Graham

AC Adjustable Frequency Drive Instruction Manual

1575 Series 5 through 15 HP

7/89 For after-hours emergency service call 414-9645782 23-6080

Graham Company
Box 23880 / 8800 W. Bradley Road
Milwaukee, Wisconsin 53223
Phone: 414/355-8800 Fax: 414/355-6117

SAFETY FIRST

Rotating shafts and electrical equipment can be hazardous. Therefore, it is strongly recommended that all electrical work conform to National Electrical Code and local regulations. Installation, alignment and maintenance should be performed only by qualified personnel.

Factory recommended test procedures, included in the instruction manual, should be followed. Always disconnect electrical power before working on the unit.

Although shaft couplings or belt drives are generally not furnished by the manufacturer, rotating shafts, couplings and belts must be protected with securely mounted metal guards that are of sufficient thickness to provide protection against flying particles such as keys, bolts and coupling parts. REFER TO OSHA RULES AND REGULATIONS PARAGRAPH 1910.219 FOR GUARDS ON MECHANICAL POWER TRANSMISSION APPARATUS. Even when the motor is stopped, it should be considered "alive" as long as its controller is energized. Keep hands away from the output shaft until the motor has completely stopped and power is disconnected from the controller.

⚠ DANGER
HIGH VOLTAGE

Motor control equipment and electronic controls are connected to hazardous line voltage. When servicing drives and electronic controls, there may be exposed components at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case of an emergency. Disconnect power whenever possible to check controls or to perform maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic control or electrical rotating equipment.

Since improvements are continually being made to available equipment, the enclosed data is subject to change without notice. Any drawings are for reference only, unless certified. For additional information contact Graham Company Service Department.

Graham Company

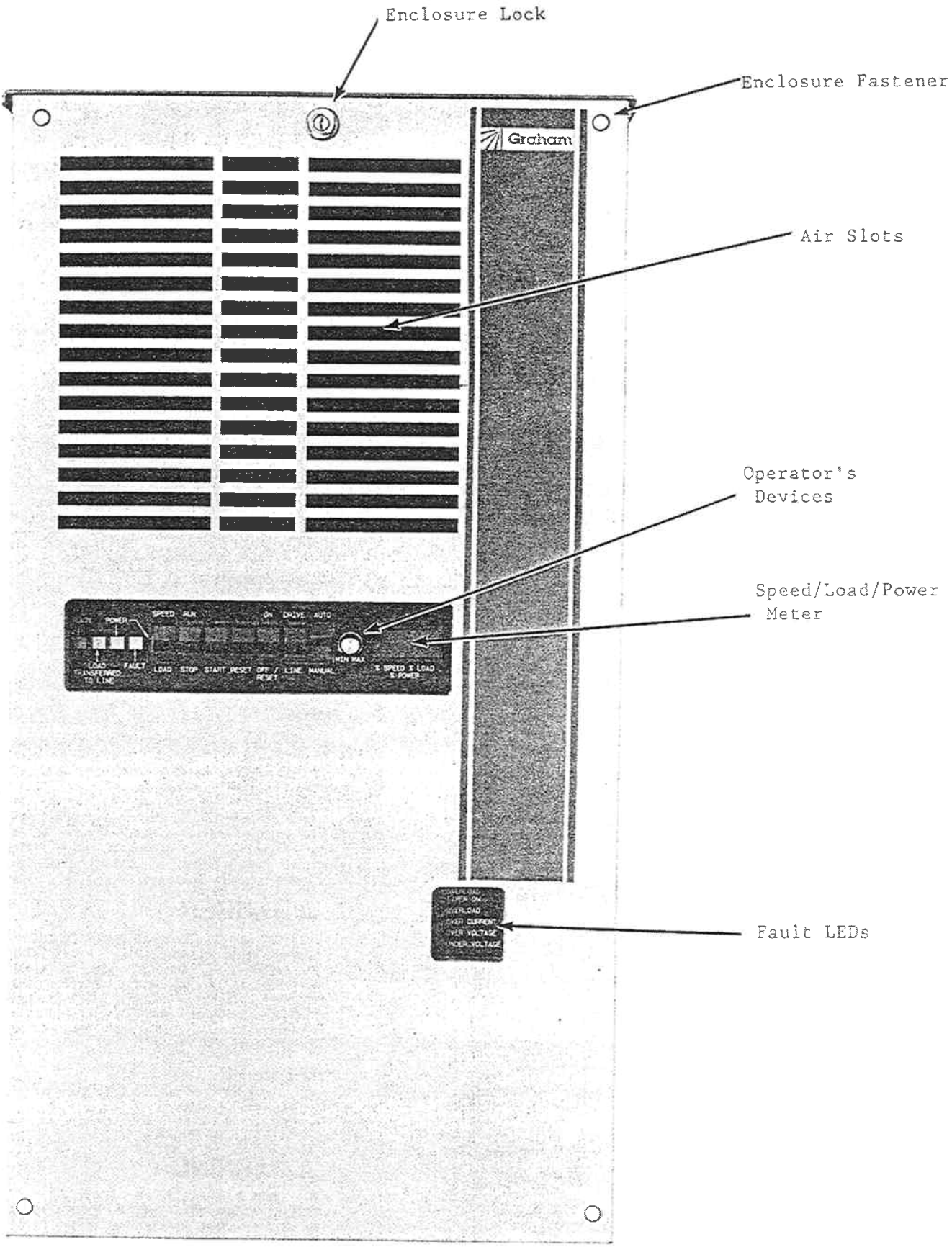
Box 23880 / 8800 W. Bradley Road
Milwaukee, Wisconsin 53223 U.S.A.
Phone: 414/355-8800 Fax: 414/355-6117

Shipping Address:
Graham Company
8800 W. Bradley Road
Milwaukee, WI 53224

SECTION ONE -- INSTALLATION MANUAL

SECTION TWO — SERVICE MANUAL

SECTION THREE — OPTIONS



Typical 1575 Series
Figure 1

SECTION ONE -- INSTALLATION MANUAL

GENERAL

This instruction and service manual provides the necessary installation, adjustment and maintenance procedures for the 5 thru 15 horsepower Graham Model 1575 adjustable frequency drive. Since these instructions are general, problems may occur which are beyond the scope of the manual. If further information is desired, please contact Graham Company for assistance.

Although every precaution has been taken in the design of the drive to insure reliability under extreme operating conditions, it is possible to damage the equipment through misuse or misapplication. Therefore, this instruction manual should be carefully reviewed before installing and operating the equipment.

RECEIPT OF SHIPMENT

When the drive is received, it should be compared with the packing slip to insure that everything is received. Any damages or shortages which are evident should be reported immediately to the commercial carrier who transported the drive. If necessary, contact Graham for assistance, referring to the order number, equipment description and serial number.

STORAGE

For long periods of storage, the drive should be covered to prevent corrosion. It should be stored in a clean, dry location and should be checked periodically to insure that no condensation has formed in the drive. After storage, again check that it is dry before applying power.

Some of the electrolytic capacitors used in the drive are subject to the relaxation of an internal formed oxide film after long periods of storage and may require reforming prior to applying power. If the drive has been stored for over one year, Graham should be contacted for a determination as to whether a reforming procedure is necessary.

HANDLING

Care should be used to prevent damage due to dropping or jolting when moving the drive. These drives have a lifting bar at the top of the back panel. Use hooks or clevis pins thru the lifting eyes. Do not attempt to lift from the bottom of the enclosure.

1. INSTALLATION

1.1 MOUNTING

These drives must be wall mounted. Remove drive from shipping container. Remove enclosure by loosening the four quarter turn fasteners, unlocking the lock and lifting the enclosure free. The drive is mounted using the four keyhole slots in the back panel. After positioning the fasteners in the wall, lift the drive using the lifting bar on top. Insert and tighten the fasteners. The lifting bar may now be removed and discarded. Replace the enclosure until it is time to wire the drive.
The following clearances are recommended:

Floor to bottom of drive	6"
Right side	12"
Left side (cooling air outlet)	24"
Top (conduit entry)	As req'd
Front (enclosure removal)	36"
Back	None

Conduit must enter the drive thru the top plate. Sufficient clearance must be allowed.

Do not remove the conduit entry plate while mounting the drive. See Section 2.7 for details on wiring the drive.

1.2 TEMPERATURE AND VENTILATION

All electronic equipment is susceptible to failure if operated in ambient temperatures outside of its rating. For the Graham drive, the operating range is 0°C (32°F) to 40°C (104°F). Normally, the drive should not be operated outside these extremes. If it is known that the ambient will be below 0°C, Graham should be notified so that special precautions can be taken, such as adding a space heater within the enclosure. Conversely, if the ambient is known to exceed 40°C, extra cooling will have to be added.

The drive is cooled by fans drawing air through the slots. The slots must never be restricted in any way. FLAMMABLE MATERIALS MUST BE KEPT AWAY FROM ALL OPENINGS IN THE ENCLOSURE. The drive must be installed in a clean, dry environment. Periodically, the drive should be opened after shutting off the input disconnect. Any accumulation of dust should be carefully removed from the heatsinks with a vacuum cleaner and a soft long bristled brush. Lightly brush the dust from the drive components with the brush and use the vacuum cleaner to remove the dust as it falls. DO NOT USE THE VACUUM CLEANER DIRECTLY ON THE ELECTRONIC COMPONENTS.

⚠ DANGER

ALWAYS SHUT OFF THE INCOMING POWER BEFORE REMOVING THE ENCLOSURE.

2. WIRING

2.1 GENERAL

The drive operates on 460 V AC (+10, -5%) 50 or 60 Hz, 3 phase power, unless it has been modified for a different input voltage. Check the drive nameplate for proper voltage before wiring the drive. A ground lug is provided for a dedicated ground wire connection. The drive must be grounded to avoid possible electrical noise problems and potential safety hazards. All provisions of the National Electrical Code and all local codes must be followed.

⚠ DANGER

A GROUND LUG IS PROVIDED FOR A DEDICATED GROUND WIRE CONNECTION. A SEPARATE GROUNDING WIRE MUST BE RUN TO AVOID POSSIBLE ELECTRICAL NOISE PROBLEMS AND POTENTIAL SAFETY HAZARDS. CONDUIT GROUNDING OR DAISY CHAIN GROUNDING IS NOT ADEQUATE. COLD WATER PIPE CONNECTIONS ARE NOT ADEQUATE.

2.2 INPUT DISCONNECT

The drive may be supplied with or without an input disconnect. Size the input disconnect to handle the rating of the input fuses.

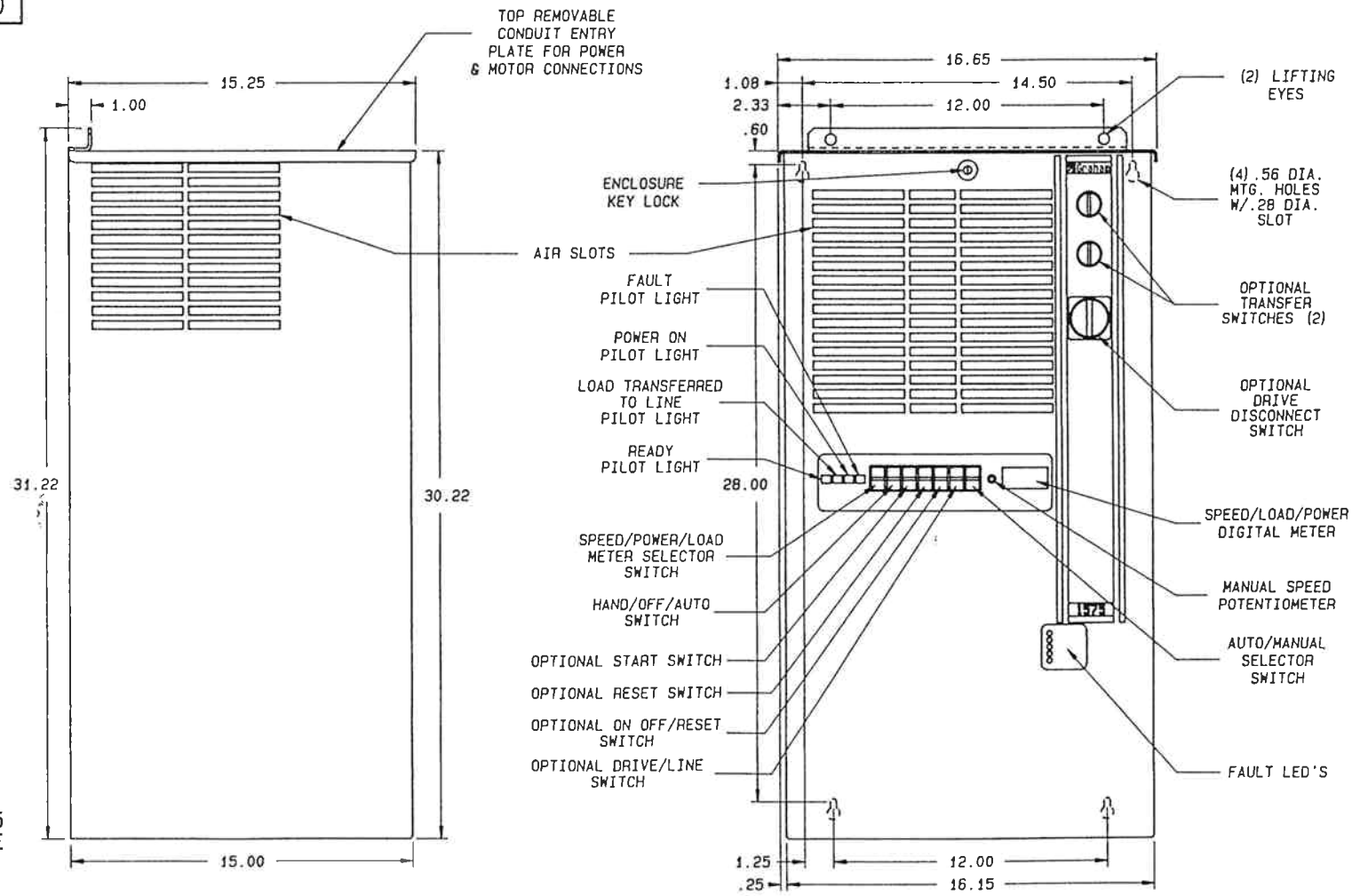
⚠ WARNING

THE INPUT DISCONNECT, OR ANY OTHER INPUT POWER DISCONNECTING DEVICE, SHOULD NEVER BE USED TO START OR STOP THE DRIVE

2.3 ISOLATION TRANSFORMER

If an isolation transformer is used, an input disconnect must be placed between the transformer secondary secondary and the drive input.

DWG. No. 12-6181-00



MODEL 1575
ADJUSTABLE
FREQUENCY
DRIVE
(1575AFC5-15)
APPROX. WT. 125 lbs.

L		G		C	880100
K		F		B	860745
J		E		A	860643
H		D		DR	860390
LET	ECN	LET	ECN	LET	ECN

aC-4/6

DRN GCC 6/16
CHK
APR

TOLERANCE: Unless Otherwise Specified
2PLC. .030
3 PLC.
SCALE NONE

NAME DIMENSIONAL DWG.
1575 SERIES

MATERIAL

MODEL 1575 SERIES

Graham Company

DWG. No. 12-6181-00

Figure 2

⚠ CAUTION

DO NOT OPEN ANY DISCONNECT ON THE PRIMARY SIDE OF THE TRANSFORMER UNTIL AFTER THE DISCONNECT ON THE SECONDARY SIDE IS OPENED. OPENING A DISCONNECT ON THE TRANSFORMER PRIMARY MAY DAMAGE THE DRIVE.

2.4 INPUT WIRING

Wire types and sizes should be selected in accordance with the input fuse ratings and must conform to all local codes and practices.

2.5 OUTPUT WIRING

Graham recommends that output wires be sized to carry the output current rating of the drive. When selecting wire to be used, all local codes and practices should be followed.

HP AT 460 V	MAX OUTPUT AMPS
5	7
7.5	12
10	14
15	21
HP AT 230 V AC	**MAX OUTPUT AMPS**
5	14
7.5	21
10	28

⚠ CAUTION

DO NOT INSTALL INPUT WIRING AND MOTOR WIRING IN THE SAME CONDUIT OR RACEWAY.

2.6 OUTPUT DISCONNECT

It is recommended that the output disconnect device be interlocked to terminal strip TB3 terminals 3 and 4 by means of a normally open contact which would be closed only when the disconnect is closed. If the optional bypass transfer switch is supplied, the output disconnect contact should be wired in series with the wire connected to TB3-3 (transfer switch auxiliary contact is across terminals 3 and 4). If the optional contactor bypass is supplied, wire the disconnect contact in series with TB3 terminal 12.

⚠ WARNING

IF AN OUTPUT CONTACTOR OR OTHER DISCONNECTING MEANS IS USED BETWEEN THE DRIVE OUTPUT TERMINALS AND THE MOTOR, THE FOLLOWING MUST BE OBSERVED.

1 Do not close the disconnect with the drive operating.
2. Do not close the disconnect while the motor is turning.

2.7 CONDUIT ENTRY

Remove the drive enclosure by unlocking the cover using the key lock and turning the quarter turn fasteners. Pull the enclosure away from the back panel. Mark on the top plate the locations of the conduit entries. Wires must not be brought thru the area indicated. Remove this plate and drill the entry holes.

⚠ CAUTION

DO NOT DRILL, SAW, FILE OR PERFORM ANY OPERATION ON THE ENCLOSURE OR TOP PLATE WHEN THEY ARE ON THE DRIVE. NO CHIPS OR OTHER MATERIALS CAN BE ALLOWED TO FALL ON THE DRIVE COMPONENTS.

2.8 CONTROL CIRCUIT WIRING

Control circuit wiring connections are made to terminal block CTB1, on the top of the control board. See Figure 3. Use shielded cable for all control signals. Terminate the shield to terminal 7. Common in this drive is earth ground. Do NOT ground the other end of the shield. Insulate the other end of the shield to insure that it is not grounded. This is necessary to ensure noise immunity.

2.9 FOLLOWER CONNECTIONS

For automatic operation, the input signal is supplied to the follower circuit on the Control Board. Proper connections are listed below and depend upon the type of input signal connected to CTB1. The settings shown below were factory made if a follower was specified. To convert to a follower or to change the signal followed, make the appropriate selection by moving jumper JB1000. See Figure 4. Position 1 is at the right side of JB1000; Position 5 is at the left.

FOLLOWER SIGNAL SETTINGS 5 - 15 HP

SIGNAL	JP1 POSITION
1-5mA	3
4-20mA	4
10-50mA	4
0-1 V DC thru 0-10 V DC	2
0-18 V DC	1
0-180 V DC	5

The positive (+) connection for the follower is to CTB1, terminal 6 and the negative (-) connection is to CTB1, terminal 14 for all follower signals. See Figure 5.

2.10 ADJUSTABLE SPEED/LOAD CONTACT CLOSURE

A signal is available to activate external equipment at a pre-determined speed or load. This signal is available at CTB1 terminals 17, 18 & 19.

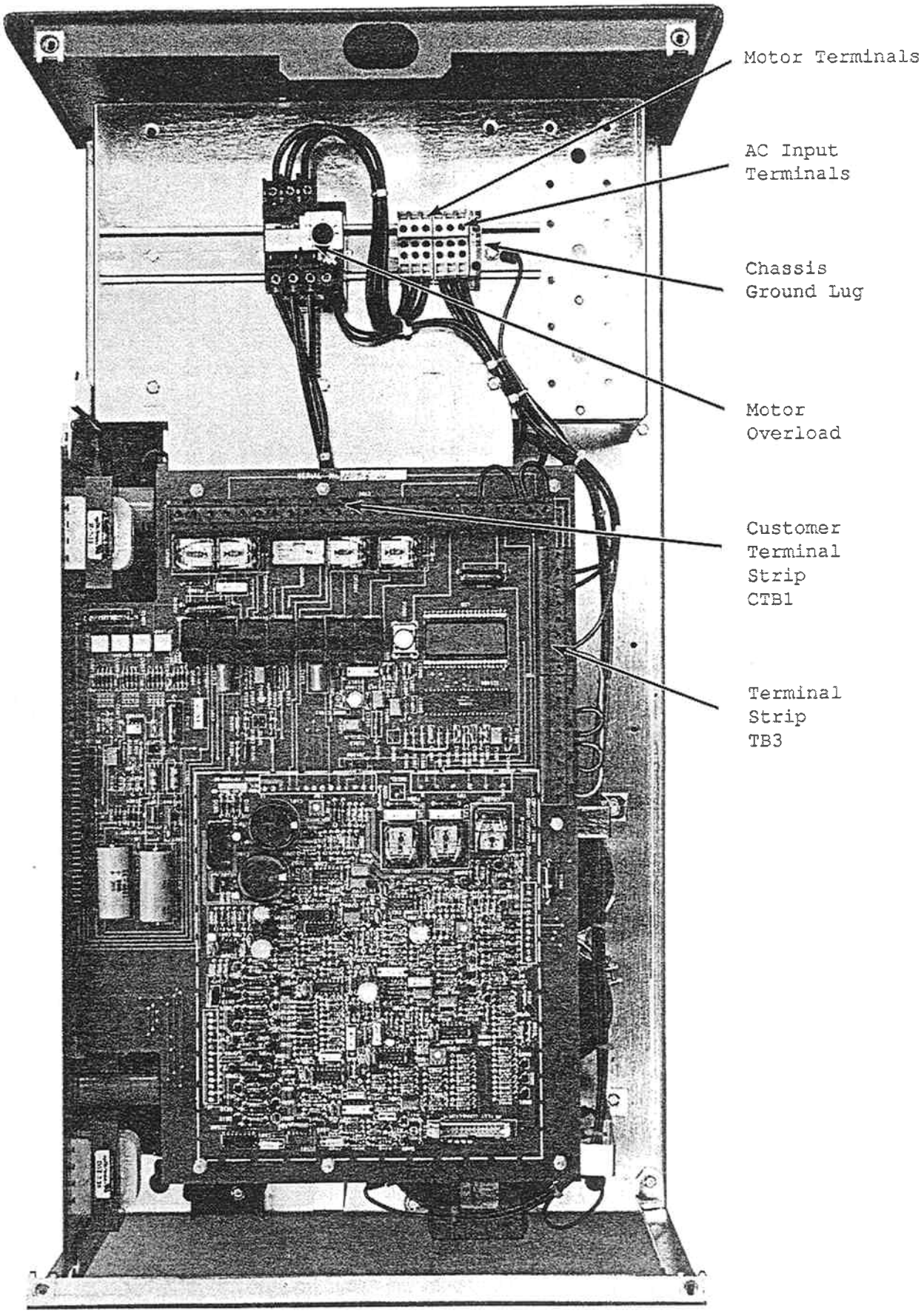
To sense load, place the jumper on JB1001 on the Control Board to position 1. To sense speed, place the jumper to position 2. Position 1 is to the right; 2 is to the left. Adjust the trip point to the load or speed desired by turning potentiometer P1001 on the Control Board. It is adjustable from 0 to 100%.

3. START-UP PROCEDURE

3.1 PRE-CHECK

To prevent damage to the drive, the checks listed below should be completed before applying AC power to the drive.

1 Visually inspect the drive for any signs of shipping damage, loose connections or other defects.
2 Make sure the input line voltage is correct. On standard units, it should be between 437 and 506 V AC. Make sure that the lines are not unbalanced more than 5 V AC.
3. Make sure the drive and motor ratings are properly marked as to horsepower and voltage. Consult Graham if the motor's horsepower rating is larger than the drive's rating.
4. Check all electrical connections for tightness and re-tighten, if necessary.
5 Insure that the wiring between the drive, the motor and other external locations is connected as shown on the connection diagram.



Typical 1575 Series with Cover Removed
Figure 3

⚠WARNING

NEVER OPERATE THE DRIVE INTO A SHORT CIRCUIT.
NEVER CONNECT A MOTOR TO A DRIVE WHEN THE DRIVE IS RUNNING.
NEVER CONNECT A ROTATING MOTOR TO A DRIVE.
NEVER OPERATE MOTOR TRANSFER CIRCUITS WHILE DRIVE IS RUNNING.

3.2 OPERATOR CONTROLS

SPEED/POWER/LOAD SWITCH - Select SPEED to show a percent speed indication on the digital display. Select POWER to show percent of full power. Select LOAD to show percent of full load.

HAND/OFF/AUTO SELECTOR SWITCH - Select HAND to energize the run relay and start the drive. Select OFF to stop the drive. Select AUTO to start and stop the drive from a remote set of dry contacts provided by the customer.

RUN/STOP SELECTOR SWITCH - Some drives have a RUN/STOP selector switch in place of the HAND/OFF/AUTO selector switch. Select RUN to energize the run relay and start the drive. Select STOP to stop the drive.

When a two-wire RUN/STOP control is used, select RUN to energize the run relay and start the drive. Select STOP to stop the drive.

If required, the drive can be wired to operate using a three-wire START/STOP control. With this control, select RUN to allow the START switch to start the drive. Select STOP to stop the drive.

START SWITCH - This switch is ONLY active when a three-wire START/STOP control is used. With the RUN/STOP switch in the RUN position, flip this momentary-contact switch to the START position to start the drive. Either flipping the RUN/STOP switch to STOP, a fault trip or an open customer supplied interlock will stop the drive. The drive will then remain stopped until the START switch is again flipped. NOTE: the RUN/STOP switch MUST be in the RUN position for the drive to start.

RESET SWITCH - This switch operates ONLY when the optional Reset Limiter option is installed in the drive. With this option, the drive will only attempt to restart three times after an undervoltage trip occurs. To attempt additional restarts, the RESET switch must be flipped to the RESET position.

When the Reset Limiter option is NOT installed in the drive, the drive will continuously attempt to restart after an undervoltage trip.

ON/OFF-RESET SWITCH - This switch is ONLY used when the Manual Contactor Bypass or the Automatic Contactor Bypass option is installed. This option provides switches and motor starters inside the drive to allow the motor to bypass the drive and be started and operated at full speed from the AC power line. In the ON position, the motor is connected to either the drive or the AC line (depending on the position of the DRIVE/LINE SWITCH). In the OFF-RESET position, the motor is disconnected from both sources of power and the bypass logic is reset to allow the motor to be transferred back to adjustable speed operation from the AC drive. See section 7.2 or 7.3 for details.

DRIVE/LINE SWITCH - This switch is ONLY used when the Manual Contactor Bypass or the Automatic Contactor Bypass option is installed. This option provides switches and motor starters inside the drive to allow the motor to bypass the drive and be started and operated at full speed from the AC power line. In the DRIVE position, the motor is connected to operate at an adjustable speed from the output of the drive. In the LINE position, the motor is connected to operate at full speed from the AC power line. In order for the motor to have power applied to it, the ON/OFF-RESET SWITCH must be in the ON position. See section 7.3 or 7.4 for details.

MANUAL/AUTO SELECTOR SWITCH - In the MANUAL position, the drive's speed follows the reference from the MANUAL SPEED POTENTIOMETER. In the AUTO position, the follower is in the circuit and the drive follows an external reference such as 4-20mA, 0-10 V DC or 135 ohm potentiometer. In the AUTO position, the AUTO LED (LD200) will light.

MANUAL SPEED POTENTIOMETER - Allows the operator to set the running speed of the drive between the lower limit (set by the MIN SPEED potentiometer) and the upper limit (set by the MAX SPEED potentiometer).

3.3 DRIVE STATUS INDICATORS

See Figures 1, 6 and 7.

POWER - This lights whenever the power is applied to the drive.

READY - This lights after the drive has gone thru its power up sequence and the RUN/STOP switch is in the RUN position.

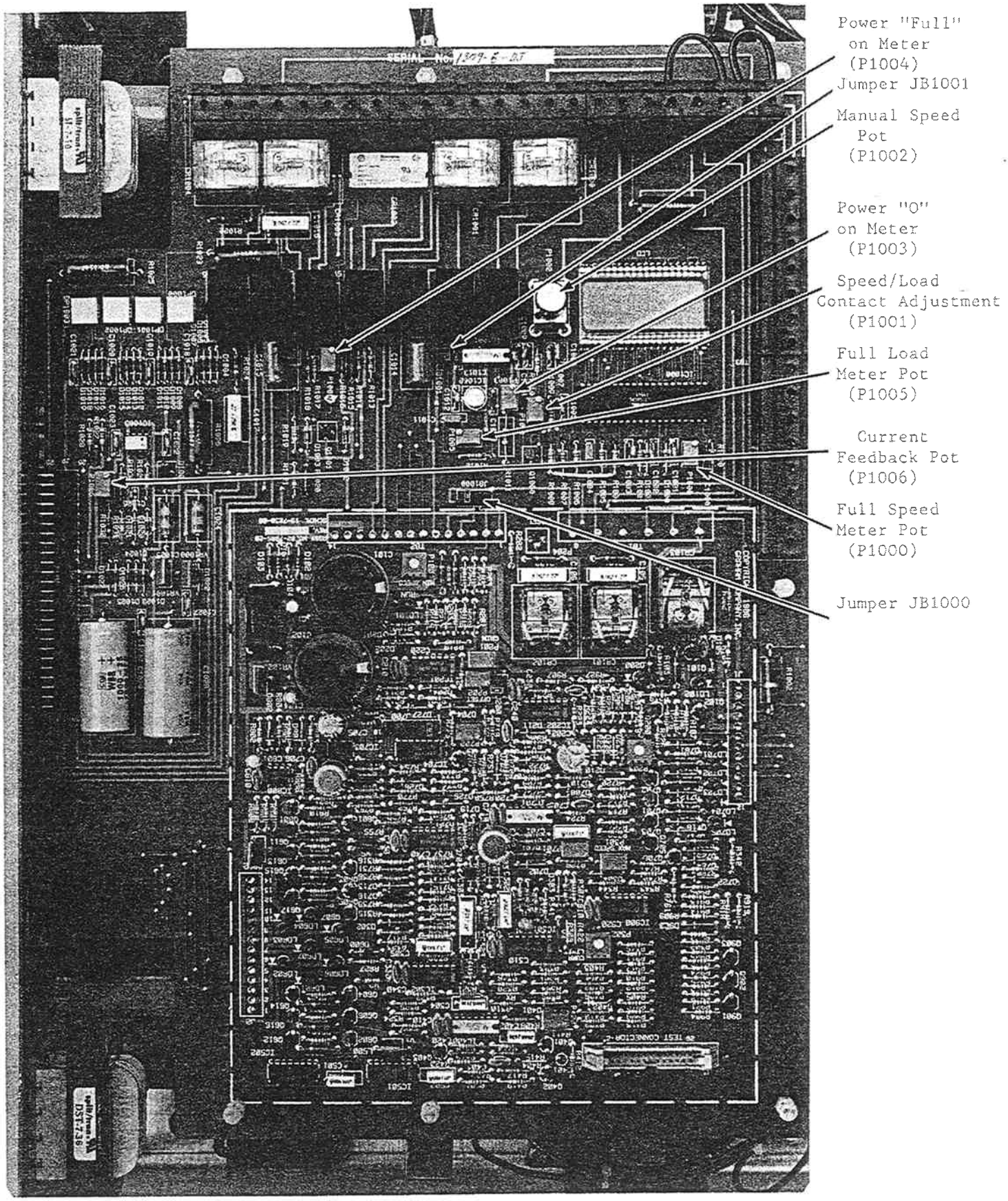
FAULT - If the fault relay is activated due to an UNDERVOLTAGE, OVERVOLTAGE, OVERCURRENT or OVERLOAD, this light indicates that the drive is in a fault shutdown condition.

UNDERVOLTAGE - If the input voltage to the drive drops too low, this LED will light and the drive will stop, allowing the motor to coast. As soon as the low voltage condition is corrected, a timer will start. After the time delay, the LED will go out, and a drive that is wired for two wire RUN/STOP control will automatically restart. A drive which is supplied with three wire START/STOP will not restart until the START switch has been moved to START. See Section 6.1 for a description of the automatic reset/restart timer and time selections.

OVERVOLTAGE - If the DC output bus voltage rises too high, this LED will light and the drive will stop, allowing the motor to coast.

OVERCURRENT - If the inverter section (drive output) is subjected to a sharp increase in current, this LED will light and the drive will stop, allowing the motor to coast. Possible causes of overcurrent are misapplication of the drive to too large of a motor, a defective motor, power factor correction capacitors connected to the motor leads, a short circuit or component failure. To reset, remove the power to the drive, reconnect the power and have the drive go thru its normal power-up sequence. If the fault does not reset, see Section Two -- Service Manual.

OVERLOAD TIMER ON - If the drive is called upon to deliver 110% or more of its nameplate load rating, this LED will light to indicate that the one minute OVERLOAD TIMER has been activated. The LED will go out as soon as the load is reduced below the 110% level. If the load is not reduced, the OVERLOAD TIMER will time out in approximately one minute and trip the OVERLOAD SAFETY CIRCUIT. The overload trip will cause the motor to decelerate to zero speed and remain at zero speed until the OVERLOAD SAFETY CIRCUIT is



Typical 1575 Series Control Board

Figure 4

reset. To reset, switch the RUN/STOP switch to the STOP position and then restart the drive.

RUN - When the drive run relay is activated, this LED will light. If the READY light is lit, but the RUN LED is not lit, a customer interlock is open or, for three wire START/STOP control, the START switch is not flipped.

LOAD TRANSFERRED TO LINE - This lights when the optional bypass DRIVE/LINE switch is in the LINE position.

AUTO/MANUAL - When the drive is in the MANUAL mode (manual speed potentiometer), this LED will be off. When the drive is in the AUTOMATIC mode (speed follower for transducers or external speed commands), this LED will light.

CHOPPER CONDUCTION INDICATOR - The intensity of this LED is proportional to the duty cycle of the chopper transistor and so it varies with the load on the drive.

INVERTER ACTIVITY INDICATOR - These six LEDs are arranged in a circle to show the firing sequence of the six inverter transistors. When power is applied, approximately three seconds after the undervoltage timer resets, three consecutive LEDs will light. Each LED indicates that a turn-on command is being sent to the corresponding inverter transistor driver circuit. In a properly functioning drive, only three sequential LEDs are lit at one time. The rate of flashing will increase with increasing motor speeds. Eventually, they will flash so quickly that they appear to glow continuously. The lighted LEDs will appear to rotate even when the drive is stopped.

CHOPPER TRANSISTOR DRIVER LED - This LED is located on the Interface Board and works in conjunction with the CHOPPER CONDUCTION INDICATOR on the Control Board. If the CHOPPER TRANSISTOR DRIVER LED does not light but the CHOPPER CONDUCTION INDICATOR DOES light, the Interface Board, or the wiring to it, has a fault.

INVERTER TRANSISTOR DRIVER LEDs - An LED on the Interface Board lights to indicate that turn-on base drive is being supplied to the inverter power transistor. The transistor drivers work in conjunction with the INVERTER ACTIVITY INDICATOR on the Control Board. The rate of flashing of the LEDs corresponds to the speed of the motor. If an LED on a transistor driver fails to light but the corresponding LED on the Control Board does light, the Interface Board, or the wiring to it, has a fault.

INPUT SURGE CYCLE COMPLETE - This Interface LED lights when the initial application of energy to the input bus
capacitors is complete.

INPUT BUS CHARGED - This Power Board LED lights when there is a charge on the input capacitor bank. After power is removed, the LED will dim as the capacitor bank slowly discharges.

⚠ DANGER

DO NOT SERVICE THE DRIVE WHILE THE INPUT BUS CHARGED LED IS ILLUMINATED.

OUTPUT BUS CHARGED - This LED on the Power Board lights when there is a charge on the output bus capacitors. Its intensity varies with motor speed. After power is removed, the LED will dim as the output bus capacitors slowly discharge.

⚠ DANGER

DO NOT SERVICE THE DRIVE WHILE THE OUTPUT BUS CHARGED LED IS ILLUMINATED.

3.4 INTERNAL CUSTOMER ADJUSTMENTS See Figure 7.

MINIMUM SPEED - This Control Board potentiometer is used for adjusting the minimum speed when the manual speed potentiometer is used (i.e. when the MANUAL/AUTO switch is in the MANUAL position). To change this adjustment, turn the manual speed potentiometer fully counterclockwise and adjust the MINIMUM SPEED potentiometer for the desired minimum speed.

MAXIMUM SPEED - This Control Board potentiometer sets the motor's maximum speed. To adjust it, set the MANUAL/AUTO switch to the MANUAL position and turn the manual speed potentiometer fully clockwise. Then adjust the MAXIMUM SPEED potentiometer for the desired maximum speed. Do not set the MAXIMUM speed potentiometer for a speed greater than the motor nameplate speed.

GAIN - This Control Board potentiometer adjusts the drive's response to an automatic speed reference signal when the automatic follower is used (i.e. when the MANUAL/AUTO switch is in the AUTO position). To calibrate this adjustment, set the automatic speed reference signal at its maximum value, (10 V DC or 20 mA, etc.) and adjust the GAIN potentiometer for the desired maximum speed. IN THE AUTO MODE, THE MAXIMUM SPEED CANNOT BE GREATER THAN IT IS IN THE MANUAL MODE AS SET BY THE MAXIMUM SPEED POTENTIOMETER.

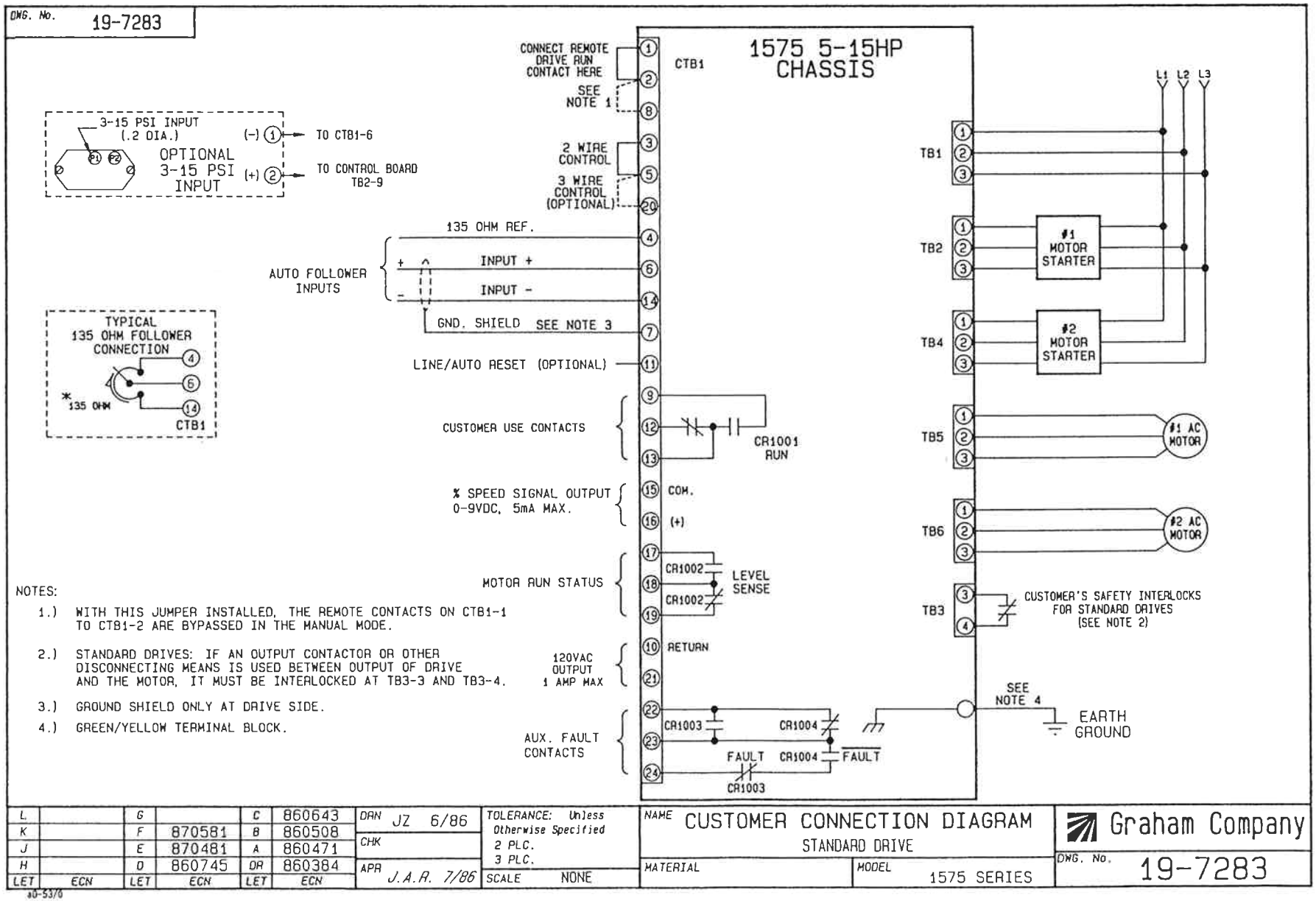
OFFSET -This Control Board potentiometer adjusts the minimum speed when the automatic reference input is used (i.e. when the MANUAL/AUTO switch is in the AUTO position). To calibrate this adjustment, set the input follower circuit signal at its minimum value (0 V DC or 4 mA, etc.) and adjust the OFFSET potentiometer for the desired automatic follower minimum speed. See Section 3.5, step 15. This adjustment does not affect the MINIMUM SPEED setting for the manual mode, although it does interact with the GAIN control.

ACCELERATION TIME - This Control Board potentiometer adjusts the length of time it takes the drive to accelerate the motor from zero speed to maximum speed. This time is adjustable from 3 to 50 seconds. The factory setting was approximately 50 seconds. To reduce the peak demand when starting a fan or a pump, the drive provides a soft start by increasing the length of time it takes the motor to reach set speed. Clockwise rotation of the ACCELERATION TIME potentiometer increases the accel time and counterclockwise rotation of the potentiometer decreases the accel time.

DECELERATION TIME - The minimum deceleration time is fixed by the setting of the ACCELERATION TIME potentiometer. If the load requires a longer deceleration time, the drive will automatically compensate by extending the deceleration time.

CURRENT LIMIT - This Control Board potentiometer is used to set the maximum current in the chopper circuit. The chopper current is proportional to the motor load, except when abrupt changes in motor torque requirements occur. If the drive is to be used with a motor whose full load rating is less than the nameplate rating of the drive, the CURRENT LIMIT potentiometer may be turned counterclockwise to limit the maximum available current to the motor.

3.5 INITIAL START-UP



NOTES:

1.) WITH THIS JUMPER INSTALLED, THE REMOTE CONTACTS ON CTB1-1 TO CTB1-2 ARE BYPASSED IN THE MANUAL MODE.

2.) STANDARD DRIVES: IF AN OUTPUT CONTACTOR OR OTHER DISCONNECTING MEANS IS USED BETWEEN OUTPUT OF DRIVE AND THE MOTOR, IT MUST BE INTERLOCKED AT TB3-3 AND TB3-4.

3.) GROUND SHIELD ONLY AT DRIVE SIDE.

4.) GREEN/YELLOW TERMINAL BLOCK.

LET	ECN	LET	ECN	LET	ECN
L		G		C	860643
K		F	870581	B	860508
J		E	870481	A	860471
H		D	860745	DR	860384

DRN JZ 6/86
CHK
APR J.A.R. 7/86

TOLERANCE: Unless Otherwise Specified
2 PLC.
3 PLC.
SCALE NONE

NAME CUSTOMER CONNECTION DIAGRAM
STANDARD DRIVE
MATERIAL
MODEL 1575 SERIES

Graham Company
DWG. No. 19-7283

a0-53/6

figure 5

Prior to shipment, each Graham drive is thoroughly tested at the factory and is adjusted for maximum performance for its intended application. Minor adjustments may be necessary at the installation site.

Before any adjustments are made, this manual should be studied carefully. Do not make any adjustments without the proper measuring instruments and without a clear understanding of the function and limitation of the adjustment being made. Make sure that everything in paragraph 3.1 has been checked before power is applied to the drive. Insure that the drive is connected per the proper connection diagram.

⚠ DANGER

460 V AC AND OVER 700 V DC IS PRESENT INSIDE THE DRIVE ENCLOSURE. THIS VOLTAGE IS EXTREMELY DANGEROUS AND COULD BE FATAL IF CONTACTED BY AN INDIVIDUAL. THEREFORE, THE UTMOST CAUTION MUST BE EXERCISED WHEN WORKING WITHIN THE DRIVE ENCLOSURE.

1. Set the MANUAL SPEED potentiometer fully counterclockwise, the RUN/STOP switch to STOP or the HAND/OFF/AUTO switch to OFF and the AUTO/MANUAL selector to MANUAL.

2. Turn the CURRENT LIMIT potentiometer on the Control Board fully counterclockwise. Access this potentiometer thru the hole in the plastic shield over the Control Board. See Figure 7.

3. Insure that the prechecks in Paragraph 3.1 have been successfully completed.

4. Apply power to the drive thru the input disconnect switch. If the drive is supplied with a constant speed bypass using motor starters, set the ON/OFF-RESET switch to the ON position and turn the DRIVE/LINE switch to the DRIVE position.

5. When power is applied to the drive, the following should occur:
   1. INPUT SURGE CYCLE COMPLETE LED (LD1) on the Interface Board and INPUT BUS CHARGED LED (LD2) on the power board illuminate.
   2. POWER and FAULT pilot lights are lit.
   3. SPEED/POWER/LOAD meter is on.
   4. FAULT and UNDERVOLTAGE LEDs illuminate on Control Board.

6 After a power up time delay (see Section 6.1, Undervoltage Reset Adjustment) the following will occur:
   1. FAULT pilot light extinguishes.
   2. FAULT and UNDERVOLTAGE LEDs on Control Board extinguish

7. Two or three seconds after the FAULT light extinguishes, the INVERTER ACTIVITY LEDs on the Control Board will light and sequence in a slow clockwise direction. The INVERTER TRANSISTOR LEDs should light and sequence in correlation with the INVERTER ACTIVITY LEDs.

8. Switch the RUN/STOP switch to RUN or the HAND/OFF/AUTO switch to HAND. The READY pilot light should illuminate. With three wire START/STOP, flip the START switch.

9. The RUN LED on the Control Board should illuminate.

10. Turn the MANUAL SPEED potentiometer clockwise about 20% of its rotation. Slowly adjust the CURRENT LIMIT potentiometer clockwise until you hear a high pitched sound coming from the drive. As the sound increases with further clockwise movement of the CURRENT LIMIT potentiometer, you will see the CHOPPER CONDUCTION LED and the CHOPPER TRANSISTOR DRIVER LED illuminate dimly and increase in intensity with further clockwise adjustment.

11. Check the motor rotation.
   1. If the motor doesn't rotate, check to make sure that the motor is properly connected and free to rotate. If it is, turn the CURRENT LIMIT potentiometer clockwise until rotation occurs.
   2. If the motor rotates, check for proper direction of rotation. If the motor does not rotate in the correct direction, reverse two of the motor leads.
   3. If the drive is supplied with a constant speed bypass, also check the motor's direction of rotation in the bypass mode. If it is incorrect, reverse two of the drive's incoming AC power leads.

12. If the motor rotates in the proper direction, turn the CURRENT LIMIT potentiometer fully clockwise.

⚠ CAUTION

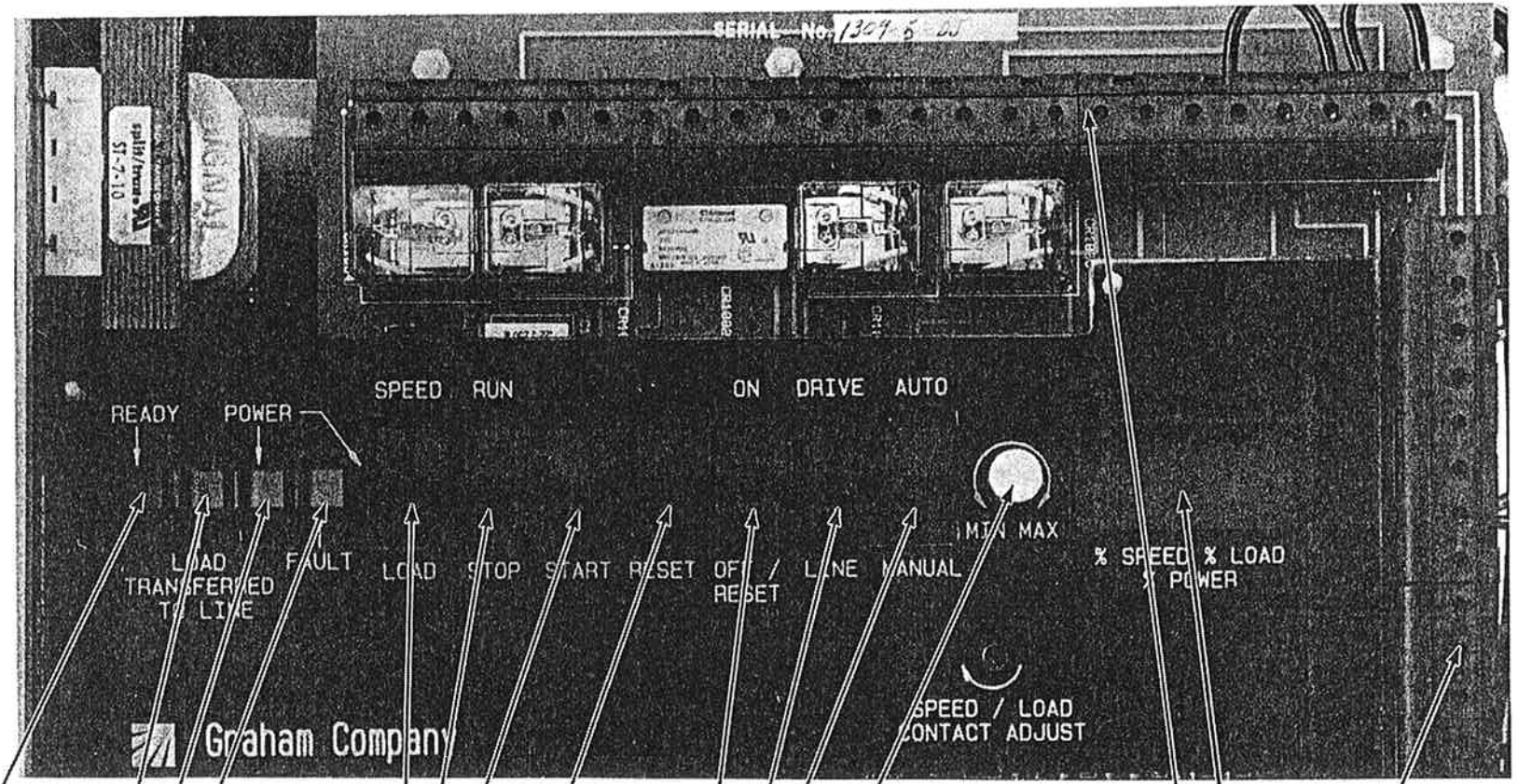
WHEN USING MOTORS WHICH ARE SMALLER THAN THE DRIVE OUTPUT RATING, A REDUCED CURRENT LIMIT SETTING MAY BE DESIRED TO LIMIT THE DRIVE'S CURRENT CAPABILITY. THIS DOES NOT REDUCE THE OVERLOAD TRIP THRESHOLD. MOTOR OVERLOAD SETTINGS SHOULD BE SET TO PROTECT THE MOTOR. IF MULTIPLE MOTORS ARE CONNECTED TO THE DRIVE OUTPUT, INDIVIDUAL MOTOR OVERLOADS SHOULD BE SUPPLIED FOR EACH INDIVIDUAL MOTOR.

13. Turn the MANUAL SPEED potentiometer fully clockwise. The OUTPUT BUS CHARGED LED, CHOPPER CONDUCTION LED and CHOPPER TRANSISTOR DRIVER LED should be brightly illuminated. Set the SPEED/POWER/LOAD selector switch to SPEED. The SPEED/POWER/LOAD meter should now indicate 100% speed, unless a lower maximum speed setting was set. Set the SPEED/POWER/LOAD selector switch to LOAD. The SPEED/POWER/LOAD meter should now indicate the percentage of the drive's output torque capability that is being required by the motor.

14. To set up the drive for signal follower operation, set the RUN/STOP switch to STOP or the HAND/OFF/AUTO switch to OFF. When the drive stops, set the AUTO/MANUAL switch to AUTO. The AUTO/MANUAL LED should now illuminate. Set the SPEED/POWER/LOAD switch to SPEED.

15. Adjust the automatic signal from the sending device to its maximum signal. Start the drive. The drive should accelerate to maximum speed and the SPEED/POWER/LOAD meter should indicate 100% speed, unless otherwise specified. If the meter does not indicate the desired speed, verify that the input reference signal is at its maximum level and adjust the GAIN potentiometer for the desired indication on the meter. IN THE AUTO MODE, THE MAXIMUM SPEED CANNOT BE GREATER THAN IN THE MANUAL MODE. The GAIN potentiometer should not be adjusted any farther than is necessary to obtain the required maximum speed.

16. Adjust the automatic signal from the sending device to its minimum signal.



"Ready" Light

"Load Transferred to Line" Light (used only with Bypass option)

"Power On" Light

"Fault Light"

"Speed/Load/ Power" Switch for Meter

"Off/Hand/Auto" or "Run/Stop" Switch

"Start" Switch (used only with 3-wire start/stop)

"Reset" Switch (used only with Reset Limiter option)

Manual Speed Potentiometer

"Auto/Manual" Switch

"Drive/Line" Switch (used only with Bypass option)

"On/Off/Reset" Switch (used only with Bypass option)

Terminal Strip TB3

Speed/Load/Power Meter

Customer Terminal Strip CTB1

Typical 1575 Series Operator's Devices
Figure 6

Adjust the OFFSET potentiometer for the desired minimum speed. To obtain a lower minimum speed, remove plug P200 from jack J200 (see Figure 7) and replace it on the end of J200 marked with the minus sign (-). To obtain a higher minimum speed, replace P200 on the end of J200 marked with the plus sign (+).

17. After making any changes in Step 16, recheck the maximum speed per Step 15 and readjust, if necessary. In some cases, it may be necessary to repeat Steps 15 and 16 a few times.

18. Switch the RUN/STOP switch to STOP or the HAND/OFF/AUTO switch to OFF and disconnect the input power to the drive. The drive is now calibrated for the manual and automatic speed control functions and the drive has completed the operational check out.

19. Replace the enclosure.

SECTION TWO -- SERVICE MANUAL

4. INTRODUCTION

This section of the manual is intended for those who wish to perform their own troubleshooting and repair. Persons attempting to perform the drive service described in this section should have a strong background in power electronics, experience in using test equipment and a good understanding of analog and digital control circuitry. Graham Company offers service schools to show you how to troubleshoot and repair this drive. Contact Graham Company Service Department for service assistance.

5. DESCRIPTION OF OPERATION

The drive consists of three main sections, the Power Section, the Control Section and the Interface Section.

The first part of the Power Section is the Input Bridge. It converts the incoming three phase AC to a fixed DC voltage. The Chopper converts the fixed DC to a regulated DC voltage. The last part of the Power Section is the Inverter. The Inverter directs the regulated DC to the correct phase of the motor for the proper period of time.

The Control Board contains the voltage and current regulating circuits and the transistor switching logic circuitry. The circuitry for following external references such as 0-10 V DC, 4-20 mA and a 135 ohm potentiometer is also on this board.

The Interface Board contains the power up sequencing circuit and the circuitry to interface the high voltage Power Section with the low voltage Control Section.

6. ADJUSTMENTS AND TROUBLESHOOTING

6.1 INTERNAL ADJUSTMENTS -- Factory Adjustments

To access these factory adjustments, the plastic cover over the Control Board must be removed.

⚠ CAUTION

THESE ADJUSTMENTS SHOULD ONLY BE MADE BY FACTORY TRAINED PERSONNEL

OVERLOAD POTENTIOMETER (P701) - This adjustment sets the load at which the overload timer starts.

UNDERVOLTAGE POTENTIOMETER (P702) - The UNDERVOLTAGE POTENTIOMETER is set to turn off the drive when the input line voltage falls below 437 V AC for a 460 V drive, or 219 V AC for a 230 V drive. To properly set this trip, a means of adjusting the input voltage is necessary.

UNDERVOLTAGE RESET ADJUSTMENT (J700) - The length of the time delay before the drive resets is adjustable. When shipped from Graham, the delay was set for the maximum, which is approximately four minutes. To reduce the delay, remove the plug from J700 pin #7 and replace on a different pin. Refer to Figures 4 and 7 for location of potentiometer.

⚠ CAUTION

THE DELAY MUST BE LONG ENOUGH SO THAT THE MOTOR IS NOT ROTATING WHEN THE UNDERVOLTAGE TRIP RESETS. To assure this, run the drive at maximum speed and then switch the drive to stop. Measure the time until the motor is completely stopped. Only select time delays which are longer than this coastdown time.

UNDERVOLTAGE RESET ADJUSTMENT

J700 PIN #	TIME DELAY
2	35 sec
3	1 min
6	1 min 30 sec
8	2 min
1	2 min 20 sec
4	2 min 50 sec
5	3 min 15 sec
9	3 min 40 sec
7	4 min 10 sec

FULL LOAD METER POTENTIOMETER (P1005) - The load meter calibration potentiometer is located on the Control Board and is used to calibrate the digital display. Adjust it to indicate 100% when the motor is fully loaded.

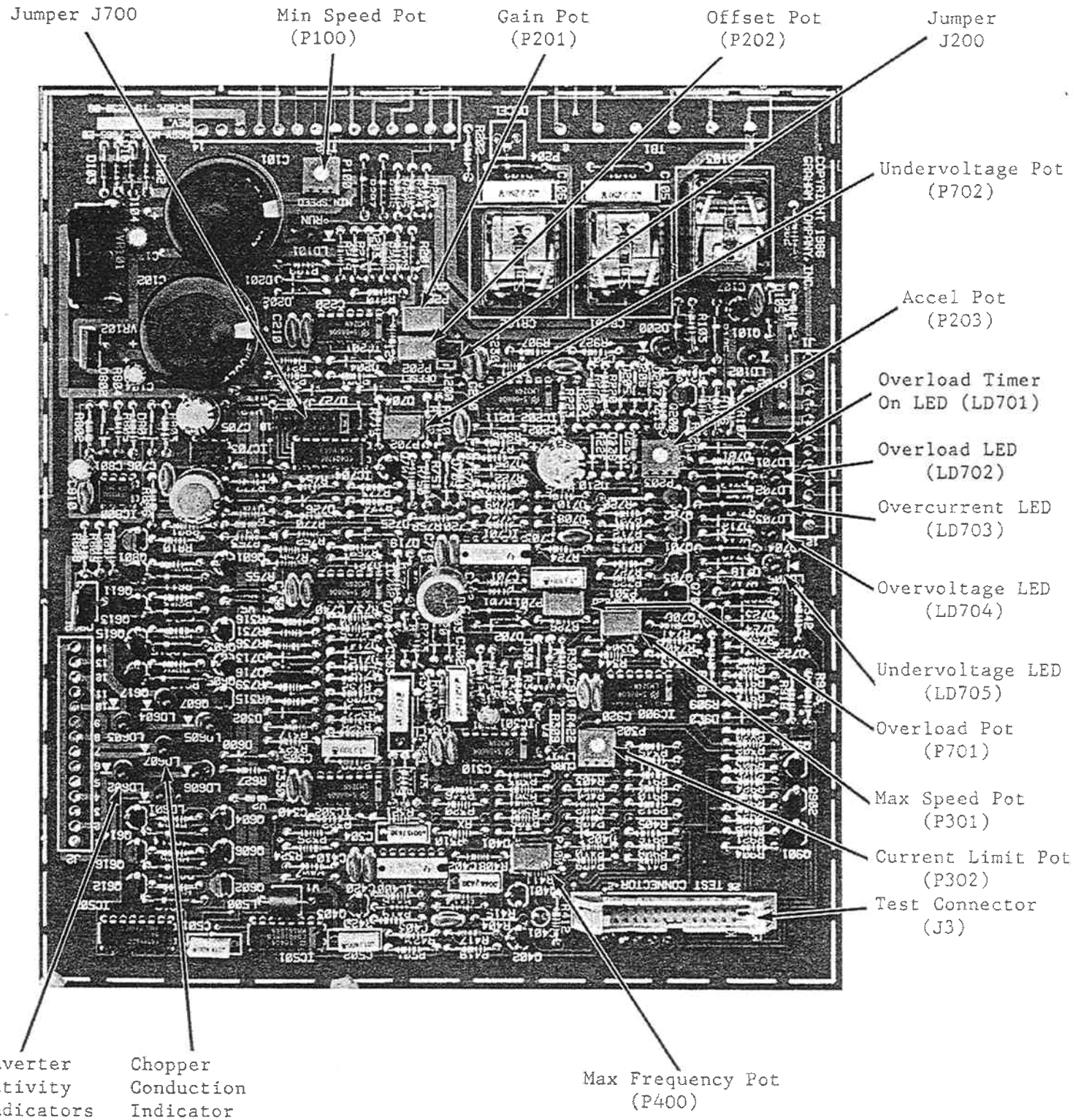
FULL SPEED METER POTENTIOMETER (P1000) - The speed meter calibration potentiometer is located on the Control Board and is used to calibrate the digital display. Adjust it to indicate 100% when the motor is operated at full speed.

POWER METER POTENTIOMETERS (P1003 and P1004) - The power meter calibration potentiometers are located on the Control Board and are used to calibrate the digital display. To calibrate the meter:

1 Set the SPEED/POWER/LOAD switch to SPEED and run the drive at full speed.
2. Adjust P1000 so that the meter reads 100.0.
3. Switch the meter to LOAD and run the drive at full speed and load.
4 Adjust P1005 so that the meter reads 100.0.
5. Switch the meter to POWER and stop the drive.
6. Adjust P1003 so that the meter reads 00.0.
7. Run the drive at full speed and load.
8. Adjust P1004 so that the meter reads 100.0.

MAX FREQUENCY POTENTIOMETER (P400)- The voltage controlled oscillator on the Control Board is calibrated using the MAX FREQUENCY adjustment. Adjustment of this potentiometer will alter the volts per hertz ratio on the drive's output. This control has been set at the factory and should not be readjusted in the field.

CURRENT FEEDBACK POTENTIOMETER (P106) - This potentiometer on the Control Board calibrates the amount of current feedback supplied to the Control Board's current control circuits. The chopper duty cycle and current limit circuits are dependent on this calibration. This control has



Typical 1575 Series Control Board
LEDs and Customer Adjustments Section

Figure 7

been set at the factory and should not be readjusted in the field.

6.2 TROUBLESHOOTING

The procedures outlined here are intended to assist in locating and correcting a problem in a standard drive. The use of replacement circuit boards, where necessary, is suggested to eliminate extended downtime. Power circuit measurements should only be made by qualified technicians.

⚠ DANGER

EXTREME CAUTION MUST BE USED WHENEVER POWER IS APPLIED AND THE ENCLOSURE IS OPEN. ANYONE WORKING ON THE DRIVE WILL BE EXPOSED TO HIGH VOLTAGE. ALWAYS REMOVE POWER WHEN SERVICING THE COMPONENTS OF THE DRIVE. WAIT UNTIL THE "INPUT BUS CHARGED" AND "OUTPUT BUS CHARGED" LEDS EXTINGUISH. THEN, MEASURE FOR VOLTAGE ACROSS THE TERMINALS OF CAPACITOR C18 AND THE TERMINALS OF CAPACITOR C19 ON THE POWER CIRCUIT BOARD USING A VOLTMETER SET ON THE 100 V DC SCALE. ALLOW THESE VOLTAGES TO DROP TO ZERO BEFORE WORKING ON THE DRIVE.

All power circuit voltages are floating at a very high voltage with respect to ground and require isolated or floating test equipment. All control signal voltages are referenced to ground. If a problem is isolated to a calibration setting, refer to the internal adjustments section of this manual before attempting any changes.

Some steps in these instructions use conditions set up in previous steps. Therefore, any time power is interrupted or controls are changed, care must be taken to repeat the specified set-up.

It is recommended that a complete checkout of the Control Board be made or a known good Control Board be installed whenever problems reoccur or components continue to fail. A log of all service should be maintained. The following information should be included.

1. Date and time of failure
2. Description of symptoms
3. Operating conditions
4. What component failed
5. Other conditions occurring at the same time which may be related
6. Service performed
7. Who performed the service

6.3 MINIMUM RECOMMENDED TEST EQUIPMENT

Volt Ohm Meter -- Simpson #260, Fluke 8020A, or equivalent
AMMETER -- Simpson #150 or equivalent
OSCILLOSCOPE -- Tektronix #323 or equivalent
SCOPE PROBE -- Tektronix #P600T or equivalent; set on X10 scale for use on circuit boards, X100 scale for power components
TORQUE WRENCH -- For power components, with hex key sockets
HAND TACHOMETER - For measuring motor speed

6.4 DIODE AND TRANSISTOR TEST PROCEDURE

Remove the input power and wait for the INPUT BUS CHARGED LED and OUTPUT BUS CHARGED LED to extinguish. After checking to confirm that no voltage is present across capacitors C18 and C19. Visually inspect the drive for any physical evidence of a failure such as:

1. Leaking or distorted capacitors
2. Discolored components
3. Loose connections
4. Cracked or broken semiconductors

Check all fuses.

To access the power components, remove the Control Board, carefully separating it from the Interface Board at Jack J9. Remove the interface Board from its mounting brackets. See Figure 9 for removal procedures.

6.4.1 DIODES AND TRANSISTORS

Diodes and transistors may be tested by using the procedure outlined to check for shorts or open circuits. When readings fall into questionable or faulty areas, do not replace the device until a comparison test is made with a known good device. Check the component out of the circuit. Always use the same ohmmeter when performing comparison tests. Failure of a power transistor indicates the need to completely check out the Interface Board. This check out must be performed by a factory trained technician. Otherwise, the Interface Board may be replaced. Failure to check out or replace the board will probably cause repeated failure.

6.4.2 DIODE AND TRANSISTOR REPLACEMENT

To remove power components, remove the hex head mounting screws, the Phillips head screws and any slip on connectors. Slide the component out from the left side. A new thermal pad, included with the replacement module, must be used. The heatsink must be thoroughly cleaned before reassembly. Retorque to 20 to 24 inch pounds.

6.4.3 REASSEMBLY

Carefully insert the pins on the Interface Board into the sockets on the Power Board. Then carefully insert the pins on the Interface Board into the sockets on the Control Board.

⚠ CAUTION

BE SURE ALL PINS ARE STRAIGHT AND ALIGNED BEFORE ATTEMPTING TO CONNECT EITHER BOARD. BE SURE ALL PINS ARE SEATED PROPERLY IN THE MOUNTING SOCKETS.

6.5 INTERFACE BOARD AND CONTROL BOARD TEST

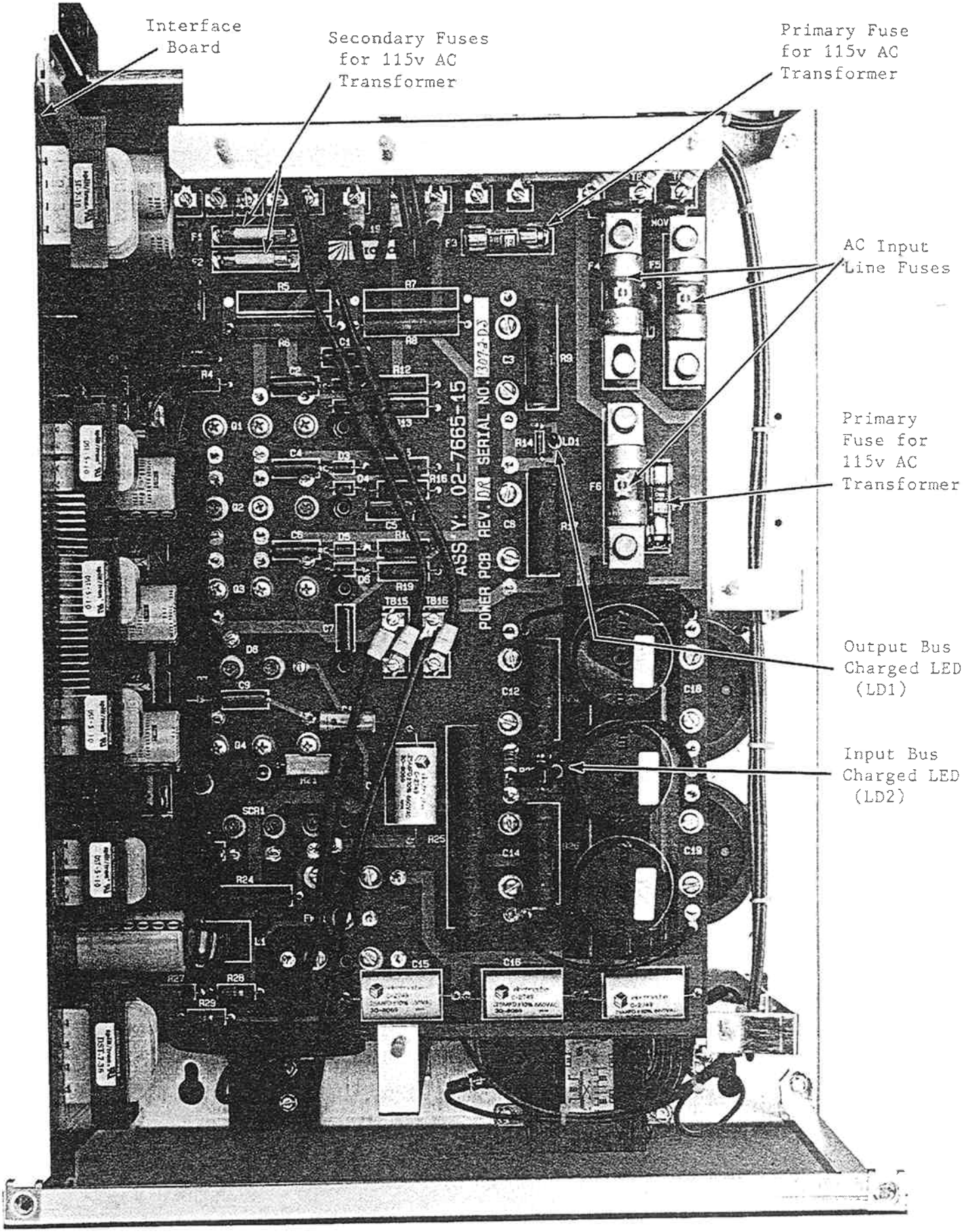
6.5.1 MODEL 1000 TEST METER

The Model 1000 digital test meter provides an accurate and convenient method of monitoring critical signals on the Control Board. These readings are an important diagnostic aid in tracing problems occurring in the drive. The test meter simply plugs into the lower right corner of the Control Board at J3 and uses a rotary switch to select the signal to be monitored. Contact Graham Company for information on ordering this meter.

6.5.2 POWER UP SEQUENCE

⚠ DANGER

HIGH VOLTAGE WILL BE PRESENT IN THE DRIVE WHEN PERFORMING OPERATIONAL TESTS WITH POWER APPLIED TO THE DRIVE. THE POWER CIRCUITS OF THE DRIVE NECESSARILY FLOAT AT A HIGH VOLTAGE ABOVE GROUND POTENTIAL. BOTH LEADS OF ANY TEST EQUIPMENT THAT IS CONNECTED TO THE DRIVE'S POWER CIRCUITS WILL ALSO BE AT A HIGH VOLTAGE WITH RESPECT TO GROUND. INSTRUMENTS CONNECTED TO THE POWER CIRCUITS _MUST_ HAVE _BOTH_ LEADS ISOLATED FROM EARTH GROUND. IF ONE TEST LEAD IS CONNECTED TO THE CASE OF THE TEST INSTRUMENT, THE TEST INSTRUMENT'S



Typical 1575 Series Power Board
with Control Board Removed

Figure 8

CASE WILL ALSO BE AT A HIGH VOLTAGE WITH RESPECT TO EARTH GROUND.

Disable the chopper by unplugging Q4's base lead. This will keep the chopper from supplying high voltage to the inverter and output sections of the drive.

Apply input power to the drive. The SURGE CYCLE COMPLETE LED on the Interface Board should light and SCR1 should be conducting. The INPUT BUS CHARGED LED should light indicating the capacitors are charged. The UNDERVOLTAGE LED and FAULT LED should light and remain lit until the undervoltage reset timer completes its cycle. About four seconds later, the INVERTER ACTIVITY INDICATOR LEDs should light and should appear to slowly rotate clockwise.

6.5.3 POWER SUPPLY ON CONTROL BOARD

Power supply common (PWR GND) is connected to TB3 terminal 10 on the Control Board. This terminal is connected to a ground terminal block which is located just above the Control Board. The ground strap on this terminal block can be used for test equipment connection in the following steps.

Check the +22 V DC power supply (Vp) on J3 terminal 17 for +18 to +30 V DC.

Check the -22 V DC power supply (Vn) on J3 terminal 15 for -20 to -30 V DC.

Check the +15 V DC power supply (V+) on J3 terminal 2 for +14.4 to +15.6 V DC.

Check the -15 V DC power supply (V-) on J3 terminal 12 for -14.4 to -15.6 V DC.

An oscilloscope should also be used in checking the above voltages to insure that there is no excessive ripple in these DC voltages.

6.5.4 INPUT REFERENCE

Switch the AUTO/MANUAL switch to MANUAL and start the drive. The AUTO/MANUAL LED should be off and the RUN LED should be on. Adjust the MANUAL SPEED potentiometer to maximum. The speed reference signal (SR) can be monitored at J3, terminal 8 on the Control Board. It should increase, reaching a maximum of approximately 8 V DC.

6.6 OUTPUT CHECKS

Remove input power from the drive. Reconnect Q4's base lead.

Start the drive and accelerate the motor to full speed. Measure the currents on the motor leads. These should be balanced within +0.5 A AC. Any lack of balance indicates a problem with the motor windings, the wiring to the motor or the inverter circuits in the drive.

Motor leads must be disconnected from the drive. The resistance values shown below are for good components. If a reading is in doubt, compare it to a known good component. Exact values cannot be given, as readings will vary with meter and scale used. If an inverter transistor module is found to be defective, the Interface Board must be completely checked out by a factory trained technician or replaced. Failure to do this will probably result in continued failure of the transistor module.

6.7 FAULT LED DIAGNOSIS

The following sections list conditions which could cause fault indications in the drive.

6.7.1 UV LED - UNDERVOLTAGE

1. Input AC line voltage less than 437 V AC.
2. Input AC line imbalance of greater than 5 V AC.
2. One or more of fuses F1 thru F7 bad
3. Control Board power supply voltages out of tolerance. The correct tolerances are:
   +15 V DC Between +14.4 and +15.6 V DC
   -15 V DC Between -14.4 and -15.6 V DC

6.7.2 OV LED - OVERVOLTAGE

1. Motor rotating when the drive was started.
2. Fan draft or pump fluid flow causing the motor to try to run faster than the drive's speed.
3. Power interruption to the drive while the drive is running.

6.7.3 OC LED - OVERCURRENT

1. Motor winding shorting to ground or to another phase winding.
2. Motor windings connected for an incorrect voltage.
3. Power factor correction capacitors installed between the drive output and the motor.
4. Motor starter or contactor on the drive's output being opened and closed while the drive is running.
5. Inverter Transistor Driver LED's sequencing improperly.
6. Inverter Transistors Q1, Q2, Q3 open.
7. Chopper Transistor Q4 shorted.
8. Clamp Diode D8 shorted.

6.7.4 OL LED - OVERLOAD

1. Motor not free to rotate.
2. Belts, if used, improperly tensioned or aligned.
3. Sheaves and/or shaft couplings improperly aligned.
4. Motor overloaded when connected to the AC line.
5. Maximum speed of the drive adjusted too high.

SECTION THREE -- OPTIONS

7. INTRODUCTION TO DISCONNECTS AND BYPASSES

The following options represent the input disconnect, output disconnect and bypass switching arrangements which are commonly supplied with Model 1575 drives. Each is mutually exclusive, that is, any drive will have, at most, one of these options. It is not necessary for a drive to have any of these options supplied by Graham.

7.1 INPUT DISCONNECT SWITCH

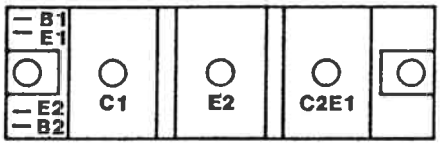
The Input Disconnect Switch is a three pole, two position rotary switch. It is used as a means of interrupting the AC input line to the drive. When the switch is in the OFF position, the contacts are open and the drive circuits are isolated from the power wires feeding the drive input. In the ON position, the contacts are closed and power is fed to the drive.

⚠ DANGER

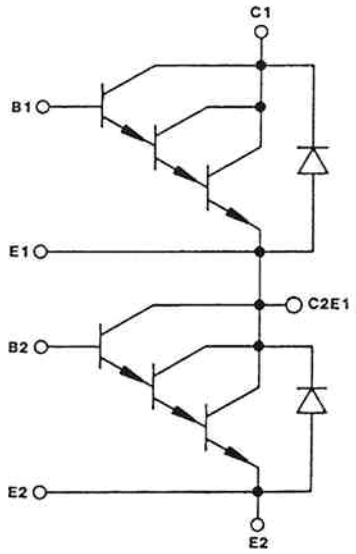
THE INPUT DISCONNECT SWITCH DOES NOT INTERRUPT THE POWER TO THE BYPASS CIRCUITS. INPUT POWER WILL BE PRESENT INSIDE THE DRIVE ENCLOSURE FOR THE BYPASS

Motor leads must be disconnected from the drive. The resistance values shown below are for good components. If a reading is in doubt, compare it to a known good component. Exact values cannot be given, as readings will vary with meter and scale used. If an inverter transistor module is found to be defective, the Interface Board must be completely checked out by a factory trained technician or replaced. Failure to do this will probably result in continued failure of the transistor module.

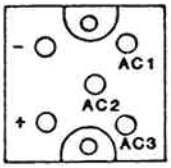
INVERTER TRANSISTOR MODULE



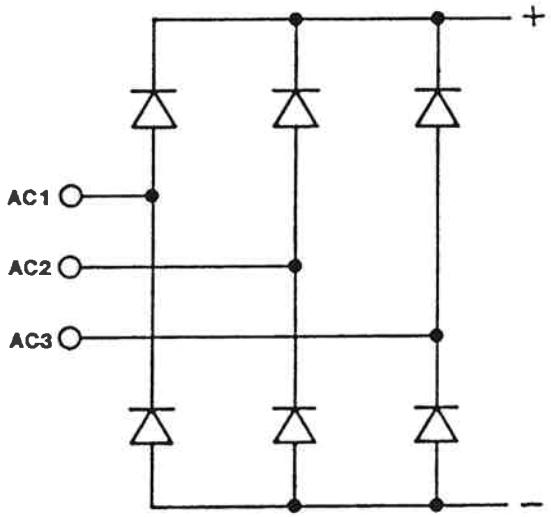
METER LEADS		RESISTANCE READING
Positive Lead	Negative Lead	Ohms
C or C1	B or B1	>10,000
E or E1	B or B1	< 1,000
B or B1	E or E1	< 1,000
B or B1	C or C1	< 1,000
C or C1	E or E1	>10,000
E or E1	C or C1	< 1,000
C2	B2	>10,000
E2	B2	< 1,000
B2	E2	< 1,000
B2	C2	< 1,000
C2	E2	>10,000
E2	C2	< 1,000



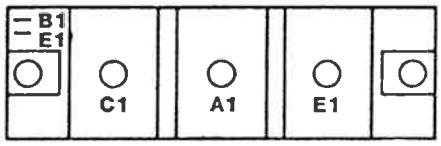
INPUT BRIDGE MODULE



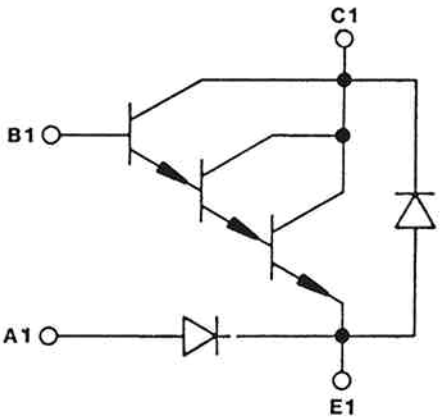
METER LEADS		RESISTANCE READING
Positive Lead	Negative Lead	Ohms
+	AC1	>10,000
+	AC2	>10,000
+	AC3	>10,000
AC1	+	< 1,000
AC2	+	< 1,000
AC3	+	< 1,000
-	AC1	< 1,000
-	AC2	< 1,000
-	AC3	< 1,000
AC1	-	>10,000
AC2	-	>10,000
AC3	-	>10,000



CHOPPER TRANSISTOR MODULE

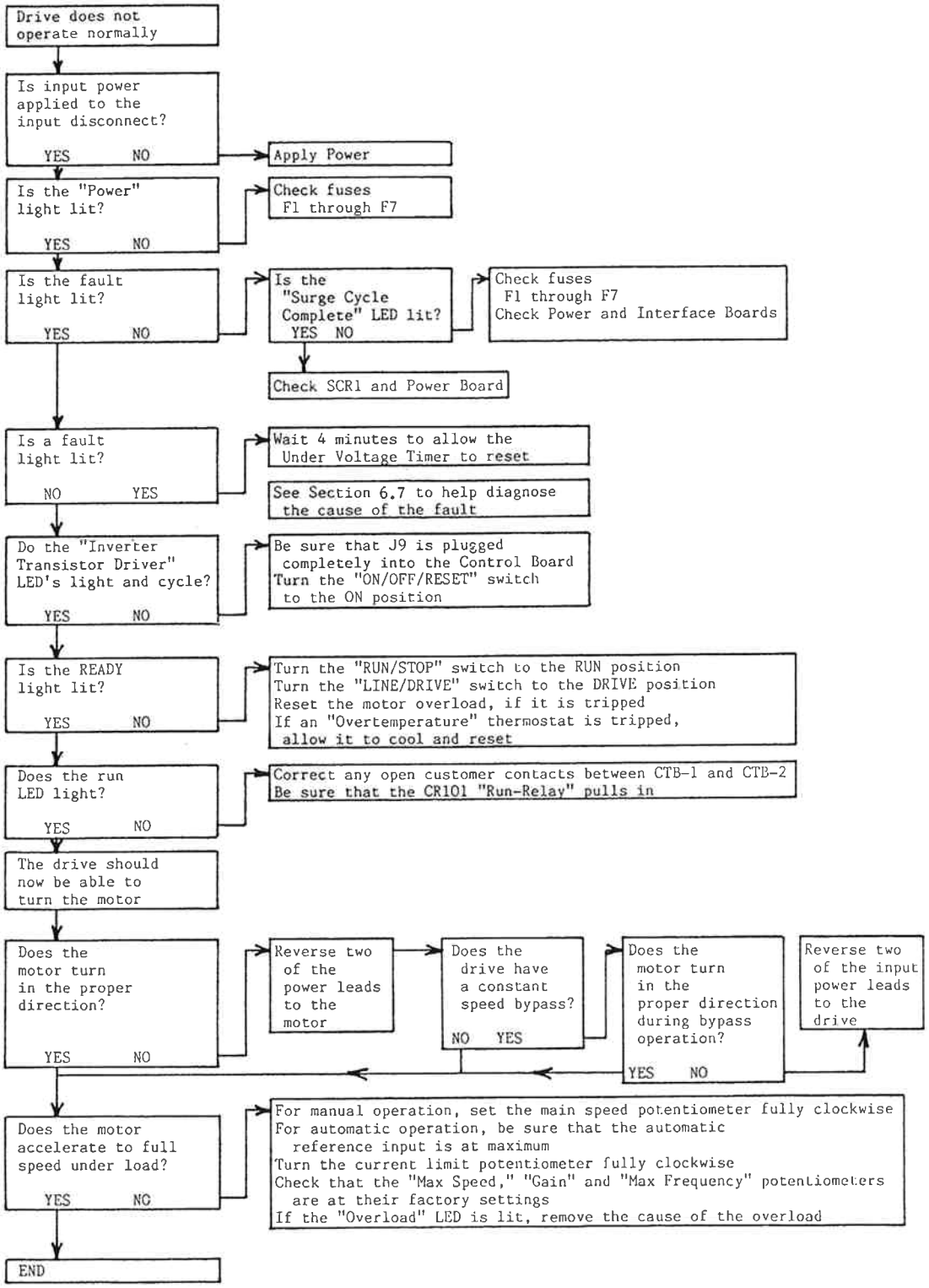


METER LEADS		RESISTANCE READING
Positive Lead	Negative Lead	Ohms
C1	B1	>10,000
E1	B1	< 1,000
B1	E1	< 1,000
B1	C1	< 1,000
C1	E1	>10,000
E1	C1	< 1,000
A1	E1	< 1,000
E1	A1	>10,000

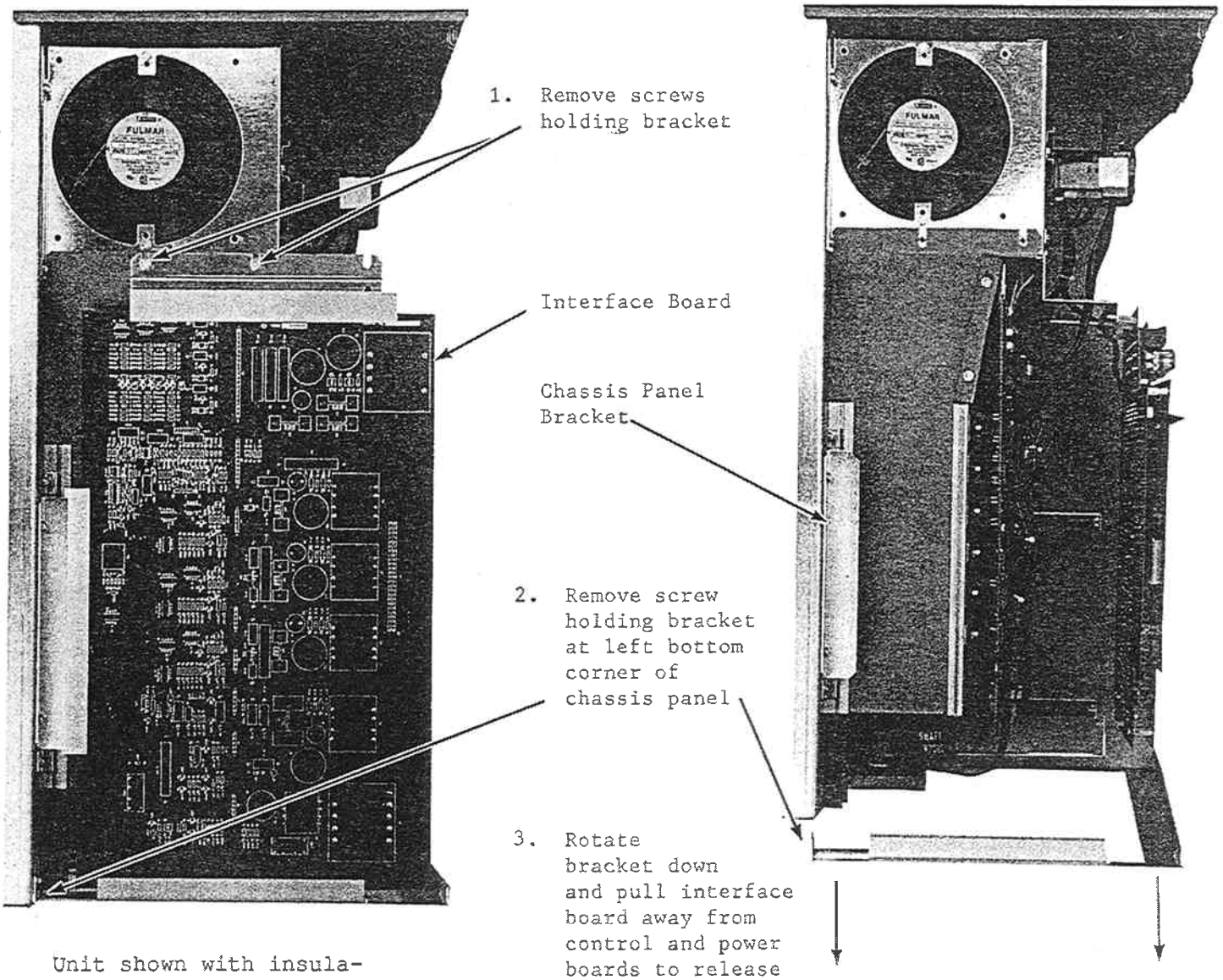


TRANSISTOR AND DIODE TESTING

6.8 1575 TROUBLESHOOTING FLOW CHART

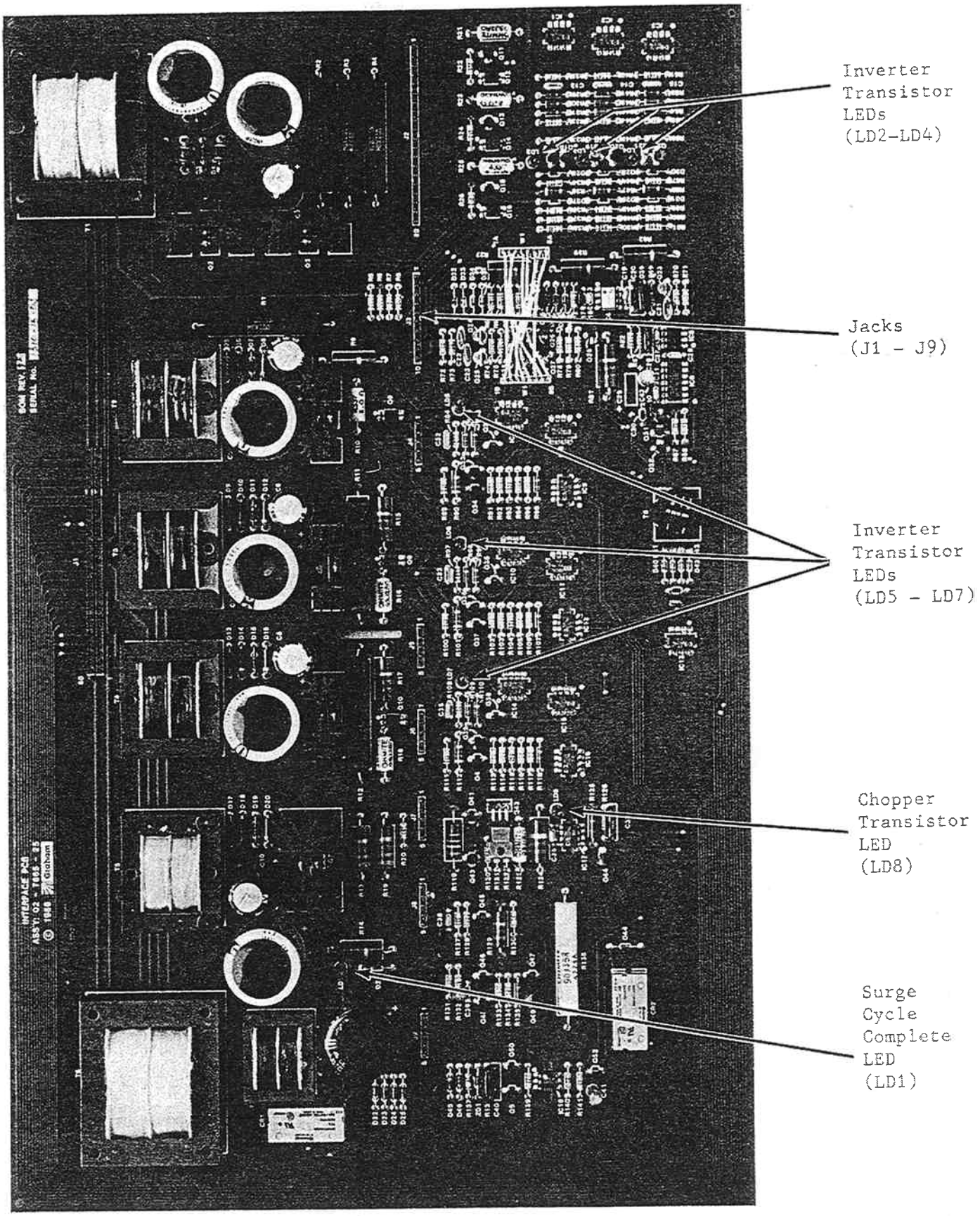


Interface Board Removal



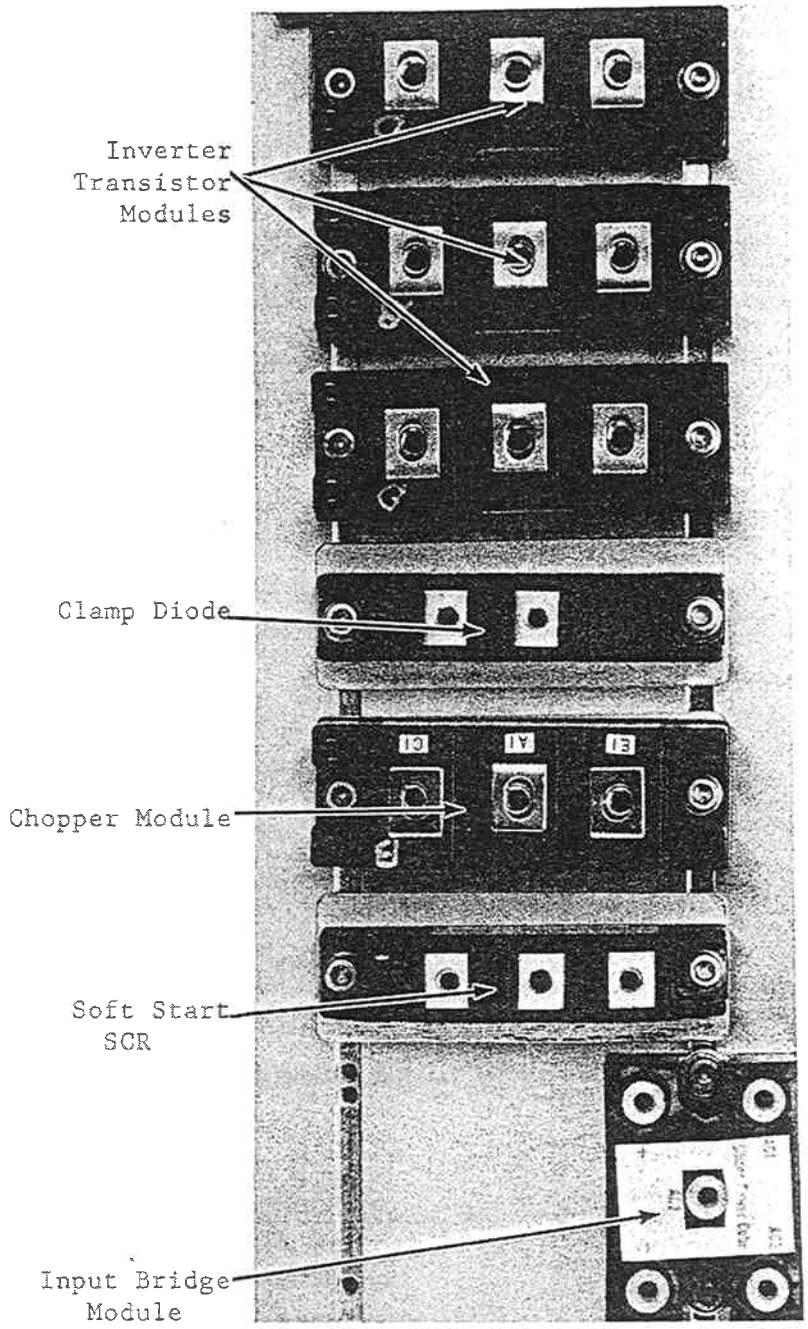
Typical 1575 Series - Viewed from Left Side

Figure 9



Typical Model 1575 Series Interface Board

Figure 10



Typical 1575 Series Power Modules
with Control Board and Power Board Removed
Figure 11

CIRCUITS UNLESS THE POWER LINE FEEDING THE BYPASS IS INTERRUPTED THRU THE CUSTOMER'S DISCONNECT SWITCH, WHICH IS EXTERNAL TO THE DRIVE. OPEN THE CUSTOMER PROVIDED POWER LINE DISCONNECT TO THE DRIVE WHEN WORKING INSIDE THE DRIVE ENCLOSURE.

7.2 BYPASS TRANSFER SWITCH

The BYPASS TRANSFER SWITCH is a three pole, three position rotary switch which is used as a means of interrupting, isolating and transferring the three phase motor leads from the output of the drive to the output of the customer's motor starter. The switch (multiple if the drive operates more than one motor) is labeled LINE-OFF-DRIVE.

In the LINE position, the motor is connected to the output of the motor starter. The motor will be run at base speed in this bypass mode. The drive will be isolated from the motor. Start/stop functions for the motor are provided thru the customer provided contacts and switches in series with the motor starter coil.

In the OFF position, all three phases of the motor are isolated from the output of the drive and the output of the customer's motor starter.

In the DRIVE position, the motor is connected to the output of the drive. Adjustable motor speed from the drive is now available from either the manual speed potentiometer or the automatic reference signal follower circuit. The customer's motor starter is isolated from the motor.

A two pole contact block on the TRANSFER SWITCH provides a stop/disable signal when the switch is in the LINE or OFF positions. This disables the drive control logic circuits. In the DRIVE position, the drive control logic and the drive RUN circuits are enabled.

⚠ DANGER

POWER IS PRESENT INSIDE THE DRIVE ENCLOSURE THRU THE BYPASS CIRCUITRY WHEN THE DRIVE INPUT DISCONNECT SWITCH IS IN THE OFF POSITION. OPEN THE CUSTOMER PROVIDED POWER LINE DISCONNECTS TO THE DRIVE WHEN WORKING INSIDE THE DRIVE ENCLOSURE.

7.3 MANUAL CONTACTOR BYPASS

The Manual Contactor Bypass is a means of interrupting, isolating and transferring the motor leads from the output of the drive to the AC line. The bypass consists of a motor starter in parallel with the drive and a contactor on the output of the drive. The operation of the motor starter and contactor are controlled thru the switches on the front of the enclosure labeled DRIVE/LINE and OFF-RESET/ON and thru customer contacts connected to TB3-12 and F3.

The DRIVE/LINE switch selects between the motor being connected to the drive, for adjustable speed operation, and to the AC line for fixed speed operation from the AC line. To actually apply power to the motor in either case, the OFF-RESET/ON switch must be in the ON position.

To operate the motor in a adjustable speed mode, switch the DRIVE/LINE switch to the DRIVE position and switch the OFF-RESET/ON switch to the ON position. This will connect the motor to the output of the drive and isolate the motor from the AC line. After a 4 minute time delay (provided to allow the motor to come to rest from previous operation), the standard drive operations will be enabled. Adjustable speed control of the motor will be available thru the operator controls on the front of the drive. The drive can also be started and stopped thru the customer contacts connected to TB3-12 and F3. The LOAD TRANSFERRED TO LINE pilot light will be off when in the DRIVE position.

To disable the start and run operation of the drive and the bypass motor starter, switch the OFF-RESET/ON switch to the OFF-RESET position. In the OFF-RESET position, the drive output contactor and the bypass motor starter are disabled therefore the motor is isolated from both power sources. This position is also used to reset the bypass logic when going from LINE to DRIVE operation.

To operate the motor with the constant speed bypass, switch the DRIVE/LINE switch to the LINE position and switch the OFF-RESET/ON switch to the ON position. This selection will connect the motor to the AC line and disconnect the motor from the output of the drive. Start and stop control of the motor starter is obtained through the OFF-RESET/ON switch and by using customer contacts connected to terminal strip TB3-12 and F3. The LOAD TRANSFERRED TO LINE pilot light will be on when the motor starter is energized.

⚠ DANGER

POWER IS PRESENT INSIDE THE DRIVE ENCLOSURE EVEN WHEN THE SWITCHES ARE IN THE LINE AND OFF-RESET POSITIONS. OPEN THE CUSTOMER PROVIDED POWER LINE DISCONNECTS TO THE DRIVE WHEN WORKING INSIDE THE DRIVE ENCLOSURE.

7.4 AUTOMATIC CONTACTOR BYPASS

All of the features present in the MANUAL CONTACTOR BYPASS are included in the AUTOMATIC CONTACTOR BYPASS, and the operation is the same for both, except in cases of a drive fault condition. If a drive fault condition occurs, the AUTOMATIC CONTACTOR BYPASS will automatically transfer the motor from output of of the drive to the AC line after a five minute time delay. This automatic transfer will place the motor in a full speed running mode. The LOAD TRANSFERRED TO LINE pilot light will now be on.

In cases of an automatic transfer, the motor can be reconnected to the drive output by clearing the drive fault, switching the OFF/RESET/ON switch to OFF/RESET and switching the OFF/RESET/ON switch to ON. The drive will provide adjustable speed operation after a four minute time delay. This delay allows the motor to come to rest before the restart.

⚠ DANGER

POWER IS PRESENT INSIDE THE DRIVE ENCLOSURE EVEN WHEN THE SWITCHES ARE IN THE LINE AND OFF-RESET POSITIONS. BECAUSE OF THE AUTOMATIC NATURE OF THE TRANSFER AND THE TIME DELAYS INVOLVED, POWER TRANSFERS CAN TAKE PLACE WITHOUT MANUALLY OPERATING A SWITCH. OPEN THE CUSTOMER PROVIDED DISCONNECT TO THE DRIVE WHEN WORKING INSIDE THE DRIVE ENCLOSURE.

8. PRESSURE-TO-ELECTRICAL TRANSDUCER

When specified, a pressure-to-electrical transducer is supplied to control the speed of the drive. This is commonly accomplished by using a 3 to 15 psi pressure signal. 3 psi corresponds to minimum speed and 15 psi corresponds to maximum speed. The pressure signal should be connected to the port marked "P1".