PHASE-TO-GROUND SHORTS EXIST IN THE MOTOR CIRCUIT OR THE MOTOR! Failure to do this may result in repeated shear pin trips or possible controller damage.

5.2.11 Reapply plant power to the FHP ParaJust controller. Be sure that the speed control potentiometer is set fully counter-clockwise (zero speed). Push the start button. Slowly rotate the speed control potentiometer and note:

5.2.11.1 The motor should start stepping or coggin in even increments and should rotate faster as the speed potentiometer is turned clockwise.

5.2.11.2 If the motor does not step or cog, you should note whether the motor was trying to rotate before the shear pin circuit trips. In this case, move the Boost potentiometer on the control module clockwise and counter-clockwise. Clockwise rotation will increase the starting torque. If after several Boost settings have been tried, the shear pin LED continues to light and the motor will not rotate, refer to section 10.8 for additional trouble-shooting information.

5.2.12 The Boost potentiometer should be set to as low as possible while still supplying sufficient breakaway torque. Set the Boost potentiometer as follows: turn clockwise to increase. Turn the Boost potentiometer to the minimum setting at which the controller will just start the load. Turn the Boost potentiometer approximately 45° clockwise from this setting. This adjustment should be made at very low frequencies or when the motor is stepping.

5.2.13 Set the Volts/HZ adjustment as follows (turn clockwise to increase):

5.2.13.1 With the motor loaded to normal full load and operating at 80% of base speed (48 HZ), turn the Volts/HZ adjustment potentiometer (clockwise or counter-clockwise) until motor amps are minimum. Use a clamp on ammeter on any controller output lead to measure output amps.

5.2.13.2 If the motor is not loaded to its normal full load, accelerate the motor up to the base speed (60 HZ) and measure the voltage across the filter capacitor with a DC voltmeter using the 500 VDC scale. Start with the Volts/HZ potentiometer fully counter-clockwise and rotate the potentiometer clockwise until 280 VDC is measured across the filter capacitor.

5.2.13.3 On load sharing and multiple motor applications, set the Volts/HZ potentiometer as described in paragraph 5.2.13.1. Measuring the total motor current (the sum of all motor currents) with the full load on the conveyor or machine, adjust the Volts/HZ for minimum total motor current.

5.2.14 Set the Accel and Decel times to as long as desired (turn clockwise to increase). (Standard range is 1.5 to 15 seconds.) Too short of an accel or decel time deserves mention.

5.2.14.1 If the Electronic Shear Pin circuit is activated during accelerating or decelerating, increase the accel or decel time by rotating the adjustment potentiometer clockwise.

5.2.14.2 INERTIA LOADS. IMPORTANT. When the ParaJust controller is used with a high inertia load (a load which coasts for a long period of time when power

is removed), the Accel and Decel settings are critical. Use the maximum time to start with. If too quick a deceleration rate is used, the motor will regenerate excessive current and activate the Electronic Shear Pin circuit, and the motor will coast to a stop. Extend the accel/decel time as described in paragraph 7.2 if this occurs.

6.2.15 If the optional reversing control module is to be used, refer to paragraph 7.3.

6.0 OPERATION

6.1 GENERAL

The FHP ParaJust controller is a motor speed controller for 3-phase, 230 VAC motors up to 3/4 HP. It furnishes variable frequency and variable voltage to convert a fixed 230 volt AC motor to a variable speed motor. In the ParaJust controller, as the frequency is increased the voltage is also increased. This maintains constant motor torque.

Reference Figure 9. In the FHP ParaJust controller, single phase 230 VAC power is converted to variable voltage DC power by the DC power module. The variable voltage DC power is then smoothed out by the filter choke and the filter capacitors. This power is then inverted into three phase AC power by the transistor module. The operation of the SCRs in the power module is controlled by the control module. The control module also sequences the driver module and controls the automatic reversing function.

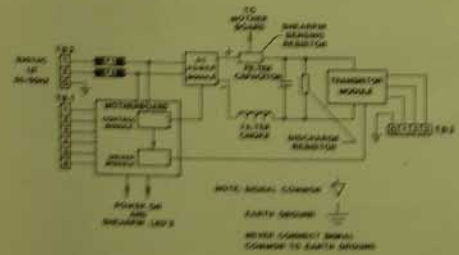


FIGURE 9

The driver module switches the transistors in the transistor module to develop three phase variable frequency power. The correct voltage to frequency relationship is maintained by the control module.

6.2 STARTING - ACCELERATING - DECELERATING - STOPPING

The FHP ParaJust controller does not start the motor, it accelerates it. When the control relay, K1, is closed, the output frequency rises from zero frequency to the frequency set by the speed control potentiometer. The rate of frequency rise is adjustable from 1.5 to 15 seconds by the Accel potentiometer. High starting currents are avoided by controlled acceleration as opposed to across the line starting of the motor.

When the speed control potentiometer setting is changed, the ParaJust controller will accelerate or decelerate at the rate set by the accel or decel potentiometer. Controlled acceleration and deceleration is furnished at all times.

When the control relay, K1, is opened, by pushing the normally closed stop button for example, the FHP ParaJust controller will cease operating and the motor will coast to a rest. Should a restart be attempted before the motor stops rotating, or before the filter capacitor has discharged, the control's current limit may be exceeded and a Shear Pin trip will occur. A second restart will then be required.

6.2.1 FREQUENT STARTING AND STOPPING

6.2.1.1 MOTOR LIMITATIONS. Because the FHP ParaJust controller accelerates the motor, high inrush currents are avoided and the normal limitations on frequent motor starting are eliminated. The motor can be started (accelerated) up to 20 times per minute with the FHP ParaJust controller, if the load allows.

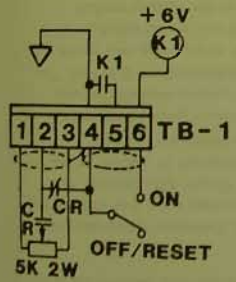
6.2.1.2 FHP PARAJUST CONTROLLER DISCHARGE CIRCUIT. Every time the ParaJust controller is stopped, the discharge circuitry must remove all the DC power stored on the large filter capacitor. Allowing 30 seconds between restarts will allow this circuit to discharge.

6.2.1.3 REQUIRED FREQUENT STARTING OR JOGGING. If the application requires frequent starting or jogging, two alternatives are suggested. Jog with the speed poten-

tiometer at a low speed, or decelerate and accelerate the controller using the accel and decel potentiometers, rather than stopping and starting. If the control is accelerated and decelerated rather than started and stopped, the discharge circuit is not used and there is no limitation on time between restarts.

Decelerating a motor can be accomplished more rapidly than letting it coast to a stop. The reason is the ParaJust controller coupled with the motor can produce up to 25% braking torque when decelerating, as compared to no torque when coasting to a stop.

For these reasons, acceleration and deceleration is recommended rather than starting and stopping. In situations where frequent starting and stopping is necessary, or braking torque is required, a relay may be installed, having both normally closed (NC) and normally open (NO) contacts to accelerate and decelerate an FHP ParaJust controller. The coil of the relay is activated by the customer's limit switch, pushbuttons or other control circuitry. The contacts of the relay (shown as CR) should be wired as shown in Figure 10.



Acceleration and Deceleration
FIGURE 10

6.3 ELECTRONIC SHEAR PIN

The FHP ParaJust controller supplies as a standard feature, a circuit to protect your ParaJust controller from various power fluctuations and overloads. The Electronic Shear Pin circuit will trip if:

6.3.1 The output current to the motor exceeds 150% of the ParaJust controller's rating. Reference paragraph 2.1.3.

6.3.2 Regenerative current during deceleration exceeds 150% of the ParaJust controller's rating. Reference paragraph 2.1.3.

6.3.3 Input voltage drops below 205 VAC on 230 VAC models. Input voltage drops below 185 VAC on 208 VAC models.

6.3.4 Bus Voltage exceeds 360 VDC. Bus voltage will exceed 360 VDC when input voltage rises above 253 VAC and the controller is operating at 100% speed.

When the electronic shear pin circuit trips, the driver modules and the DC power module are immediately turned off electronically. At the same time, the Shear Pin LED circuit receives power, illuminating the electronic shear pin LED. The filter capacitor then discharges into the discharge resistor.

To reset the electronic shear pin circuit, the stop circuit must be activated (K1 de-energized). This will reset the overload trip circuit, and remove power from the shear pin LED circuit. When the start circuit is again activated (K1 energized) the load may be accelerated back up to speed. If the filter capacitor has not discharged sufficiently, the shear pin circuit may trip again, requiring another reset and restart. Allow 60 seconds for the filter capacitor to discharge after a shear pin trip to avoid tripping again.

7.0 OPTIONS

7.1 EXTENDED SPEED RANGE

The standard FHP ParaJust controller produces a 0 to 50 or 60 HZ output. For other output frequencies ranges, circuitry is changed on the plug-in control module. For a full discussion of FHP ParaJust controller operation at frequencies above 60 HZ, you should consult the ParaJust Application Manual form AM6010.

7.2 EXTENDED OR SHORTENED ACCELERATION/DECELERATION TIMES

The standard FHP ParaJust controller is furnished with a linear controlled accleration/deceleration circuit.

This circuit is adjustable from 1.5 to 15 seconds, when accelerating from zero frequency to maximum frequency. Also when decelerating from maximum frequency to zero frequency.

Where longer or shorter acceleration/deceleration times are required, plug-in control modules with special circuitry can be provided. This special circuitry has a 10 to 1 adjustment ratio over a customer specified range. For example, 1 to 10 seconds, 0.5 to 5 seconds, or 5 to 50 seconds. 250 seconds is the longest time available and 0.5 seconds is the shortest time available.

7.3 ELECTRONIC REVERSING

7.3.1 REVERSING

In the FHP ParaJust, electronic reversing is made available by substituting the electronic reversing control module for the standard control module. The reversing control module will allow a motor to reverse direction at the command of an external switch, limit switch, or relay contact. It is the equivalent of changing two motor leads. The reversing control module has a five (5) connection terminal block labeled TB4 (refer to Figure 11).

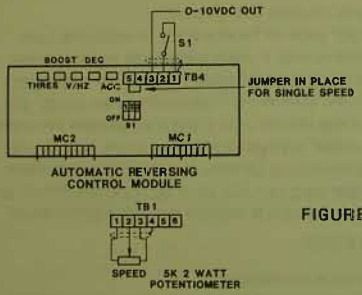


FIGURE 11

7.3.2 FORWARD AND REVERSE CONTROL

7.3.2.1 SINGLE SPEED. Connect a forward/reverse switch or contact across terminals 1 and 2 of TB4 on the control module (reference Figure 11). Connect the 5000 ohm speed potentiometer to terminals 1, 2 and 3 of TB1 as described in paragraph 4.4.1. BE SURE THAT THE JUMPER IS IN PLACE BETWEEN TERMINALS 4 AND 5 OF TB4 ON THE CONTROL MODULE.

When a contact closure appears between terminals 1 and 2 of TB4, the controller will automatically decelerate the motor from the set speed to zero speed, reverse directions, and accelerate the motor back to the set speed in the forward direction.

NOTE: The contact closure across terminals 1 and 2 of TB4 must be maintained in order to run in the reverse direction. Refer to Figure 13 if momentary switches are to be utilized.

7.3.2.2 TWO PRESET SPEEDS. Connect a forward/reverse switch or contact across terminals 1 and 2 of TB4 on the control module (reference Figure 12). Connect two 10,000 ohm speed potentiometers in parallel across terminals 1 and 3 of TB1 as shown in Figure 12. Connect the wiper of the forward speed potentiometer to terminal 4 of TB4 on the control module. Remove the jumper from between terminals 4 and 5 of TB4. This jumper will not be utilized when using two preset speeds. Connect the wiper of the reverse speed potentiometer to terminal 5 of TB4 on the control module.

When a contact closure appears across terminals 1 and 2 of TB4 on the control module, the controller will automatically decelerate from the forward speed to zero speed, reverse direction, and accelerate up to the speed set by the reverse speed potentiometer. When the contact opens, the control will then decelerate from the reverse speed down to zero speed, reverse directions, and accelerate back up to the forward speed.

7.3.2.3 ZERO REVERSE THRESHOLD ADJUSTMENT. (THRES) This adjustment allows a reversal to take place before the controller reaches zero HZ which allows for a quicker reversal. Turn this adjustment clockwise to increase the frequency at which the reversal takes place.

When the Zero Reverse Threshold adjustment is increased (clockwise), the controller, when reversing will decelerate down to some low frequency and the motor will be 'Plug Reversed' at that frequency. Plug reversing is fast and a jolting of the motor may be noticed as the reversal takes place. The higher the setting of the threshold potentiometer, the more severe the jolting and the more rapid the reversal.

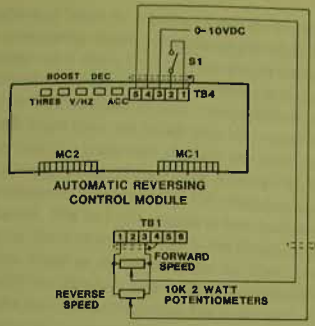


FIGURE 12

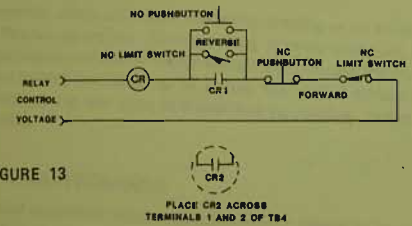


FIGURE 13

If the threshold adjustment is set too high, the ParaJust controller's electronic shear pin circuit may trip. The shear pin circuit is then the limit on how high the Zero Reverse Threshold adjustment may be set.

7.4 EXTERNAL SHEAR PIN CONTACTS

The External Shear Pin Contact is an auxiliary relay kit for use with any Fractional Horsepower ParaJust controller. This relay contains one set of normally open and one set of normally closed contacts rated at 5 amps resistive load, 115 VAC or 28 VDC. This accessory is designed such that the remote relay energizes when input power is applied to the ParaJust controller and drops out when a Shear Pin trip occurs or when input power is removed from the controller. For more information on the External Shear Pin Contacts, refer to form IM6836.

7.5 PARAMIZER

Paramizer is an energy saving option which automatically adjusts the output volts per hertz from the ParaJust controller in the operating speed range, above 15 HZ, of the control. The volts per hertz is automatically adjusted in proportion to the driven motors current. By automatically adjusting the volts per hertz in proportion to the current drawn by the motor, the Paramizer electrically sizes the motor driven by the ParaJust control to the torque needs of the driven load. This feature allows you to only draw and pay for the current your application needs. The FHP ParaJust controller may be furnished with the Paramizer, or it may be installed later in the field. Refer to Paramizer Instruction Manual form IM6827 for additional information.

7.6 208 VAC OPERATION

The FHP ParaJust controller is available in a 208 VAC model for operation from 208 VAC +5 −10% 50 or 60 HZ power source. The output voltage from an FHP ParaJust controller can be no higher than the input voltage, therefore a 208 VAC motor must be used. 230 VAC motors will operate from a 208 VAC ParaJust controller however, you cannot develop full rated torque above 54 HZ. It is recommended that if 230 VAC motors are used, use a 230 VAC FHP ParaJust control with a boost transformer to increase the power to 230 VAC. Refer to paragraph 4.2 for additional information on boost or isolation transformers.

7.7 SPEED REFERENCE SIGNAL

A speed reference signal is available from reversing models of FHP ParaJust controls. This signal may be used for ParaJust controller systems. The speed reference signal appears between terminals 1 and 3 of TB4 on the reversing control module. Terminal 1 is signal common and terminal 3 is the 0 to 10 VDC signal representing speed (frequency) 0 volts for zero speed and 10 volts for maximum speed.

8.0 BRAKING

When the FHP ParaJust is "decelerated," approximately 25% braking torque is available from the motor.

8.1 MECHANICAL BRAKING

If more braking effort is required from the motor than is available when decelerating or if holding torque is required when stopped,

an electro-mechanical brake or a brake motor should be used. Don't use the accelerating-decelerating circuit shown in Figure 10 when using brakes: use a two-wire start-stop circuit (see paragraph 4.4.3) and interlock the brake coil with the starting and stopping of the ParaJust controller. Brake motors require special consideration. Usually, the brake coils are wired into the motor by the manufacturer so that the brake coil receives the same power as the motor and is energized when the motor is energized. DO NOT use the variable frequency output of the FHP ParaJust controller to power a brake coil. The coil will chatter at low frequencies and overheat or trip the Electronic Shear Pin in the ParaJust controller. Instead, rewire the brake so that it operates on plant power, interlocking it with the ParaJust controller. Electro-mechanical brakes may require arc suppressing across the brake coil. A resistor capacitor (RC) type suppressor is recommended.

8.2 ELECTRONIC BRAKING

Parametrics offers solid state electronic braking as an accessory for ParaJust controllers. Furnished in a separate enclosure, electronic braking will absorb motor energy and dissipate the energy during braking (decelerating) to a stop. Full motor torque is available during the brake-to-a-stop but no holding torque is furnished.

9.0 ROUTINE MAINTENANCE

FHP ParaJust controllers require no maintenance except to keep its enclosure free of obstruction to insure proper air flow and dissipation of heat.

10.0 SERVICING

WARNING WARNING WARNING

DANGEROUS VOLTAGES

VOLTAGE ACROSS CAPACITOR CAN BE IN EXCESS OF 300 VDC!

BE SURE THAT THE LARGE FILTER CAPACITORS ON THE PARAJUST CONTROLLER ARE DISCHARGED BEFORE DOING ANY WIRING, TROUBLESHOOTING OR ANY OTHER WORK INSIDE THE PARAJUST CONTROLLER!

These capacitors are normally discharged automatically when input power is removed from the ParaJust controller. To assure that capacitors are fully discharged, always test with a DC voltmeter (500V scale) before working inside the ParaJust controller. If no reading is shown on the voltmeter, reduce scale and test again!

If automatic discharge circuitry has not discharged capacitors, carefully discharge them through a resistor rated 50 ohms minimum and 50 watts minimum. Be sure input power is off! Do not hold resistor with bare hand since resistor will get hot when discharging capacitor. Repair automatic discharge circuitry before reapplying power!

DANGER DANGER DANGER

VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL!

Therefore good electrical practices, applicable electrical codes and the contents of this service section must be followed!

WARNING: Voltage levels on this control are at a level which can cause serious injury or be fatal! Be sure INPUT POWER IS OFF and capacitors are discharged before troubleshooting this control!

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.1 "Power On" LED does not light with application of input power	10.1.1 Check connector AP7 to be sure it is fully engaged in its socket. 10.1.2 Using an AC voltmeter, measure the input power at the input fuse block, TB2. Verify that the input power is within 230 volts plus 10% minus 5%. If the correct input power is present on TB2, REMOVE INPUT POWER. 10.1.3 Check each of the input fuses for zero ohms with an ohmeter. If any fuses are blown proceed to Step 10.2 BEFORE REAPPLYING INPUT POWER. If no input fuses are blown a failure may have occurred on the motherboard. Contact Parametrics Technical Support for further troubleshooting assistance.
10.2 Input fuses blow on start-up	10.2.1 **With Input Power off,** remove input power wiring. This will prevent the possibility of false readings due to isolation transformers or other devices on the input voltage line. Measure, with an ohmeter on the RX1 scale, from terminal 1 to terminal 2 of TB2, input terminal block. A reading of approximately 150 ohms should be noted on the ohmeter. If approximately 150 ohms is not measured, a problem exists on the motherboard. Contact

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.2 continued Input fuses blow on start-up	10.2.1 continued Parametrics Technical Support for further troubleshooting assistance. 10.2.2 **If 150 ohms is measured on the ohmeter in Section 10.2.1, refer to Figures 14 and 14A.** Disconnect the six wires labeled A, B, C, D, E and F. Move these six wires aside, exposing the six connectors on the power module. With an ohmeter, on the RX100 scale, measure from terminal A to terminal B of the power module (not the wires which were removed). Observe the reading, reverse the test probes and measure again. Reading should be infinite in both directions. If any other reading is indicated, replace the power module. If reading from terminal A to terminal B is correct, measure from terminal E to terminal F. Observe reading, reverse the test probes and measure again. Readings should be typical of a diode, infinity in one direction and approximately 500 ohms with the probes reversed. If any other reading is indicated, replace the power module. If readings from terminal E to terminal F are correct, measure from terminal A to terminal F and from terminal B to terminal F. Reading should be infinite in both directions. If readings other than infinite are observed, replace the power module.

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.1 "Power On" LED does not light with application of input power	10.1.1 Check connector AP7 to be sure it is fully engaged in its socket. 10.1.2 Using an AC voltmeter, measure the input power at the input fuse block, TB2. Verify that the input power is within 230 volts plus 10% minus 5%. If the correct input power is present on TB2, REMOVE INPUT POWER. 10.1.3 Check each of the input fuses for zero ohms with an ohmeter. If any fuses are blown proceed to Step 10.2 BEFORE REAPPLYING INPUT POWER. If no input fuses are blown a failure may have occurred on the motherboard. Contact Parametrics Technical Support for further troubleshooting assistance.
10.2 Input fuses blow on start-up	10.2.1 **With Input Power off,** remove input power wiring. This will prevent the possibility of false readings due to isolation transformers or other devices on the input voltage line. Measure, with an ohmeter on the RX1 scale, from terminal 1 to terminal 2 of TB2, input terminal block. A reading of approximately 150 ohms should be noted on the ohmeter. If approximately 150 ohms is not measured, a problem exists on the motherboard. Contact

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.2 continued Input fuses blow on start-up	10.2.1 continued Parametrics Technical Support for further troubleshooting assistance. 10.2.2 **If 150 ohms is measured on the ohmeter in Section 10.2.1, refer to Figures 14 and 14A.** Disconnect the six wires labeled A, B, C, D, E and F. Move these six wires aside, exposing the six connectors on the power module. With an ohmeter, on the RX100 scale, measure from terminal A to terminal B of the power module (not the wires which were removed). Observe the reading, reverse the test probes and measure again. Reading should be infinite in both directions. If any other reading is indicated, replace the power module. If reading from terminal A to terminal B is correct, measure from terminal E to terminal F. Observe reading, reverse the test probes and measure again. Readings should be typical of a diode, infinity in one direction and approximately 500 ohms with the probes reversed. If any other reading is indicated, replace the power module. If readings from terminal E to terminal F are correct, measure from terminal A to terminal F and from terminal B to terminal F. Reading should be infinite in both directions. If readings other than infinite are observed, replace the power module.

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.2 continued Input fuses blow on start-up	10.2.3 If above readings are observed, replace wire connections to terminals A, B, E and F (reference Figure 14). Do not connect the center green wires to terminals C and D at this time. Be sure these wires cannot touch any conductive surface. Replace blown input fuses and apply input power.

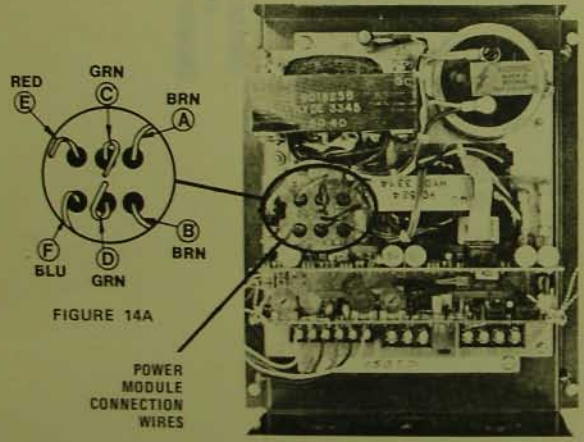


FIGURE 14A

FIGURE 14

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.2 continued Input fuses blow on start-up	10.2.3 continued If power on LED illuminates, replace the control module. If fuses still blow and Section 10.2 has not located the problem, contact Parametrics Technical Support for further troubleshooting assistance.
10.3 10 VDC not present on terminals 3 and 4 of TB1	10.3.1 REMOVE INPUT POWER. Disconnect the speed controls from terminals 1, 2 and 3 of TB1. If no voltage or low voltage is still measured, replace the control module. 10.3.2 If the correct voltage appears with the controls disconnected, repair or replace the speed controls.
10.4 K1 relay does not pick-up with start button activated	10.4.1 Check "Shear Pin" LED. If "Shear Pin" LED is illuminated, refer to Section 10.8. 10.4.2 If "Shear Pin" LED is not illuminated, and "Power On" LED is on, REMOVE INPUT POWER. With power off, disconnect the Start/Stop controls from terminals 4, 5 and 6 of TB1. Apply power and carefully jumper terminal 4 of TB1 to terminal 6 of TB1. K1 should pick up when jumper is in place and drop out with jumper removed. If K1 does pick-up with jumper in place, repair or replace start/stop controls.

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.5 No voltage is measured at TB3	10.5.1 Check that K1 picks and the "Shear Pin" LED is not illuminated. If K1 does not pick, refer to Section 10.4. If "Shear Pin" LED is illuminated, refer to Section 10.8. 10.5.2 If K1 picks and the "Shear Pin" LED is not illuminated, REMOVE INPUT POWER. Check to see that the control module is located on its Molex connectors properly. Check that connector AP6 is in place on the motherboard. 10.5.3 Check the W1 jumper to be sure it is in place. 10.5.4 If the W1 jumper is in place and voltage still is not measured at TB3, replace the control module. 10.5.5 If the condition still exists, replace the power module.
10.6 Low voltage measured at TB3	10.6.1 INPUT POWER OFF! Check connectors AP7 and AP9 to be sure they are seated in their sockets. Reference Figure 1. 10.6.2 If the voltage still measures incorrect, replace the driver module. 10.6.3 If the voltage still measures incorrect, replace the control module.

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.7 No voltage measured on TB3 with Reversing Control Module	10.7.1 Refer to Figure 15. Locate S1. Be sure that S1, pole #3 is in the 'ON' position when the Paramizer option is not used. 10.7.2 If S1, pole #3 is in the on position, refer to paragraph 10.5 and follow the procedure in that step.

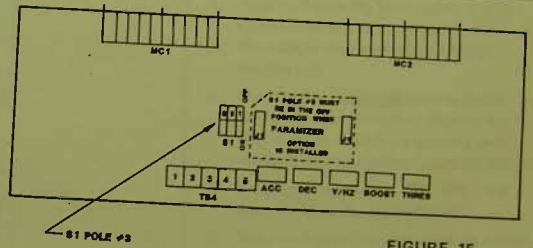


FIGURE 15

SYMPTOM	PROCEDURE
10.8 "SHEAR PIN" 10.8.1 "Shear Pin" LED is illuminated. NO MOTOR IS CONNECTED TO TB3.	10.8.1.1 If the "Shear Pin" LED lights upon application of input power, check to insure that the input power is within the 230 VAC +10% –5% rating of the ParaJust controller.

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.8.1 continued "Shear Pin" LED is illuminated. NO MOTOR IS CONNECTED TO TB3.	10.8.1.1 continued If input power is correct, replace the control module. 10.8.1.2 If "Shear Pin" LED lights after start button is activated and potentiometer is increased, monitor the large blue filter capacitor with a DC voltmeter on the 500 VDC scale. Observe polarity. Reset the shear pin circuit and attempt to start the controller. Check voltmeter at the point in which the controller's shear pin circuit trips. If voltage rises slowly with the speed potentiometer, proceed to Step 10.8.1.3. If voltage jumps directly to max voltage (200 to 300 VDC for example), refer to Step 10.2. Perform all measurements in that step. If power module tests as described in 10.2.2, replace the control module. 10.8.1.3 INPUT POWER OFF! ALLOW 60 SECONDS FOR THE FILTER CAPACITOR TO DISCHARGE. Remove connector AP6. With an ohmeter on the RX100 scale, measure from terminal 1 to terminal 2 of TB3. Be sure that the motor has been disconnected. Reverse the test leads and measure again. The reading should be infinite in both directions. Next measure from terminal 1 to terminal 3 of TB3. Reverse the leads and measure again. The

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.8.1 continued "Shear Pin" LED is illuminated. NO MOTOR CONNECTED TO TB3.	10.8.1.3 continued reading should be infinite in both directions. Measure from terminal 2 to terminal 3 of TB3. Again reverse the leads and measure again. This measurement should also be infinite in both directions. If any combination of terminals measures a resistance other than infinite, be sure that AP6 has been disconnected, replace the transistor module as follows: A. Refer to Figure 16. Remove the plug-in Control Module, by grasping the plastic tie-wraps in each corner and pulling straight out. B. Remove the ribbon cable connected to AP1 on the driver module. Remove the plug-in driver module by grasping each corner firmly and pulling it straight out. C. Disconnect connectors AP4, AP5, AP6 and AP7 from the motherboard. D. Refer to Figure 14 and remove the six (6) Power Module connection wires. E. Remove any wires connected to TB1, TB2 and TB3. F. Remove input fuse F1 exposing a motherboard connection screw. Remove the 6-32 mounting screw along with the remaining 4 mounting screws. Remove the motherboard.

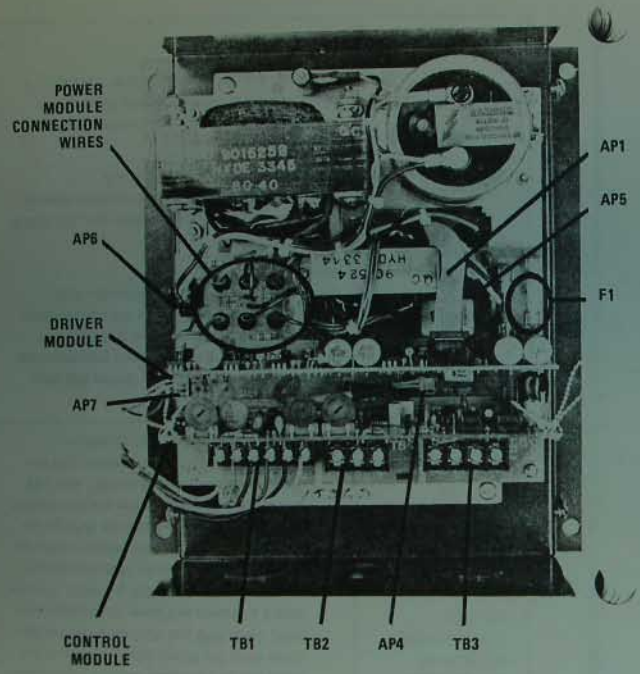
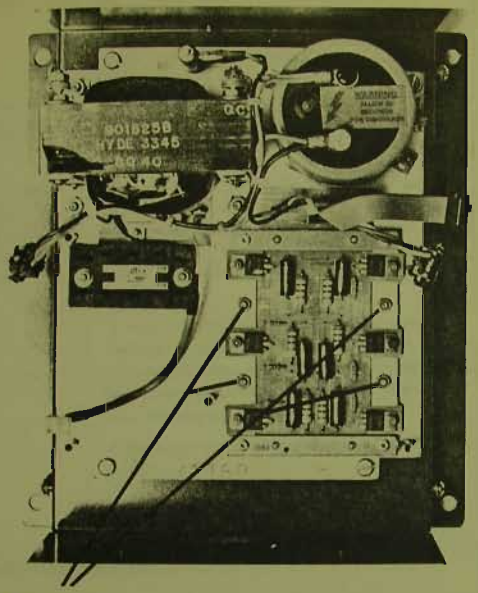


FIGURE 16

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

SYMPTOM	PROCEDURE
10.8.1 continued "Shear Pin" LED is illuminated. NO MOTOR CONNECTED TO TB3.	10.8.1.3 continued G. Refer to Figure 17. Your FHP ParaJust should now resemble Figure 15. Disconnect AP2 and AP3 from the transistor module. H. Remove the four (4) nuts holding the transistor module down to the chassis with a ¼" nutdriver or socket wrench. I. Check the serial number on your FHP ParaJust controller. If your serial number is 8236 or subsequent, proceed to step J. If your serial number is prior to 8236, remove the gray fish paper which is glued down to the chassis under the transistor module. NOTE: DO NOT REMOVE THE WHITE HEAT SINK COMPOUND ON THE CHASSIS UNDER THE TRANSISTOR MODULE! THIS COMPOUND IS NECESSARY FOR PROPER HEAT TRANSFER. J. Remove the old transistor module and place the new module in its place. K. Replace the four 6-32 nuts which hold down the module. Tighten all four nuts evenly. Be sure that the two metal heat sink bars on each side of the module are in full contact with the chassis plate. L. Replace AP2 and AP3 onto the new transistor module. Replace the motherboard onto the chassis along with the five (5) mounting screws removed in Step F.



4 MOUNTING NUTS

FIGURE 17

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

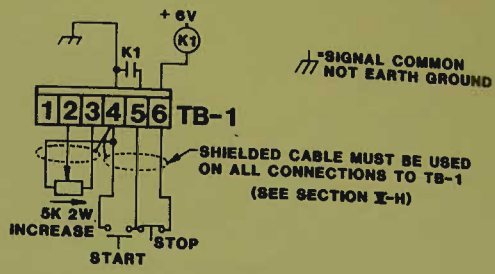
SYMPTOM	PROCEDURE
10.8.1 continued "Shear Pin" LED is illuminated. NO MOTOR CONNECTED TO TB3.	10.8.1.3 (L) continued Replace F1 fuse. Refer to Figure 13. Replace the six (6) Power Module connection wires onto the Power Module. Reconnect AP4, AP5, AP6 and AP7 onto the motherboard as shown in Figure 16. Replace the driver module onto MC3 and MC4. Be sure to line up all 10 pins on both connectors. Replace the ribbon cable which originates at the transistor module onto AP1 on the driver module. Replace the control module. Replace all connections to TB1 and TB2. Refer to the Start Up procedure and perform all the tests in that procedure.
10.8.2 "Shear Pin" LED illuminated WITH MOTOR CONNECTED TO TB3	10.8.2.1 If the motor steps smoothly before the shear pin trip occurs, rotate the boost potentiometer clockwise and attempt to run the motor. If the motor steps more before the control shear pins, move the boost potentiometer fully clockwise. 10.8.2.2 If the control continues to shear pin, REMOVE INPUT POWER. Complete the measurements in Sections 10.8.1.2 and 10.8.1.3. 10.8.2.3 If controller shear pins and Section 10.8 has not located the failure, contact Parametrics Technical Support for additional troubleshooting assistance.

WARNING: VOLTAGE LEVELS ON THIS CONTROL ARE AT A LEVEL WHICH CAN CAUSE SERIOUS INJURY OR BE FATAL! BE SURE INPUT POWER IS OFF AND CAPACITORS ARE DISCHARGED BEFORE TROUBLESHOOTING THIS CONTROL!

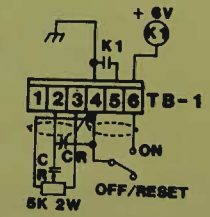
SYMPTOM	PROCEDURE
10.9 Motor will not stop. Motor steps with speed potentiometer at zero speed.	10.9.1 Refer to Figure 18 and Figure 19. Move the potentiometer lead from terminal 1 of TB1 to terminal 4. This connection will produce a small deadband on the first 5% rotation of the speed potentiometer. 10.9.2 If motor continues to step with speed potentiometer at zero (fully counter-clockwise), disconnect the wiper of the speed potentiometer from terminal 2 of TB1. Apply input power and activate start circuit. If the motor still steps, replace the control module. If the motor stops rotating, replace the speed potentiometer.

10.10 RECOMMENDED SPARE PARTS

	1 Unit	Multiple Units
Input Fuses	1 Box of 10	1 Box/Unit
DC Power Module	1	1 / 3 Units
Driver Module	1	1/Unit
Transistor Module	1	1/Unit
Control Module	1	1 / 5 Units



Control Connections
FIGURE 18

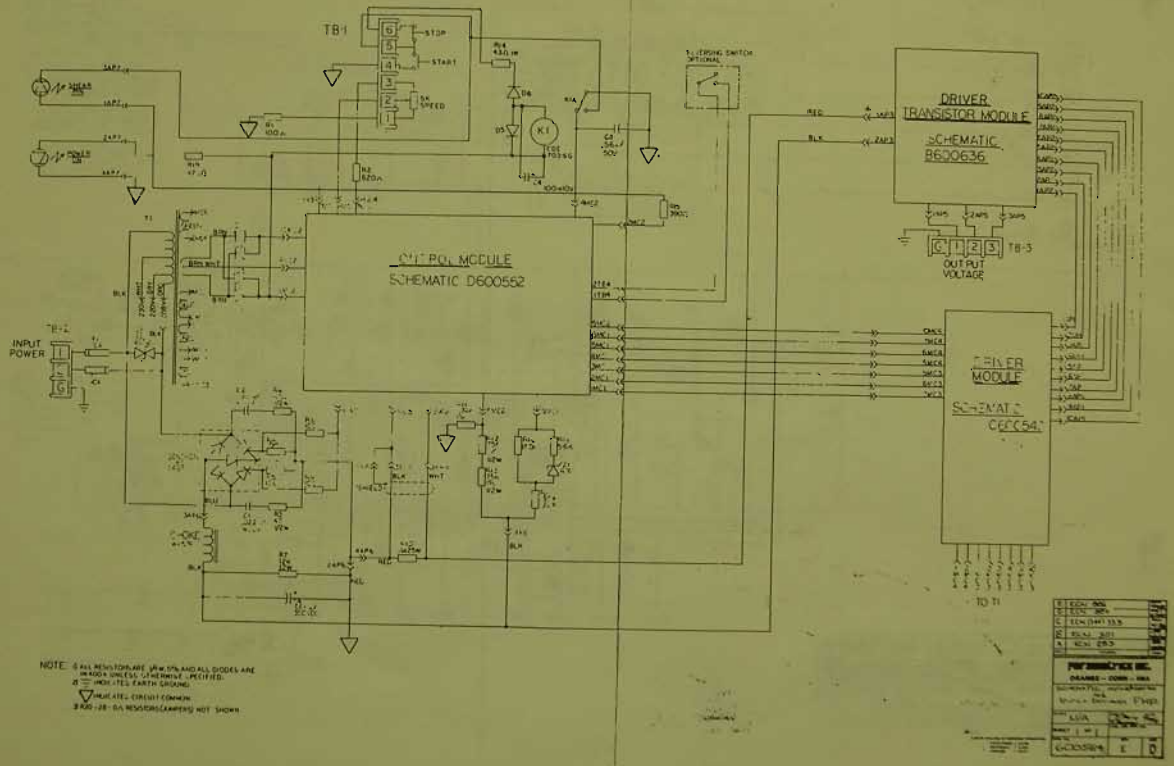


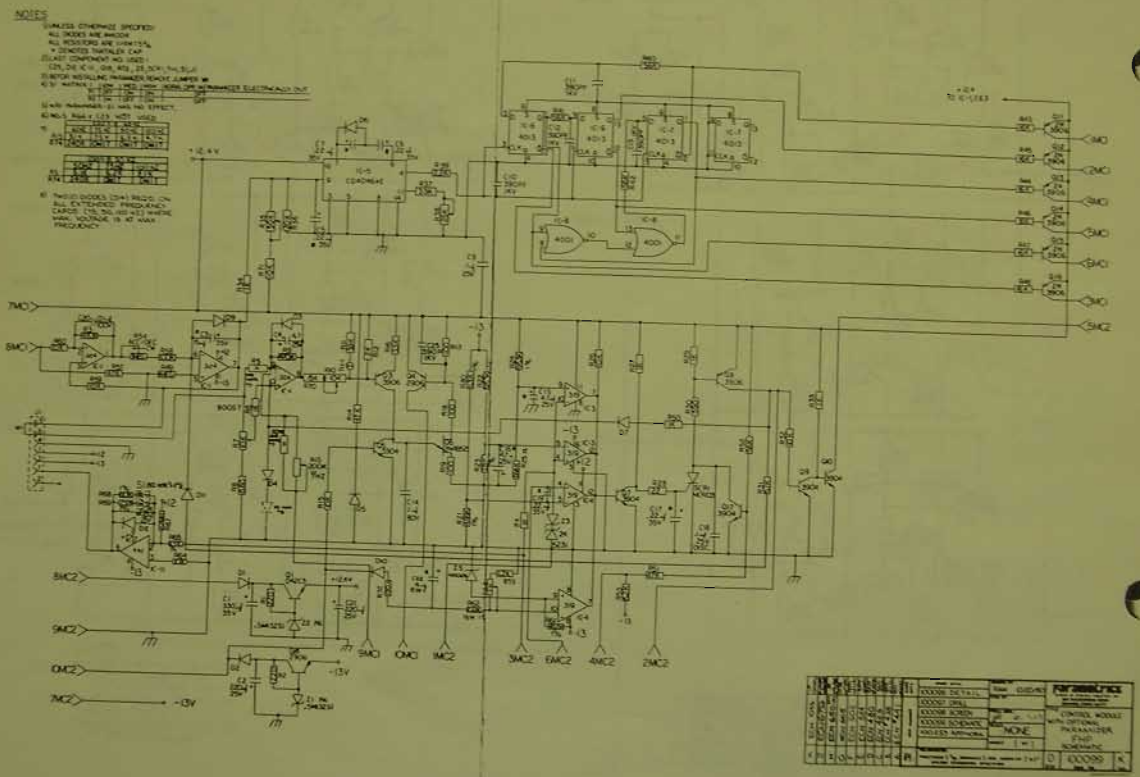
Acceleration and Deceleration
FIGURE 19

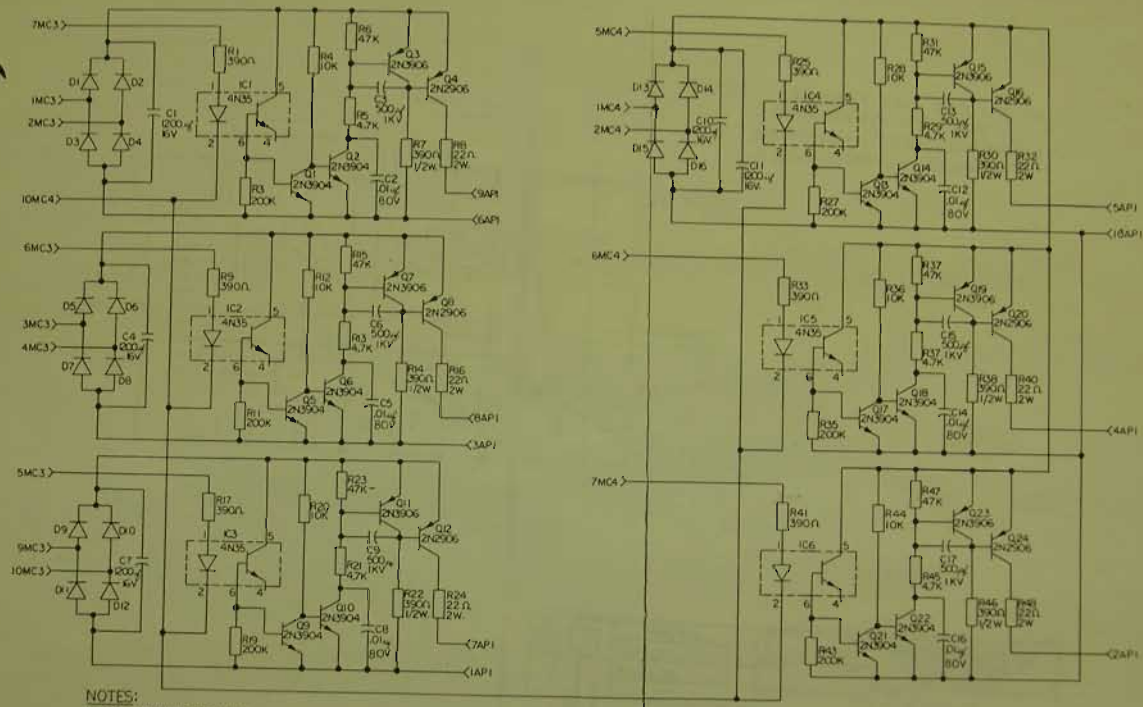
If any further assistance is required, contact the Technical Support Dept. at Parametrics.

PHONE: 203-795-0811 TELEX: 643301

(OUR PHONE IS MAINTAINED ELECTRONICALLY 24 HOURS A DAY)


TB1
STOP
START
5K SPEED
K1
DRIVER TRANSISTOR MODULE SCHEMATIC B630636
TB-3
OUTPUT VOLTAGE
CONTROL MODULE
SCHEMATIC D600552
INPUT POWER
TB-2
DRIVER MODULE
SCHEMATIC
TO T1



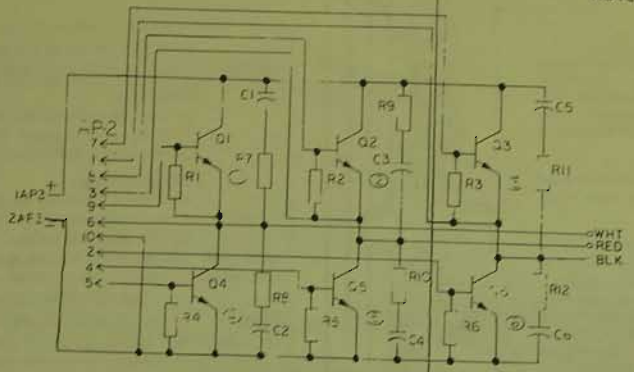


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL DIODES ARE IN4004
   ALL RESISTORS ARE 1/4W, 5%
2. LAST NUMBERS USED: R48, Q24
   C17, IC6, MC4 (API)
3. NUMBERS NOT USED: R2, R10, R18
   R26, R34, R42 (MC1-2).

				parametrics	
				FHP DRIVER MODULE SCHEMATIC	
				C 600547	0

NOTE: 1) RESISTORS R1-6 ARE 150Ω, 1.4W, 5%.
2) RESISTORS R7-12 ARE 10Ω, 1W
3) CAPACITORS C1-6 ARE .1μF @ 400V ±10%
4) TRANSISTORS Q1-6 ARE 901154



C	ECN 495	B	ECN 352	USED WITH	parametrics
				A600633	SCHEMATIC
				A600634	DRIVER TRANSISTOR
				A600635	MODULE
				A600636	FHP
				A600637	
				SHEET 1 OF 1	
					A 600636 C


ELECTRONIC SHEAR PIN
START
STOP RESET
POWER ON
PARAMETRICS ORANGE, CT USA MODEL 5007
SPEED
FHP
paraJust
AC MOTOR SPEED CONTROL