4V
EFF. 8/84
SUPERCEDES
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LANCER® JR

TYPE L INVERTER

8 TO 40 KVA (7.5 TO 40 HP)

460 VOLT 3 PHASE

INSTRUCTION MANUAL

MagneTek
Drives & Systems

This instruction manual covers installation, operation, adjustments and maintenance of the equipment, but does not provide for every possible circumstance that may occur, nor does it define all modifications, variations or details of the equipment Should further information be desired or should particular problems develop which are not covered sufficiently herein, please contact your nearest Louis Allis representative

WARRANTY

Standard products manufactured by the Company are warranted to be free from defects in workmanship and material for a period of one year from the date of shipment, and any products which are defective in workmanship or material will be repaired or replaced, at the option of the Company, at no charge to the Buyer Final determination as to whether a product is actually defective rests with the Company The obligation of the Company hereunder shall be limited solely to repair and replacement of products that fall within the foregoing limitations, and shall be conditioned upon receipt by the Company of written notice of any alleged defects or deficiency promptly after discovery within the warranty period, and in the case of components or units purchased by the Company, the obligation of the Company shall not exceed the settlement that the Company is able to obtain from the supplier thereof No products shall be returned to the Company without its prior consent Products which the Company consents to have returned shall be shipped f o b the Company's factory The Company cannot assume responsibility or accept invoices for unauthorized repairs to its components, even though defective The life of the products of the Company depends, to a large extent, upon type of usage thereof, and THE COMPANY MAKES NO WARRANTY AS TO FITNESS OF ITS PRODUCTS FOR SPECIFIC APPLICATIONS BY THE BUYER NOR AS TO PERIOD OF SERVICE UNLESS THE COMPANY SPECIFICALLY AGREES OTHERWISE IN WRITING AFTER THE PROPOSED USAGE HAS BEEN MADE KNOWN TO IT

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE

This warranty does not apply to experimental or developmental products

RECEIPT OF SHIPMENT

All equipment is tested against defect at Louis Allis and is shipped in good condition Any damages or shortages evident when equipment is received must be reported immediately to the commercial carrier who transported the equipment Assistance is available from the nearest Louis Allis district office, if required Always refer to Louis Allis order number, equipment description and serial number when contacting Louis Allis

EQUIPMENT STORAGE

For long periods of storage, equipment should be covered to prevent corrosion Equipment should be stored in a clean, dry location After storage, insure that equipment is dry and no condensation has accumulated before applying power All rotating equipment stored longer than three months requires regreasing

SAFETY FIRST

This equipment has been designed to provide maximum safety for operating personnel However, hazardous voltages exist within the confines of the enclosure Installation and servicing should therefore be accomplished by qualified personnel only and in accordance with OSHA regulations

NOTICE

This equipment is exempted from FCC regulations.

See 47CFR15.801.

CAUTION

NEVER CONNECT CAPACITORS ACROSS THE INVERTER OUTPUT AND MOTOR. UPON APPLICATION OF POWER, THE INVERTER INITIALLY SEES THE CAPACITORS AS A SHORT CIRCUIT, HIGH CURRENTS RESULT AND EQUIPMENT WILL BE DAMAGED.

IF REQUIRED, POWER FACTOR CORRECTION CAPACITOR NETWORKS MAY BE CONNECTED ACROSS THE INPUT POWER SOURCE ONLY AFTER CONSULTING LOUIS ALLIS.

IMPROPER USE OF POWER FACTOR CORRECTION CAPACITOR NETWORKS WILL DAMAGE EQUIPMENT.

SPECIAL CONSIDERATIONS, ELECTROLYTIC CAPACITORS

GENERAL

Electrolytic capacitors have shelf-life limits of one to two years. For equipment stored six months or more, SPECIAL CARE MUST BE TAKEN DURING STARTUP TO MINIMIZE THE CHANCE OF FAILURE OF ELECTROLYTIC CAPACITORS. Shelf-life shall be considered as the dead time between last operating use and restart of the unit. If the shelf-life is approximately two years, the capacitors must be reformed, and their leakage current determined. Each capacitor must be treated separately, not in banks. This applies not only to the larger capacitors, but also to the smaller electrolytics on the PCBs.

CAPACITOR REFORMING

To reform an aluminum electrolytic capacitor, connect it in series with a variable DC power supply and a 1000 ohm (1K) resistor, as shown in Figure 1.

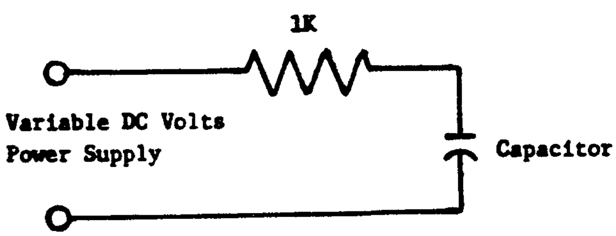


FIGURE 1

Over a period of one minute, slowly build up the DC voltage to apply the full rated voltage across the series system of resistor and capacitor. Keep the voltage applied at full rated level for 30 minutes. Then disconnect the system without discharging the capacitor. Wait at least 24 hours.

LEAKAGE CURRENT TEST

To determine the leakage current, reform the capacitor as outlined above, and disconnect it without discharging. Set it aside at least 24 hours, then perform the following test.

Connect the capacitor in a test circuit as shown in Figure 2.

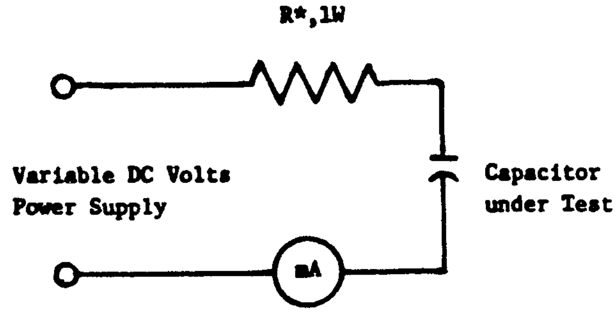


FIGURE 2

*R (in ohms) = not less than rated voltage of capacitor (in DC volts); (e.g., for a capacitor rated 500VDC, use a 500 ohm, 1W resistor).

Over a period of one minute, build up the DC voltage to apply the full rated voltage across the series system of resistor, capacitor, and milliameter. Observe the leakage current for ten minutes, and record the highest value.

Use the formula and table below to calculate the maximum allowable leakage current.

Max Leakage Current (mA) = (capacitor ufd x K) + X

RATED DC VOLTAGE	K	X
3	0.0003	+.1
6	0.0005	+.1
10	0.0007	+.1
15	0.001	+.1
25	0.002	+.1
50	0.004	+.1
150	0.010	+.2
250	0.013	+.25
300	0.015	+.25
350	0.015	+.25
400	0.02	+.25
450	0.02	+.3

Example: for a 50 WVDC 150 ufd capacitor
Max Leakage Current = (150 x .004) +0.1
= 0.6 + 0.1
= 0.7 mA

Capacitors which exceed the limit should be replaced.

CONTENTS

FOREWORD

This instruction manual is concerned with installation, operation, and troubleshooting procedures for the LANCER® Jr general purpose inverter. The unit is a 460V sinusoidal wave, pulse width modulated (P.W.M.), controlled voltage inverter with sizes available from 7.5 to 40 horsepower.

The unit may be combined with a general purpose induction motor to constitute a reliable variable speed drive system. A few of the advantages are easy operation, automatic control capability, reversing, high efficiency, and energy savings. Before using your unit, carefully read this manual and observe all precautions to ensure long trouble free service of your inverter.

The standard specifications are listed in Table 1. Options or additions may change the standard specifications (see Table 2).

TABLE 1-STANDARD SPECIFICATIONS

Applicable Motor Power (HP) max		7.5	10	15	20	25	30	40
Model and Ratings	1	92039P	92040K	92041S	92042Q	92043F	92044M	N/A
	2	92027M	92028K	92029S	92030N	92031L	92045K	N/A
	Capacity (KVA)	7.5	11	16	22	27	33	40
	Rated Current (A)	11	15	23	30	37	45	55
Power Supply	Voltage Frequency	3-phase, 460V, 50/60HZ *						
	Allowable variation	Voltage +10% -5% frequency ±2HZ						
Control Specifi-cations	Control system	Sinusoidal wave PWM control						
	Output voltage	3-phase, 460V (maximum)						
	Frequency accuracy	±0.5% of highest frequency (at 25°C ±10°C)						
	Voltage/Frequency ratio	3 to 60 HZ: V/F constant 60 to 80 HZ: V constant						
	Overload capacity	150% for 60 seconds; 110% continuous						
	Control Reference	0 to 12 VDC or 4 to 20mADC						
	Acceleration/ Deceleration Time	1 to 20 seconds (acceleration and deceleration individually adjustable)						
Operat-ing Function	Braking	By capacitor charge						
	Starting	By dry contact (hold)						
	Normal run, reverse	Reversing can be added using a dry contact or switch						
	Zero speed signal output	Open collector output						

1 Blank OCS Plate with Top and Bottom Covers.

2 Blank OCS Plate without Top and Bottom Covers.

Protecting Functions	Protection	Stall prevention, overcurrent protection, shortcircuit protection, overvoltage protection, undervoltage protection, momentary power failure protection, input fuse and circuit breaker protection.
	Fault detection	Fault relay form-C contacts (250 VAC 1A resistive). The relay will engage when overcurrent, shortcircuit, overvoltage, or undervoltage is detected.
	Display	CHG. LED to indicate charge on bus. OV LED indicating overvoltage. UV LED indicating undervoltage. OC LED indicating overcurrent. OL/OH LED indicating overheat or overload.
Ambient Conditions	Location	Indoor NEMA 1 Enclosure.
	Ambient Temp.	0 to 40°C
	Relative Humidity	Less than 90%, non condensing
	Vibration	Less than 0.5 G
Construction		NEMA Type 1
Cooling		Forced Air
Instruments installed on cover (when chassis unit is supplied).		Frequency meter, frequency setting potentiometer (3 K ohms, 1 W), RUN-STOP switch.

*Some applications for the unit allow 380 to 440V 3 phase 50/60HZ. Consult your local Louis Allis District Office for details.

The optional specifications shown in Table 2 are available.

TABLE 2- OPTIONAL SPECIFICATIONS

Frequency Increase	Maximum frequency can be raised to 160 HZ or 320 HZ by using jumpers.
Speed Feedback Control	Speed feedback control can be made by installing an optional circuit board. In this case, a motor with an AC tachometer generator (TG) is necessary. TG specifications: Single-phase, 24 pole, 1800 RPM, 12 V/1000 RPM.
Regenerated Power Discharge Unit (DB UNIT)	This unit is used for quick deceleration or stopping a load with high inertia.
Multiple Motor Operation	Operation with multiple motors on one inverter is possible. Additional motor overload protection is required for each motor.
Additional Auxiliary Contacts	Optional relays are available to indicate inverter run, stop or fault.
Isolation Transformer	Isolation transformer provides electrical isolation from the power line and can be used to step 480V down to 230V.
Enclosures	The unit can be installed in a NEMA 4 or NEMA 12 Enclosure.

OPTIONAL SPECIFICATIONS CONTINUED

Bypass Operation	Bypass operation provides circuitry that allows motor to operate at variable speed (inverter) or on fixed 60 HZ line voltage.
Jogging	Jogging option prevents seal-in of the input contactor for inching or threading operation.
Manual/Auto or Local/Remote Selector	The manual/auto or local/remote option allows switching between two separate input references. Switching of the inputs can be performed while the inverter is running; no shutdown is necessary.
Meters: Amp, Volt, or Freq. Analog or Digital	The standard inverter provides an analog frequency meter to indicate speed. Optional frequency, current and voltage meters are available for remote or local mounting. Digital models are also available.
10 Turn Speed Pot.	The normal 270° (one turn) speed pot. can be substituted with a 10 turn precision potentiometer for precise speed settings.
Remote Operators Station	Operator controls and meters can be mounted in a separate enclosure for remote locations. The remote operators station is available in NEMA 12 or NEMA 4 enclosures.
Forward/Reverse	The forward/reverse option allows direction change of the motor without reversing contactors. Shutdown or manual stopping of the inverter is not necessary to change motor direction.
Fault Light	A fault light (indicating inverter fault) can be installed at the operators station or on the inverter enclosure.

PRINCIPLES OF OPERATION

Most A.C. induction motors in the past have been limited to fixed speeds. The unit provides a simulated (P.W.M.) A.C. that varies the speed of the motor using transistors (G-TR) with a microprocessor controlled regulator to accomplish the conversion.

Motor speed ratings usually show the motor base speed at 60 HZ operation. Slower speeds (below base speed) are produced by reducing both the voltage and the frequency of the output.

FIGURE 1

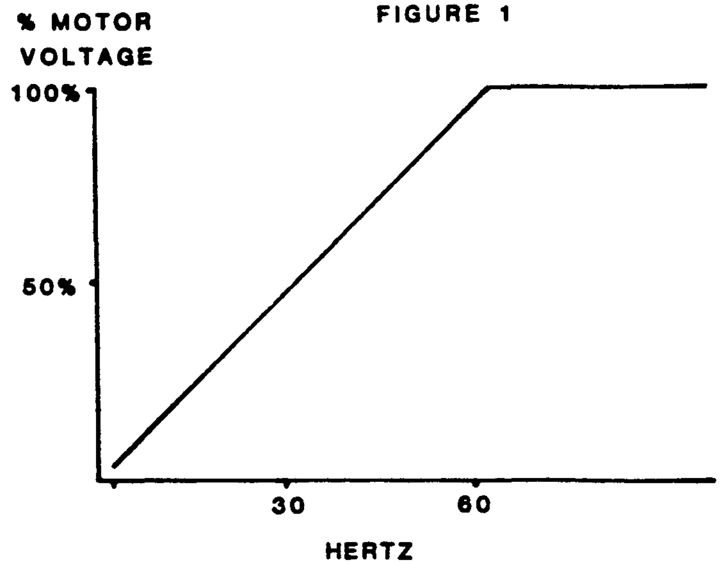


Figure 1 shows the voltage varying with the frequency until base speed (60 HZ). Above base speed, the voltage remains constant while frequency varies.

P.W.M. (Pulse Width Modulated) inverters change the incoming power to D.C. and then pulse the D.C. into the motor leads to simulate A.C. Figure 2 shows a representation of the output voltage waveform.

An A.C. waveform is superimposed on the pulse waveform for illustration.

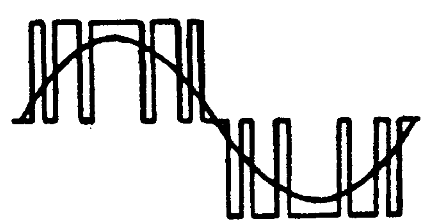


FIGURE 2

Pulse width is decreased for lower RMS voltage and increased for higher voltage. Lower frequencies have a greater number of pulses in one cycle. As the frequency increases, the microprocessor selects the optimum number of pulses per waveform.

Figure 3 shows a block diagram of the 460V unit.

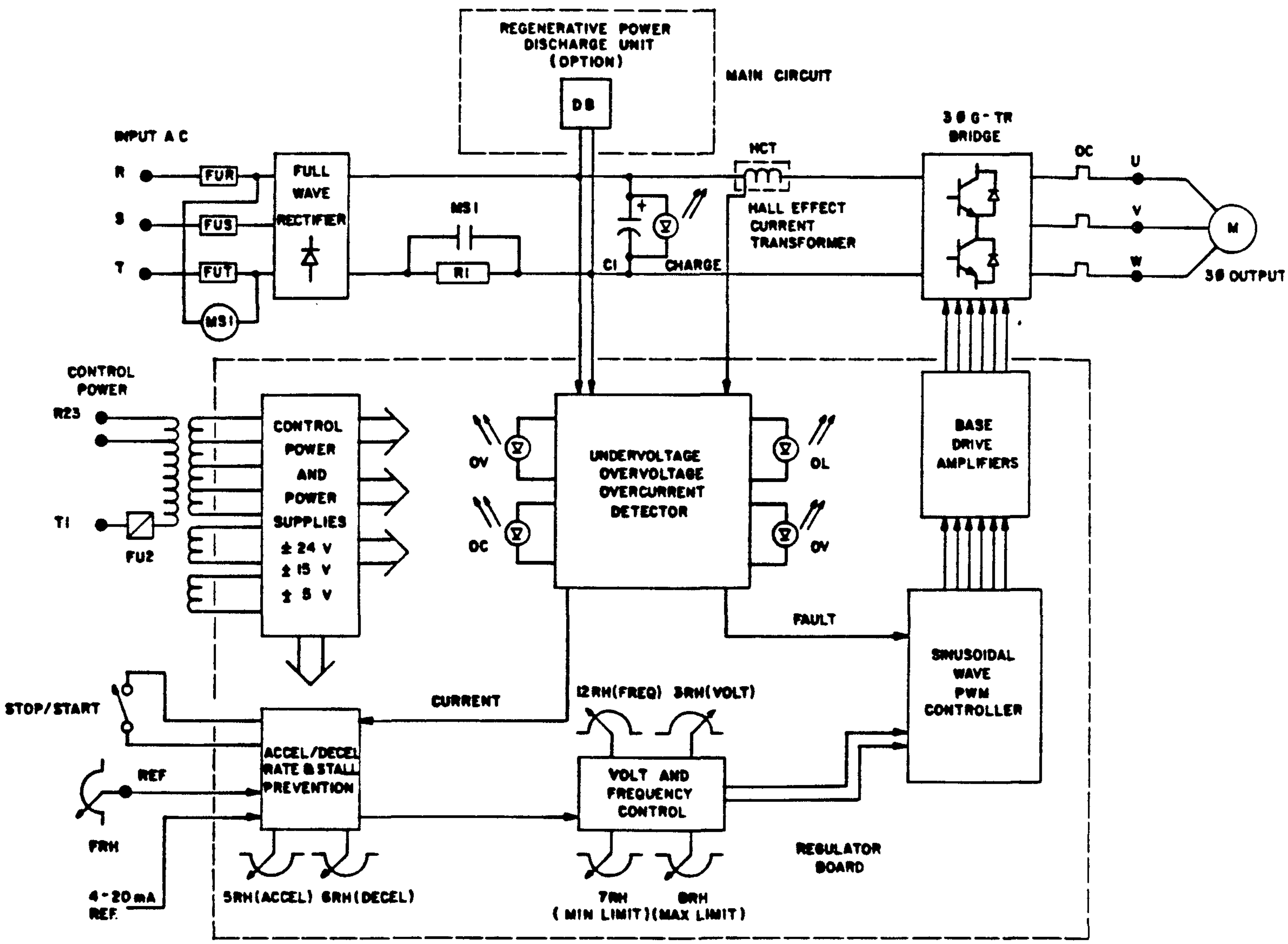


FIGURE 3

Figure 3 is divided into three parts; the MAIN CIRCUIT which handles the input and output power, the REGULATOR BOARD which senses input information to direct the power transistors (GTR), and the optional REGENERATIVE POWER DISCHARGE UNIT (D.B. unit).

A. MAIN CIRCUIT

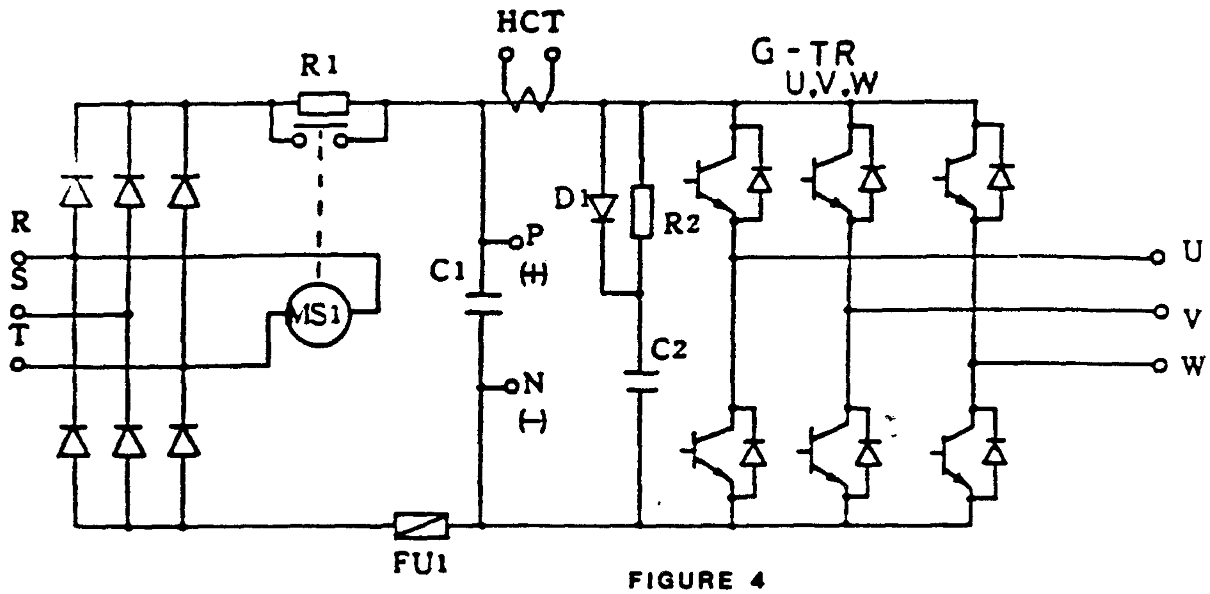


FIGURE 4

Incoming 3 phase A.C. line voltage is rectified to a 650V D.C. bus by the diodes in the full wave rectifier.

Fuses FUR, FUS, and FUT protect the main circuit from fault currents.

When the input contactor (1M) is first energized, contactors MS1 and ACT1 with resistor R1, provide a slow charge to filtering capacitors C1. A red LED (light emitting diode) on the regulator board turns on to indicate voltage on the bus.

A Hall-Effect D.C. current transformer HCT monitors bus current for the regulator board.

Output to the motor is obtained by chopping the D.C. bus with the transistor (GTR) bridge. G-TR control comes from the regulator board through the base amplifiers.

HCT is a Hall-Effect current transformer detecting bus current. Figure 5 shows the H.C.T. and power connections.

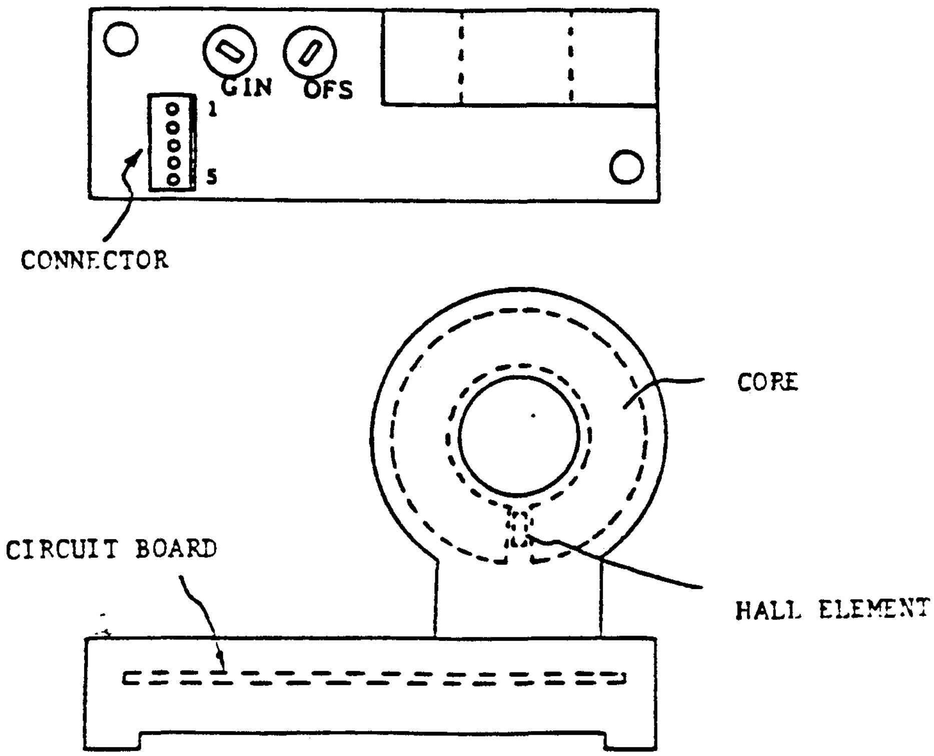


FIGURE 5

HCT is identical for all 7.5 through 40 horsepower inverters. Current scaling for proper feedback on different size units is accomplished by changing the number of turns of wire around the core. Table 9, Parts List shows correct number of turns for each inverter. Factory sealed potentiometers on the HCT should never be adjusted.

Switching of the transistors is controlled by the regulator board.

Output waveforms are illustrated in Figure 6.

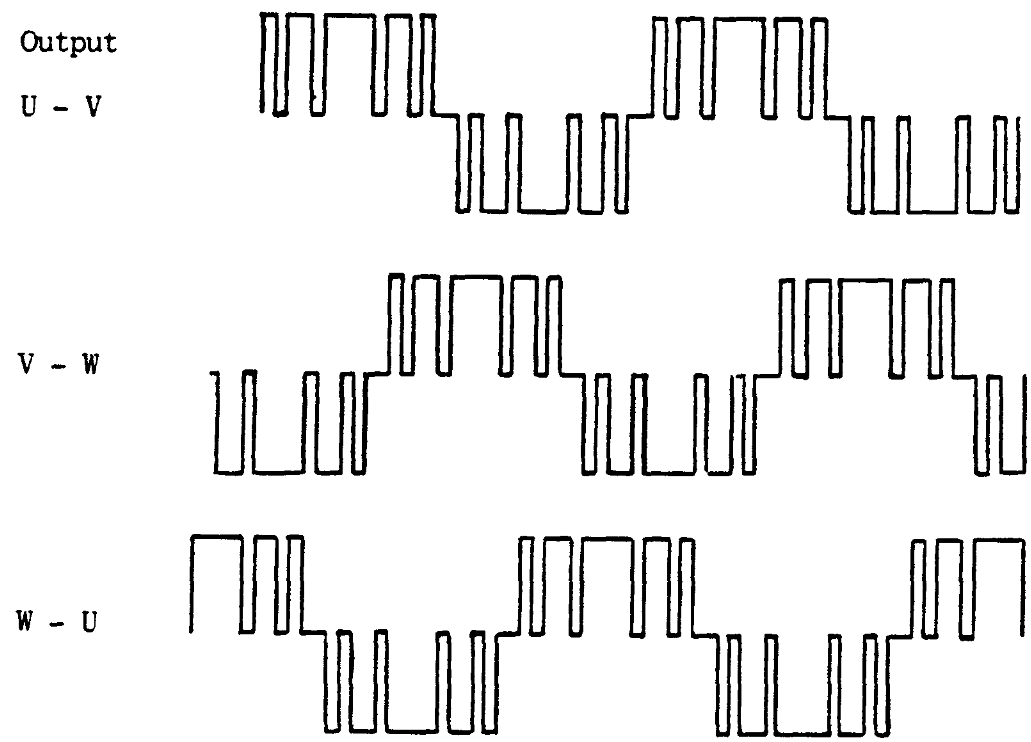
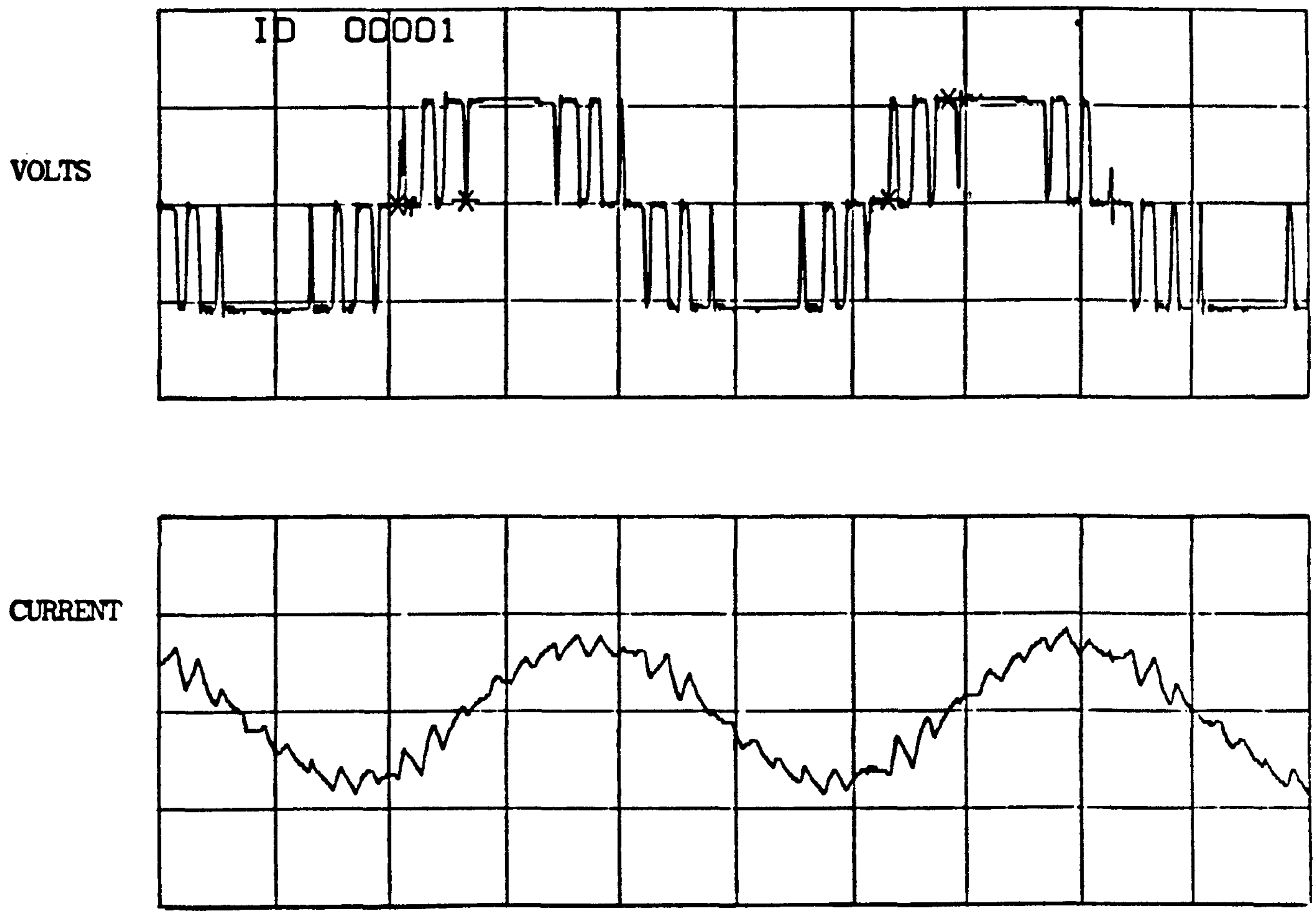


FIGURE 6

Proper 120° phase shift between output leads stays constant over the entire frequency range. Typical motor voltage and current at 60 hertz (full load) is shown on Figure 7. Note that although the voltage is pulses, the current waveform is near sinusoidal. Voltage is leading current, typical in induction motors.

FIGURE 7

OUTPUT VOLTAGE AND CURRENT



B. REGULATOR BOARD

The wiring diagrams at the end of this manual show a block diagram of regulator board functions and adjustments.

The regulator board accepts operator information and outputs base signals to control the G-TR's. Refer to the wiring diagrams for the following description:

The operator speed pot. (frequency setting signal) is connected to P-P, REF, and COM. 0 to 12VDC at REF controls full range output of the inverter.

A 4 to 20mA signal can be connected at I-IN and common. A contact opening the P-P wire of the speed pot will automatically switch to the current reference.

ST (start), F (forward), and R (reverse) connected to -24 controls the start/stop function and direction of inverter output.

The HCT connects to the regulator board through connector CN13. Current feedback is present at pins 1 and 2.

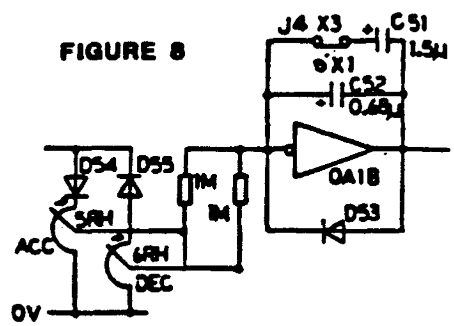
Bus voltage feedback is sensed through connectors CN5-4 (negative) and CN1-1 (positive). 125% bus voltage will trip off the inverter and indicate overvoltage.

Fault relay (contacts at FLA, FLB, and FLC) latches on if a fault occurs. Pressing the reset button or turning off power for five seconds will reset the fault.

A low speed relay may be used to detect inverter speed below 3Hz. A 24V, 75mA (max) relay coil (connected from -24 to LOW) will de-energize when low speed is detected.

Figure 8 shows the accel and decel circuit. A step input reference is changed to a ramp output. Separate accel (5RH) and decel (6RH) potentiometers provide 1 to 20 seconds ramp time (6 to 60 seconds is available by applying a jumper at J-4).

FIGURE 8



Adjustment potentiometers 3RH and 11RH adjust the inverter output voltage with respect to frequency. Commonly called the volts per hertz adjustments (V/HZ); 11RH (voltage boost, VB) adjusts voltage at lower frequencies and 3RH (voltage limit, VL) adjusts voltage at the higher frequencies.

Factory adjustment provides 0 to 60 HZ operation. Moving jumper J-7 from the 60 HZ to the 50 HZ position automatically changes maximum output to 50 HZ. Frequency range is adjustable from 45 HZ to 80 HZ with no connection at J8. Connecting 2F to J8 raises output frequency to 160 HZ and 4F on J8 raises output frequency to 320 HZ. Note that adjustments or changes in output frequency may require readjustment of frequency meter (2RH) and V/HZ (3RH and 11RH).

Figure 9 shows an analog to digital conversion chip. The voltage signal is converted to a 4 bit code the microprocessor can understand. Connector CN11- pin 3 (measured to COM) is the voltage proportional to output voltage. 5V at CN11-3 means maximum output voltage. Voltage at this point will rise above 5V but inverter output voltage will not increase.

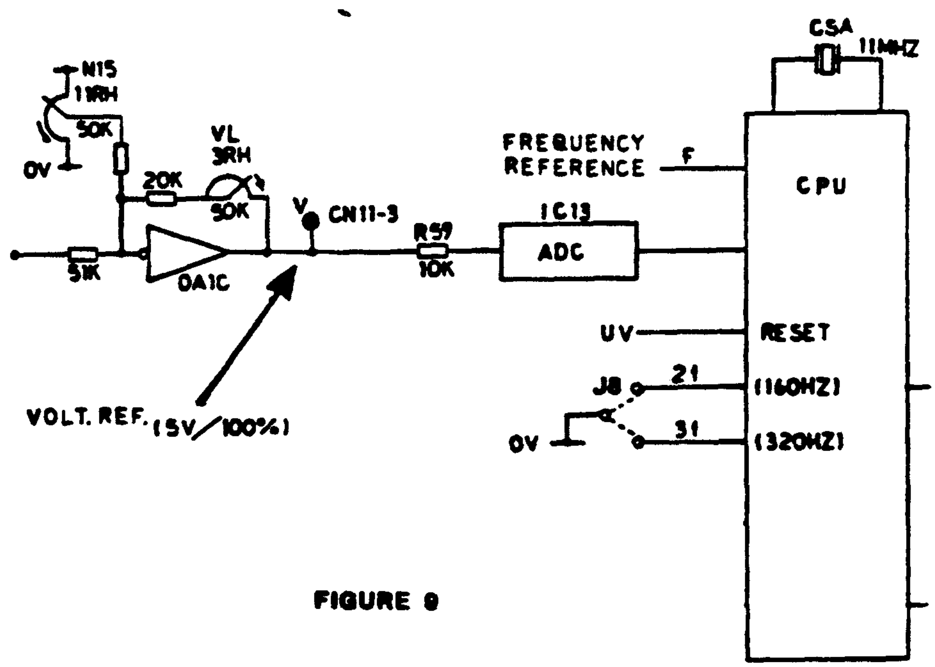


FIGURE 9

Figure 10 shows a voltage to frequency conversion ship. Output of IC7 is a frequency pulse proportional to output frequency. With no jumper at J8, CN11-2 has a frequency 1152 times inverter output frequency.

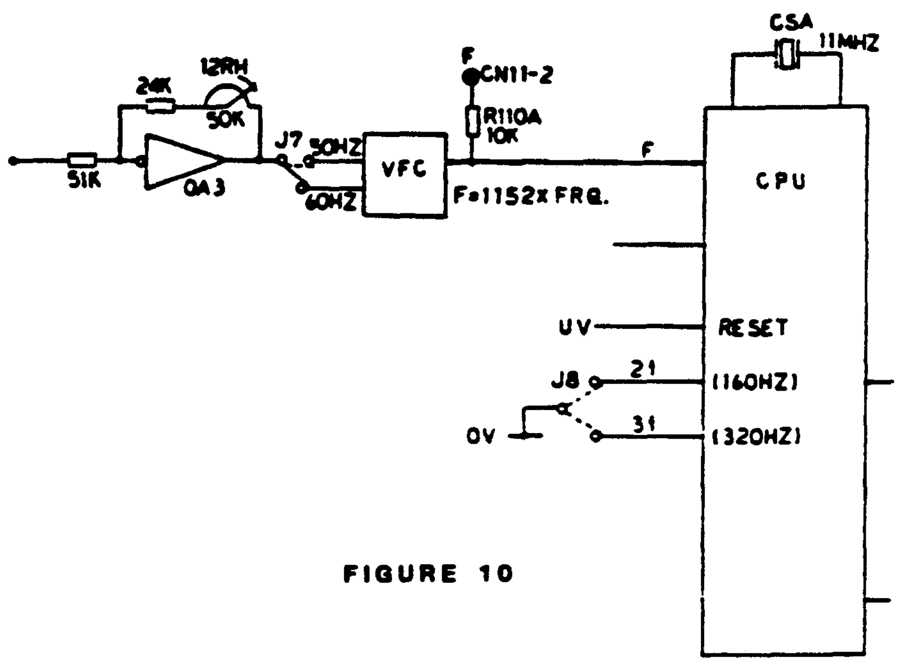


FIGURE 10

The current detector monitors bus current from the HCT. If bus current rises to 163%, stall prevention circuitry phases back both voltage and frequency until current decreases. 190% current shuts the G-TR base drive off until current decreases. 240% current turns base drive off and latches the fault relay and OC overcurrent LED. If the motor runs at 150% current for 60 seconds, the inverter will shut off and indicate on the overheat (OH) LED.

Bus voltage level is monitored on the regulator board. Fast deceleration rates can cause the bus voltage to rise absorbing energy from the motor. If bus voltage rises to 750V (650V normal), deceleration time is lengthened regardless of setting. At 800V, the inverter shuts down to protect filter capacitors C1 and G-TR's from damage and latches fault relay and OV LED.

The microprocessor (CPU) develops base signals which are isolated and amplified by the base driver circuit. Transformer T1 provides isolated low voltage A.C. which is rectified and filtered for the base driver amplifiers. Connectors CN-3, 4, 5, 7 and 9 connect the base pulses to the G-TR's.

C. REGENERATIVE POWER DISCHARGE UNIT

Regenerative power discharge unit (Dynamic Braking Unit) is an option that allows fast deceleration on high enertia loads.

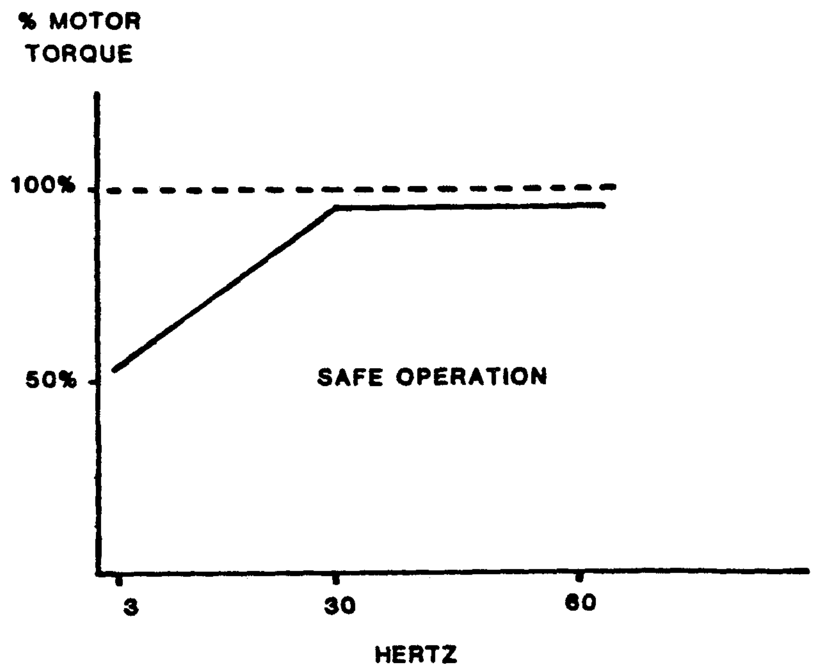
Without the DB unit, a fast deceleration would cause the bus voltage to rise absorbing regenerative energy from the motor. At 125% bus voltage, the inverter shuts down (to protect the transistor power circuit) and turns on the OV overvoltage LED. The DB unit senses the voltage rise and turns on a GTR that puts low resistance on the bus to absorb the energy before overvoltage trip.

D. APPLICATION

The unit provides a high quality output voltage and current, but it is not a perfect sine wave. Therefore, some increase in motor temperature, noise, and vibration may be noticed.

Special considerations must be taken when applying an inverter to an existing motor. At slower speeds, cooling is not as effective due to reduced fan RPM. Full load torque at slow speeds may damage the motor from overheating. In situations where the load requires high torque at slow speeds, the minimum speed must be raised for cooling effect. Figure 11 shows a curve plotting acceptable torque vs. speed.

Note that for a safety margin, the curve shows no more than 90% motor rated torque at any speed. If torque requirements at slow speeds continuously exceed levels shows in Figure 11, a motor rated for inverter operation can be substituted.



Fixed speed machinery may not run properly at available speed ranges. Operation above 60 HZ may damage bearings or rotating parts. Slow speeds may provide insufficient lubrication on oil filled gear boxes or speed reducers. Manufacturer specifications may need to be consulted.

The above precautions should be looked at carefully to prevent any problems. It is most often the case, however, that the motor or motors on a fixed speed application can be directly applied to the unit.

INSTALLATION PROCEDURES

A. INITIAL INSPECTION

Upon receipt of your unit; a careful inspection for shipping damage should be made. After uncrating, check:

1. Whether there are any parts which might be loose, broken or separated.
2. Whether the rated capacity shown on the nameplate is the same as specified on your order.

B. GENERAL REQUIREMENTS

Unless supplied in a special optional enclosure, the unit should be installed in an area where:

1. Cabinet mounting is upright leaving room for door clearance.
2. Ambient atmosphere is free of dust, corrosive gases, high moisture content and temperature extremes.
3. Vibration is kept to a minimum.
4. Unit should be easily accessible for maintenance and trouble-shooting.
5. Regenerative power discharge resistors (optional) should be

installed where heating will not raise the ambient above 40°C (104°F) around the inverter.

C. WIRING PROCEDURES

Each unit is shipped with wiring diagrams that show interconnections necessary. A standard unit with operator controls in the door, simply requires connecting input power to the inverter and output to the motor. A remote operator station and other options require more interconnections. Figures 12 and 13 show diagrams that would be received with the standard unit. Bypass option diagrams are shown in Figures 15 and 16.

Two types of SPEED pots are shown on schematics in this instruction manual:

1) 2.5KΩ, 2W
2) 3.0KΩ, 1W

Louis Allis has adopted the standard of using the 2.5KΩ, 2W SPEED pot. Either valued pot will work however because the pots are connected in a voltage divider circuit whose voltage at the wiper when the pot is at maximum is described by the formula:

$$\left(\frac{\text{Resistance pot}}{\text{Resistance pot + Series resistance}}\right)(15\text{VDC}) = \text{MAXIMUM VOLTAGE AT WIPER}$$

Plugging the value of each SPEED pot in the above formula yields:

$$\frac{2.5\text{K}\Omega}{2.5\text{K}\Omega + 750\Omega}(15\text{VDC}) = 11.54\text{VDC}$$

$$\frac{3.0\text{K}\Omega}{3.0\text{K}\Omega + 750\Omega}(15\text{VDC}) = 12.00\text{VDC}$$

Maximum speed is defined as being 11.30VDC at the SPEED pot wiper. Therefore, because 11.30VDC is less than either of the two voltages calculated above, either pot will work.

	POWER UNIT						
HP	1	2	OL (A)	CB (A)	M SIZE	CPT (VA)	3FU (A)
7.5	92039P	92027M	11	15	1	100	1
10	92040K	92028K	14	20	1	100	1
15	92041S	92029S	21	25	2	150	1 5

1 Blank OCS Plate with Top & Bottom Covers
2 Blank OCS Plate without Top & Bottom Covers

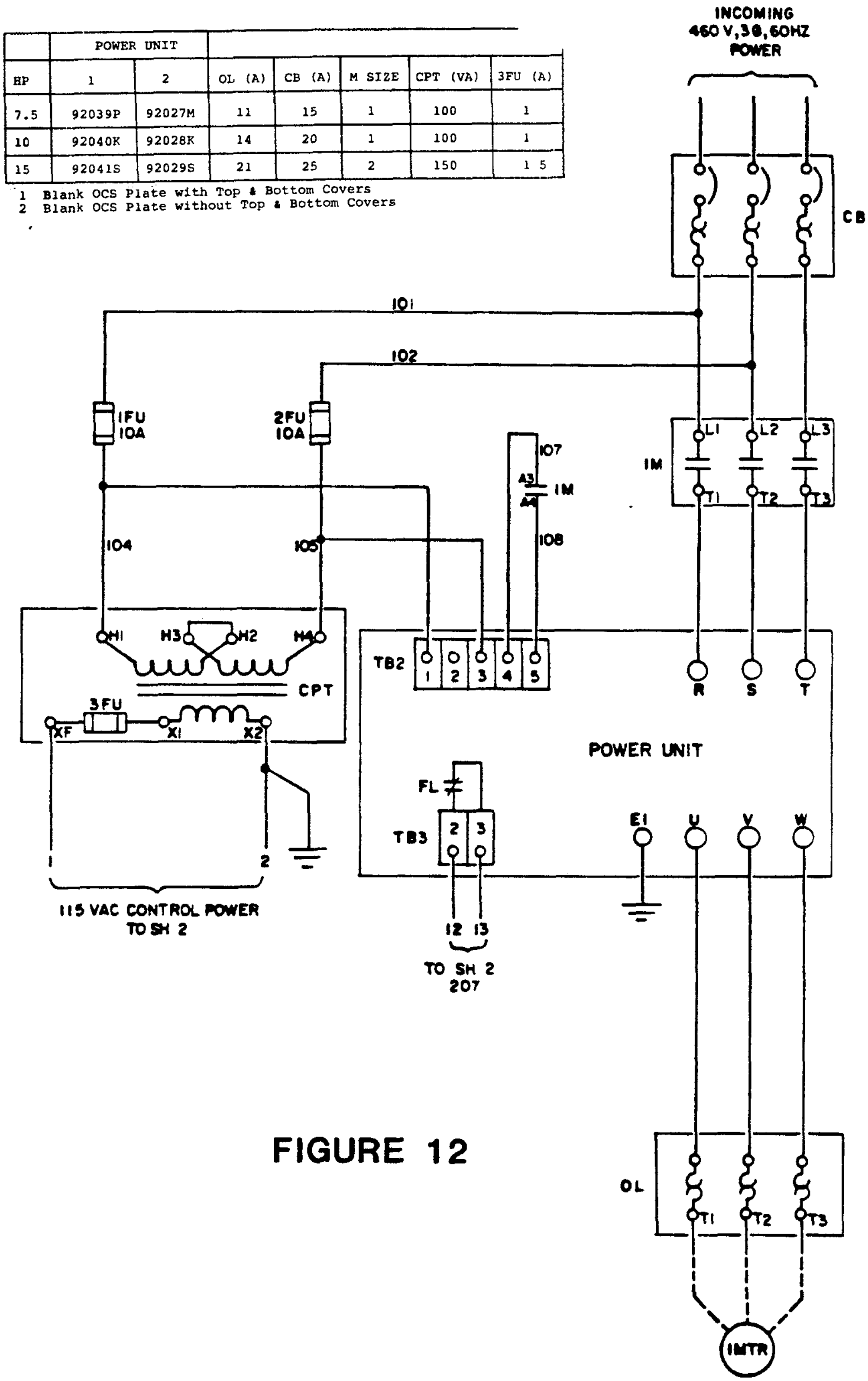


FIGURE 12

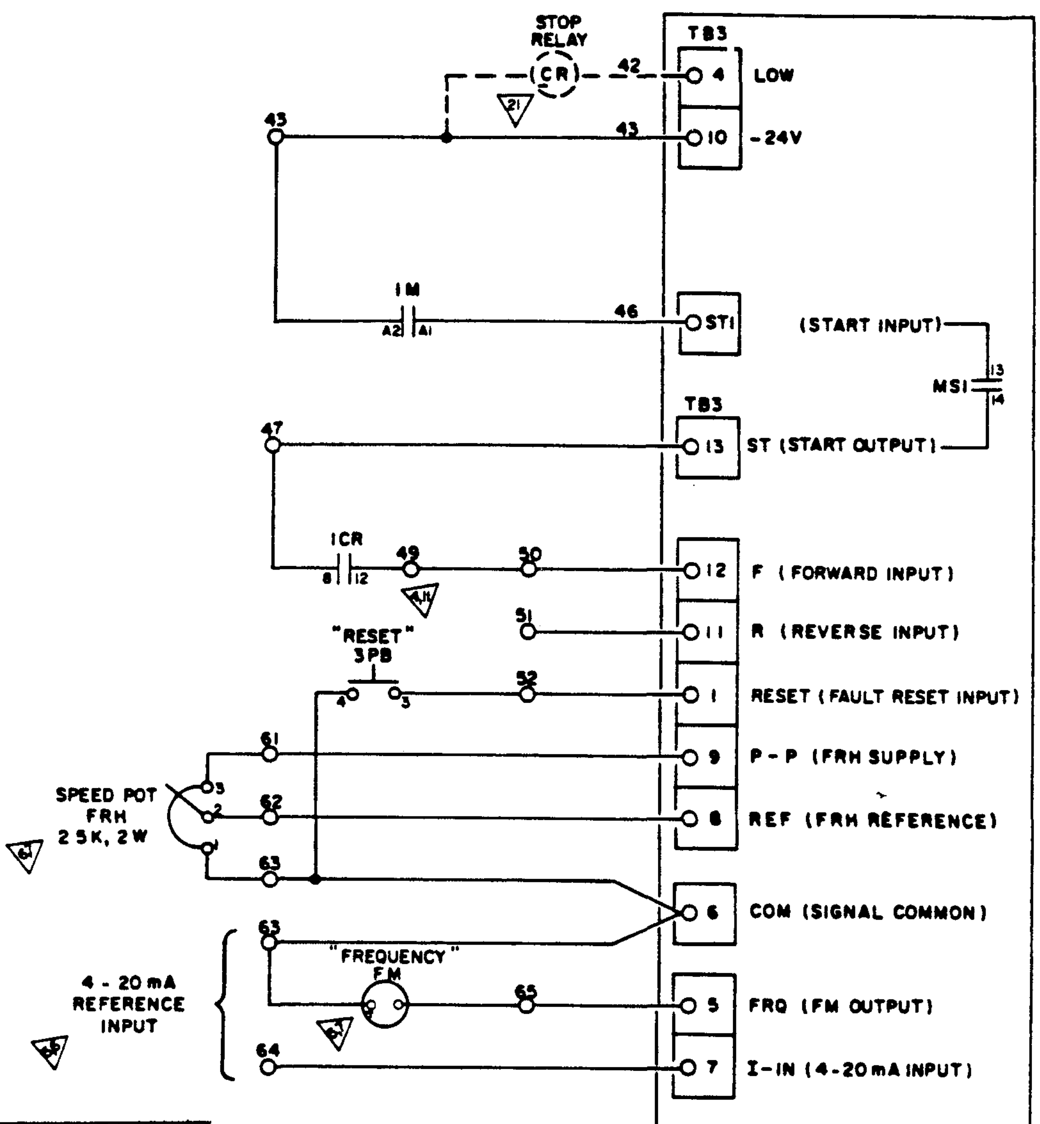
TITLE SCHEMATIC DIAGRAM
POWER ELEMENTARY — — HP
Standard

DRAWN BY	DATE	SCALE	ORDER NO
LVH	2-09-83	NONE	
CHECKED	DATE	CUST NAME	
RAE	2-10-83		
APPROVED	DATE	P.O NUMBER	
M A	2-10-83		

NO	REVISION	DATE	BY

DRAWING NO 73-501743-38

SH 1 OF 4



	POWER UNIT	
HP	1	2
7.5	92039P	92027M
10	92040K	92028K
15	92041S	92029S

1 Blank OCS Plate with Top & Bottom Covers
2 Blank OCS Plate without Top & Bottom Covers

FIGURE 13

NOTE LEGEND IS ON SHEET 4

TITLE: SCHEMATIC DIAGRAM 460 _ _ _ _ _ HP
SIGNAL AND DC CONTROL INTERFACE *Standard*

DRAWN BY: LVH | DATE: 2-14-83 | SCALE: NONE | ORDER NO:
CHECKED: RAE | DATE: 2-15-83 | CUST NAME
APPROVED: MA | DATE: 2-16-83 | P.O NUMBER:

NO | REVISION | DATE | BY

DRAWING NO: 73-501743-38

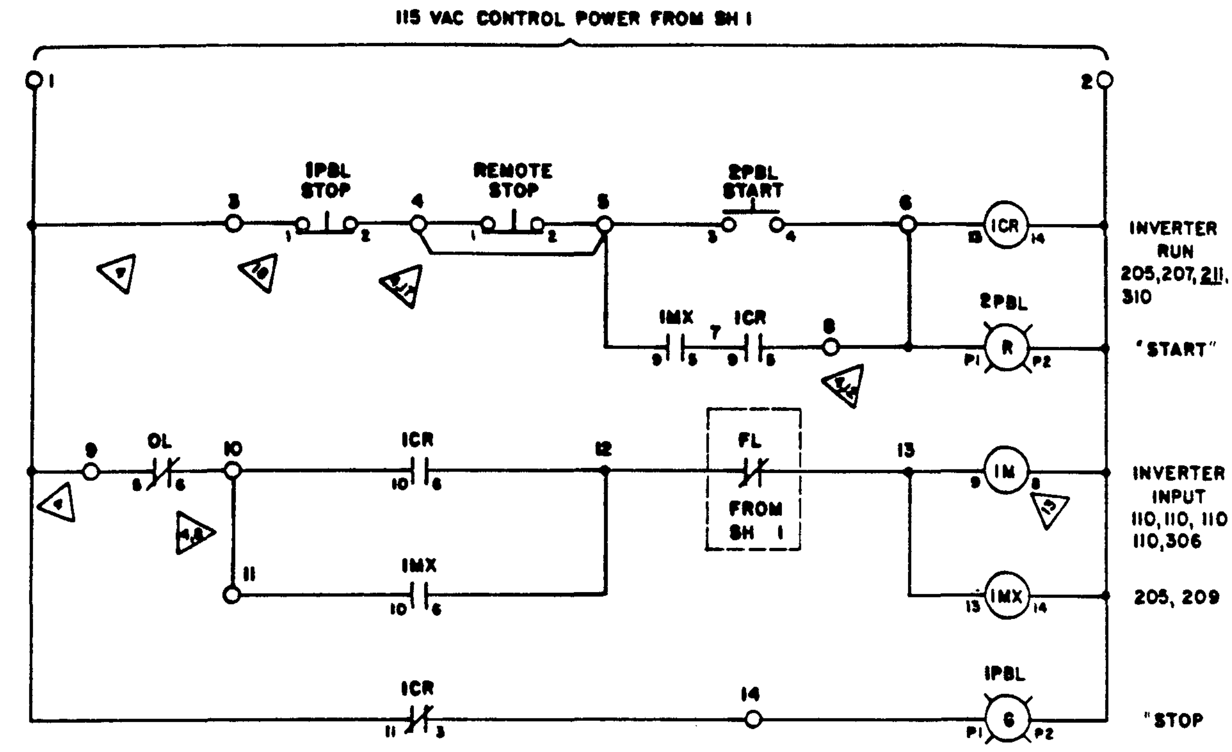


FIGURE 13A

NOTE LEGEND IS ON SHEET 4

TITLE SCHEMATIC DIAGRAM ___HP AC CONTROL ELEMENTARY STANDARD					NO / REVISION / DATE / BY
Page 21	DRAWN BY C KIM	DATE 1 - 6 - 83	SCALE	ORDER NO	
	CHECKED RAE	DATE 1 - 6 - 83	CUST NAME		DRAWING NO 73-501743-38
	APPROVED MA	DATE 1 - 6 - 83	P.O NUMBER		SH 2 OF 4

	POWER UNIT							
HP	1	2	OL (A)	CB (A)	M SIZE	CPT (VA)	3FU (A)	FU R,S,T (A)
7.5	92039P	92027M	11	15	1	150	1.5	30
10	92040K	92028K	14	20	1	150	1.5	30
15	92041S	92029S	21	25	2	250	2.5	60

1 Blank OCS Plate with Top & Bottom Covers
2 Blank OCS Plate without Top & Bottom Covers

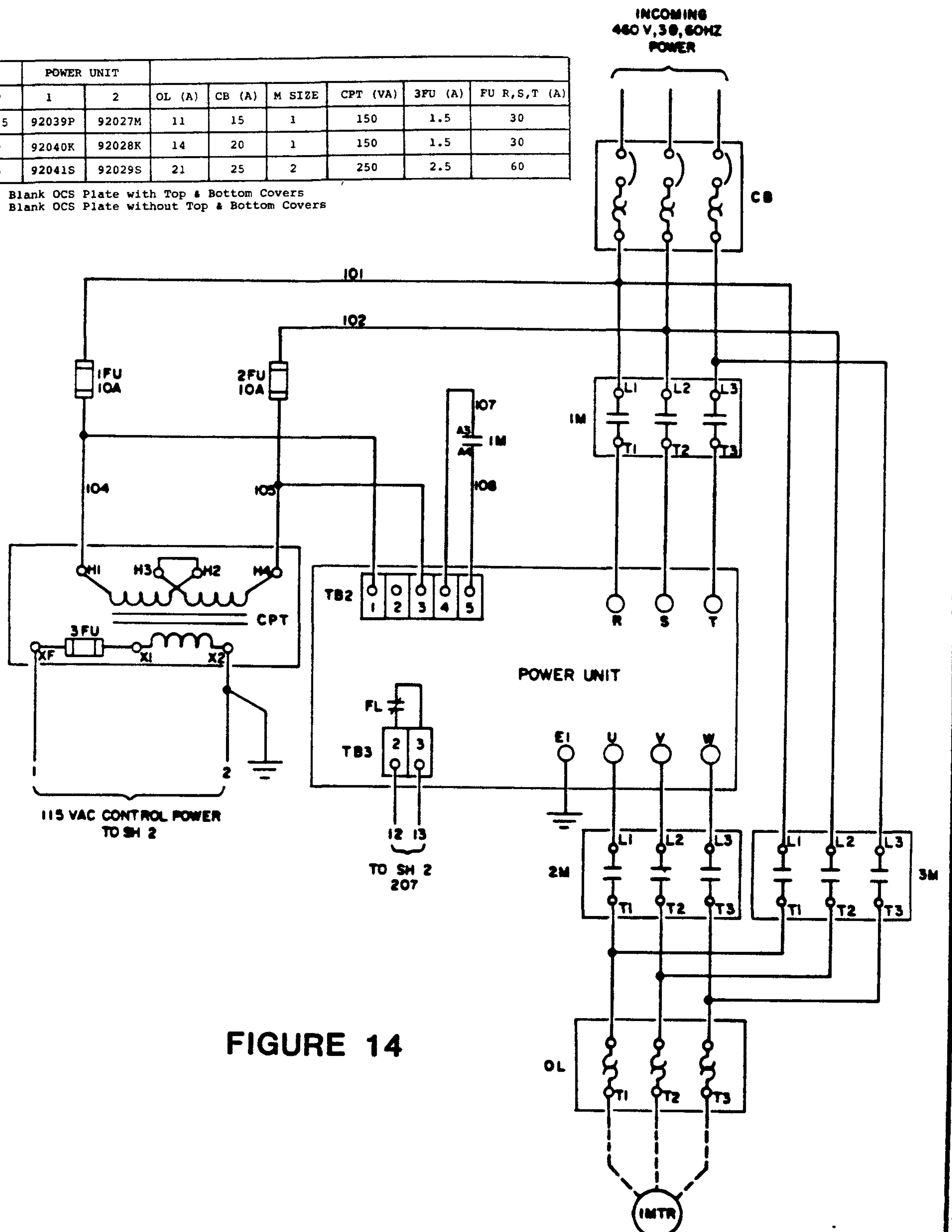


FIGURE 14

TITLE: SCHEMATIC DIAGRAM POWER ELEMENTARY -- --HP

BYPASS STANDARD

DRAWN BY: LVH	DATE: 2-09-83	SCALE: NONE	ORDER NO:
CHECKED: RAE	DATE: 2-10-83	CUST NAME	
APPROVED	DATE:	PO NUMBER:	

NO	REVISION	DATE	BY

DRAWING NO 73-501743-38

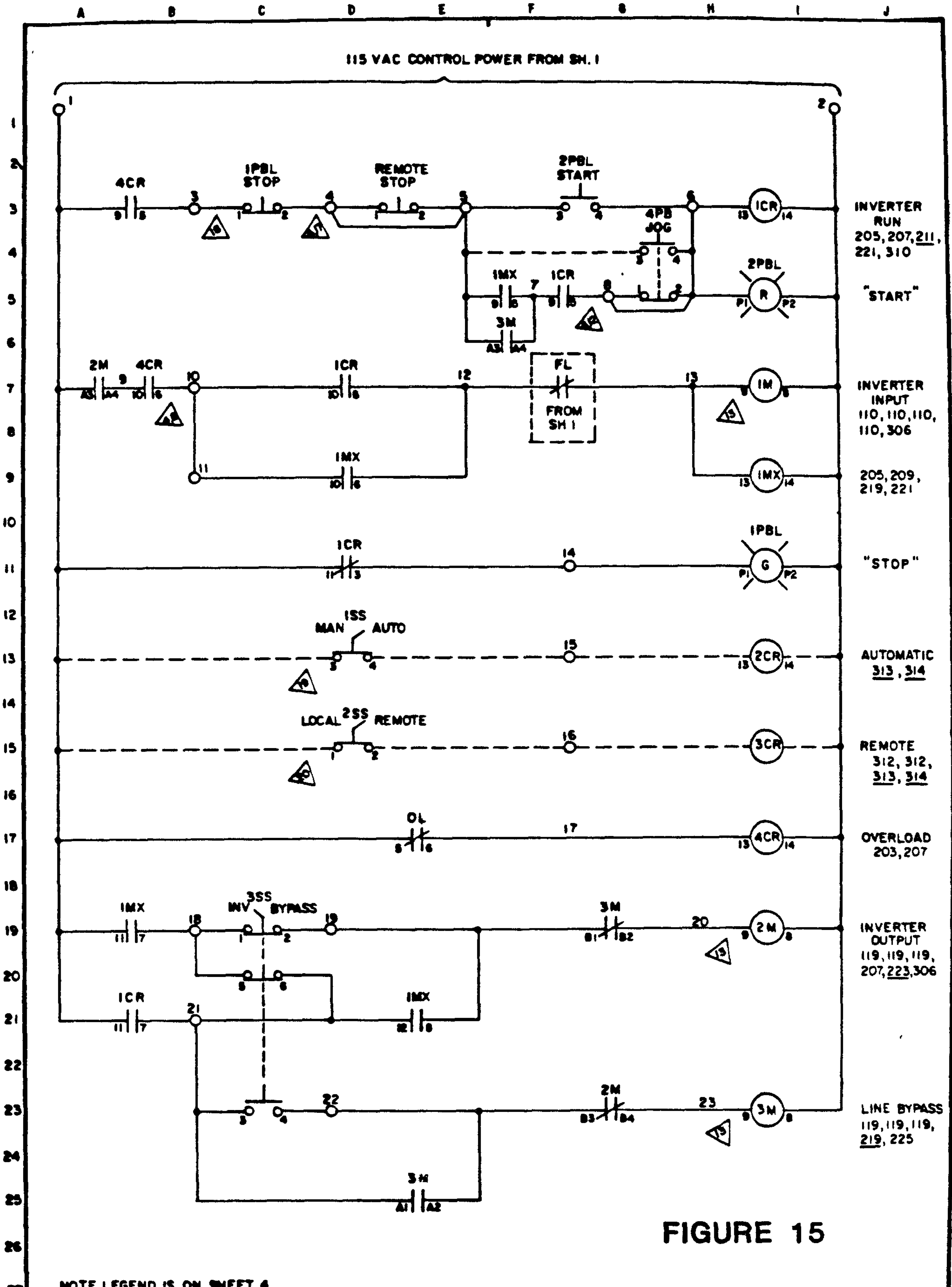


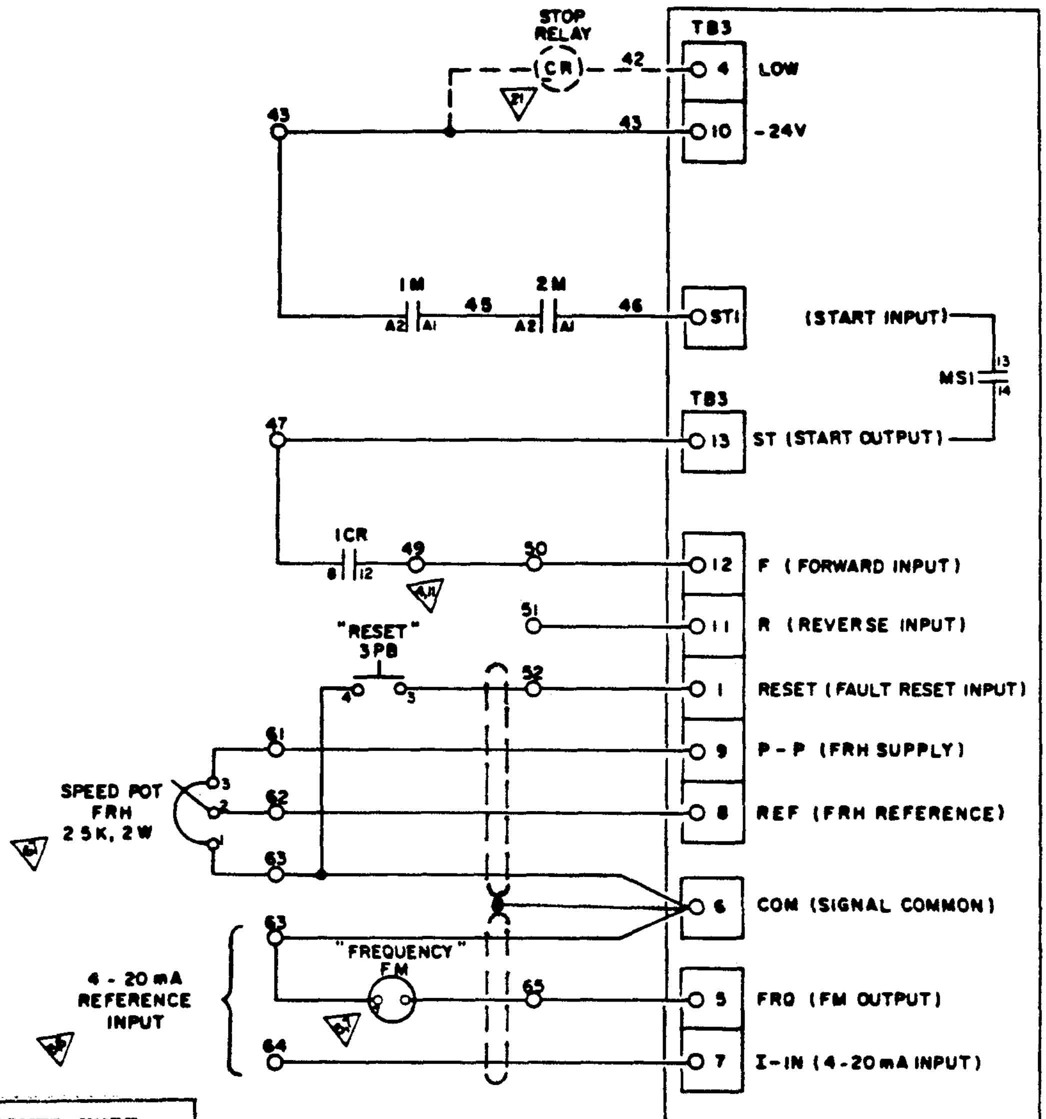
FIGURE 15

TITLE: SCHEMATIC DIAGRAM AC CONTROL ELEMENTARY — HP BYPASS STANDARD			
DRAWN BY LVH	DATE 2-17-83	SCALE NONE	ORDER NO:
CHECKED RAR	DATE 2-18-83	CUST NAME	DRAWING NO 73-501743-38
APPROVED MA	DATE 2-18-83	P.O NUMBER	SH 29 OF 48

NO	REVISION	DATE	BY

4V EFF. 8/84

VT130G-4 ___



	POWER UNIT	
HP	1	2
7.5	92039P	92027M
10	92040K	92028K
15	92041S	92029S

1 Blank OCS Plate with Top & Bottom Covers
2 Blank OCS Plate without Top & Bottom Covers

FIGURE 15A

NOTE LEGEND IS ON SHEET 4

TITLE SCHEMATIC DIAGRAM 460 ___ __ HP
SIGNAL AND DC CONTROL INTERFACE BYPASS STANDARD

DRAWN BY	DATE	SCALE	ORDER NO
LVH	2-14-83	NONE	
CHECKED RAE	DATE 2-15-83	CUST NAME	

NO | REVISION | DATE | BY

DRAWING NO 73-501763 ...

1. SUPPLIED BY USER
2. INSTALLED BY USER
3. REMOTELY LOCATED
4. JUMPER ON TERMINAL STRIP
5. SIGNAL REQUIRES TWISTED PAIR CABLE
6. SIGNAL REQUIRES TWISTED TRIPLE CABLE
7. SIGNAL CABLES MUST BE IN SEPERATE CONDUIT CANNOT BE RUN WITH NON-SIGNAL WIRES
8. REMOVE JUMPER FOR COAST STOP FUNCTION
9. ESTABLISH CORRECT MOTOR ROTATION WITH INVERTER OPERATION FIRST BY INTERCHANGING T1 AND T3 LEADS ESTABLISH CORRECT ROTATION WITH BYPASS OPERATION BY INTERCHANGING A PHASE AND C PHASE LEADS AT LINE SIDE OF CIRCUIT BREAKER
10. REMOVE JUMPER IF FORWARD AND REVERSE SELECTION IS USED
11. REMOVE JUMPER FROM TERMINALS 49 TO 50 INSTALL JUMPER FROM TERMINALS 49 TO 51 FOR REVERSE OPERATION
12. REMOVE JUMPER IF JOG FUNCTION IS USED OR TO PREVENT "INVERTER RUN" SEAL IN
13. COIL IS SUPPRESSED OR MUST BE SUPPRESSED
14. CN1, CN2, CN3 IS LOCATED ON THE MAIN PRINTED CIRCUIT BOARD
15. TB3 IS LOCATED ON THE MAIN PRINTED CIRCUIT BOARD
16. TB4 IS LOCATED ON THE TACH FEEDBACK PRINTED CIRCUIT BOARD
17. REMOVE JUMPER IF REMOTE STOP IS USED
18. INSTALL JUMPER FROM TERMINAL 3 TO TERMINAL 4 IF DOOR MOUNTED STOP PUSHBUTTON IS NOT USED.
19. THIS CIRCUIT IS USED FOR SELECTION OF 4-20mA REFERENCE SIGNAL IN 'AUTO' OR FREQUENCY REFERENCE POTENTIOMETER IN 'MAN' CHECK SALES ORDER FOR OPTION 4
20. THIS CIRCUIT IS USED FOR SELECTION OF 'LOCAL' OR 'REMOTE' FREQUENCY REFERENCE POTENTIOMETERS OR TWO(2) REMOTE REFERENCE SIGNALS CHECK SALES ORDER FOR OPTION 20
21. LOW SIGNAL HAS A 75mA CONTINUOUS CURRENT RATING. MOUNT STOP RELAY IN CLOSE PROXIMITY TO TB3. RELAY COIL IS RATED 24 VDC. SEE FIGURE 15, PAGE 23, OR FIGURE 15 PAGE 24 FOR EXPLANATION OF LOW SIGNAL.

FIGURE 16

TITLE SCHEMATIC DIAGRAM NOTES LEGEND				STANDARD	
	DRAWN BY C.KIM	DATE 1-7-83	SCALE	ORDER NO	NO / REVISION / DATE / BY
	CHECKED RAE	DATE 1-7-83	CUST NAME		DRAWING NO
	APPROVED MA	DATE 1-7-83	PO NUMBER		73-501743-38 SH 48 OF 48

Terminal numbers in the standard units will vary with options requested and are shown clearly in wiring diagrams. Terminal strips are mounted at a convenient angle for easy access. Read the following precautions before installing the inverter;

1. The leads used for speed reference, feedback, and other low level signals must be shielded cable and placed in conduit which is separate from conduit which is used for the motor armature, field and AC power.

   Connect the shields of shielded cable to common (com) at the Inverter end only. The far end of the shield is to be dressed neatly and left unconnected.

   In long cable runs, take care to prevent excessive voltage drop.

2. The inverter enclosure should be grounded to conform with all electrical codes.

3. Noise suppressors should be attached to the coils of all relays and contactors that are added to the enclosure.

4. A disconnect (fuse or breaker) external to the inverter may be required to conform to electrical codes. The standard input circuit breaker will clear a fault of 14,000 symmetrical amps.

5. Standard units supply an overload sized for motor protection. When wiring a power unit only, a motor overload should be wired to shut the inverter off if overload occurs.

D. PREPOWER CHECKS

Before energizing power, check the following:

1. For any wiring errors or grounds.
2. Source voltage to ensure 460V +10%, -5%.

E. INITIAL OPERATION

1. Initial conditions before power up:
   a) Frequency pot. (speed adjustment) should be at minimum setting.
   b) Forward/Reverse switch (if used) in forward position.
2. Pressing start button should close 1M contactor. The charge LED should come on to indicate voltage on the bus.
3. Adjusting the speed pot. slightly should start the motor turning. If motor runs backwards: stop inverter, turn off power, and reverse any two output leads U, V, W to correct direction.
4. Forward/Reverse (if used) should be checked while motor is running. Engage switch to reverse, motor should stop, and reverse direction to the same speed it was running in forward.
5. Run speed to full speed slowly, watch motor operation. Leave setting at full speed. Press stop button. Motor should decelerate or coast without tripping off. Press start button, motor should accelerate smoothly to full speed without tripping. Motor current should be checked at several different speed settings. Continuous currents above motor full load rating may burn the motor out.

F. ADJUSTMENT PROCEDURES

The 460V inverter is adjusted for standard 3 to 60 HZ operation. Before adjusting, determine if factory adjustment is not satisfactory. If the speed range is not correct for the motor or machine, recalibration is necessary. If inverter stalling or shutdown occurs during normal machine

Operation, adjustment is necessary. Table 3 shows a list of adjustments and ranges.

NOTE: STANDARD UNITS IN NEMA 1, 4, OR 12 ENCLOSURES ARE ADJUSTED FOR 60HZ MAX OPERATION. IF BUYING A CHASSIS (POWER UNIT ONLY), THE MAXIMUM SPEED IS 80HZ AND REQUIRES READJUSTMENT IF 60HZ MAX IS REQUIRED.

TABLE 3

RH NO. (POT)	FUNCTION	WHEN TURNING CLOCKWISE	ADJUSTMENT AT SHIPPING	REMARKS
1RH	Overvoltage Level	Decreases Level	800V	Factory set, do not adjust
2RH	Frequency Meter Adjust	Deflection becomes less	1mA @ 60HZ	
3RH	Voltage Limit (V/HZ)	Decreases V/HZ	460V @ 60HZ	5V @ CN11-3 means maximum output
4RH	Inverse Time Trip	Increases Time	150% for one minute	Adjustable for 20 seconds to 2 minutes
5RH	Acceleration Time	Decreases Time	15 seconds	Adjustable 1 to 20 seconds or 3 to 60 seconds
6RH	Deceleration Time	Decreases Time	15 seconds	Adjustable 1 to 20 seconds or 3 to 60 seconds
7RH	Minimum Speed	Increases Minimum Speed	0 speed	Adjustable 0 to 55 HZ
8RH	Maximum Speed Clamp	Increases Maximum Speed	60HZ	Adjustable 10 to 80 HZ
9RH	4 to 20 mA Span	Increases Speed		60HZ @ 20mA
10RH	4 to 20 mA Zero	Increases Speed		0HZ @ 4mA
11RH	Voltage Boost	Decreases Voltage		Minimum setting (CW)
12RH	Frequency	Decreases Frequency	60HZ	Adjusting 12RH makes frequency meter inaccurate and requires correction with 2RH.

WARNING!

ADJUSTING THE INVERTER WITH POWER ON REQUIRES SPECIAL PRECAUTIONS: ALL TEST EQUIPMENT SHOULD BE CONNECTED AND DISCONNECTED WITH POWER OFF. HIGH VOLTAGE EXISTS ON THE REGULATOR BOARD: ALL POTENTIOMETERS SHOULD BE ADJUSTED WITH INSULATED HANDLE SCREWDRIVERS. IMPROPER USE OF GROUNDED TEST EQUIPMENT MAY DAMAGE THE INVERTER. ENSURE THAT TEST EQUIPMENT, SUCH AS DIFFERENTIAL OSCILLOSCOPE, IS CONNECTED PROPERLY TO AVOID GROUNDING THE INVERTER. THE D.C. BUS REMAINS CHARGED FOR SEVERAL MINUTES AFTER POWER IS REMOVED.

Table 4 shows a test sheet that gives test points and voltages at different speeds to aid readjustment. Table 5 is a blank test sheet for adjusting in the field. The following describes each testpoint;

SPEED REFERENCE is measured at the wiper of the speed pot (REF) to common. 11.3VDC means maximum output of the inverter.

4 to 20 mA REFERENCE is measured at terminal I-IN to common.Potentiometer 10RH adjusts for zero speed at 4mA.

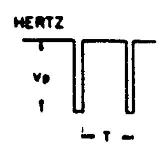
VF is measured at test point CN10-2 to common. Factory set at the voltages shown in Table 4, potentiometer 8RH can be used to adjust desired maximum output frequency. The V/HZ ratio stays the same for proper motor operation. Potentiometer 7RH adjusts the minimum speed. The frequency meter will read the new speed range.

V is used to determine the V/HZ ratio. Measured at CN11-3 to common, 5V means maximum output voltage has been reached. Most applications and motors require 460V at 60HZ.

HERTZ - is measured at CN11-2 test point. Hertz is a strobe pulse with a frequency 1152 times inverter output frequency. 69,120 HZ means the inverter is running at 60HZ.

IR COMP BOOST - is a V/HZ adjustment at 11RH. Output voltage at low frequencies is raised for more starting torque.

DESCRIPTION OF TEST	TEST POINT TO		0 Hz	30 Hz	60 Hz NO LOAD	60 Hz FULL LOAD	RPM 80Hz MAX	TYPE
SPEED REFERENCE	REF	COM	0 V	5.64 V	11.28 V	——	11.28 V	+VDC
4-20 MA INPUT	I-IN		2.48V	7.44 V	12.4 V	12.4V	12.4 V	+VDC
VF	CN10-2		— 0 V	— 6.0 V	—12.0V	——	—12.0V	-VDC
V	CN11-3		0 V	2.5 V	5 V	5 V	6.67 V	+VDC
HERTZ	CN11-2		0 ms	.029ms	.014ms	——	.0109ms	PULSE
TG	TGN	TGP	0 V	12.5V	25 V	——	33.3 V	VDC VAC
INPUT POWER	R	S	460V	——→				VAC IAC
INPUT POWER	S	T	460V	——→				
INPUT POWER	T	R	460V	——→				
OUTPUT POWER	U	V	0 V	230 V A	460 V A	460 V A	460 V A	
OUTPUT POWER	V	W	0 V				V	
OUTPUT POWER	W	U	0 V				V	
D C BUS	P	N	650V	640V	640V	620V	644 V	+VDC
IR COMP BOOST	W	U	0V	23 V	0V	——	—— V	VAC
CURRENT FEEDBACK	CN11-1	COM	0.6V	0.5 V	0.5 V	4.0V	0.4 V	+VDC
+15V SUPPLY	CN11-4		+15 V					
-15V SUPPLY	CN11-6		-15 V					
+5V SUPPLY	CN11-5		+5 V					
-24V SUPPLY	(-24V)		-28 V					



OPTIONS: 4 20mA___ ,ACTG___ ,DCTG___ .

MOTOR DATA ___HP, ___ RPM ___VOLT ,30 ,60Hz ___ AMP

START/STOP (min. 10 times) _____, REF UP/DOWN (min 10 times) _____

ACCEL TIME: _____ sec, DECELTIME: _____ sec

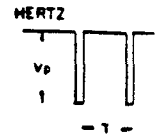
OCR SETTING: _____ AMPS, TRIPPED AT 150 % OL: _____ sec, _____ ft-lbs, _____ RPM

CURRENT LIMIT ____ AMPS MAX, ____ AMPS CONTINUOUS

TABLE 4

TABLE 5

DESCRIPTION OF TEST	TEST POINT TO		0 Hz	30 Hz	60 Hz NO LOAD	60 Hz FULL LOAD	RPM Hz MAX	TYPE
SPEED REFERENCE			V	V	V	—	V	+VDC
4-20 MA INPUT			V	V	V	V	V	+VDC
VF			— V	— V	— V	—	— V	-VDC
V			V	V	V	V	V	+VDC
HERTZ			Vp ms	ms	ms	—	ms	PULSE
TG			V	V	V	—	V	VDC VAC
INPUT POWER	R	S	V	V	V	—	V	VAC IAC
INPUT POWER	S	T	V	V	V	—	V	
INPUT POWER	T	R	V	V	V	—	V	
OUTPUT POWER	U	V	V	V A	V A	V A	V A	
OUTPUT POWER	V	W	V				V	
OUTPUT POWER	W	U	V				V	
D C BUS	P	N	V	V	V	V	V	+VDC
IR COMP BOOST	W	U	V	V	V	—	— V	VAC
CURRENT FEEDBACK			V	V	V	V	V	+VDC
+15V SUPPLY			+ V					
-15V SUPPLY			- V					
+5V SUPPLY			+ V					
24V SUPPLY			+ V					



OPTIONS: 4-20mA___, ACTG___, DCTG___.

MOTOR DATA ___HP, ___RPM ___VOLT, 50, 60 Hz ___AMP

START/STOP (min 10 times) ____, REF UP/DOWN (min 10 times) ____

ACCEL TIME ____sec, DECEL TIME ____sec

OCR SETTING ____AMPS, TRIPPED AT 150 % OL ____sec, ____ft-lbs, ____RPM

CURRENT LIMIT ____AMPS MAX, ____AMPS CONTINUOUS

A procedure is described below for recalibrating the inverter assuming all potentiometers are misadjusted. If familiar with an oscilloscope or frequency counter, the motor does not have to be connected.

1. Run the inverter by pressing the start button. Turn the speed pot to minimum (CCW). Adjust desired minimum speed with 7RH. VF testpoint CN10-2 to COM will show a D.C. voltage proportional to minimum speed (4.5V = 30 HZ, 2.25V = 15 HZ, etc...).

2. Turn the speed pot to maximum speed (CW). Adjust 8RH for the desired maximum speed. VF test point CN10-2 to COM will show a D.C. voltage proportional to maximum speed (9V = 60 HZ, 12V = 80 HZ). For speeds above 80HZ, a jumper must be placed at J-8 on either 2F or 4F.

Jumpering 2F on J-8 divides the VF voltage by two (4.5V = 60 HZ, 9V = 120 HZ, etc...). Jumpering 4F on J-8 divides the voltage by four (4.5 = 120 HZ, 9V = 240 HZ, etc...).

3. An oscilloscope or frequency counter connected at CN11-2 to COM will show a frequency proportional to output frequency with no jumper at J-8, the testpoint will show a frequency 1152 x output frequency (69120 HZ = 60 HZ output).

   If an oscilloscope or frequency counter is unavailable, a hand held tachometer can be used to monitor motor speed. Adjust 12RH to the desired maximum speed to correspond to the voltage adjusted in Step 2. Adjust 2RH to calibrate the frequency meter to read the correct maximum speed.

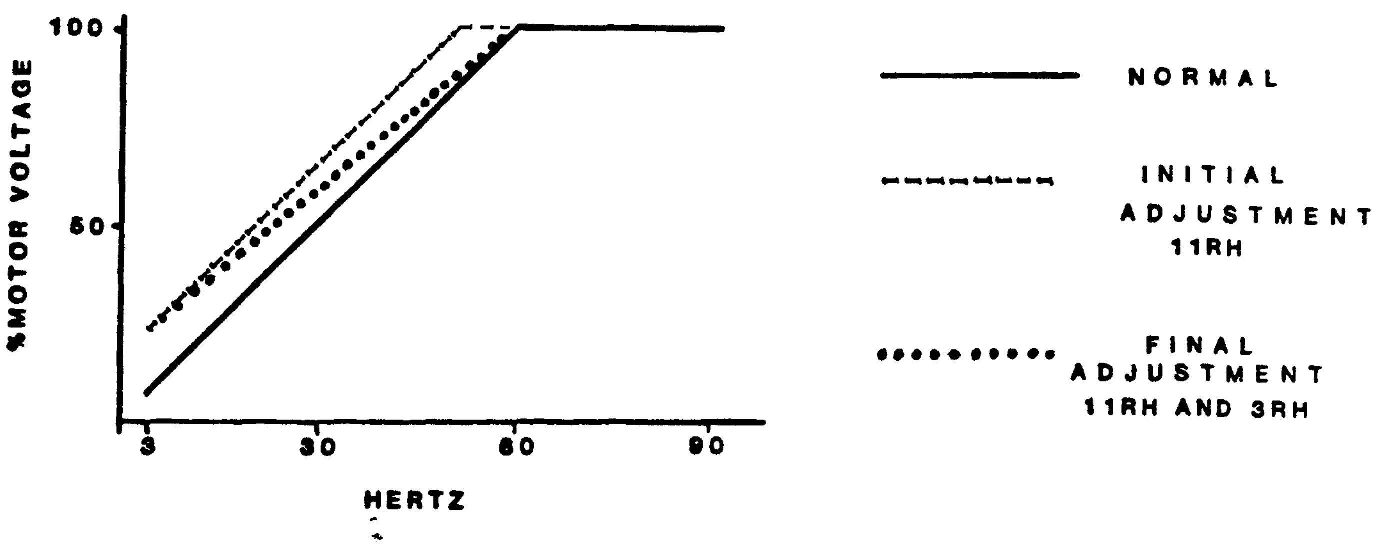
4. The volts/hertz curve requires readjustment if maximum frequency (12RH) was changed. Adjust the output of the inverter to 60 HZ with the speed pot. Make sure potentiometer 11RH (voltage boost) is at minimum setting (CW). Adjust 3RH for 5 volts at CN11-3 to COM.

5. If a 4 to 20mA reference is used, put the auto/manual switch to the auto position. Put in 4mA, adjust 10RH for the desired minimum speed (cannot be lower than adjusted speed in Step #1). Put in 20mA, adjust 9RH for the desired maximum speed (cannot be higher than adjusted speed in Step #2).

6. Motor stalling or rough running at low speeds can be corrected with 11RH (VB). Voltage boost gives more voltage at slow speeds. Care should be used when adjusting 11RH, too much voltage boost can

heat up the motor and/or cause overcurrent tripping. When 11RH is adjusted, 3RH volts/hertz needs readjusting. Both adjustments interact, so several adjustments may be necessary to get the proper V/Hz ratio. Figure 17 shows a graph of the adjustments 11RH (VB) and 3RH (V/HZ).

FIGURE 17



7. Overvoltage level (1RH) is factory adjusted for safe operation. It should never be adjusted.
8. After completion of adjustments, check motor current at several different operating speeds. Continuous currents above the motor nameplate (rated) current may damage the motor.

TROUBLESHOOTING PROCEDURES

Improper adjustment, wiring, or inverter malfunction can cause the fault relay to latch. To reset a fault, the reset button must be pressed or the power must be turned off for five seconds and then back on.

Figure 18 is a troubleshooting flow chart in the event the motor doesn't run. Table 6 shows some trouble indications and causes.

WARNING! WHEN TROUBLESHOOTING WITH POWER ON, CARE MUST BE TAKEN TO AVOID ELECTRIC SHOCK. GROUNDED TEST EQUIPMENT MAY DAMAGE INVERTER. D.C. BUS VOLTAGE REMAINS CHARGED FOR SEVERAL MINUTES AFTER POWER IS REMOVED.

FIGURE 18

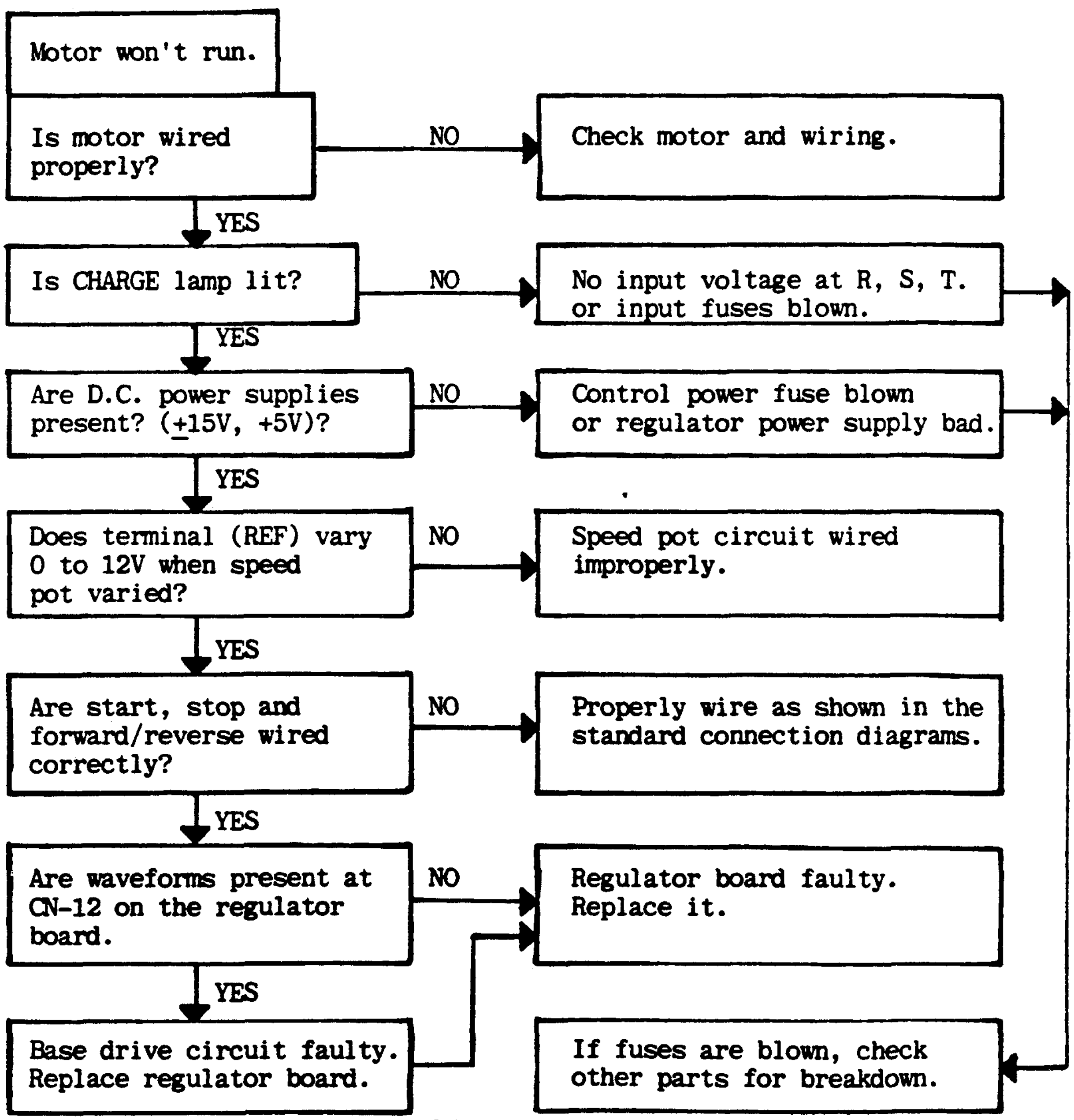


TABLE 6– TROUBLE INDICATIONS AND CAUSES

INDICATION	POSSIBLE TROUBLE
LED OC Lights	Inverter KVA and motor horsepower not correctly sized. Wire shorted or grounded. Overload or abrupt load variations. Accel and Decel time too short. Internal inverter problem.
LED OV or UV Lights	Input voltage too high or low. Momentary power failure. Decel time too short.
LED OH/TH Lights	Overheat (fan stopped) or motor overload trip.
Input Fuse Blown	Inverter main circuit problems, possible bad GTR, C1, or input rectifier.
Control Circuit Fuse Blown	T1 control circuit power trouble.

base amplifiers after G-TR replacement is a good practice:

1. Remove voltage at R, S, T but keep control voltage at R23 and T1.
2. Run the inverter and check base pulses with an oscilloscope. The ground lead of the scope should be connected to the emitter and the probe on the base. Connectors CN-3 to 8 provide access for measurement. Check all six base amplifier voltages. Figure 20 shows normal levels for proper operation.

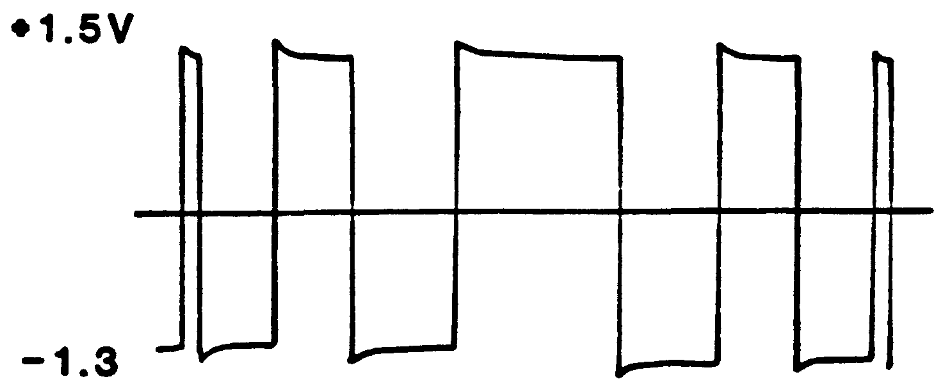


FIGURE 20 - BASE PULSE

TABLE 7- REGULATOR BOARD FUNCTIONS

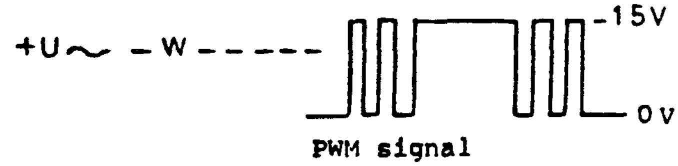
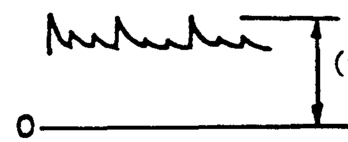
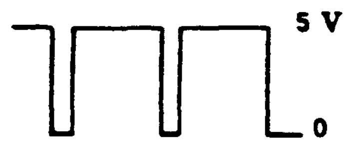
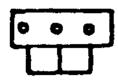
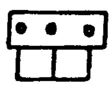
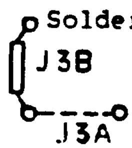
Test Point symbol	Function	Waveform example
CN12-1 to 6 +U +V +W -U -V -W	Base drive circuit input signal	PWM signal of sinusoidal wave distribution 
CN11-1 I	Current feedback rate	Waveform repeated every 60°  Approx. 3.5V (under 100% load)
CN11-2 F	Voltage/frequency converter circuit output pulse	Pulse having a frequency 1152 times the inverter output frequency  About 50% duty cycle
CN11-3 V	Voltage control circuit amplifier output voltage	Varies from 0 to 12V with frequency setting resistor varied from 0 to maximum.
CN11-4 P15	Control voltage +15 v	d.c. voltage of +15 V
CN11-5 N15	Control voltage -15 v	d.c. voltage of -15 V
CN11-6 P5	Control voltage +5 v	d.c. voltage of +5 V
CN11-7 0	Control voltage 0 V	0 V Common

TABLE 8– JUMPERS

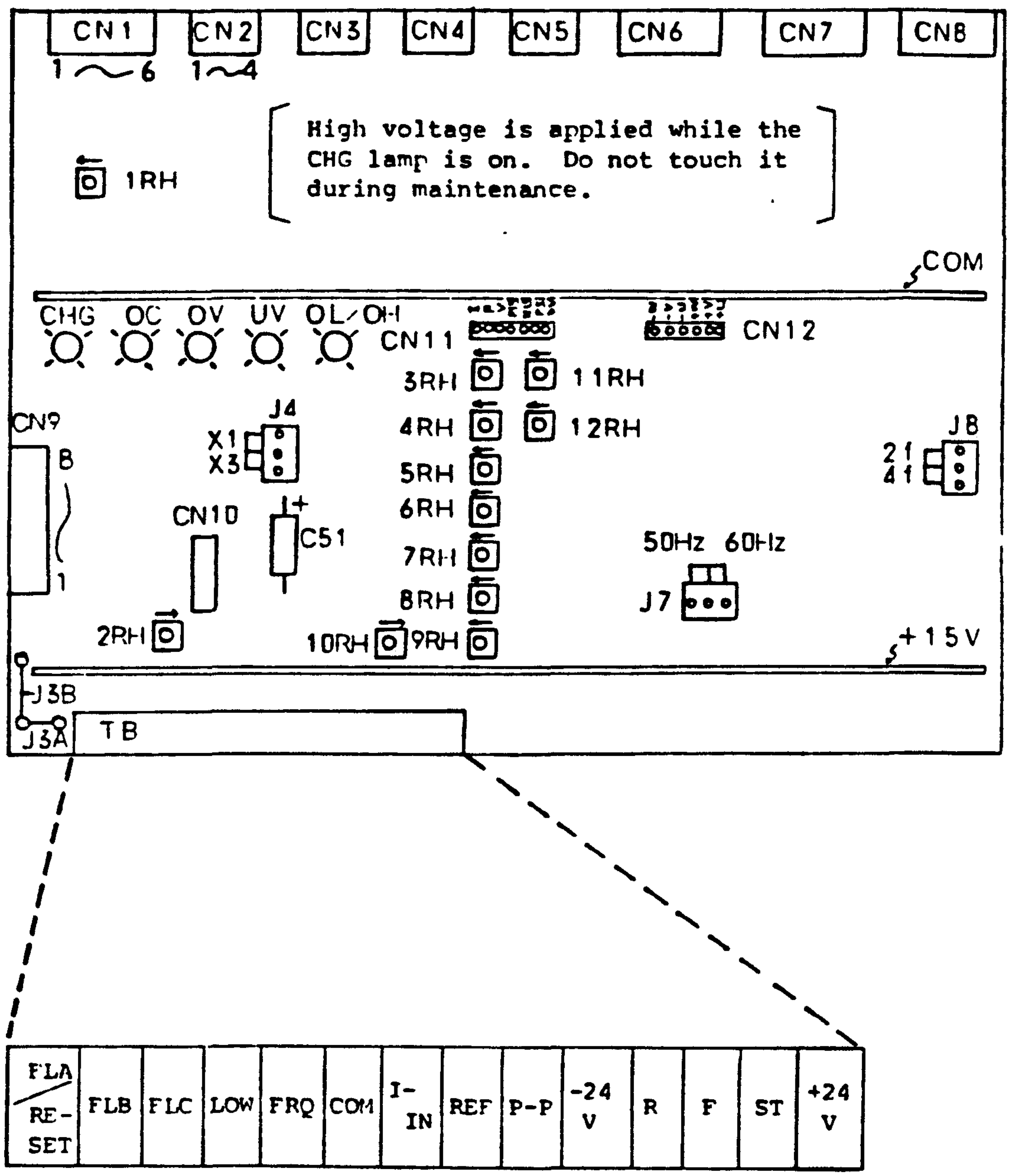
NO.	PC BOARD SYMBOL	FUNCTION	FACTORY CONNECTION	REMARKS
J8		2f: Output frequency x 2 4f: Output frequency x 4	None	Note 1
J7		60 Hz: Maximum output frequency 60 Hz 50 Hz: Maximum output frequency 50 Hz	60 Hz	
J4		X1: Acceleration time 1 to 20 secs X3: Acceleration time 3 to 60 secs	X3	
J3 J3B		J3B: RESET J3A: FLA	J3B	

NOTE: Other Jumper connections are for factory use. Removing or changing may cause improper operation.

NOTE 1: If extended frequency ranges are required: A jumper at 2F will raise the maximum to 120HZ (or double the original frequency). The testpoint CN11-2 now gives a frequency pulse 576 times output frequency.

A jumper at 4F will raise the maximum to 240HZ (or 4 times the original frequency). The testpoint CN11-2 now gives a frequency pulse 288 times output frequency.

FIGURE 21– PARTS LAYOUT AND
TERMINAL STRIP ON REGULATOR BOARD



C. TRANSFORMER T1 TROUBLESHOOTING

Fuse FU2 blowing can indicate a wiring problem, a bad transformer, or a bad regulator board. Page 2 of the wiring diagrams (main circuit) shows transformer connections and output voltages.

MAINTENANCE AND STORAGE

If the inverter is stored, it should be kept in a clean dry location free of temperature extremes. Storage for longer than six months without power requires reconditioning of the filter capacitor:

1. Apply bus voltage for a few seconds and check capacitor temperatures.
2. Repeat Step 1 several times monitoring capacitor temperatures. If a capacitor gets warm, allow it to cool before repeating.
3. Capacitors are reconditioned when a constant bus voltage causes no heating.

Periodically check the operating inverter for cleanliness. Keep the cooling heatsink free of debris. Check connections (with power off) for tightness. Proper maintenance and operation will allow the inverter to give long troublefree service.

PARTS

Contact the nearest Louis Allis District Office for parts ordering information. When ordering, specify the model and serial number stamped on the unit nameplate.