Unitron
Incorporated

MAINTENANCE MANUAL
for
MODEL GFC–25M PWR-KART™
FREQUENCY CONVERTER
P/N 195–39000–58

This manual supersedes
Maintenance Manual
P/N 195–39000–58
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for
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PREFACE

1. GENERAL

This publication is essentially divided into two parts:

a. Installation and Operation instructions are provided in Sections I through III. These sections contain an overview of the frequency converter featured herein, specifications for the unit, installation instructions, operating instructions, and a discussion of the operational controls and indicators.

b. Maintenance information is provided in Sections IV through VIII. These sections contain theory of operation, troubleshooting instructions, illustrated parts breakdown, schematics, and recommended spare parts.

NOTE

When assistance of any type is desired by the customer, from Unitron, locate the Identification Plate (Figure 6–1) and note the PART NUMBER and SERIAL NUMBER. *You must have this information available when calling Unitron for assistance.*

Unitron Incorporated
ATTN: Customer Service Dept.
10925 Miller Road
Dallas, Texas 75238
Phone: (800) 527-1279
(214) 340-8600
Fax: (214) 341-2099

2. HOW TO USE THIS MANUAL

a. All personnel, both operating and maintenance, should read completely through Sections I through III so they may become familiar with the general capabilities of the frequency converter, how to turn the unit on and off, and with the purpose and use of each control and indicator.

b. Maintenance personnel, after becoming familiar with the information in Sections I through III, should read through Sections IV and V and scan the contents of Sections VI and VII before accessing the interior of the frequency converter or attempting repair of the unit. This manual should be kept at hand for frequent reference

while performing maintenance on the unit.

3. SAFETY

To prevent possible injury to personnel and/or damage to the equipment, the following safety guidelines must be observed.

a. Be familiar with the contents of this manual.

b. Always be aware of the hazards of working with high voltage equipment. Remember that potentially lethal voltages may be present within the frequency converter even when power has been removed from the unit.

c. Always ensure that the control panel access door is securely shut when operating the unit. Only trained maintenance personnel should ever access the interior of the unit.

d. Always follow all standard safety practices and procedures.

e. Never indiscriminately touch or probe internal components of the unit.

f. If you are not sure, ASK. Above all else, USE COMMON SENSE.

4. WARNING, CAUTION AND NOTE ADVISORIES

Throughout this publication, advisory information is provided in the following forms:

WARNING

Warning messages indicate when a specific procedure or practice is not followed correctly, personal injury could result. It may warn of hazardous conditions. Warning messages appear in bold faced type.

CAUTION

Caution messages indicate procedures or practices which, if not followed, could result in damage to the equipment. Caution messages appear in italics.

NOTE

Notes contain important information set off from the text. Special attention should be paid to this information. Notes appear in plain but distinctive type.

SECTION I
GENERAL INFORMATION

1.1 SCOPE

This manual provides installation and operation information for the GFC series mobile Pwr-Kart frequency converter. The manual is written and provided with the understanding that the user is fully cognizant of the fact that dangerously high levels of voltage are present within the frequency converter and, therefore, only fully qualified equipment maintenance personnel should access the interior of the unit.

1.2 PURPOSE OF EQUIPMENT

The Pwr-Kart frequency converter changes 60 Hz, 3-phase input power into regulated 400 Hz, 3-phase, 115/200 VAC output power. Refer to Table 1–1 of this manual, or to the nameplate located on the back of the unit, for specific input voltage requirements.

1.3 ELECTRICAL, ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS

The specifications for the Pwr-Kart are provided in Table 1–1.

1.4 STANDARD FEATURES

The following features are standard in all Pwr-Kart frequency converters.

1. *Unit Control.* See Section III, Figure 3–1 and Table 3–1.

   a. Unit Control READY indicator. This indicator, when illuminated, indicates that input power is applied to the frequency converter.

   b. Unit Control ON pushbutton switch. This switch controls the input contactor of the frequency converter. Pressing the switch in starts the unit and places it in a standby operational status; the ON indicator illuminates.

   c. Unit Control OFF pushbutton switch. Pressing this switch opens the input contactor and removes power from the unit; the ON indicator extinguishes. The READY indicator will remain illuminated as long as external input power is available to the frequency converter.

2. *Input Power Cable.* A 100 foot input power cable is provided with the Pwr-Kart. The service end of the cable is unterminated so as to permit the user to configure the cable to facility requirements. Unitron Incorporated does not specify user-furnished wiring or connectors due to differing codes throughout the world. All wiring and connectors must be in accordance with the National Electrical Code (or the equivalent) and prevailing local codes. See also Section II, paragraph 2.1, step 1.

3. *Output Power Cable.* Each output power cable (dual output optional) is 30 feet long and terminates in an aircraft industry standard connector (MS90328). Each cable is suitable for connecting 400 Hz power directly to the aircraft and is equipped with 4 power wires and 2 control wires for a 28 Vdc safety signal. The pin out for the load connectors is as follows:

   Pin A ..... Phase A
   Pin B ..... Phase B
   Pin C ..... Phase C
   Pin D ..... Grounded Neutral
   Pin E .. 28 VDC Safety Signal (out)
   Pin F ... 28 VDC Safety Signal (in)

4. *Output Control.* The Output Control controls and indicators provide for operation of the unit in either a REMOTE (automatic) or LOCAL (manual) mode. This permits the user to start up the frequency converter (in standby) and then control the output power from either the unit or from the aircraft. See Section III.

5. *Standard Circuits.* Each Pwr-Kart is equipped with the following standard enhancement circuits.

   a. Soft Start Circuit. A soft start circuit is provided to reduce the initial surge current required to charge the internal capacitors.

   b. Automatic Line Drop Compensation Circuit. This circuit permits the selection of up to 5 percent compensation for drops in the output load line. It is preset at the factory to insure optimum operation.

   c. Protection Circuits:
      - Input over/under voltage
      - Loss of phase
      - Input overcurrent
      - Output over/under voltage
      - Overload
      - Short circuit
      - Overtemperature

1.5 SPECIFIC OPTIONS

The GFC mobile frequency converter described in this manual is a standard Pwr-Kart with input contactor, single output contactor, and the Alternate Input Voltage (T–3) option. The unit is equipped with an input transformer that permits the frequency converter to operate on 208V input power from the facility service (utility). The transformer steps the input power to the 480V required for operation of the frequency converter.

1.6 OPTIONAL FEATURES

Built In Test Equipment. A BITE board is optionally available for installation as an accessory. The BITE board contains a non-volatile memory latch circuit that retains fault information even if input power is removed. This fault information is indicated by status indicators located on the BITE board. This status information is used to aid in rapidly isolating a malfunction to a replaceable part or assembly so as to facilitate troubleshooting.

1.7 SAFETY AND SECURITY FEATURES

The Pwr-Kart series of frequency converters has been designed with safety, both of operating and maintenance personnel and of equipment, foremost in mind. Proper security of the equipment to prevent unauthorized tampering or unintentional changes in the operational status of the unit has also been considered. Some of these features are:

1. Unit Control ON switch is protected by a transparent cover that can be padlocked.

2. Access door can be padlocked.

3. In the REMOTE operating mode, the safety interlock circuit must be enabled (circuit completed) before output cable(s) can be energized.

4. Front panel indicators prominently display operational status of unit.

5. Oversized, mushroom type, pushbutton switch provides for emergency shut down.

6. 18″ hazard area clearance.

7. Audible summary alarm alerts to fault condition.

8. Maintenance (bypass) capability.

9. Access door safety interlock.

10. Internal DC link voltage meter indicates *SAFE* and *DANGER* levels.

1.8 COMPLEMENTING SERVICES

Unitron considers proper upkeep and maintenance of the frequency converter to be your best insurance against unscheduled downtime. Therefore, the services outlined below are offered on an individual basis. For further information regarding any of these services, please contact:

Unitron Incorporated
ATTN: Customer Service Dept.
10925 Miller Road
Dallas, Texas 75238
Phone: (800) 527-1279
(214) 340-8600
Fax: (214) 341-2099

1.8.1 Maintenance Training Courses

To ensure that our customers derive maximum benefit from their Pwr-Kart frequency converter, Unitron offers a variety of training classes tailored to specific interests and requirements.

Maintenance classes can be presented either at the Unitron factory or at the customer's site.

1.8.2 Continuing Maintenance Program

Unitron offers a continuing maintenance program available throughout the continental United States. This program, in effect, extends the warranty on your Unitron equipment and assures prompt and complete maintenance assistance when required.

1.8.3 Spare Parts

To facilitate service on your frequency converter, it is recommended that a stock of spare parts be maintained on-site. A spares stock ensures immediate parts availability and helps reduce system downtime. Unitron can supply any of several recommended levels of spares to meet each customer's specific requirements. Please see Section VIII of the Maintenance Manual for a listing of recommended spares for this unit.

FIGURE 1–1. TYPICAL PWR–KART™ FREQUENCY CONVERTER.

Table 1–1. General Specifications for Part Number 195–39000–58

Input:

Voltage	208 VRMS ± 10%, 3-phase, 3 wire plus ground
Frequency	60 Hz ± 10%
Phase Rotation	Any
Protection	Over/Undervoltage, Loss of Phase, Over Current
Starting Current	Soft start circuit limits peak input starting current to less than the 150% peak full-load steady state input current.
Input Current at Rated Load*	65 amperes at nominal input voltage. 72 amperes at low line (–10%) voltage. *Does not consider overload conditions.
Input Power Cable	100 foot input power cable supplied as part of the unit.

Output:

Voltage	115/200 VRMS, 3-phase, 4 wire, grounded neutral
Voltage Regulation	±1% under all conditions of line, balanced load and temperature; ±3% under 50% unbalanced load; ±5% under 100% unbalanced load.
Automatic Line Drop Compensation	0 – 5% selectable
Frequency Regulation	400 Hz ±1% under all conditions of line, load and temperature.
Harmonic Distortion	3% maximum

Table 1–1. General Specifications (continued)

Output (continued):

Phase Angle Regulation	120° ± 2° for balanced loads; ± 4° for unbalanced loads.
Phase Rotation	Clockwise sequence of AB–BC–CA.
Overload	175% for 5 minutes; 300% for 20 seconds.
Power Rating	25 kVA at 0.8 pf lagging
Output Current at Nominal Input Voltage and Rated Load	72 amperes
Output Power Cable	Output power cable, with 28 VDC safety control and aircraft industry standard connector, MS90328, supplied as part of the unit.
Protection	Over/under voltage, overload, short circuit, thermal switch on heatsink

Mechanical/Environmental:

Weight	Approximately 700 pounds depending on options selected, exclusive of cables.
Cooling	Forced air
Construction	Indoor/outdoor environment
Clearance	18″ hazard area clearance
Operating Temperature	–40°C to +55°C (–40°F to +131°F)

Monitoring/Controls:

Meters/Controls/Indicators	See Figure 3–1 and Table 3–1.

SECTION II
INSTALLATION

2.1 INSTALLATION

Installation of the Pwr-Kart Frequency Converter with input power cable and output power cable is simplified to the following tasks.

1. Since the input power cable A42 is normally supplied with the service end unterminated, it is necessary for the user to provide and install an appropriate connector compatible with facility electrical requirements.

   The four wire cable, is color coded as:

   Green wire ..... Ground
   Black wire ..... Phase A
   Red wire ..... Phase B
   White or Tan wire ..... Phase C

   Unitron Incorporated does not specify user-furnished wiring or connectors due to differing electrical codes throughout the world. All cable sizing and connectors must be in accordance with the National Electrical Code (or equivalent) and prevailing local codes.

   Manufacturers of appropriate connectors for the input power cable include, but are not limited to:

   Appleton Electric Co.
   1701 W. Wellington Ave.
   Chicago, IL 60657

   Cooper Industries Inc.
   Crouse-Hinds Electrical
   Construction Materials
   Route 4, Box 156
   LaGrange, NC 28551-9804

   Hubbell Harvey Inc.
   584 Derby Milford Road
   Orange, CT 06477-2204

   Refer to Section I, Table 1–1 for input power specifications.

2. With an appropriate connector properly installed, connect the input cable to the 60 Hz, 3-phase power source of the specified voltage as denoted in Table 1–1 or on the equipment nameplate located on the back of the unit.

3. When ready for use, position the Pwr-Kart within range (30 or 60 feet, depending on cable length) of the load connector. See Section III for proper connection to the load and operation of the frequency converter.

2.2 INSTALLATION OF INPUT POWER CABLE

The frequency converter is routinely shipped with the input power cable installed. However, in the instance that it is ever necessary for the user to install or replace the cable, the following guidance is provided. (See paragraph 5.4.8 of the Maintenance Manual for more detailed instructions.)

1. Ensure that all power is removed from the frequency converter.

WARNING

The input power cable *MUST NOT* be connected to the service input power during cable installation.

2. Remove the back protective panel to provide access to the options enclosure.

3. Install the large threaded end of the cord grips in the opening in the options enclosure that is labeled INPUT (upper left side of enclosure). Secure the cord grips with locknuts.

4. Slide the remaining part of the cord grips onto the input cable.

5. Install the lugged end of the input cable through the INPUT opening and secure the two parts of the cord grips.

6. Securely connect the cable wires to ground and XF5 terminals (at the top of the input fuses) as indicated.

Green wire	Ground
Black wire	Phase A
Red wire	Phase B
White or Tan wire	Phase C

7. Replace the options enclosure protective panel and secure.

2.3 INSTALLATION OF OUTPUT POWER CABLE

The frequency converter is routinely shipped with the output power cable (or, with Dual Output, both output power cables) installed. However, in the event that it is ever necessary for the user to install or replace an output cable, the following guidance is provided. (See paragraph 5.4.9 of the Maintenance Manual for more detailed instructions.)

1. Ensure that all power is removed from the frequency converter.

2. Remove the back protective panel to provide access to the options enclosure.

NOTE

For single output capability, Output No. 1 is always used. When dual output is involved both Output No. 1 and Output No. 2 are used. Instructions are applicable to both connections.

3. Install the large threaded end of the cord grips onto the applicable options enclosure opening (labeled Output No. 1 or Output No. 2). Secure with locknuts. The Output No. 1 opening is

at the top right of the enclosure; the Output No. 2 opening is in the top center of the enclosure.

4. Slide the remaining part of the cord grips onto the output cable being installed.

5. Install the lugged end of the output cable through the appropriate opening and secure the two parts of the cord grips.

6. When installing the output cable to Output No. 1, connections are made to terminal block TB2. If installing the output cable to Output No. 2, connections are made to terminal block TB3.

7. Securely connect the output cable wires as follows:

Phase A	Terminal A
Phase B	Terminal B
Phase C	Terminal C
Grounded neutral	Terminal N
28 VDC (output) signal wire	Terminal E
28 VDC (input) signal wire	Terminal F

8. Replace the options enclosure protective panel and secure.

2.4 LINE DROP COMPENSATION ADJUSTMENT

2.4.1 Units With Factory Installed Output Power Cable(s)

For units with factory installed output power cable(s), the line drop compensation control has been properly adjusted to compensate for the voltage drop in the cable. The line drop compensation circuit maintains the 115/200V (±1%) output voltage at the end of the cable under a no load to full load condition.

2.4.2 Units Using Customer Installed Output Power Cable(s)

For units using customer installed output power cable(s), the line drop compensation control (located inside the frequency converter) must be adjusted as required to compensate for the voltage drop in the output power cable. This adjustment should be made at the time of installation as follows:

1. Open the frequency converter access door(s). Pull the door interlock switches (if so equipped) to the override position.

WARNING

Lethal voltages are present within the frequency converter with input power applied. The following procedure should be performed by experienced maintenance personnel.

2. Perform the operating procedures provided in Section III.

3. Apply a normal load to the unit.

4. Adjust the internal line drop compensation control (refer to Figure 3–1 and Table 3–1 to locate this control) for the desired voltage at the load.

5. Turn the unit off as described in the procedures provided in Section III.

6. Close the frequency converter access door(s).

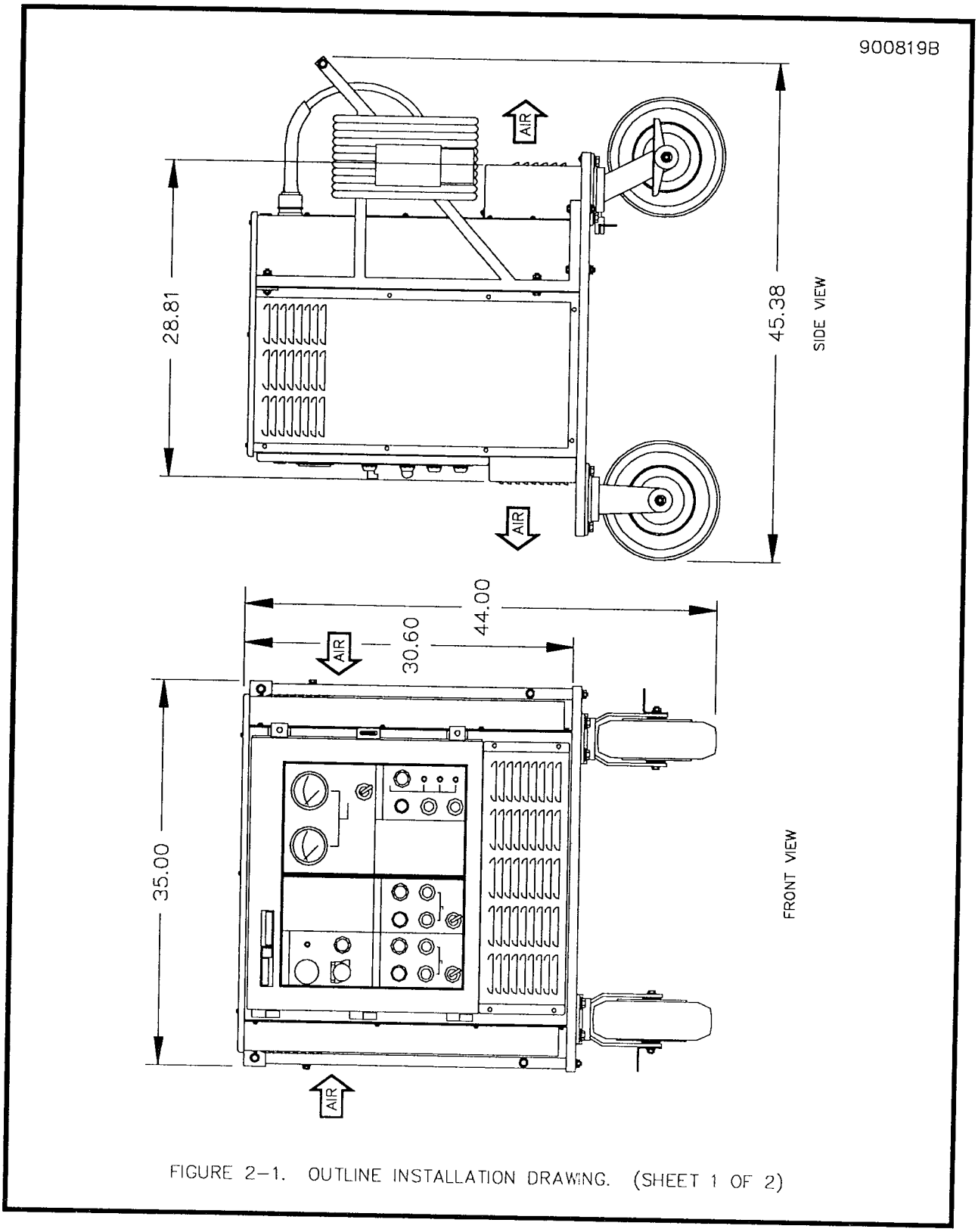

FIGURE 2–1. OUTLINE INSTALLATION DRAWING. (SHEET 1 OF 2)

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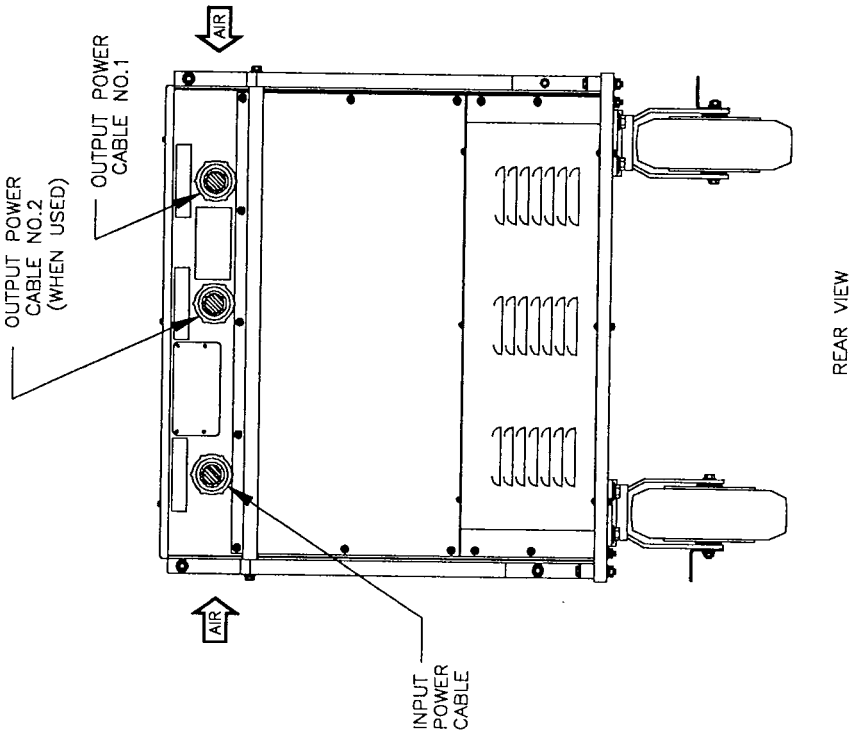

FIGURE 2-1. OUTLINE INSTALLATION DRAWING (SHEET 2 OF 2)

SECTION III
OPERATING PROCEDURES

3.1 GENERAL

This section contains the following information:

1. Equipment setup procedures.
2. Equipment start up procedures.
3. Normal equipment turn-off (shutdown) procedures.
4. Emergency equipment turn-off (shutdown) procedures.
5. A description of each operator control and indicator.

3.2 EQUIPMENT SETUP PROCEDURES

Before attempting to apply power to or start up the Pwr-Kart frequency converter, read completely through this section and compare the location and description of each operator control and indicator, as found in Figure 3–1 and Table 3–1, to the actual operator controls and indicators on the unit. Then read through the *Normal Operating Procedures* located on the unit front panel.

1. Ensure that the input power cable is properly connected to the service input and that the external circuit breaker or disconnect switch is opened so that no power is available to the frequency converter.
2. Ensure that the access door of the frequency converter is closed and secured.
3. The Voltage and Current Select Switch (Figure 3–1, Index 10) may be set to any position.

3.3 EQUIPMENT START UP PROCEDURES

NOTE

The following instructions are an expanded version of the *Normal Operating Procedures* located on the unit front panel.

1. Close the external circuit breaker or disconnect switch, thereby applying power to the input of the frequency converter. Confirm that the READY indicator (Figure 3–1, Index 1) illuminates.

NOTE

The green READY indicator indicates that power is being applied to the input of the frequency converter. If the READY indicator does not illuminate when external power is applied to the input of the frequency converter, run a "Lamp Test" (see Figure 3–1 and Table 3–1, Index 15). If the lamp test circuit is inoperable, the problem is with the input line; check the service input and correct as necessary.

2. Press the Unit Control ON pushbutton switch (Figure 3–1, Index 2). Confirm that the Unit Control ON indicator (Figure 3–1, Index 3) illuminates. The frequency converter is now operational; 400 Hz power is being applied to the output contactor of the unit.

WARNING

Hazardous voltages are now present within the frequency converter. Do not attempt to access the interior of the unit while power is applied.

NOTE

When the frequency converter is equipped with the Dual Output Option (C–4), OUTPUT CONTROL NO. 1 and OUTPUT CONTROL NO. 2 operate independently of each other. Either output may be operated in the REMOTE or the LOCAL mode. The following instructions are equally applicable to either output control except that on OUTPUT CONTROL NO. 2 the indexed controls and indicators are specified as 5A, 6A, 7A, 8A , 9A and 23A.

3. Select the Output Control mode of operation by turning the Selector Switch (Figure 3–1, Index 5) to REMOTE or LOCAL.

a. In the REMOTE (automatic) mode of operation, the output contactor automatically closes when the output power cable is connected to the aircraft or other load that supplies a 28 VDC safety interlock signal. In this mode of operation, the F lead of the output power cable is sensed for the presence of 28 VDC being supplied by the aircraft. When the 28 VDC signal appears on the F lead, the safety interlock circuit is enabled, the output contactor closes, the Output Control ON indicator (Figure 3–1, Index 8) illuminates, and 400 Hz power is supplied to the load. When the safety interlock circuit is interrupted (by loss of the 28 VDC signal), the output contactor opens; the Output Control ON indicator extinguishes. Restoration of the 28 VDC signal again enables the safety interlock circuit, and 400 Hz power is again supplied to the load. In this REMOTE mode, the operator can easily switch 400 Hz power from aircraft to aircraft without the necessity of powering up or powering down the frequency converter; dry line start capability is retained. Or, the operator can remotely energize and deenergize the aircraft and thus activate or remove 400 Hz power

by applying or removing the 28 VDC safety signal to the output power cable F control lead.

b. In the LOCAL (manual) mode of operation, the output power cable is first connected to the aircraft (load) so that a return 28 VDC safety signal will be available. With the output power cable connected to the load, press and hold in the Output Control ON switch (Figure 3–1, Index 6).

CAUTION

When the Output Control ON switch is pressed, the output contactor is closed; 400 Hz power is applied to the output cable; the cable is energized. The output cable remains "hot" until the output contactor is opened as indicated below.

(1) If the 28 VDC signal **is** returned to the frequency converter from the load, the safety interlock circuit is enabled, and the output contactor is "locked" closed; the Output Control ON indicator (Figure 3–1, Index 7) illuminates steadily and 400 Hz power is supplied to the aircraft. Release the ON switch.

(2) If the 28 VDC safety signal **is not** returned to the frequency converter within approximately 3 seconds, the safety interlock circuit is not enabled, and the output contactor opens, removing power to the output cable; the Output Control ON indicator (Figure 3–1, Index 7) begins flashing. Release the ON switch. Momentarily press the Output Control OFF switch (Figure 3–1, Index 8) to recycle the circuit. The Output Control ON indicator extinguishes. Check the connection between the output power cable and the aircraft. Try again to apply power to the load by pressing and holding the Output Control ON switch (Figure 3–1, Index 6).

NOTE

In the LOCAL mode of operation, if the output power cable is removed from the aircraft or the 28 VDC safety signal is otherwise interrupted, the frequency converter output contactor opens and output power to the cable is removed; the Output Control ON indicator begins flashing. The Output Control OFF switch must be pressed to recycle the output contactor circuit. If the output power cable is reinserted into the aircraft, the Output Control ON switch (Figure 3–1, Index 6) must again be pressed. With the cable properly connected to the aircraft, the frequency converter 400 Hz power to the load may be switched on and off by alternately pressing the Output Control ON (Figure 3–1, Index 6) and OFF (Figure 3–1, Index 8) switches.

3.4 NORMAL EQUIPMENT TURN-OFF (SHUTDOWN) PROCEDURES

1. If operating in the LOCAL mode, press the Output Control OFF switch (Figure 3–1, Index 8) to open the output contactor. If in the REMOTE

mode, disconnect the output power cable from the load. The Output Control ON indicator (Figure 3–1, Index 7) extinguishes. Power is removed from the load.

2. Press the Unit Control OFF switch (Figure 3–1, Index 4). The Unit Control ON indicator (Figure 3–1, Index 3) extinguishes. Unit Control READY indicator (Figure 3–1, Index 1) remains illuminated.

3. Open the external input power circuit breaker or disconnect switch to remove power to the frequency converter. The Unit Control READY indicator (Figure 3–1, Index 1) extinguishes. Shutdown is complete.

3.5 EMERGENCY EQUIPMENT TURN-OFF (SHUTDOWN) PROCEDURES

1. Press the Unit Control OFF switch (Figure 3–1, Index 4). The Unit Control ON indicator (Figure 3–1, Index 3) extinguishes; the Unit Control READY indicator (Figure 3–1, Index 1) remains illuminated.

2. Open the external input power circuit breaker or disconnect switch. Unit Control READY indicator (Figure 3–1, Index 1) extinguishes.

NOTE

It is recommended that the power cables be disconnected and stowed when the frequency converter is not in use.

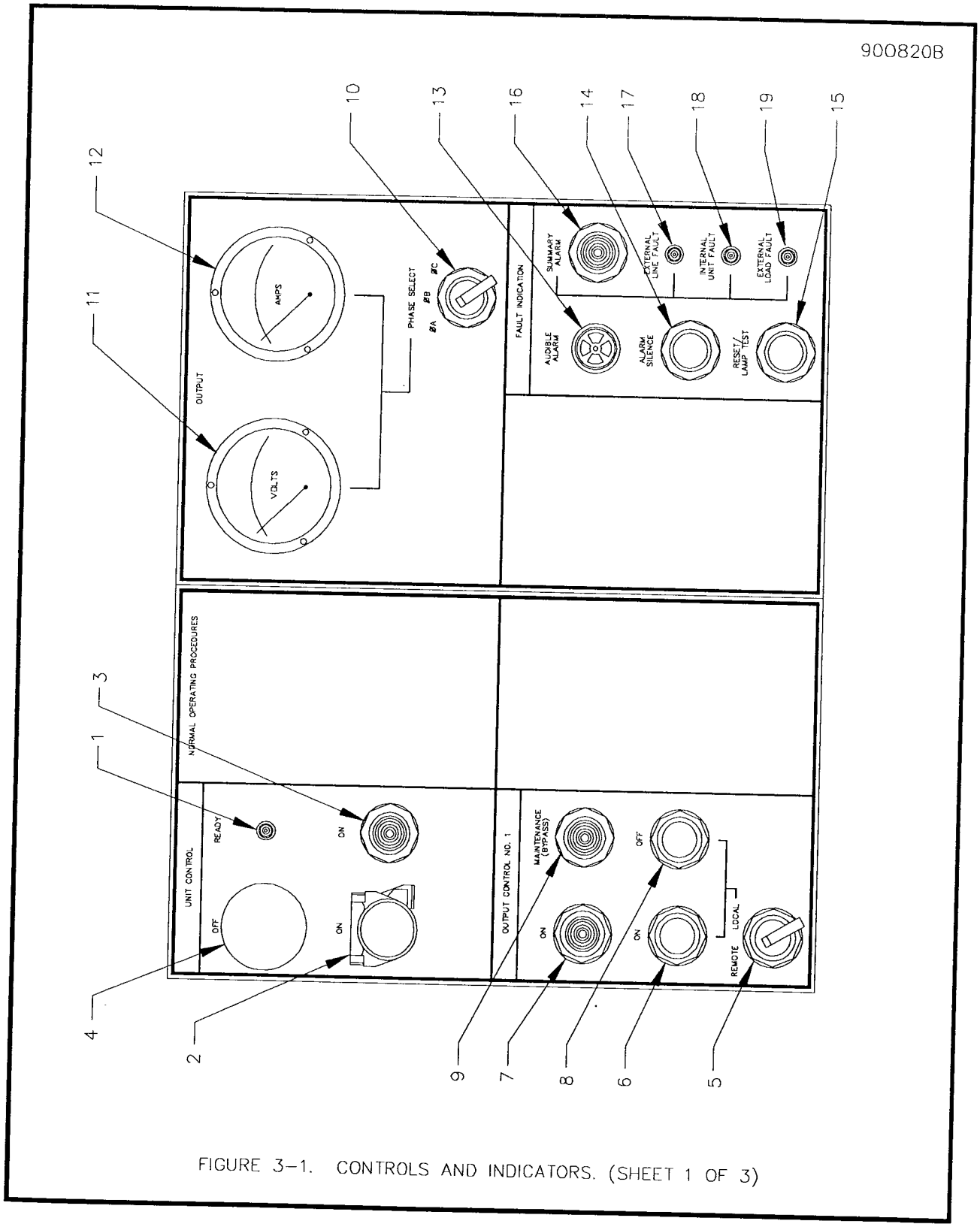

FIGURE 3–1. CONTROLS AND INDICATORS. (SHEET 1 OF 3)

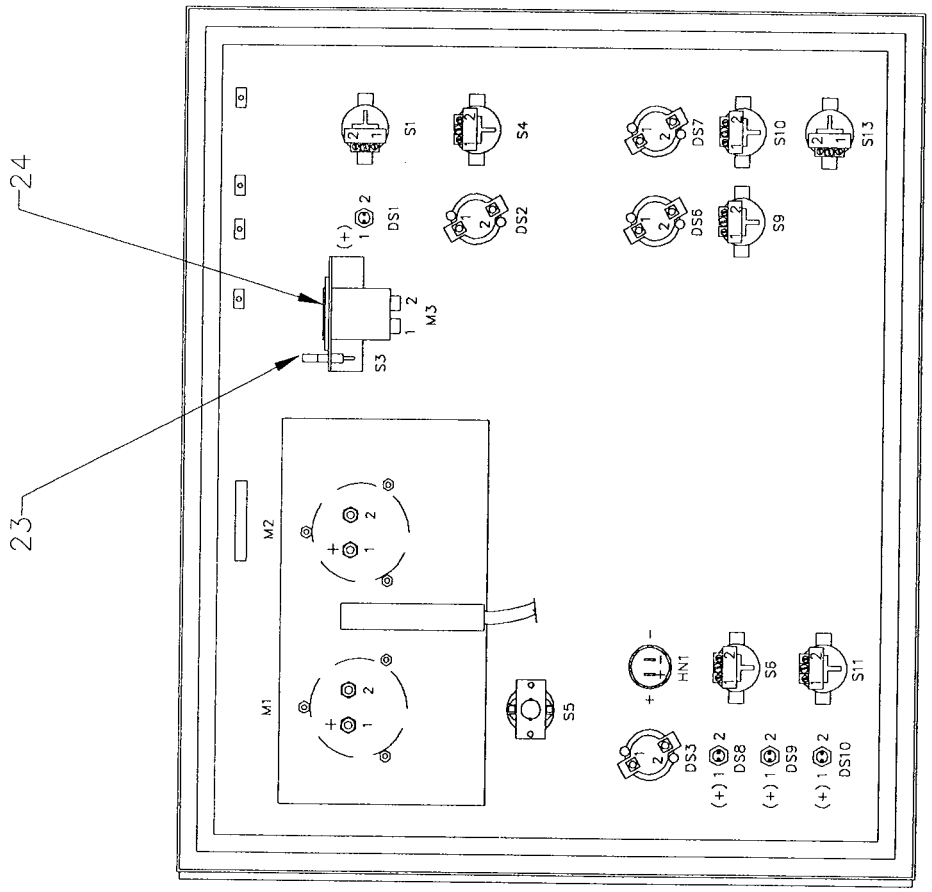

FIGURE 3–1. CONTROLS AND INDICATORS. (SHEET 2)

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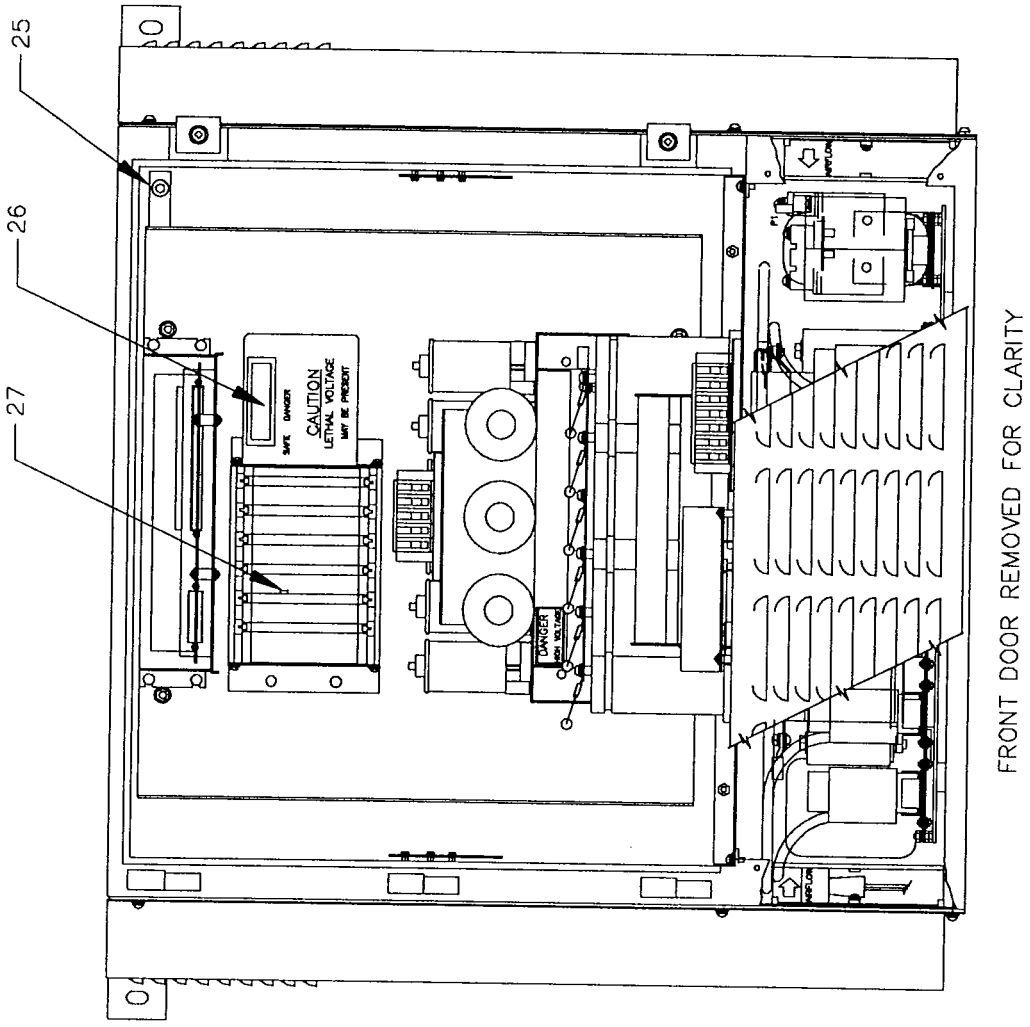


FIGURE 3–1. CONTROLS AND INDICATORS (SHEET 3)

Table 3–1. Controls and Indicators

Fig. 3–1 Index #	Control/ Indicator	Description
1	READY Indicator	This green indicator illuminates when power is applied to the input cable of the frequency converter. It signifies that input power is available to operate the unit. Input power is applied to the front panel logic circuitry. *CAUTION* *If the READY indicator does not illuminate when input power is applied to the unit, press the RESET/LAMP TEST switch (Index 15) to determine if all indicators are operational; replace indicators, as necessary. If the RESET/LAMP TEST circuit is inoperable, the problem is external to the frequency converter. Correct the service input.*
2	Unit Control ON Switch	This pushbutton switch closes the input contactor and activates the frequency converter. The inverter is turned on, and 400 Hz power is applied to the output contactor. To prevent accidental powering up of the unit, this switch is protected by a clear plastic, hinged cover. The cover can be padlocked.
3	Unit Control ON Indicator	This green Unit Control ON indicator alerts the operator that the unit is operational; 400 Hz power is being generated internally. *Hazardous voltages are present within the frequency converter.*
4	Unit Control OFF Switch	This mushroom pushbutton switch opens the input contactor and turns the unit off. It removes power from the inverter and therefore from the output contactor. The Unit Control ON indicator will extinguish. The READY indicator will remain illuminated indicating that utility power is still available to the frequency converter.

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
		NOTE For units equipped with the Dual Output option, OUTPUT CONTROL NO. 1 and OUTPUT CONTROL NO. 2 operate independently of each other. Controls and indicators for OUTPUT CONTROL NO. 1 are numbered 5 through 9, and 23; for OUTPUT CONTROL NO. 2 they are numbered 5A through 9A, and 23A. Corresponding index numbers, i.e., 5 and 5A or 6 and 6A, serve the same role for the respective Output Control. For example, Index 5A performs the same function for OUTPUT CONTROL NO. 2 that Index 5 performs for OUTPUT CONTROL NO. 1.
5 or 5A	Output Control Selector Switch	This self-indicating, two position switch permits the operator to select the mode of operation, REMOTE or LOCAL, of the output contactor. In the REMOTE (automatic) mode, the output contactor automatically closes when the output power cable is connected to the aircraft (load) and a 28 VDC signal is returned to the frequency converter through the F control lead of the cable. This 28 VDC signal enables the safety interlock circuit of the unit; the output contactor closes and 400 Hz power is supplied to the aircraft. In this mode of operation, the output power cable may be disconnected from the load and then either reconnected or connected to another aircraft without the necessity of powering down or powering up the frequency converter. Dry-line start capability (no power is present within the output cable until connection to the load is completed and the safety interlock circuit enabled) is retained. The operator may also remotely control power to the aircraft (by energizing/deenergizing the cable) by applying or removing the 28 VDC signal along the F control lead. The LOCAL (manual) mode of operation requires the operator to press the Output Control ON switch (see Index 6 below) to close the output contactor and energize the output power cable. The output cable must

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
5 or 5A	Output Control Selector Switch *(continued)*	be connected to a source supplying (or returning) a 28 VDC signal. When the ON switch is pressed and held, the unit senses the F control lead for the 28 VDC; if the 28 VDC signal is identified, the safety interlock circuit is enabled, the output contactor remains closed and 400 Hz power is supplied to the aircraft through the power cable; the Output Control ON indicator (Index 7) illuminates steadily. If the 28 VDC signal is not returned within approximately 3 seconds, the safety interlock circuit is not enabled and the output contactor opens; the Output Control ON indicator begins flashing. Interruption of the 28 VDC signal opens the output contactor (causing the Output Control ON indicator to flash) which must then be closed again (if desired) by pressing the ON switch <u>after</u> pressing the Output Control OFF switch (Index 8) to recycle the circuit. The advantage of this mode of operation is that it permits the operator to supply power to the aircraft, remove it, and reapply it as often as necessary by alternately pressing the Output Control ON and OFF buttons on the frequency converter front panel. *CAUTION* *When operating in the LOCAL mode, the output cable is energized whenever the output contactor is closed. This includes during the approximate three-second time frame the output control circuit searches for the 28 VDC signal on the F lead.*
6 or 6A	Output Control ON Switch	This pushbutton switch is used only in the LOCAL mode of operation or when the unit is in Maintenance (Bypass) ON mode (see Index 9 and 23). Pressing and holding the ON switch closes the output contactor and energizes the output power cable; this causes the unit to sense the F control lead for a 28 VDC signal being returned from the aircraft (load). If the 28 VDC signal is received, the safety interlock circuit is enabled, the output contactor remains closed, and 400 Hz power is supplied through the output power cable to the air-

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
6 or 6A	Output Control ON Switch *(continued)*	craft; the Output Control ON indicator (Index 7) illuminates steadily; release the ON switch. If the 28 VDC signal is not returned within approximately 3 seconds, the safety interlock circuit is not enabled and the output contactor opens; the Output Control ON indicator begins flashing; release the ON switch. In this later instance, it is necessary to press the Output Control OFF Switch (Index 8) and attempt to reactivate the output cable by again pressing the On switch. This switch is disabled in the Maintenance (Bypass) OFF mode.
7 or 7A	Output Control ON Indicator	This green indicator illuminates (steady light) when the output contactor is closed and the output power cable is energized. In the LOCAL mode of operation, this indicator will flash, indicating the output contactor has opened, when a 28 VDC signal is not returned on the F control lead within about 3 seconds of pressing the Output Control ON Switch (Index 6), or if the 28 VDC signal is interrupted. Whenever the indicator is flashing, the output contactor circuitry must be recycled by pressing the Output Control OFF Switch (Index 8).
8 or 8A	Output Control OFF Switch	This pushbutton switch is used only in the LOCAL mode of operation or in the Maintenance (Bypass) ON mode. Momentarily pressing this switch opens the output contactor, removing power to the load; it recycles the output contactor circuitry. This switch is disabled in the Maintenance (Bypass) OFF mode.
9 or 9A	MAINTENANCE (BYPASS) Indicator	This red indicator operates in conjunction with the internal Maintenance (Bypass) selector switch (see Index 23). When the selector switch is in the NORMAL position, this indicator remains extinguished. When the selector switch is in the OFF position, the indicator illuminates (steady light). When the selector switch is in the ON position, the indicator flashes.

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
10	PHASE SELECT ØA, ØB, ØC Voltage and Current Select Switch	This self-indicating, 3 position rotary switch connects the Output Voltmeter (Index 11) and Output Ammeter (Index 12) to the output ØA, ØB, ØC. The voltmeter indicates the 400 Hz output line-to-neutral voltage of the selected phase. The output ammeter indicates the 400 Hz output current.
11	Output Voltmeter	The Output Voltmeter indicates the 400 Hz output line-to-neutral voltage. The phase being monitored is controlled by the PHASE SELECT ØA, ØB, ØC select switch (Index 10).
12	Output Ammeter	The Output Ammeter indicates the 400 Hz output line current in amperes. The output line being monitored is controlled by the PHASE SELECT ØA, ØB, ØC select switch (Index 10).
13	AUDIBLE ALARM	The AUDIBLE ALARM is a summary alarm. It is activated for several seconds during initial powering up to verify proper operation. After initial turn on of the frequency converter, the alarm will sound (and the Summary Alarm indicator, Index 16, will illuminate) if any of the following conditions occur: a. External Line Fault (see Index 17). b. Internal Unit Fault (see Index 18). c. External Load Fault (see Index 19). The AUDIBLE ALARM can be silenced by momentarily pressing the ALARM SILENCE switch (Index 14).

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
14	ALARM SILENCE Switch	The ALARM SILENCE pushbutton switch permits the operator to silence the AUDIBLE ALARM (Index 13).
15	RESET/LAMP TEST Switch	This pushbutton switch resets the protection circuits. If the SUMMARY ALARM and other indicators are illuminated, indicating a fault condition, pressing this switch will recycle the logic circuits, and test and then extinguish the indicators; the frequency converter will attempt to restart. However, if the fault condition still exists, the indicators will again illuminate. Without an alarm condition, this switch controls the LAMP TEST function. Momentarily pressing the switch will cause all indicators on the front panel to illuminate. Should any indicator fail to illuminate during the lamp test, it should be replaced as soon as possible.
16	SUMMARY ALARM Indicator	The red SUMMARY ALARM indicator illuminates when any of the following conditions exists: a. External Line Fault (Index 17). b. Internal Unit Fault (Index 18). c. External Load Fault (Index 19). When a condition exists that causes the SUMMARY ALARM indicator to illuminate, it will also cause the AUDIBLE ALARM (Index 13) to sound.

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
17	EXTERNAL LINE FAULT Indicator	This red indicator will illuminate when the service input to the unit is out of specification tolerances. This includes: a. Input over/under voltage. b. Loss of phase. If a loss of the phase driving the logic circuitry occurs, the input contactor will open but no indicators will illuminate.
18	INTERNAL UNIT FAULT Indicator	This red fault indicator illuminates when there is a malfunction within the frequency converter. Contact trained equipment maintenance personnel to troubleshoot the unit.
19	EXTERNAL LOAD FAULT Indicator	This red indicator illuminates only if the output current is in the overload range of its rated load for more than 5 minutes, or if a short circuit current condition exists for more than 20 seconds. The protection circuit will cause the unit to shut down. The overload protection circuit can be reset by momentarily pressing the RESET/LAMP TEST switch (Index 15).
20	RESERVED	Not used in this configuration.
21	RESERVED	Not used in this configuration.
22	RESERVED	Not used in this configuration.

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
		WARNING **Hazardous voltages are present within the frequency converter even when external power is not applied to the unit. The following controls and indicators are located inside the frequency converter; therefore, only trained equipment maintenance personnel should access these components.**
23 or 23A	MAINTENANCE (BYPASS) Selector Switch	This self-indicating, 3 position locking toggle switch, which must be pulled outwards when changing its position, is used for maintenance purposes only. For this reason, and since the switch is located internal to the unit, *only trained equipment maintenance personnel should access this switch.* The position of this switch determines the operational parameters of the output contactor. Index 23 switch controls Output Control No. 1; Index 23A controls Output Control No. 2 when used. NORMAL. In the Normal position, the output contactor may be operated in either the Remote or Local mode of operation. The Maintenance (Bypass) indicator (Index 9) remains extinguished. OFF. In the Off position, the output contactor is disabled; therefore, the Output Control ON switch (Index 6) and OFF switch (Index 8) are disabled in this mode. Output power cannot be supplied to the load; the output power cable cannot be energized. The Maintenance (Bypass) indicator (Index 9) illuminates (steady light). ON. In the On position, the safety interlock circuit is bypassed. The output contactor must be operated in the Local mode by use of the Output Control On switch (Index 6) and the Output Control Off switch (Index 8). 400 Hz power can be applied to the output cable without the cable being connected to the aircraft. The Maintenance (Bypass) indicator (Index 9) flashes.

Table 3–1. Controls and Indicators (continued)

Fig. 3–1 Index #	Control/ Indicator	Description
24	Elapsed Time Meter	This meter indicates the number of hours that the frequency converter has been in operation. Since the meter is located internal to the unit, *only trained equipment maintenance personnel should access this component.*
25	Access Door Interlock Switch Assembly	This safety switch disables the input contactor circuit while the access door is open. For maintenance purposes, the interlock switch can be overridden by pulling the switch plunger to a fully out position. This switch is also in series with a thermal switch located on the soft start resistor. If the frequency converter is repeatedly turned on and off, the thermal switch on the soft start resistor will sense this operation as a malfunction condition and shut down the unit. Since the switch is located internal to the unit, *only trained equipment maintenance personnel should access this component.*
26	DC Link Voltage Meter	This **safety feature** meter provides the user with a visual indication of the DC link voltage. ***Lethal** voltage may be present on the DC link.* The DC link circuit is equipped with a bleeder resistor that discharges the DC link when input power is removed. Discharge of the DC link must always be monitored/verified on this voltage meter. The voltmeter indicates a **Safe** (less than 30 volts) and a **Danger** (greater than 30 volts) voltage range. Observe that this meter indicates that the DC link is discharged (voltage in the **Safe** range) prior to touching any component within the frequency converter. Since the meter is located internal to the unit, *only trained equipment maintenance personnel should access this component.*

Table 3–1. Controls and Indicators

Fig. 3–1 Index #	Control/ Indicator	Description
27	Control Board Line Compensation Select Switch	The Control board is equipped with a line compensation switch, S2. This switch is preset at the factory to properly compensate the unit at the output cable connector. Do not attempt to adjust the line compensation without first consulting your factory representative. Since the switch is located internal to the unit, *only trained equipment maintenance personnel should access this component.*

SECTION IV
THEORY OF OPERATION

4.1 GENERAL

This section provides theory of operation to support the maintenance concept of fault isolation by interpreting the indicators on the *B*uilt-*I*n *T*est *E*quipment (BITE) board. Simplified diagrams of each indicator circuit are provided to permit rapid identification of the assemblies and components associated with the particular BITE board indicator.

Repair consists of removal or replacement of circuit board assemblies and major components listed as replaceable parts in Section VI of this manual.

4.2 STANDARD INPUT/OUTPUT FEATURES

Each Pwr-Kart frequency converter is equipped with the following input/output features.

1. Input Power Cable.

2. Input Contactor Kit with access door interlock switch.

3. Output Contactor Kit, Single. See Options below for information pertaining to dual output contactors, if applicable.

4. Output Power Cable. See Options below for information pertaining to dual output power cables, if applicable.

4.3 OPTIONS

The frequency converter can be equipped with various input/output options such as an input transformer for alternate input voltages, variable output frequency, etc. The operation of all frequency converters is the same except for input and output options. Figure 7–1 depicts the input/output circuitry, including input/output options, if any, for this specific configuration. Figures 4–1 and 7–2 illustrate the circuits for the basic frequency conversion circuits common to all configurations of this frequency converter. Refer to Table 6–1 and Figures 6–1 and 7–1.

Pwr-Kart frequency converter P/N 195–39000–58 is equipped with the Alternate Input Voltage option (T–3) that permits the unit to operate from a 208 VAC utility power source. This transformer steps the input voltage to 480V as required by the unit.

4.4 INPUT POWER CONTROL CIRCUITS

See Figure 7–1. Three-phase, 60 Hz input power is applied through the input power cable and fuses A22F8 through F10 to input contactor A22K1, the Line Monitor board A53, the Alternate Input Voltage transformer T7, and then to the low voltage transformer A22T1.

Low voltage transformer A22T1 provides power for the Door Interface board A15 and the door interlock (safety) switch S3.

The input contactor A22K1 operation is controlled by the logic circuitry of the Door Interface board A15, Line Monitor board A53, Unit Control ON and OFF pushbutton switches A50S4 and A50S1, and the access door interlock switch S3. If the door interlock switch S3 is closed (access door closed or switch plunger pulled out to an override position), the door interlock relay A22K2 actuates. Power for the door interlock circuit is routed through fuse A22F5, transformer T7, and transformer A22T1 to the door interlock relay A22K2 by way of the door interlock switch S3.

Line Monitor board A53 (Figure 6–1, sheet 3 and Figure 4–12) senses the input power for over/under voltage and loss of phase. The frequency converter is not sensitive to phase rotation. Line Monitor board A53 relay terminals 1 and 2 are normally closed and terminals 2 and 3 are normally open when deenergized by removing input power or if an input line fault condition exists. When input power is applied and the Line Monitor board A53 senses that it is within specifications, relay terminals 1 and 2 open, 2 and 3 close, and permits Input Contactor A22K1 to close.

Momentarily pressing the Unit Control ON switch A50S4 causes relay A22K2 to actuate (close), provided door interlock switch S3 is closed, thereby energizing input contactor A22K1. If input power is interrupted, the input contactor opens. This prevents the frequency converter from automatically restarting upon reapplication of input power. Input contactor A22K1 can be opened (input power removed) by momentarily pressing the Unit Control OFF switch A50S1.

As an additional safety feature, the input contactor provides a circuit for rapidly discharging (less than 10 seconds) the DC link capacitors upon removal of input power (whenever the input contactor K1 is open). See Figure 7–1. The auxiliary contacts 61 and 62 on input contactor A22K1 are normally closed (contactor deenergized). These contacts are connected across the DC link filter circuit through resistor R1 (175W, 150Ω resistor provided as part of the Input Contactor Kit). Resistor R1 is mounted on the A39 board beneath A39R3. See Figure 6–2, sheet 8. Without this safety feature, the DC link discharges within 2 to 5 minutes after the removal of input power. This slower discharge circuit is provided by resistors connected directly across the DC link filter capacitors A39C1–C6. In either event, discharge of the DC link must always be monitored on the DC Link Voltage meter A16A4.

With input power applied and input contactor A22K1 closed, Alternate Input Voltage transformer T3 steps the power to 480 VAC which is then applied through fuses A22F1–F3 to the following circuits:

1. Input rectifier A36A1D1.

2. Logic power supply circuits, through cable A16A2A3 and Power Interface board A16A2A1.

3. Fans A26 and A27, through fuse A22F4 and stepdown transformer A22A1T2.

4. Soft Start Control board A39A1.

The operation of the frequency converter circuits is described in paragraph 4.6.

4.5 OUTPUT POWER CONTROL CIRCUITS

See Figure 7–1. Output power from the frequency converter is routed from magnetics assembly A36 through output current transformers A22T4–T6 to the output contactor.

NOTE

For Pwr-Kart Frequency Converters with the Dual Output option, Output Control No. 1 and Output Control No. 2 operate independently of each other. Circuitry is identical for each output. Output No. 1 is controlled by output contactor A22K3; Output No. 2 by output contactor A22K4.

1. The operation of output contactor A22K3 (and/or A22K4 Output No. 2) is controlled by:

   a. Output Control selector switch (REMOTE or LOCAL) A50S13 (A50S12 for Output No. 2) located on the unit's front panel. This two position rotary switch permits the selection of the mode of operation of the output contactor.

   b. External 28 VDC safety signal.

   c. Output Control No. 1 ON switch A50S10 (Output No. 2, A50S8) and Output Control No. 1 OFF switch A50S9 (Output No. 2, A50S7).

   d. Output No. 1 Maintenance (BY-PASS) selector switch A50S3 (Output No. 2, A50S2) located on the back of the front panel.

   Power is applied to the coil of output contactor A22K3 through fuse A22F6 and the normally open contacts of relay A22K5 (and, when applicable, to contactor A22K4 through fuse A22F7 and contacts of relay A22K6). The coil of relay A22K5 (and/or A22K6) is energized by the 24 Vac output of transformer A22T1 if the output contactor enable circuit is closed.

2. When any one of the following conditions exists, the 24 VAC from transformer A22T1 is routed to relay A22K5 (and A22K6) coil.

   a. The Output Control selector switch A50S13 (or A50S12) is set to REMOTE (automatic) mode of operation, and the external 28 VDC return safety signal is sensed

and routed to the door cable assembly A37 and Door Interface board A15.

b. The Output Control selector switch A50S13 (or A50S12) is set to LOCAL (manual) mode of operation, and the 28 VDC return safety signal is sensed and routed to the door cable assembly A37 and Door Interface board A15; Output Control ON switch A22S10 (A22S8 for Output No. 2) is pressed.

NOTE

Pressing and holding the Output Control ON switch (Figure 3–1, Index 6) will close the output contactor for approximately three seconds. This allows time for control systems on the aircraft to sense the presence of the 400 Hz power and initiate the required 28 VDC interlock signal. If the 28 VDC interlock signal is not detected, the output contactor will drop out and the Output Control ON indicator (Figure 3–1, Index 7) will start flashing. Pressing the Output Control OFF switch (Figure 3–1, Index 8) resets the circuit.

c. The Maintenance (Bypass) selector switch A50S3 (or A50S2 for Output No. 2) is set to ON, bypassing the external 28 VDC safety interlock circuit; the Output Control ON switch is then used to control the output contactor.

If any one of these conditions is met, the 24 VAC from transformer A22T1 is routed from A15J2 to the coil of relay A22K5 (or A22K6). The contacts of the relay close, applying 480 VAC to the coil of output contactor A22K3 (or A22K4), thereby locking the contactor closed and applying 400 Hz output power through A22TB2 to the load. The Output Control ON indicator A50DS7 (or A50DS5) illuminates when the output contactor is closed. The Output Control Maintenance (Bypass) indicator A50DS6 (or A50DS4) flashes when the Maintenance (Bypass) selector switch A50S3 (or A50S2) is toggled to the ON position.

As indicated above, operation of the output contactor is dependent upon the 28 VDC safety interlock signal while in the Remote mode of operation. It is dependent upon the 28 VDC safety interlock signal and the Output Control ON and OFF switches while in the Local mode. It is dependent upon the Output Control ON and OFF switches while in the Maintenance (Bypass) ON mode of operation. See Section III of this manual.

4.6 OVERALL FUNCTIONAL DESCRIPTION

The frequency converter is a transistorized solid state switching unit that converts 60 Hz input power into 400 Hz output power. Refer to Figure 7–1. Input voltage (480 VRMS) at the input power fuses A22F1–F3 is the same for all configurations of the frequency converter. Also, the circuitry for all configurations of the frequency converter, from the input power rectifier A36A1D1 (Figure 7–2, Sheet 1) to the output filter A16A3 (Figure 7–2, Sheet 4) is identical. The

conversion from 60 Hz to 400 Hz power is accomplished in two basic steps as follows:

1. The 60 Hz input power is rectified into DC power.
2. The DC power is switched on and off by two three-phase inverter assemblies whose outputs are shifted by 30°. The outputs of these inverters are combined by two output transformers to provide 400 Hz output power.

When input power is applied, power is routed through the Power Interface board A16A2A1 to the Logic Power Supply board A1. This provides logic power to the unit's control, protection, detection, and drive circuits. See Figure 4–5.

Input power (480 VRMS, 60 Hz) is applied through the input circuitry (see Figure 7–2, Sheet 1) to the rectifier A36A1D1. The output of the rectifier is applied through a DC link soft start circuit to the input of the DC filter. When the input filter has charged to approximately 450 VDC and the charging current to the filter is less than 20 amperes, the DC link soft start current limiting resistor is bypassed (SCR A36A1D2 is gated on). The DC link voltage continues to charge the filter capacitors to approximately 650 VDC. The output from the DC rectifier and filter is routed to the input of the left and right inverter assemblies. The transistor switching circuits within the inverter assemblies begin switching ON and OFF (as controlled by the Pulse Width Modulation (PWM) signals from the Control board A3). The PWM signal controls the ON time of the inverter transistor switches, thereby controlling the output voltage. The output soft start circuit on the Control board starts with a minimum pulse width condition. This permits the 400 Hz output voltage to increase without a sudden surge current condition. As the output voltage reaches a set level, the voltage feedback circuit takes command and regulates the output voltage to the desired level.

The outputs of the two inverters are combined by transformers A36T1 and T2, to provide a filtered 400 Hz output. The unique arrangement of the transformers, the phasing of the inverters and the transistor switching characteristics eliminate the even numbered harmonics, harmonics divisible by three, and the fifth and seventh harmonics from the 400 Hz output. Output filter A16A3 filters the eleventh and thirteenth harmonics from the 400 Hz output power.

The filtered output power is routed through current transformers A22T4–T6 and the output circuitry (see Figure 7–1) to output terminal block A22TB2 (and optional A22TB3). From this point power is routed to the load. The circuit boards provide control, drive, detection, and protection circuits for the unit.

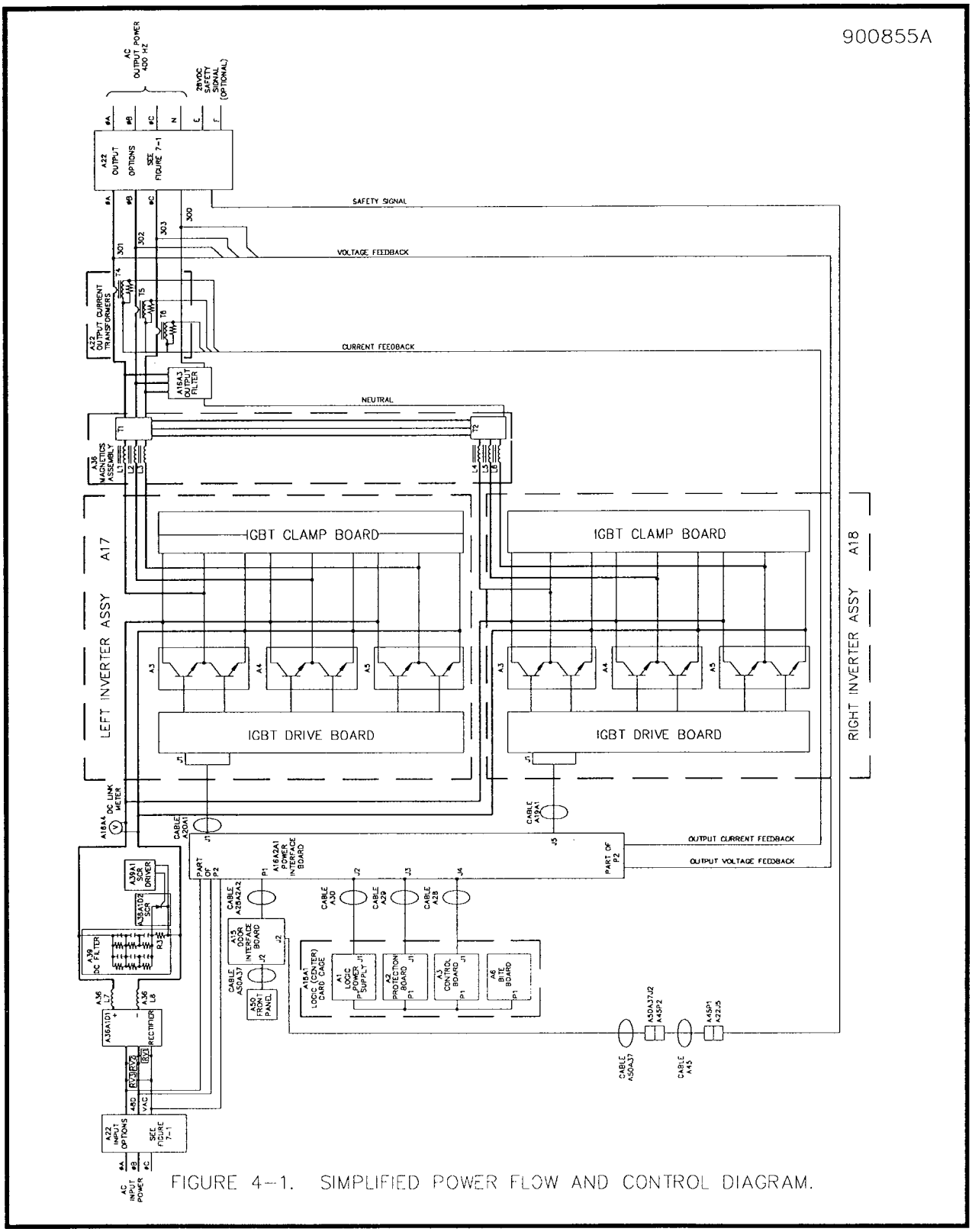


FIGURE 4–1. SIMPLIFIED POWER FLOW AND CONTROL DIAGRAM.

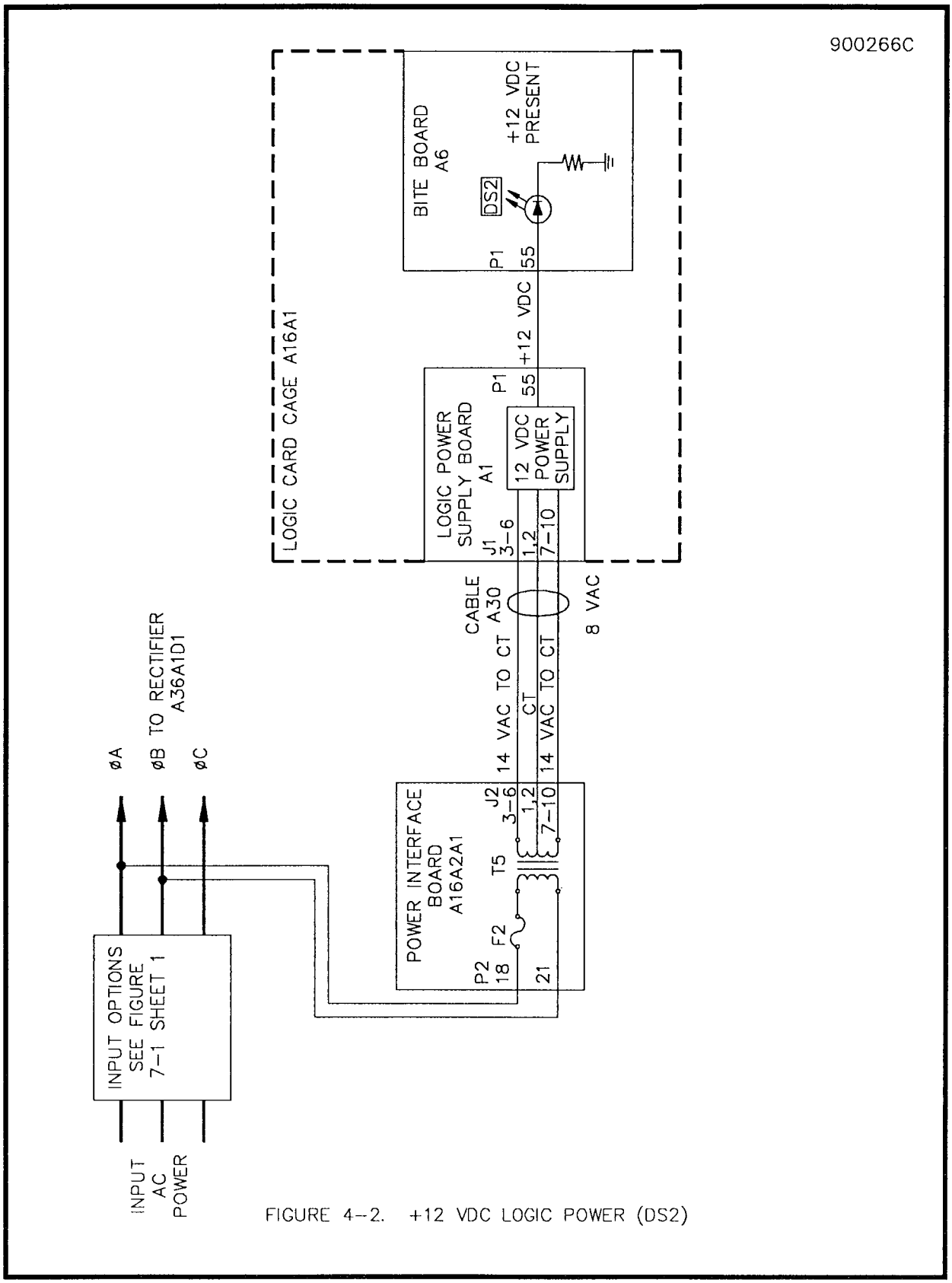


FIGURE 4-2. +12 VDC LOGIC POWER (DS2)

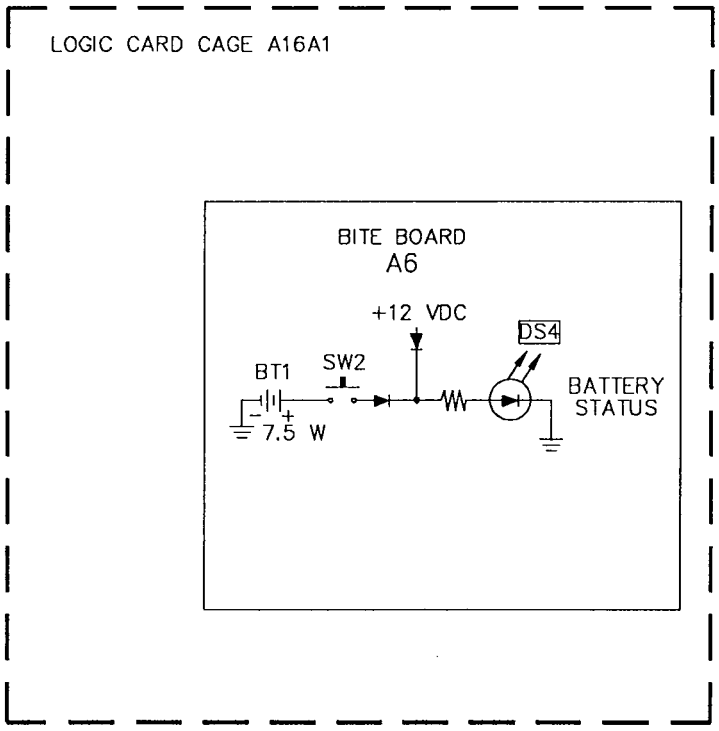


FIGURE 4–3. BITE BOARD BATTERY STATUS (DS4)

900268C

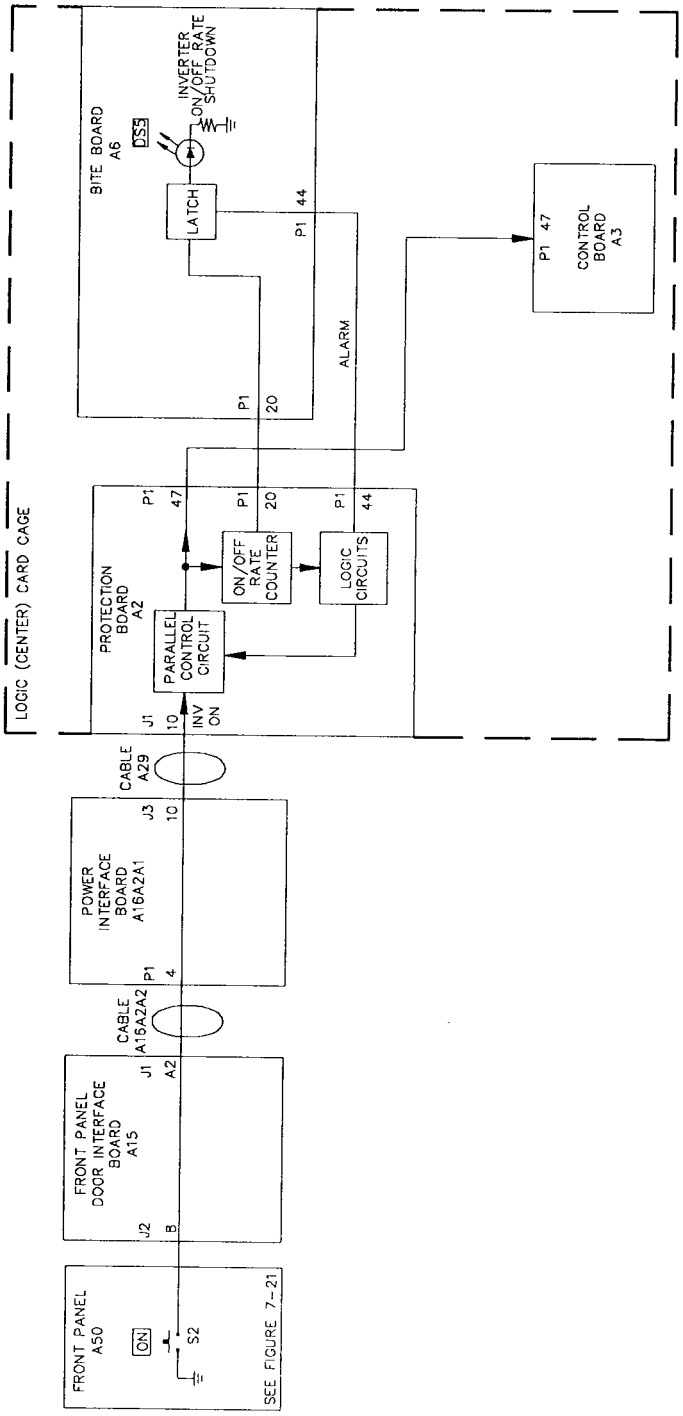
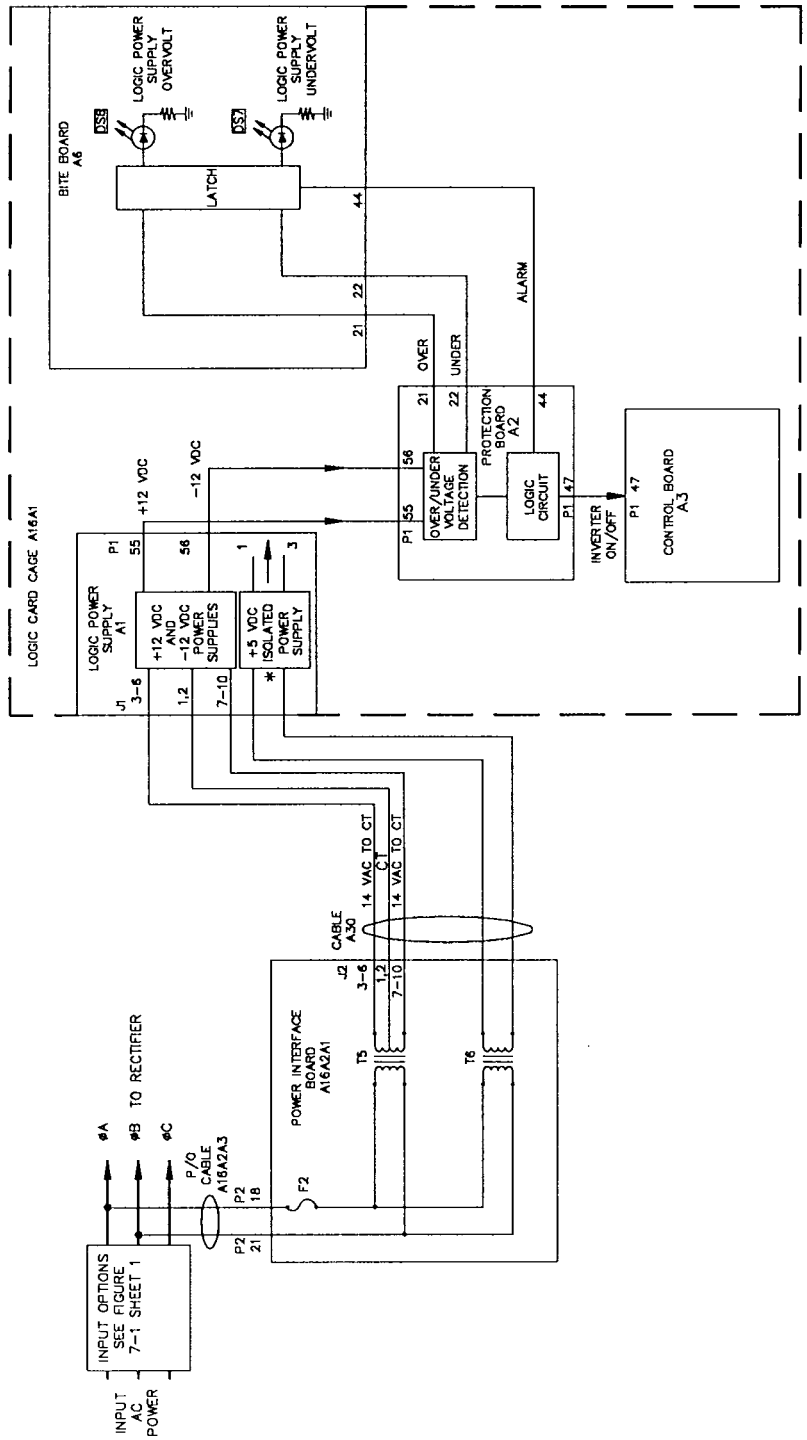


FIGURE 4-4. INVERTER ON/OFF RATE (DS5)

900269E



* ISOLATED +5 VDC POWER SUPPLY IS USED ON PARALLELING UNITS ONLY.

FIGURE 4-5. LOGIC POWER SUPPLY OVER/UNDER VOLTAGE (DS6, DS7)

900856B

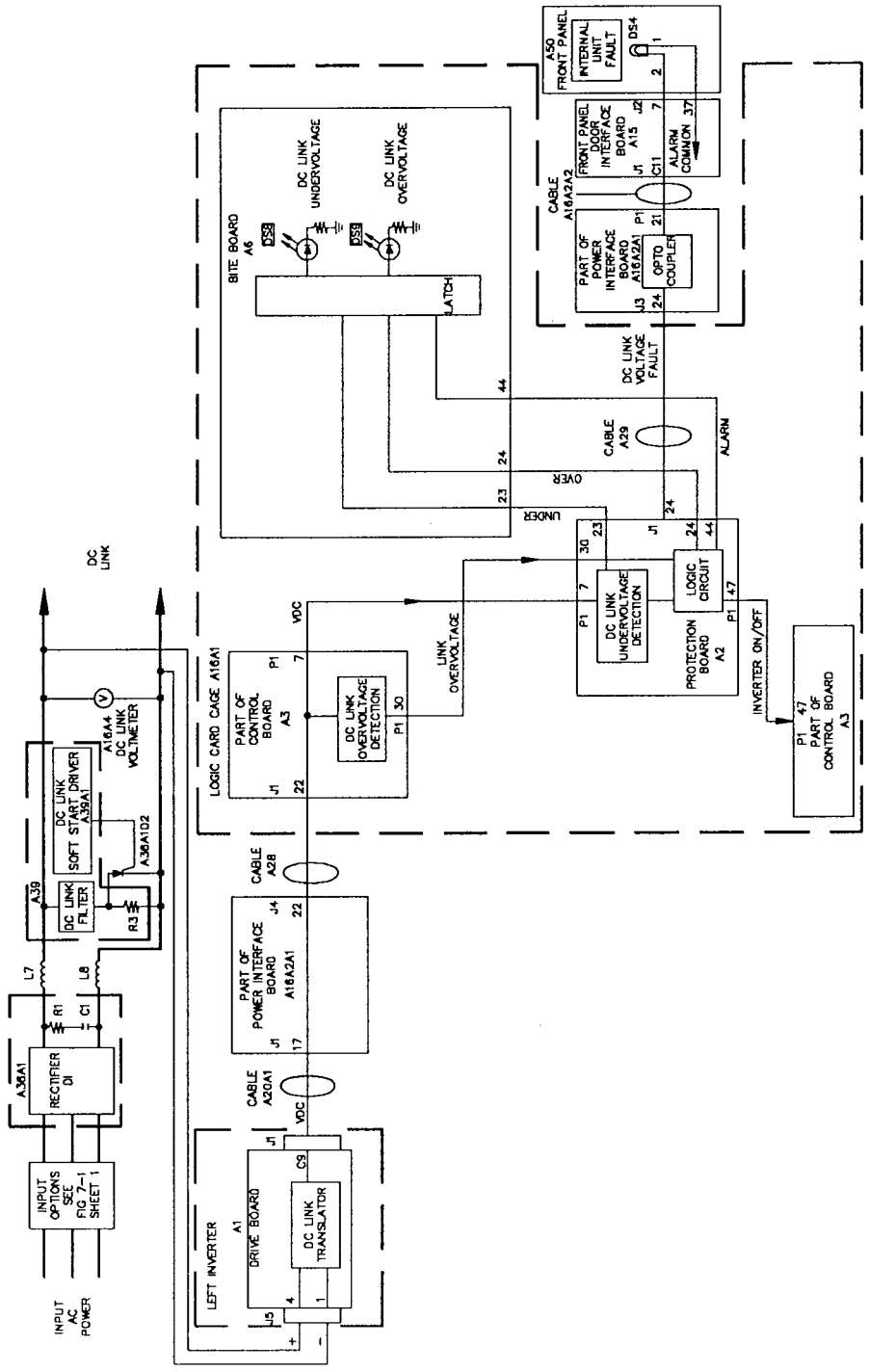


FIGURE 4–6. DC LINK UNDER/OVERVOLTAGE (DS8, DS9)

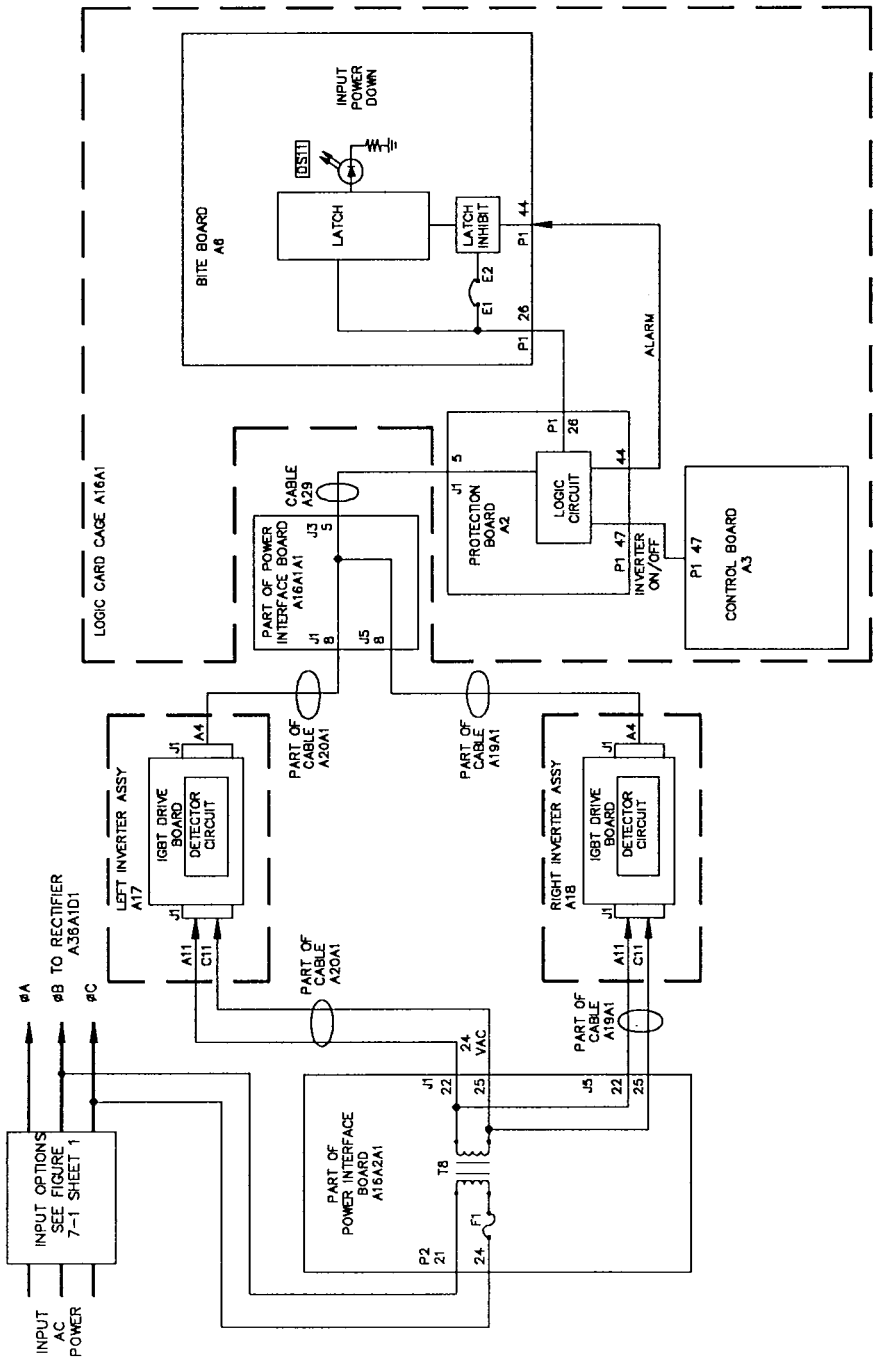


FIGURE 4–7. BITE BOARD LATCH–INHIBIT (INPUT POWER DOWN)(DS11)

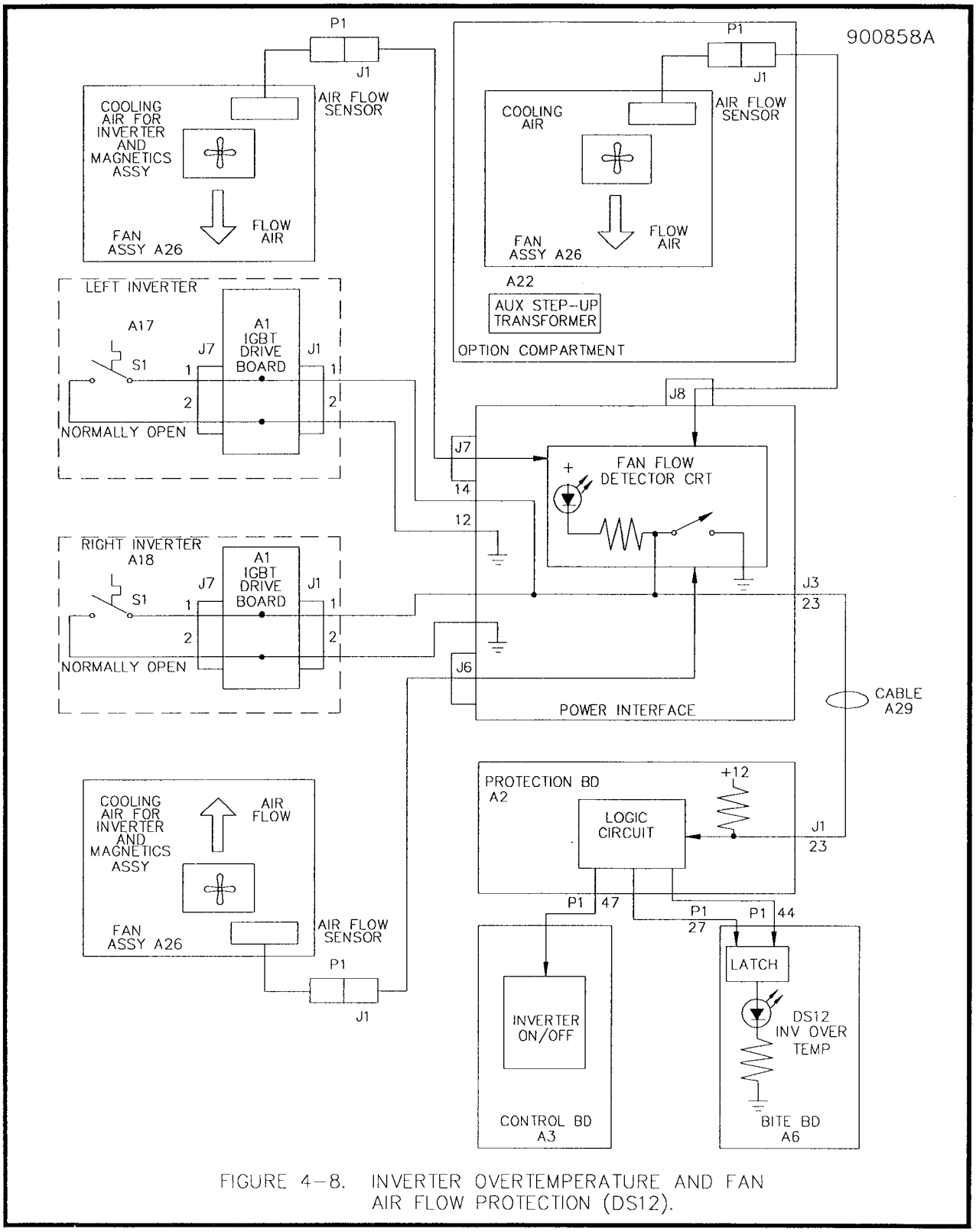


FIGURE 4–8. INVERTER OVERTEMPERATURE AND FAN AIR FLOW PROTECTION (DS12).

900274D

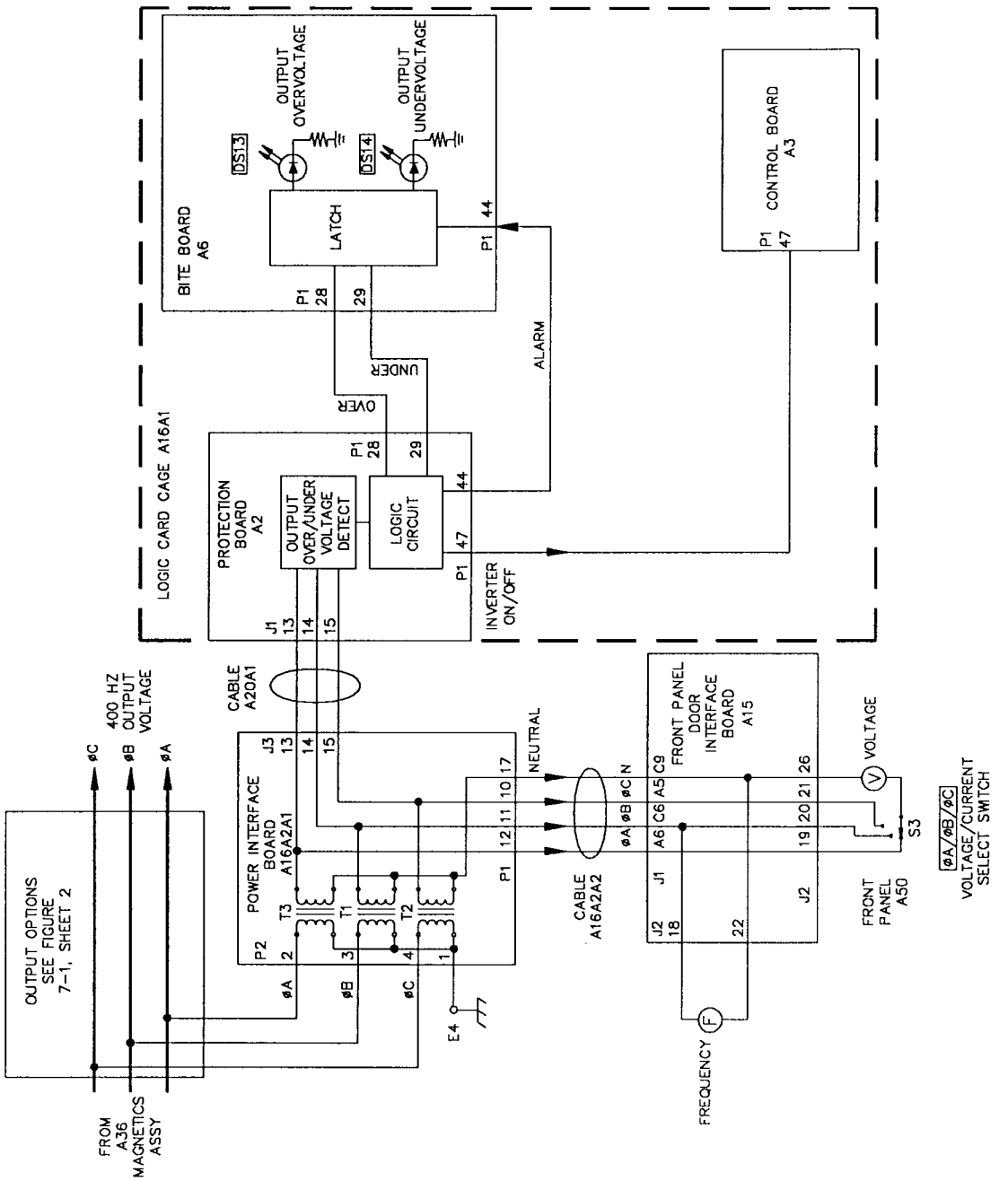


FIGURE 4–9. OUTPUT OVER/UNDER VOLTAGE (DS13, DS14)

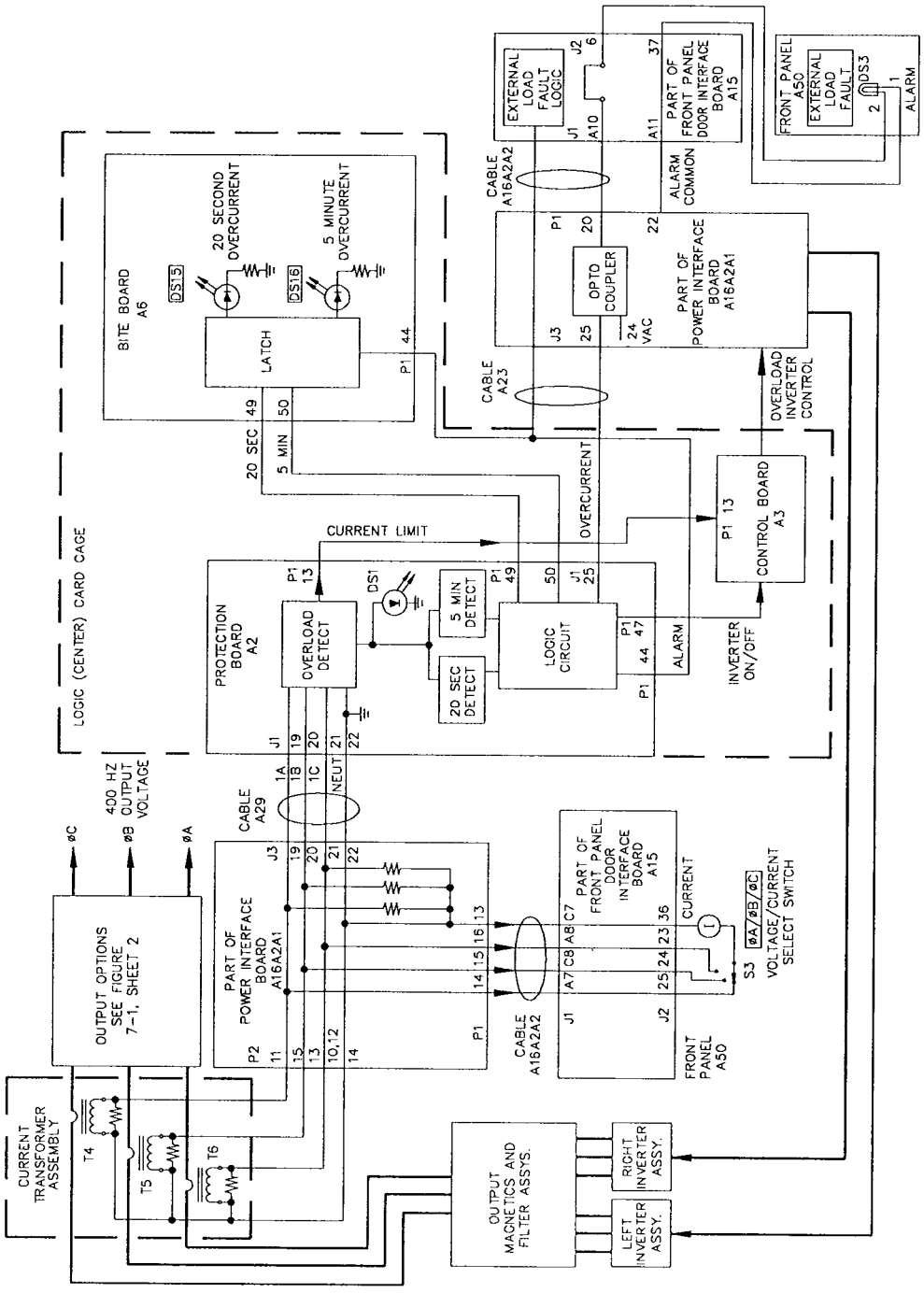


FIGURE 4-10. 20 SECONDS/ 5 MINUTE OUTPUT OVERLOAD (DS15, DS16)

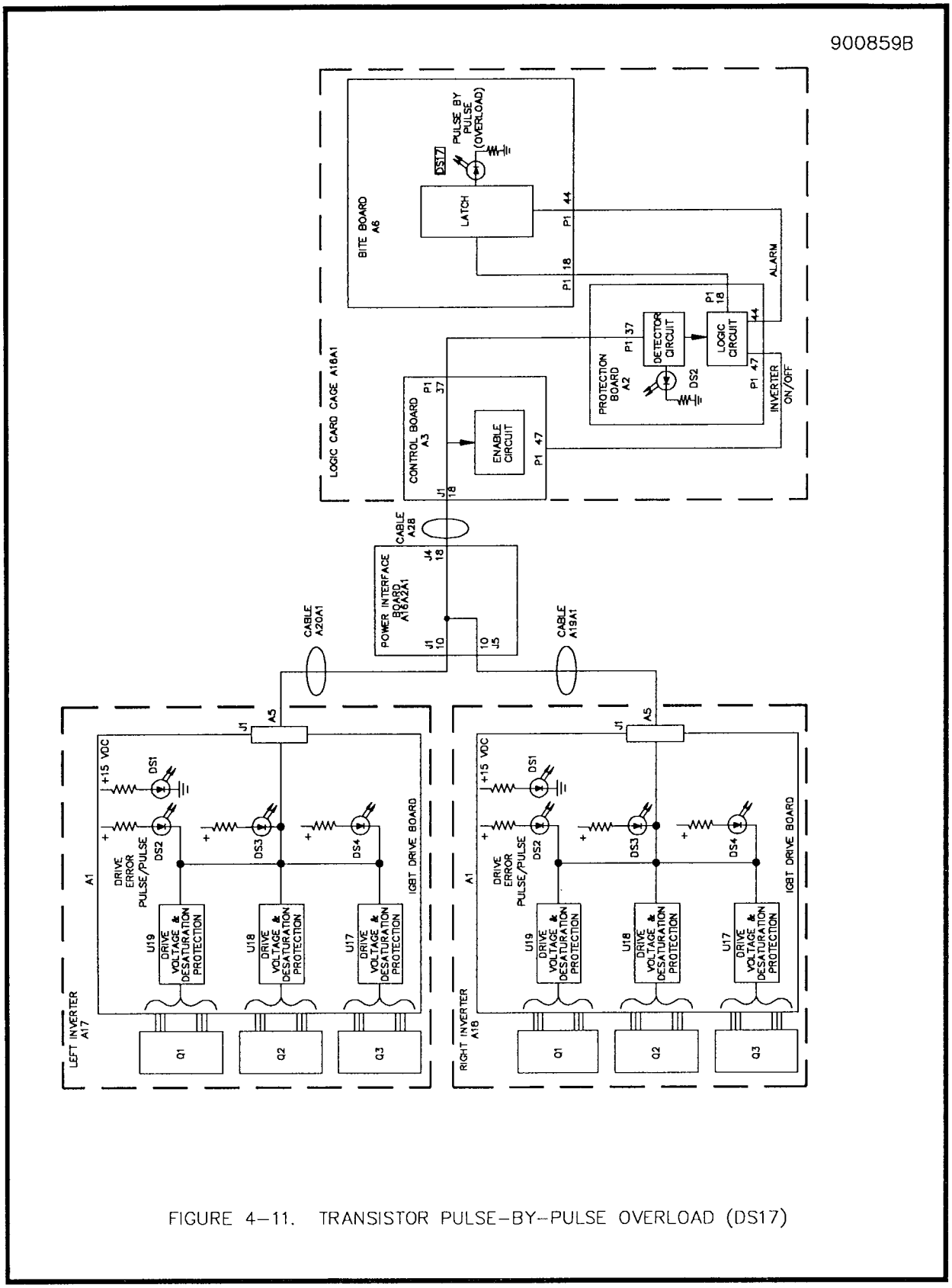


FIGURE 4–11. TRANSISTOR PULSE–BY–PULSE OVERLOAD (DS17)

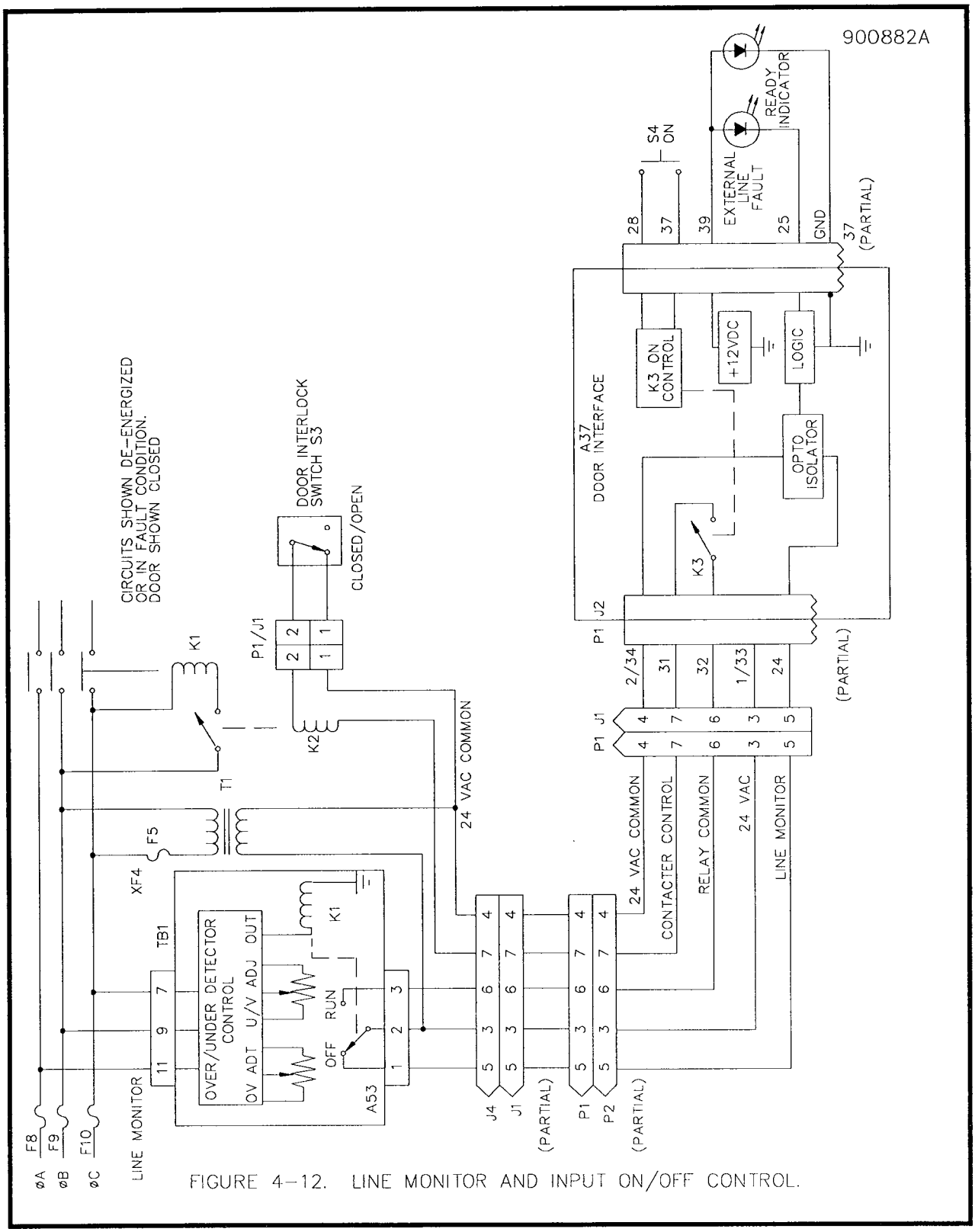


FIGURE 4–12. LINE MONITOR AND INPUT ON/OFF CONTROL.

4.7 FUNCTIONAL DESCRIPTION OF EACH MAJOR ASSEMBLY

4.7.1 Logic Power Supply Board A1

This board is installed in the logic (center) card cage.

See Figure 6–2 sheet 2, Figure 4–13, and Figure 4–5. The Logic Power Supply board provides regulated plus and minus 12 VDC power for the control circuits. When input/output power is applied, 480 VAC, 60 Hz power is routed through fuse A16A2A1F2 to stepdown transformer A16A2A1T5 on the Power Interface board. The input voltage is stepped down to 14 VAC then routed through cable A30 to the Logic Power Supply board A1. This AC input is rectified, filtered, and regulated to provide plus and minus 12 VDC power to the logic circuits within the unit.

Input AC power is routed through fuse A16A2A1F2 to stepdown transformer A16A2A1T6 on the Power Interface board. Transformer T6 provides 8 VAC to the input of the Logic Power Supply board A1 for an isolated +5 VDC power supply. This power supply is not used in Pwr-Kart configurations.

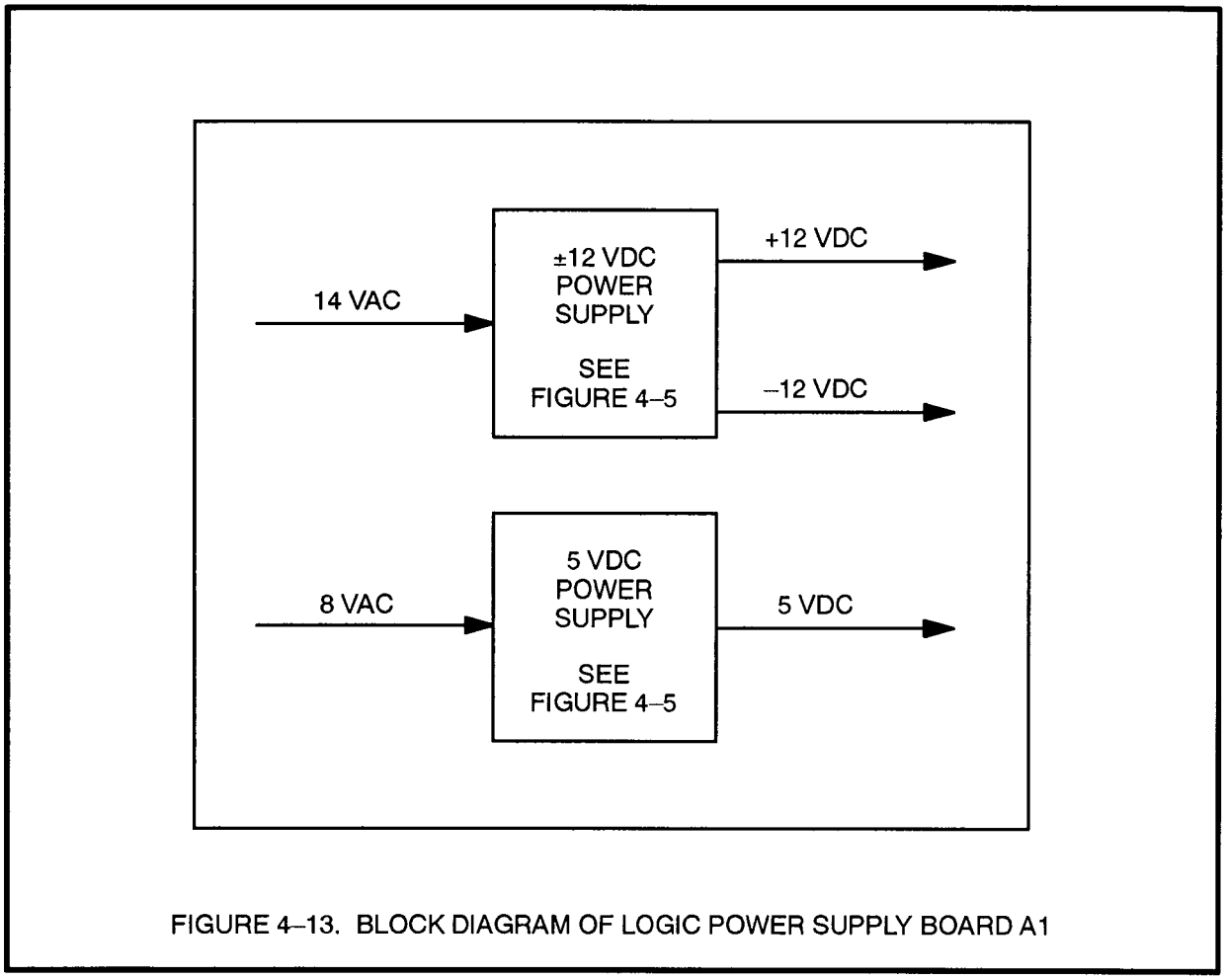


FIGURE 4–13. BLOCK DIAGRAM OF LOGIC POWER SUPPLY BOARD A1

4.7.2 Protection Board A2

The Protection board provides the following protection and control functions.

1. Pulse-By-Pulse Transistor Overload.
2. Inverter ON/OFF Rate.
3. Logic Power Supply Under/Overvoltage.
4. Inverter Overtemperature and Fan Flow Detector circuits.
5. Output Over/Undervoltage.
6. Twenty second/five minute Overload.
7. DC Link Over/Undervoltage Protection.
8. BITE Board Latch – Inhibit (Input Power Down).
9. Power ON Reset Signal.
10. Inverter ON/OFF Signal.
11. Inverter Inhibit, and fault alarm control.

Each of these functions are described in the following paragraphs.

4.7.2.1 Pulse-by-Pulse Overload, Transistor Desaturation Protection

See Figure 4–11. The transistor desaturation protection is designed to protect the power switching transistor from overcurrent conditions. The voltage across the transistor is monitored by a detection circuit on the Drive board. During conduction the voltage across the device will be determined by the current through it. If excessive current causes the voltage to rise across the device a pulse-by-pulse overload signal is generated and DS2, DS3 or DS4 will illuminate for a minimum of ten seconds. This signal is routed through the Power Interface board and Control board to the Protection board.

See Figure 6–2, Sheet 2. The Control board A3 senses each pulse-by-pulse overload signal and immediately shuts down the inverter sections of the unit. The inverter sections reprogram up within 30 milliseconds. If the overload is due to an output fault (overload) condition the unit will enter a current limit mode (output current regulation). Refer to paragraph 4.7.3.8. This action immediately protects the inverter switching circuit.

The Protection board A2 detects the pulse-by-pulse overload signal and triggers a one-shot circuit to establish a one-tenth second time window. If pulse-by-pulse overload signals are still being received after approximately one-tenth of a second (after the first signal), the fault is internal to the frequency converter and an inhibit signal is generated. This causes the unit's inverter sections to shut down and a pulse-by-pulse fault condition to be latched into the BITE board memory.

If the pulse-by-pulse overload signals are not present for more than one-tenth second, the one-tenth second time window is reset and the unit continues to operate in a normal manner.

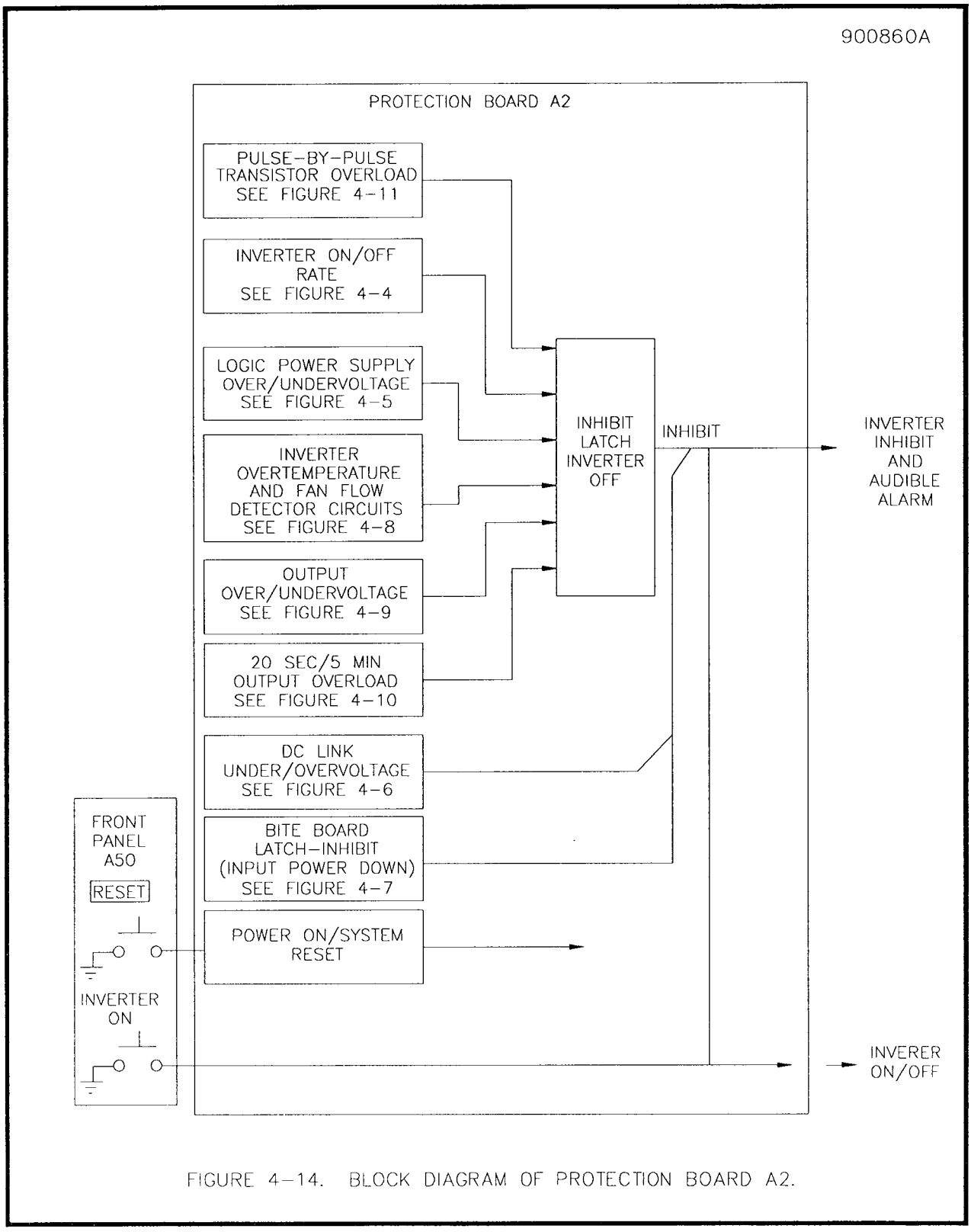


FIGURE 4-14. BLOCK DIAGRAM OF PROTECTION BOARD A2.

4.7.2.2 Inverter On/Off Rate

This circuit protects the inverter from repetitively switching on and off. An inverter inhibit signal is generated if the inverter switches on and off at a rate that equals or exceeds four times in any one-second time period.

See Figure 4–4. The inverter can be switched on and off from the front panel Unit Control ON and OFF switches, or by the DC link over/undervoltage protection circuit. All other faults shut down and latch (or hold) the inverter in an off condition.

If the inverter cycles on/off as many as four times within any one second time period, the Protection board generates an inhibit signal that shuts down the inverter and latches the fault condition into the BITE board memory circuit (DS5). The inverter will not automatically restart from this condition.

4.7.2.3 Logic Power Supply Under/ Over Voltage

This circuit constantly monitors the plus and minus 12 volt power supplies to ensure that the voltage remains within acceptable limits to permit proper operation of the CMOS logic and analog circuits. The under/overvoltage circuit is triggered if the power supply voltage exceeds the range of approximately 12 ± 1.8 VDC.

See Figure 4–5. Input AC power is routed through fuse A16A2A1F2 and stepdown transformer A16A2A1T5 (on the Power Interface board) to the Logic Power Supply board A1. The plus and minus 12 VDC output of the logic power supply is routed to the Protection board A2 under/overvoltage monitoring circuits.

If a logic power supply under or overvoltage condition is detected, the Protection board generates a latched inhibit signal causing the inverter sections of the unit to shut down. The inverter will remain shut down until input power is momentarily removed and reapplied or the front panel RESET switch is pressed. If the under/overvoltage condition is still present the unit will again shut down.

The inhibit signal causes the BITE board to latch the fault into a nonvolatile memory latch circuit. Indicator DS6 (overvoltage) or DS7 (undervoltage) illuminates to indicate the detected fault condition.

4.7.2.4 Inverter Overtemperature and Fan Flow Detection

See Figure 4–8. Each inverter section is equipped with normally open thermal switches A17S1 and A18S1. If the inverter temperature reaches 175 degrees Fahrenheit, the switch contacts close. The thermal switches will reopen when the inverter temperature drops below 140 degrees Fahrenheit.

The left and right inverter thermal switches are constantly monitored. If either of the switches close, an overtemperature signal is routed to the Protection board. Inverter temperature is dependent on air flow that is provided by a cooling fan located below each inverter assembly. Air flow is sensed by a thermistor circuit on each fan assembly and monitored by a detector circuit located on

the Power Interface board. If the cooling air is lost or severely diminished, the voltage across the sensor rises and the detector circuit produces an overtemperature signal (and LED lamp indication) that is routed to the Protection board.

The Protection board generates a latched inhibit signal which shuts down the inverter sections of the unit. The latched inhibit signal prevents the inverters from automatically turning on when the temperature of the inverter returns to normal and the thermal switch reopens.

The inhibit signal from the Protection board causes the fault condition to be latched into the BITE board memory circuit (DS12).

4.7.2.5 Output Over/Under Voltage

An output overvoltage or undervoltage signal is generated and the inverter sections of the unit shut down only if all three of the following conditions exist.

1. The inverter is ON.
2. The inverter is not in an output overload condition.
3. The output line-to-neutral voltage is less than 105 VRMS, or more than 135 VRMS, for a period of 0.2 seconds.

See Figure 4–9. The output voltage is sampled and routed through stepdown transformers A16A2A1T2, A16A2A1T1, and A16A2A1T3 (located on the Power Interface board) to the input of the Protection board A2. The Protection board rectifies the three phase input and provides a Voltage Feedback (VFB) signal to the over/undervoltage detection circuits on the Protection board.

The over/undervoltage detection circuit located on the Protection board generates an over/undervoltage signal that triggers a one shot (0.2 second window) circuit (if the three previously described conditions are met). If the output voltage is outside the acceptable range (105 to 135 VAC) for more than 0.2 seconds, a latched inhibit signal is generated causing the unit's inverter sections to shut down. The unit will not automatically restart from this shut down condition. The inhibit signal generated by the Protection board latches the fault condition into the BITE board memory, DS13 (overvoltage) or DS14 (undervoltage).

The stepped down output voltage is also routed through the Door Interface board to the voltage/current Phase Select switch A50S5. The select switch permits any one of the output voltage phases to be monitored. The meter circuit is calibrated to provide a line-to-neutral reading equivalent to the output voltage.

If the Voltage Adjust option has been selected, output voltage may be adjusted over a range of 105 to 135 VAC by turning the coin-operated switch R1 (see Figure 3–1, Index 22) on the front panel. If the Voltage Adjust option has not been selected, output voltage may be adjusted at A15R54 (see Figure 6–1, sheet 2). Voltage adjustment is monitored on the front panel output voltmeter M2.

Phase B of the stepped down output voltage is also routed to the optional fre-

quency meter (when applicable) to permit the output frequency to be monitored.

4.7.2.6 20 Second/5 Minute Overload Circuits

The output load conditions are constantly monitored. If the output load conditions exceed 175% (including a short circuit), the 20 second overload circuit is triggered. If the output load is between 110% and 175% of the rated load, the 5 minute overload circuit is triggered. Both conditions result in DS1 illuminating as long as the overload condition exists. If the load condition is present for more than 20 seconds or 5 minutes, as applicable, an overload signal is generated by the Protection board A2. This overload signal, in turn, generates a latched inhibit signal that shuts down the inverter sections of the unit. The inverter will not automatically restart from this condition. DS1 is not a latching LED and will be extinguished when the inverter shuts down.

See Figure 4–10. The output current transformers A22T4, A22T5, and A22T6 monitor the output current in each output phase. The resulting signal is routed through the Power Interface board to the Protection board A2. The Protection board monitors the output current signal and generates a current limit signal that is equivalent to the output overload condition. This current limit signal is applied to the 20 second and 5 minute overload detection circuits of the Protection board.

If the signal level is large (representing an output current condition exceeding 175% of the rated load), both the 20 second and 5 minute timer (windows) circuits are triggered. If the 176% (or greater) overload signal is present for 20 seconds, the Protection board generates a latched inhibit signal that shuts down the inverter sections of the unit.

If the overload signal level is 110% to 175%, only the 5 minute timer (window circuit) is triggered. If the overload condition is present for 5 minutes, the Protection board will generate a latched inhibit signal. The latched inhibit will shut down the inverter sections of the unit. The inverters will not automatically restart from either of these shut down conditions (20 second or 5 minute). Indicator DS1, located on the Protection board A2, illuminates to indicate the presence of overloads greater than 110 percent.

If a 20 second or 5 minute overload condition is detected, the inhibit signal generated by the Protection board latches the fault condition into the BITE board memory, DS15 (20 second overload) or DS16 (5 minute overload).

The Summary Alarm and External Load Fault indicators on the front panel illuminate if a 20 second or 5 minute overload condition is detected.

See Figure 4–10. The sampled output current is also roued from the Power Interface board to the output ammeter located on the front panel.

NOTE

During short circuit or extreme overload conditions, the output voltage feedback signal is overridden by the overcurrent signal. See paragraph 4.7.3.8. The unit will automatically regulate the output voltage to prevent the current from exceeding the rated full load current (see Table 1–1, General Specifications, in Section I). This is accomplished by reducing the output voltage.

4.7.2.7 DC Link Over/Under Voltage

See Figure 4–6. The DC link voltage is monitored, isolated, and stepped down by the IGBT Drive board located on the Left Inverter assembly A17. The reduced voltage is routed through the Power Interface board and Control board to the BITE board and Protection board. The Control board A3 monitors the input for a DC link overvoltage condition and the Protection board A2 monitors the input for a DC link undervoltage condition.

If a DC link overvoltage condition is detected, the Control board A3 routes an input overvoltage signal to the Protection board. This DC link overvoltage condition causes the unit's inverter sections to shut down by generating an unlatched inhibit signal. The Protection board inhibit signal also latches the fault condition into the BITE board memory circuit DS9. When the DC link overvoltage condition is corrected, the inverter sections of the unit will automatically restart.

If a DC link undervoltage condition is detected, the Protection board generates an inhibit signal to shut down the inverter sections of the unit. When the DC link undervoltage condition is corrected, the inverter sections of the unit will automatically restart. The Protection board inhibit signal latches the fault condition into the BITE board memory DS8.

4.7.2.8 BITE Board Latch – Inhibit (Input Power Down)

This circuit is used to disable the BITE board memory latch during normal power down conditions. This prohibits random faults from being latched into the BITE board when power is removed. The BITE board is designed to enable this function if required, by removing the E1–E2 jumper. In addition, this circuit monitors the unregulated 20 VDC used for the IGBT Drive board power.

See Figure 4–7. The input line-to-line voltage is routed through fuse A16A2A1F1 and stepdown transformer A16A2A1T8 on the Power Interface board to the inverter Drive boards A17A1 and A18A1. If either board detects a loss of voltage, a fault signal is routed through the Power Interface board to the Protection board. The Protection board then generates an inhibit signal which causes the unit's inverter sections to shut down and inhibit the BITE board from latching any fault condition.

Normal input over/undervoltage, protection, and loss of phase protection is provided by the Line Monitor board.

4.7.2.9 Power On Reset

A power on reset signal is generated each time the input power is switched from off to on or the front panel Reset/Lamp Test

switch is pressed. This reset signal resets the protection and control circuits, but does not reset the BITE board memory latch circuit.

4.7.2.10 Inverter On/Off Signal

The inverter ON/OFF signal is controlled from the front panel Unit Control switch circuitry.

4.7.3 Control Board A3

See Figure 4–15. The Control board contains the following major circuits which are discussed individually in subsequent paragraphs.

1. Frequency Generator.
2. Pulse Width Modulator (PWM).
3. Inverter Drive Decoder.
4. Inverter Enable Logic.
5. Pulse Width Regulator.
6. DC Link Voltage Feedforward.
7. Output Voltage Feedback.
8. Output Current Feedback and Output Soft Start.
9. DC Link Overvoltage Detection.

4.7.3.1 Frequency Generator

The frequency generator provides a triangular wave signal for the PWM circuit and a clock signal for the inverter drive decoder. The frequency of the triangular wave and clock signal is six times (2400 Hz) the output frequency (400 Hz). An optional front panel frequency control permits the output frequency to be adjusted from 380 to 420 Hz as desired. Units not equipped with the frequency control option provide an output frequency of 400 ± .01% Hz. Switch S3, located on the control board, must be positioned to Variable or Fixed as dictated by the options provided on the particular unit.

NOTE

Older systems, configured with P/N 195–16051 Control boards have a frequency specification of 400 ± .5% Hz.

4.7.3.2 Pulse Width Modulator

The pulse width modulator circuit generates the pulse width signals to control the on time of the inverter switching circuits. The pulse width modulator consists of two comparators for the left inverter and two for the right inverter. These sets of comparators function identically for each inverter.

One of the comparators within each set establishes the minimum pulse duration, while the other comparator within the same set is controlled by the pulse width regulator output for the DC link feedforward voltage, the voltage feedback, and current feedback circuits. The outputs of the comparators within each set are read together. The output PWM signal is normally determined by the voltage and current feedback comparator (unless the PWM signal is less than the minimum pulse width).

Both sets of comparators are compared to the symmetrical triangular wave from the frequency generator.

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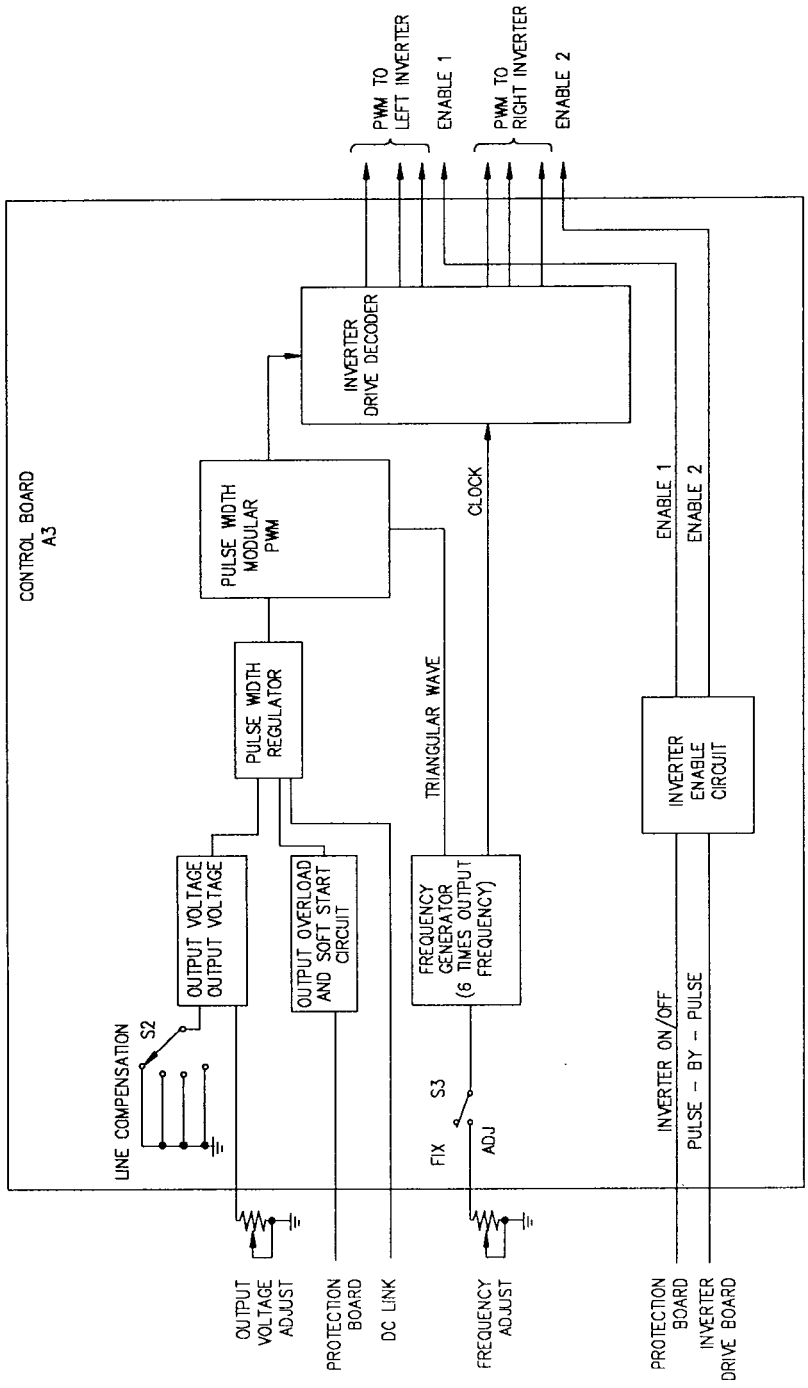

FIGURE 4–15. BLOCK DIAGRAM OF CONTROL BOARD A3

4.7.3.3 Inverter Drive Decoder

The inverter drive decoder steers the PWM signals to the proper inverter leg.

4.7.3.4 Inverter Enable

The inverter enable signal is controlled by the inverter ON/OFF signal from the Protection board. The enable signal controls the operation of the Drive boards by either enabling or disabling the PWM signals to the particular switching circuit. The inverter enable signal is overridden if a pulse-by-pulse overload signal is generated. The pulse-by-pulse overload signal immediately removes the inverter enable signal to the overloaded switching circuit for the remainder of that part of the cycle.

4.7.3.5 Pulse Width Regulator

The pulse width regulator samples the DC link feedforward voltage and output voltage or output current feedback signal in the proper relationship to the clock signal. This permits the PWM signal to precisely track the output power conditions.

4.7.3.6 DC Link Feedforward Voltage

The DC link feedforward voltage provides the coarse control of the width of the output PWM signals. The sampled DC link is routed through a DC link translator circuit, located on inverter Drive board A17A1, and Power Interface board A16A2A1 to the Control board. If the input voltage increases or decreases, the output PWM signal width decreases or increases to maintain a constant output voltage. The output voltage feedback circuit operates in conjunction with the DC link feedforward signal coarse control to provide the fine control of PWM pulse width. The two signals (DC link feedforward voltage and output feedback voltage) control the PWM pulse width to provide a highly regulated output voltage under varying input voltage and output load conditions.

4.7.3.7 Output Voltage Feedback

The output voltage feedback signal is used as a fine control to regulate the output voltage by controlling the width of the PWM signals.

When applicable, the output voltage level can be adjusted from the optional front panel Voltage Adjust control. This control permits the output voltage to be set at any point from 108 to 132 VRMS (line-to-neutral) as indicated on the front panel Output Voltage meter.

4.7.3.7.1 Line Drop Compensation

The Control board is equipped with a line compensation switch S2. This switch is preset at the factory to properly compensate the unit at the output cable connector. However, if it is desirable to maintain a constant voltage at a remote position, under varying load conditions, the switch can be set to other positions. The switch selects the percentage increase in output voltage compensation for the line drop. For example, under full load conditions the selected switch position increases the output voltage as follows:

Position 1: No compensation
Position 2: Approximately 2%
Position 3: Approximately 3%
Position 4: Approximately 4%
Position 5: Approximately 5%

4.7.3.8 Output Current Feedback and Output Soft Start

During initial turn on, the output soft start circuit momentarily overrides the output voltage feedback circuit. The soft start circuit causes the PWM signal width to start at a minimum and gradually increase. During short circuit overload conditions the current feedback circuit again overrides the output voltage feedback circuit to limit the output current to the maximum indicated in the unit General Specifications (Section I, Table 1–1).

4.7.3.9 DC Link Over Voltage Detection

See Figure 4–6. The Control board is equipped with a DC link overvoltage detection circuit. If the DC link voltage exceeds a set level, the detection circuit generates a DC link overvoltage signal. This signal is routed to the Protection board A2. The Protection board, in turn, generates an unlatched inhibit signal that shuts down the unit's inverter sections and latches the fault indication into the BITE board memory. When the DC link overvoltage condition is corrected, the unit will automatically restart.

4.7.4 BITE Board A6

The BITE (Built-In-Test-Equipment) board is used as the primary test equipment for isolating a malfunction within the unit. The BITE board provides the non-volatile memory latch circuit to retain fault information that is detected during the operation of the equipment. The fault indicators are described in Table 5–2. The fault conditions that can cause a malfunction are described in paragraph 4.7.2. Figures 4–2 through 4–12 illustrate the major components associated with a particular fault indicator. Fault isolation procedures using the fault indicators are provided in Section V. Faults are latched into the BITE board by the inhibit signal generated by the Protection board A2.

4.7.5 (Front) Door Interface Board A15

The Door Interface board interfaces the front panel controls and meters to the Power Interface board A16A2 through A15J1, and to the door circuitry A37 through A15J2. It controls the metering of the unit, the front panel alarms and indicators, the input/output contactors, and the interlock safety circuitry. It also interfaces with the Line Monitor board A53.

4.7.6 Component Panel A16

The Component Panel (center panel) consists of the following major components.

1. Logic (center) Card Cage A16A1.
2. Power Interface Assembly A16A2 and Power Interface Board A16A2A1.
3. Output Filter Assembly A16A3.

4. Terminal Boards and Mounting Bracket.

4.7.6.1 Logic Card Cage A16A1

The logic (center) card cage provides board guides and a mother board for circuit boards A1 through A6. See Figure 6–2, Sheet 2, for mother board interconnect information. The card cage mother board provides parallel circuit, runs, and connectors. The card cage connectors and control boards are keyed to ensure the following board arrangement:

Slot	Board
A1	Logic Power Supply board
A2	Protection board
A3	Control board
A4	Blank
A5	Blank
A6	BITE board A6 (option required for maintenance)

4.7.6.2 Power Interface Assembly A16A2

The Power Interface board A16A2A1 provides voltage stepdown transformers, fuses, and circuits for interfacing power circuits to the logic circuits.

4.7.6.3 Output Filter A16A3

The switching characteristics of the inverters eliminate all even harmonics (second, fourth, sixth, etc.). The phase relationship between the two inverter assemblies, along with the arrangement of the output transformers, eliminate the third, fifth, seventh, and multiple harmonics. The output filter A16A3 is tuned to eliminate the eleventh and thirteenth harmonics.

NOTE

The left inverter assembly and right inverter assembly are functionally identical except that the switching of the inverter circuits are phased 30 degrees apart. The outputs of the inverters are combined in the output transformers to eliminate the third, fifth, seventh, and multiple harmonics.

4.7.6.4 DC Link Voltage Meter A16A4

This meter is provided as a safety feature. See Index 26, Table 3–1 in Section III of this manual. The meter is visible with the front panel access door open. The meter indicates the status of the DC link voltage. DO NOT touch, remove, or replace any frequency converter component or assembly with input power applied or with the DC link voltage meter indicating that DC link voltage is present. The input contactor provides a circuit for rapidly discharging (within 10 seconds) the DC link capacitors upon removal of input power. Independent of that feature, the voltage equalizing resistors A39R1, A39R2, and A39R4–R7 connected across the DC link filter capacitors (A39C1–C6) discharge the capacitors within 2-to-5 minutes after input power is removed. Always monitor DC link discharge on the DC link voltage meter.

4.7.7 Inverter Assemblies A17, A18

The unit has two inverter assemblies (left and right). These inverter assemblies function identically except that the PWM drive signals are phase shifted by

30 degrees. As previously explained, this 30 degree phase shift along with the output transformers eliminate the third, fifth, and seventh harmonic components. The inverters contain the following major components and assemblies.

1. Inverter Drive boards A17A1 and A18A1.

2. Voltage Clamp boards A17A2 and A18A2.

3. Thermal Switches A17S1 and A18S1.

4.7.7.1 Drive Boards A17A1 and A18A1

The Drive boards are used to drive the power switching transistors in each power switching circuit. The boards are located on the left and right inverter assemblies A17 and A18.

See Figure 4–1 and Figure 7–2, sheets 2 and 3. Each transistor assembly A3 through A5 has two transistors. The transistors connect the DC link to the load through another phase of the same inverter. When the unit is operational, one of the two transistors within each transistor assembly is enabled except for a short period of time during each switching transition when both transistors are off. This prevents switching faults that could occur if both transistors were on simultaneously. The delay in time between switching one transistor off and turning the other transistor on is controlled by the drive board circuitry. The PWM signals are routed through the Drive board to the gate of the respective transistors. The drive power to the transistors is derived from the 24 VAC supplied from the Power Interface board. This AC drive power is rectified, filtered and regulated on each Drive board.

Protection circuitry on each Drive board monitors transistor saturation voltage and input power down voltage. See paragraphs 4.7.2.1 and 4.7.2.8, respectively.

4.7.7.2 Voltage Clamp Boards A17-A2 and A18A2

The Voltage Clamp board aids in clamping the DC link voltage across each switching transistor. This circuit eliminates damage to the transistor and other components due to voltage spikes.

4.7.7.3 Thermal Switches A17S1 and A18S1

Each inverter is equipped with a normally open thermal switch. The switch will close if the temperature of the inverter reaches 175° Fahrenheit (overtemperature condition) and reopen when the inverter temperature reaches approximately 140° Fahrenheit. Refer to the Protection board (A2) description for additional information.

4.7.8 Fan Assemblies A26 and A27

See Figure 7–2, sheet 1. The fan assemblies are mounted on the left and right sides of the frequency converter assembly. These fans pull air across the heat sinks of inverter assemblies A17, A18, and the magnetics, rectifier and DC link soft start SCR assembly A36. Power (230 VAC) for the fans is routed from step-down transformer assembly A22T2. Transformer A22T2 is fused by A22F4.

Fan air flow is sensed by a thermistor circuit attached to each Fan assembly A26 and A27. See Figure 4–8. A detector circuit, located on the Power Interface board, monitors each sensor and shuts down the frequency converter if cooling air is lost or greatly diminished.

4.7.9 Magnetics, DC Link Rectifier, and DC Link Soft Start SCR Assembly A36

See Figure 7–2, Sheets 1 and 4. Inductors L1–L3, and L4–L6, and transformers T1 and T2 combine the outputs of the left and right inverters in such a manner as to eliminate the third, fifth, and seventh harmonics of the unit's output power circuit. See Figure 7–2, Sheet 1. Inductors A36L7–L8, rectifier A36A1D1 and DC link soft start SCR A36A1D2 form a part of the DC link circuit. The functions of these components within the DC link circuit are described in paragraph 4.7.12 along with the DC link filter and DC link soft start drive assembly A39.

A36A1R1 and A36A1C1 are connected directly across the DC link output of rectifier A36A1D1 to eliminate high frequency voltage spikes that could occur due to power switching or other conditions.

4.7.10 DC Link Filter and DC Link Soft Start SCR Drive Assembly A39

See Figure 4–1 and Figure 7–2, sheet 1. The DC link filter provides filtering for the DC link. The filter consists of six 2000 μF capacitors. The initial inrush current to the filter is controlled by a soft start circuit. When input power is initially applied, dc power from rectifier assembly A36A1D1 is routed through inductors A36L7, A36L8, and resistor A39R3 (10Ω resistor) to the filter capacitors. When the DC link voltage reaches approximately 450 VDC and the voltage drop across resistor A39R3 has reduced to less than 13 VDC, the SCR driver A39A1 gates the bypass SCR A36A1D2 to an on condition. The gated on SCR bypasses the soft start resistor A39R3.

The filter capacitors are equipped with four 10W, 35KΩ resistors to equalize the voltage across the capacitors. These resistors serve a dual purpose in that they also provide a discharge path when input power is removed. For safety purposes, DC Voltmeter A16A4 is connected to the DC link to provide a visual indication of the DC link voltage.

With input contactor circuitry, the DC link is rapidly discharged through resistor R1, supplied as a part of the Input Contactor Kit, when the input contactor A22K1 is opened.

The amount of filter inductance provided by A36L7L8 is sufficient to reduce the pulsation on the DC link to the level that will permit the output of the unit to maintain the output voltage within the limits specified in Table 1–1, Section I of this manual. The filter inductors also serve to eliminate current surges (caused by inverter loading) from the input power line.

SECTION V
MAINTENANCE

NOTE

When assistance of any type is desired by the customer, from Unitron, locate the Identification Plate (Figure 6–1) and note the PART NUMBER and SERIAL NUMBER. You must have this information available when calling Unitron for assistance.

Unitron Incorporated
ATTN: Customer Service Dept.
10925 Miller Road
Dallas, Texas 75238
Phone: (800) 527-1279
(214) 340-8600
Fax: (214) 341-2099

5.1 GENERAL

This section provides troubleshooting and repair procedures for the Pwr-Kart frequency converter. The information supports the maintenance concept of fault isolation using the conditions indicated by the BITE board indicators. Repair consists of removal and replacement of the indicated part or assembly.

To permit efficient repair of the unit, a *B*uilt-*I*n *T*est *E*quipment (BITE) board must be installed as assembly A6 within the logic (center) card cage. The BITE board provides a non-volatile memory latch circuit that permits a fault condition to be retained even if input power is removed. The functions of these indicators and the fault circuits are illustrated in Figures 4–2 through 4–12, and are described in Table 5–2 and in the paragraphs associated with the various assemblies. These illustrations are also used in the troubleshooting procedures, provided in Section V of this manual, as a quick visual reference to determine the assemblies associated with a particular fault condition.

Perform the *Equipment Turn-on Procedures,* provided in Section III, following each replacement. The replaceable parts and assemblies are illustrated and identified in Section VI. Removal/replacement procedures for parts or assemblies where removal/replacement is not obvious are provided in paragraph 5.4.

5.2 TEST EQUIPMENT

1. BITE board installed in the card cage slot A6. (See Table 6–2 for part number.)

2. Multimeter, used for measuring continuity and voltages.

3. Test Set, DC Link Simulator, P/N 150–85005–1 (120 VAC) or 150–85005–2 (220 VAC), used to test the frequency converter at a reduced DC link voltage level. See Figure 5–1.

5.3 TROUBLESHOOTING

WARNING

Lethal voltages are present within the frequency converter. DO NOT perform continuity checks, touch, or remove components within the unit with input power applied or if the DC Link Voltage Meter A16A4 indicates that DC link voltage is present. Input contactor circuitry provides for rapid discharge (less than 10 seconds) of the DC link capacitors whenever the contactor is opened. Additionally, DC filter resistors will discharge the DC link within 2-to-5 minutes of removal of input power. In any case, always monitor DC link discharge on the DC link voltage meter.

The frequency converter has built in fault detection circuits that cause an audible alarm to be sounded if a fault condition is detected. However, if fuses A22F1–F3 or A16A2A1F2 blow, or logic power is not present, etc., the audible alarm may not sound. The following procedures provide troubleshooting information for:

1. A frequency converter that is not operative and does not sound an alarm. Proceed to paragraph 5.3.1.

2. A frequency converter that is not operative and does sound an alarm. Proceed to paragraph 5.3.2.

WARNING

DO NOT touch, remove, replace or disconnect any component or assembly with input power applied. Lethal voltages are always present within the frequency converter when input power is applied.

5.3.1 Frequency Converter Does Not Operate and Does Not Sound an Alarm

Proceed as follows to isolate the malfunction.

1. Ensure that the frequency converter door is securely closed thereby disabling the door safety interlock circuit.

2. Confirm that all three phases of input power are applied. Check the status of the Unit Control Ready lamp on the front panel. If it is illuminated, power is being provided to the Door Interface board. If it is not illuminated, check fuses A22F5, A22F8, A22F9, and A22F10 (see Figure 7–1), and replace as necessary. If power is present at the input, the Line Monitor board A53 will sense the service line for over/under voltage and loss of phase. Correct any input power or input contactor problem as applicable.

DC LINK SIMULATOR TEST SET

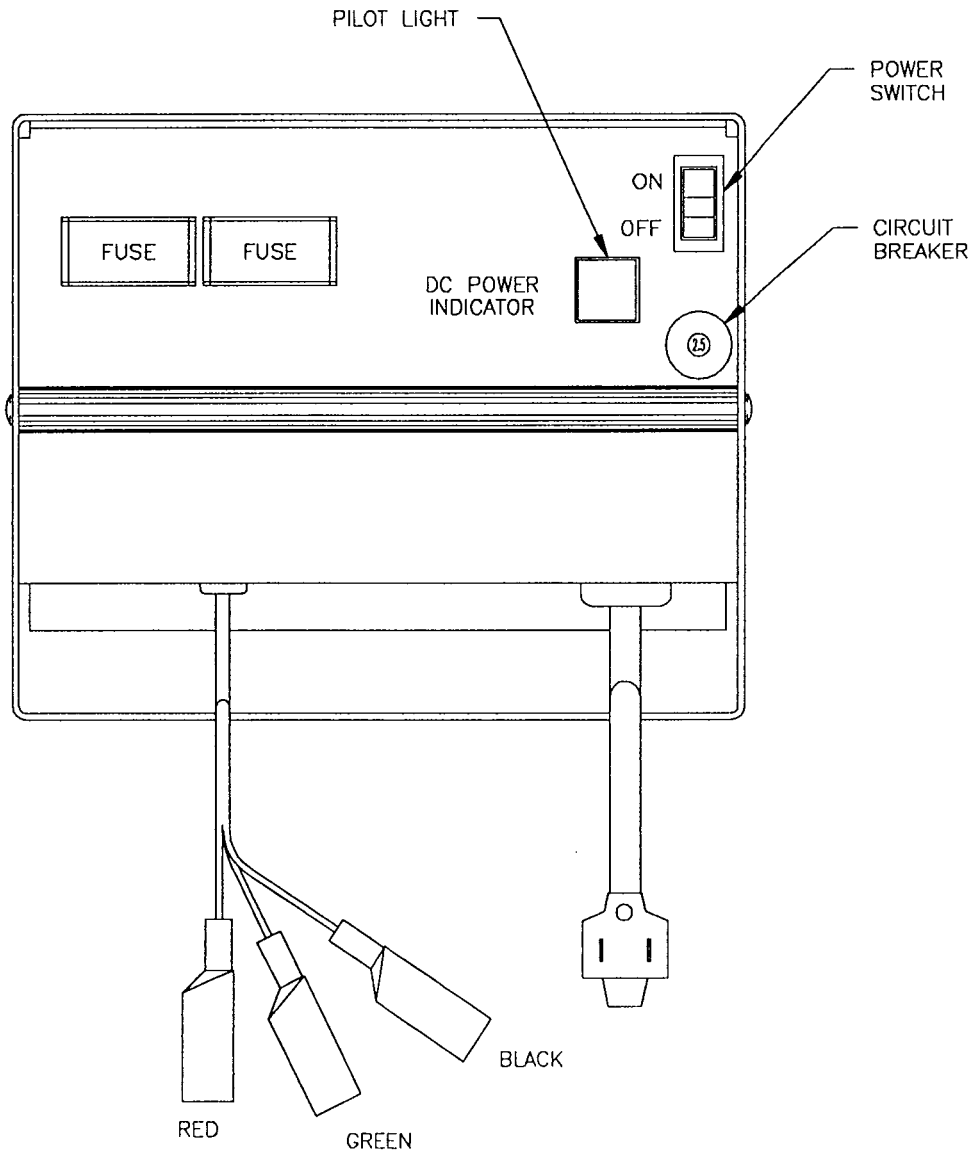

FIGURE 5-1. TEST EQUIPMENT

3. Position the external input power circuit breaker or disconnect switch to OFF.

4. Open the front panel access door.

5. Confirm that external input power is removed and that DC Link Voltage Meter A16A4 indicates less than 10 VDC.

6. Refer to Figure 4–5. Check fuse A16A2A1F2.

   a. If the fuse is blown, the Power Interface board A16A2A1 or Logic Power Supply board A1 is malfunctioning.

   b. If the fuse checks good, proceed to step 7.

7. Pull the access door interlock switch to an extended (override) position. Position the external input power circuit breaker to ON. Press the Unit Control ON switch. Observe the following:

   a. With input voltage applied, the DC Link Voltage Meter A16A4 indicates that the DC link voltage is 650 VDC (± 10%). If a proper voltage is not obtained, the rectifier A39A1D1 is probably defective.

WARNING

Lethal voltages are present within the frequency converter. DO NOT perform continuity checks, touch, or remove components within the unit with input power applied or if the DC Link Voltage Meter A16A4 indicates that DC link voltage is present.

   b. BITE board (A6) indicators DS2 and DS4 are normally illuminated. Refer to Figure 4–2. If indicator DS2 is not illuminated the logic 12 VDC is not present. Remove input power (*monitor discharge of the DC link on the DC link voltage meter*), then remove and replace Logic Power Supply board A1. After repair proceed to paragraph 5.5 to test the repaired unit.

8. If the DC link voltage is normal, and indicators DS2 and DS4 are illuminated, and the malfunction has not been detected in the previous steps, the Unit ON control, or associated circuitry is malfunctioning. Refer to Figures 4–4 and 7–8. Position the external input power circuit breaker or disconnect switch to OFF. *After the DC link voltage has discharged to a safe level as monitored on the DC link voltage meter*, proceed as follows to isolate the malfunction.

   a. Use an ohmmeter to check the Unit Control ON switch (A50S4) circuit.

   b. If the switch circuit checks good, the problem is in the Protection board A2, Control board A3, Door Interface board A15, or Power Interface board A16A2A1 (or the interconnecting cabling). Replace the boards one at a time. After each replacement, check the operation of the frequency converter using the *Equipment Turn-on Procedures* provided in Section III.

5.3.2 Frequency Converter Does Not Operate and an Audible Alarm is Sounded

1. Silence the audible alarm by momentarily pressing the Alarm Silence switch A50S6 on the front panel. Determine if the front panel External Line Fault indicator DS8 or External Load Fault indicator DS10 is illuminated. If either of these indicators is illuminated, the fault could be caused by conditions external to the unit such as an output overload condition that was present for 5 minutes (110 to 175% output overload) or 20 seconds (175% or greater overload), or input power loss. If neither indicator is illuminated, the Internal Unit Fault indicator DS9 should be illuminated: the fault is within the unit. Proceed to Step 2.

   a. If an overload condition is indicated (External Load Fault indicator illuminated), correct the condition by removing some of the output load. Restart the unit by momentarily pressing the Reset/ Lamp Test switch A50S11, then reapply power to the load. If the fault condition recurs, press the Unit Control OFF switch. Proceed to Step 2.

   b. If an input power fault condition is indicated (External Line Fault indicator DS8 illuminated), the fault condition can be caused by a loss of one or more input power phases, or by an input over or undervoltage condition. If the fault condition is caused by the input power, the Line Monitor board A53 will prevent the input contactor from closing. *Be aware of the presence of high voltages. Observe all safety precautions.* Check the input cable connections and the associated fuses A22F8–F10 (replace as necessary). Determine that all three phases of the input power are present at A22TB1. When the input power fault has been corrected, restart the unit by pressing the Unit Control ON switch A50S4. If the frequency converter does not start, check fuses A22F1–F3 (replace as necessary). If the frequency converter still does not start, press the Unit Control OFF switch A50S1. Proceed to the next step.

WARNING

Input power is applied to the frequency converter. DO NOT touch any component within the unit. Lethal voltage is present within the frequency converter.

2. Open the unit's access door to gain access to the BITE board A6 indicators. Pull the access door interlock switch to an extended (override) position and momentarily press the Unit Control ON switch to close the input contactor. This reapplies input power.

3. Observe and record the status (ON or OFF) of each of the BITE board A6 indicators. BITE board indicators DS2, DS4, and DS14 are normally illumi-

nated under this condition (input power applied). Also record the DC link voltage as indicated on the DC Link Voltage Meter A16A4. See Figure 5–2 and Table 5–1 for location and an explanation of each BITE board indicator. After the status of each indicator is recorded proceed to the next step.

4. Position the external input power circuit breaker to OFF.

WARNING

Wait until the DC link voltage has discharged to a safe level (as observed on the DC Link Voltage Meter A16A4) before touching or removing any component or part.

5. Using the recorded DC link voltage and BITE board indicator status, refer to Table 5–2 to isolate the malfunction to a replaceable part or assembly.

6. Perform the *Equipment Turn-on Procedures*, provided in Section III, following each repair. Removal/replacement procedures for parts or assemblies where removal/replacement is not obvious are provided in paragraph 5.4.

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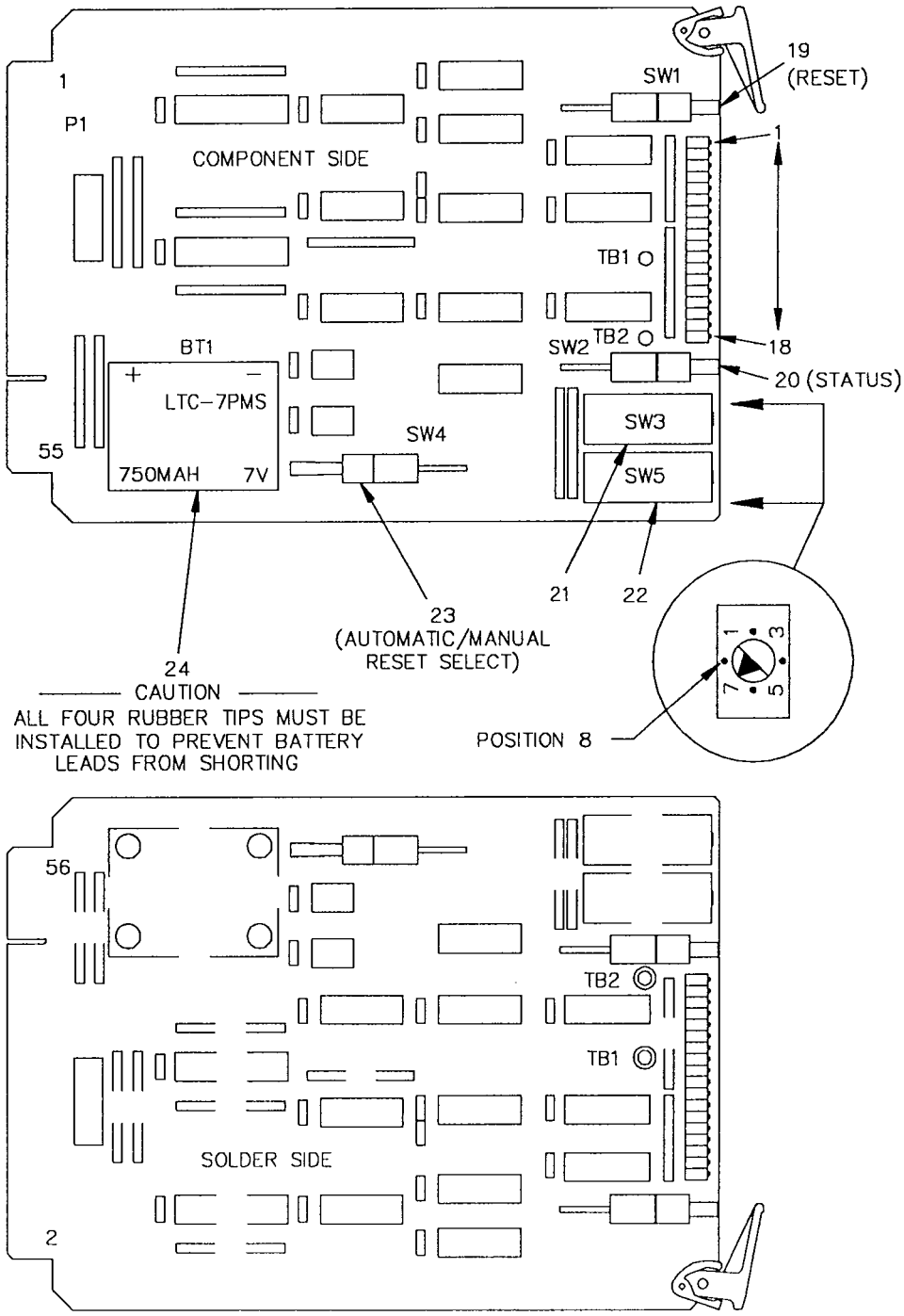


FIGURE 5–2. BITE BOARD CONTROLS AND INDICATORS

Table 5–1. BITE Board Controls and Indicators

Figure 5–2 Index No.	Control/ Indicator	Description
1	DS1 (Green) +5 VDC for the Parallel Board	This indicator is functional only with input power applied to the unit. This is not a memory circuit. The indicator is normally illuminated indicating that isolated +5 VDC power for the Parallel board is present. The Parallel board is not used in this frequency converter configuration.
2	DS2 (Green) +12 VDC Present	See Figure 4–2. This indicator is functional only with input power applied to the unit. The indicator is normally illuminated indicating that +12 VDC logic power from the Logic Power Supply board A1 is present.
3	DS3 (Red) Parallel Board Plugged In	This indicator is functional only with input power applied to the unit. This is not a memory circuit. The indicator is illuminated to indicate that a Parallel board is installed in the card cage. The Parallel board is not used in this frequency converter configuration.
4	DS4 (Green) Battery Check	See Figure 4–3. This indicator functions as follows: a. With input power removed from the unit, this indicator illuminates when switch SW2 (Figure 5–2, Index 20) is pressed. This indicates that the BITE board battery (Figure 5–2, Index 24) is operating properly. b. With input power applied to the unit, this indicator illuminates to indicate +12 VDC is present.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
		NOTE The status of indicators DS5 through DS10 and DS12 through DS18 can be determined without applying input power to the unit. This is accomplished by pressing the BITE board status switch SW2 (Figure 5–2, Index 20). Indicator DS18 illuminates to indicate that a fault condition has been latched into the BITE board memory. Indicators DS5 through DS10 and DS12 through DS17 identify the fault condition that was latched into memory. Indicator DS4 illuminates (with switch SW2 pressed) to indicate that the BITE board battery is providing power to the BITE board circuits. A fault condition (if present) is latched into the BITE board memory by the alarm signal generated by the Protection board A2.
5	DS5 (Red) Inverter On/Off Rate Fault	See Figure 4–4. This is a memory circuit. This indicator illuminates only if the inverter (400 Hz output) is turned on and off at a rate greater than 4 times in any one second time period. The Protection board circuitry generates an inhibit signal upon detection of an excessive inverter On/Off rate, thereby shutting down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
6	DS6 (Red) Logic Power Supply Overvoltage Condition and 5V REF on the Control Board	See Figure 4–5. This is a memory circuit. This indicator illuminates only if a logic power supply overvoltage fault condition is detected. If a logic power supply overvoltage condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition.
7	DS7 (Red) Logic Power Supply Undervoltage Condition and 5V REF on the Control Board	See Figure 4–5. This is a memory circuit. This indicator illuminates only if a logic power supply undervoltage fault condition is detected. If a logic power supply undervoltage condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition. NOTE On units NOT equipped with input contactors (controlled by the Line Monitor board), the power supply undervoltage also provides loss of phase protection for phase A and B.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
8	DS8 (Red) DC Link Undervoltage	See Figure 4–6. This is a memory circuit. This indicator is illuminated only if a DC Link undervoltage fault condition is detected. If a DC Link undervoltage condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will automatically restart after the DC Link undervoltage condition is removed.
9	DS9 (Red) DC Link Overvoltage	See Figure 4–6. This is a memory circuit. This indicator is illuminated only if a DC Link overvoltage fault condition is detected. If a DC Link overvoltage condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will automatically restart after the DC Link overvoltage condition is removed.
10	RESERVED	Not used in this configuration.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
11	DS11 (Red) Input Power Down	See Figure 4–7. This circuit is used to disable the BITE board latch function during normal power down conditions. This prohibits random faults from being latched into the BITE board when power is removed. The BITE board is designed to enable this function at the user's discretion by removing the E1–E2 jumper on the BITE board. NOTE On units NOT equipped with input contactors (controlled by the Line Monitor board), the input power down signal provides loss of input phase protection for phase B and C.
12	DS12 (Red) Inverter Overtemperature and Fan Flow Detection	See Figure 4–8. This is a memory circuit. This indicator illuminates if an overtemperature condition is detected by thermal switch A17S1 or A18S1. If an overtemperature condition is detected or if cooling air is interrupted, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will automatically restart from this fault condition.
13	DS13 (Red) Output Overvoltage	See Figure 4–9. This is a memory circuit. This indicator illuminates if an output overvoltage condition is detected. If an overvoltage condition is detected, the Protection board generates an inhibit alarm signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
14	DS14 (Red) Output Undervoltage	See Figure 4–9. This is a memory circuit. This indicator illuminates if an output undervoltage condition is detected. If an undervoltage condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition.
15	DS15 (Red) 20 Second Overcurrent	See Figure 4–10. This is a memory circuit. This indicator illuminates if an overload condition of 125% or greater (short circuit) is present for 20 seconds. If an overload condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition.
16	DS16 (Red) 5 Minute Overcurrent	See Figure 4–10. This is a memory circuit. This indicator illuminates if an overload condition of 110% or greater is present for 5 minutes. If an overload condition is detected, the Protection board generates an inhibit signal to shut down the inverter. The inhibit signal also enters the fault condition into the BITE board non-volatile memory latching circuit. The inverter will not automatically restart from this fault condition.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
17	DS17 (Red) Pulse-by-Pulse Overload, Transistor Desaturation	See Figure 4–11. This is a memory circuit. This indicator illuminates if an overload condition is detected in any one of the six inverter switching circuits. The load condition is monitored pulse-by-pulse. A detected overload condition is routed to the BITE board from the Protection board. The Protection board generates an inhibit signal if the pulse-by-pulse overload condition is present for approximately one-tenth of a second or more. The BITE board will not latch without an alarm latch signal from the Protection board.
18	DS18 (Red) Latched Fault Condition	This indicator illuminates only if a fault condition is latched into the BITE board memory.
19	SW1 Reset Switch	With the input power applied and the unit's inverter off (400 Hz output OFF), momentarily pressing this switch clears the BITE board memory. This switch does not clear and/or reset the front panel alarms and indicators; that must be done by pressing the front panel Reset/Lamp Test switch. Pressing the front panel Reset/Lamp Test switch does not reset the BITE board memory circuit; that can only be accomplished by pressing the BITE board reset switch SW1. With both input power and output power on (400 Hz output ON), momentarily pressing SW1 only clears the BITE board memory.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
20	SW2 BITE Board Status Switch	This switch is used to check the status of the BITE board memory circuit with input power removed from the unit. When this switch is pressed, the following conditions occur: a. Indicator DS4 illuminates to indicate that the battery is good. b. Indicator DS18 illuminates if a fault has been latched into the BITE board memory. c. The applicable indicator (DS5 through DS10 or DS12 through DS17) will illuminate to indicate the type fault latched into the BITE board memory. d. If the unit shuts down with no malfunction latched into the BITE board memory, the fault could be caused by a momentary interruption of the input voltage or input contactor. Refer to DS11 for an explanation of this condition. Also, review SW4 (automatic/manual reset switch) information concerning possible intermittent shutdown conditions.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
		CAUTION *DO NOT measure the signals at TP1 and TP2 with normal DC Link voltage applied to the inverter circuit. These tests can be made only if the DC Link circuit is disconnected as described in paragraph 5.3.4.*
21	SW3 Rotary Test Switch	This rotary switch permits the selection of the following signals for monitoring at the BITE board test point TP1 with respect to TP2 (ground). Position 1: –12 VDC (from Logic Power Supply board A1) Position 2: PWM 1 Signal Position 3: PWM 2 Signal Position 4: Enable 1 Signal Position 5: Enable 2 Signal Position 6: Triangle Wave Signal Position 7: Expansion to permit rotary switch SW5 functions to be monitored at TP1 with respect to TP2. Position 8: +12 VDC (from Logic Power Supply board A1)
22	SW4 Automatic/ Manual Reset Select Switch	This switch permits the BITE board memory latch circuit to be reset automatically every thirty (30) minutes of continuous operation (unit on and supplying 400 Hz output power), or to be manually reset only by pressing the BITE board Reset switch SW1. The automatic reset function is selected when the lever of switch SW4 is positioned in toward the BITE board. The automatic reset function permits the memory latch circuit to automatically reset every thirty minutes of continuous operation. This clears the memory latch circuit from non-equipment failure

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
22	SW4 Automatic/ Manual Reset Select Switch *(continued)*	fault conditions such as input power fault conditions or output overload conditions. The automatic reset will not occur until after thirty minutes of continuous operation. SW1 can be used to reset the BITE board memory circuit while SW4 is in either position (automatic or manual). The manual reset function is selected when the lever of switch SW4 is positioned away from the BITE board. In this position, the BITE board automatic reset function is disabled.
23	SW5 Rotary Test Switch	This switch is used in conjunction with switch SW3 to provide additional test signal monitoring capabilities. Switch SW3 must be in position 7 for this switch to be operational. Position 1: Current Limit Signal. Position 2: VDC In (reduced equivalent of DC link voltage). Position 3: VDC Out. Position 4: +5 VDC (reference from Control board A3). Position 5: Input Overvoltage Signal. Position 6: Not used. Position 7: Not used. Position 8: Sync Signal.

Table 5–1. BITE Board Controls and Indicators (continued)

Figure 5–2 Index No.	Control/ Indicator	Description
24	BT1 Battery	The BITE board memory circuit is maintained by the Battery BT1. The battery capacity is such that it requires replacement every five years under normal operating conditions. The battery can be replaced by unplugging the old battery from the BITE board battery sockets and plugging the new battery into those sockets.

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6

WARNING

Lethal voltages are present within the frequency converter. DO NOT touch, perform ohmmeter measurements, or remove any component or assembly with input power applied or with the DC Link Voltage Meter A16A4 indicating DC link voltage of greater than 10 VDC.

BITE Board Indicator	Probable Cause of Malfunction
Unit runs and sounds alarm. Only indicators DS2 and DS4 illuminate.	1. Power Interface Board A16A2A1. 2. Protection Board A2. 3. Door Interface Board A50A15.
DS1 (+5 VDC for the Parallel Board).	This indicator is used only with a Parallel Board. The Parallel Board is not used in this frequency converter configuration.
DS2 (+12 VDC) not illuminated. See Figure 4–2.	1. Fuse A16A2A1F2. 2. Logic Power Supply Board A1. 3. Power Interface Board A16A2A1. 4. Input contactor A22K1 or associated control circuit. 5. Input fuses A22F1–F3.
DS3 (Parallel Board is installed).	This indicator is used only with a Parallel Board. The Parallel Board is not used in this frequency converter configuration.

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6 (cont.)

BITE Board Indicator	Probable Cause of Malfunction
DS4 Battery Status. See Figure 4–3.	1. With input power removed from the unit, this indicator is used to check the status of the BITE Board battery. The indicator illuminates when status switch SW2 (Figure 5–2, Index 20) is pressed. If the indicator does not illuminate, the BITE Board battery is weak or malfunctioning. Replace the BITE Board battery. 2. With input power applied to the unit, this indicator illuminates to indicate +12 VDC is present. If the indicator does not illuminate, refer to the probable cause associated with indicator DS2.
DS5 (Inverter ON/OFF Rate) and DS18 illuminated. See Figure 4–4.	This indicator illuminates to indicate that the inverter cycled on and off four times within a one-second time period. This is usually an indication of an intermittent connection rather than a board problem. 1. Protection Board A2. 2. Front panel Unit Control ON switch A50S4. 3. Control Board A3. 4. Interconnecting cabling. 5. Door Interface Board A15.
DS6 (Logic Power Supply Overvoltage) and DS18 illuminated. See Figure 4–5.	1. Logic Power Supply Board A1. 2. Control Board A3 (+5 VDC reference voltage).

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6 (cont.)

BITE Board Indicator	Probable Cause of Malfunction
DS7 (Logic Power Supply Undervoltage) and DS18 illuminated. See Figure 4–5.	1. Logic Power Supply Board A1. 2. Power Interface Board A16A2A1. 3. Control Board A3 (+5 VDC reference voltage).
DS8 (DC Link Undervoltage) and DS18 illuminated. See Figures 4–1 and 4–6.	***MODE 1 – Continuously "ON"*** If the DC link voltmeter indicates proper voltage (600–750 VDC) replace or test the following: 1. Left Inverter Drive Board A17A1. 2. Control Board A3. 3. Protection Board A2. 4. Power Interface Board A16A2A1. 5. Check for open cabling from DC link connections to the Control Board A3. If the DC link voltmeter indicates no voltage or very low voltage (less than 500 VDC) check the following: 1. Open connections between input rectifier A36A1D1 to DC link capacitors. 2. Input fuses A22F1–F3. 3. Improper input voltage to rectifier bridge assembly A36A1D1. (continued next page)

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6 (cont.)

BITE Board Indicator	Probable Cause of Malfunction
DS8 (continued)	***MODE 2 – DS8 comes "ON" only when a load is applied to the frequency converter.*** 1. Inoperative soft start circuit. Replace or test the following: a. DC link Soft Start Control Board A39A1. b. DC link Soft Start SCR A31A1D2. c. Soft Start Resistor. 2. Low DC link capacitance. Ensure the following: a. Load applied is within unit specifications. b. Input source voltage does not drop below unit specifications.
DS9 (DC Link Overvoltage) and DS18 illuminated. See Figures 4–1 and 4–6.	***MODE 1 – Continuously "ON"*** If the DC link voltmeter indicates proper voltage (600–750 VDC) replace or test the following: 1. Left Inverter Drive Board A17A1. 2. Control Board A3. 3. Protection Board A2. If the DC link voltmeter indicates high voltage (more than 800 VDC) check the following: 1. Improper input voltage to rectifier bridge assembly A36A1D1. (continued next page)

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6 (cont.)

BITE Board Indicator	Probable Cause of Malfunction
DS9 (continued)	***MODE 2 – DS9 comes "ON" only when a load is applied to the frequency converter.*** 1. Inoperative soft start circuit. Replace or test the following: a. DC link Soft Start Control Board A39A1. b. DC link Soft Start SCR A31A1D2. c. Soft Start Resistor. 2. Low DC link capacitance. Ensure the following: a. Load applied is within unit specifications. b. Input source voltage does not drop below unit specifications. **WARNING** **Lethal voltage is present within the frequency converter. Confirm that external input power is OFF, and that the DC Link Voltage Meter A16A4 indicates that the DC link voltage is less than 10 VDC.**
DS10 (Reserved)	Not used in this configuration.
DS11 (Input Power Down) illuminated with input power applied. See Figure 4–7.	1. Input power phase B or C not present. 2. Power Interface Board A16A2A1. 3. Inverter Drive Boards A17A1 and A18A1. 4. Protection Board A2.

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6 (cont.)

BITE Board Indicator	Probable Cause of Malfunction
DS12 (Overtemperature or Fan Flow Detection) and DS18 illuminated. See Figure 4–8.	1. Use an ohmmeter to determine which thermal switch, A17S1 or A18S1, is closed. a. If the thermal switch A17S1 or A18S1 is closed due to overheating, the problem can be caused by a defective blower, A26 or A27, or by an ambient air condition that exceeds that specified in Table 1–1, Section I of this manual. After the unit cools and the thermal switch reopens, check the operation of the fans with input power applied. Replace the fans as required. If the thermal switch does not reopen (after cooling) remove and replace the defective switch. b. Fan air flow is monitored by a sensor mounted to each fan assembly. A detector circuit located on the Power Interface Board will shut down the unit if a fan fails or cooling air is lost. c. After repair, proceed to the Test After Repair procedure, paragraph 5.5.
DS13 or DS14 (Output Over/Undervoltage) and DS18 illuminated. See Figure 4–9.	1. Control Board A3. 2. Protection Board A2. 3. Power Interface Board A16A2A1.
DS15 and/or DS16 (20 Second/5 Minute Overload) and DS18 illuminated. See Figure 4–10.	Normal indication for output overload when output contactor is closed and output load exceeds 125% for 20 seconds, or 110% for 5 minutes. Remove the load and then perform the Test After Repair procedures, paragraph 5.5. If the condition recurs under a no load condition, the Power Interface Board A16A2A1 or Protection Board A2 is malfunctioning.

Table 5–2. Troubleshooting Using the Indicators of BITE Board A6 (cont.)

BITE Board Indicator	Probable Cause of Malfunction
DS17 (Transistor Pulse-By-Pulse Overload) and DS18 illuminated. See Figure 4–11.	The pulse-by-pulse overload condition can be caused by any of the following fault conditions. 1. Shorted output transformer A36T1 or A36T2. Inspect the transformers for obvious damage. 2. Shorted inductor A36Ll–L6. 3. Shorted AC (output) Filter A16A3. Inspect for obvious damage. 4. Inverter Drive Boards A17A1 and A18A1. NOTE Pulse-by-pulse is generated by the Inverter Drive Board protection circuitry. To assist in fault isolation each board has three red indicators that illuminate for 10 seconds when the pulse-by-pulse circuit is tripped. 5. Protection Board A2 (fails to limit output current under short circuit conditions). 6. Control Board A3 (fails to regulate output voltage under short circuit conditions).

Table 5–3. Troubleshooting Using Standard Unit BITE Indicators

Door Indicators	Probable Cause of Malfunction
DS8 External Line Fault	Review paragraph 4.4 (Input Power Control Circuits). See Figure 4–12. 1. Incoming line voltage out of tolerance or missing phase. 2. Faulty Line Monitor Board – remove TB1 and jumper pins 2–3 to bypass the Line Monitor Board. 3. Faulty Door Interface Board. 4. Open connection.
DS9 Internal Unit Fault	All internal fault conditions are generated on the Protection Board – review Table 5–2.
DS10 External Load Fault	Review paragraph 4.7.2.6 (20 Second/5 Minute Overload Circuits). See Figure 4–10. 1. Output current in excess of limits. 2. Protection Board failure. 3. Door Interface Board failure. 4. Power Interface Board failure.
DS1 Ready Indicator	See Figure 4–12. 1. ON – voltage applied to Door Interface Board. 2. OFF – no input voltage, A22F5 or A22T1 open. 3. OFF – failed Door Interface board. 4. OFF – bad indicator or faulty wiring.

Table 5–3. Troubleshooting Using Standard Unit BITE Indicators (continued)

Power Interface Board Indicator	Probable Cause of Malfunction
DS1 Fan Flow Detector	Review paragraphs 4.7.2.4 (Inverter Overtemperature and Fan Flow Detection) and 4.7.8 (Fan Assemblies A26 and A27). See Figure 7–2, sheet 1, and Figure 4–8. 1. Any fan failure. 2. Fan transformer or fuse failure. 3. Power Interface Board failure.
Drive Board Indicators	**Probable Cause of Malfunction**
	Review paragraphs 4.7.7.1 (Drive Boards A17A1 and A18A1) and 4.7.2.1 (Pulse-By-Pulse Overload and Transistor Desaturation Protection). See Figure 4–11.
DS1 Green	1. ON – Indicates +15 Vdc power is being generated on the board. 2. OFF – Drive Board failure. 3. OFF (On both boards, A17A1 and A18A1) – Power Interface Board T8 or F1 failure. See Figure 4–7.
DS2, DS3 or **DS4** Red	1. Momentary (ten seconds) only – occurs when transistor current exceeds specifications.

Table 5–3. Troubleshooting Using Standard Unit BITE Indicators (continued)

Protection Board Indicators	Probable Cause of Malfunction
DS1 (Bottom Indicator) Unit Overload	Review paragraph 4.7.2.6 (20 Second/5 Minute Overload Circuits). See Figure 4–10. 1. Output current in excess of limits. 2. Protection Board failure.
DS2 (Top Indicator)	Review paragraph 4.7.2.1 (Pulse-By-Pulse Overload, Transistor Desaturation Protection). See Figure 4–11. 1. Shorted output transformer or output filter. 2. Excessive output load. 3. Protection Board failure.

5.3.3 Testing the Frequency Converter at a Reduced, Current Limited, DC Link Voltage

WARNING

This test confirms the operation of the frequency converter at a reduced DC link voltage level. This test permits the frequency converter inverter sections to be tested without further damaging components within the unit. Lethal DC link voltage is present at the rectifier A39A1D1, DC link filter, terminal board A39TB1, etc. DO NOT touch, disconnect, or reconnect any component without confirming that the external input power is OFF, and that the DC link voltage has decreased to a safe level (less than 10 VDC) by monitoring the DC Link Voltage Meter A16A4.

1. Confirm that the external input power is OFF and that the DC link voltage has discharged to a safe level. Disconnect the wire from terminal board A39TB1 terminals 1 and 3 (front side only). See Figure 6–2, sheet 8. This disconnects the plus (+) DC link voltage from the input to inverters A17 and A18. See Figure 7–2, sheets 1 through 3.

2. See Figure 5–1. Position the DC Link Simulator Test Set power switch to OFF. Reset the Test Set 2.5 ampere circuit breaker (if tripped).

3. Connect the two wires (previously disconnected from A39TB1 terminals 1 and 3) to the red (+) clip lead of the DC Link Simulator Test Set. Tape and/or position these wires so that they do not short to chassis or other components.

4. Connect the black clip of the test set to terminal 7 of A39TB1.

5. Connect the green clip of the test set to the frequency converter chassis.

6. DC link (undervoltage) protection circuits and output voltage (undervoltage) protection circuits must be disabled to allow the unit to operate at a reduced DC link voltage. Disable the referenced protection circuits as follows:

   a. Remove the Protection board A2 from the card cage.

   b. See Figure 5–3. Use 22 AWG bus wire, or other suitable material, to connect the three test points (located on the back side of the Protection board A2) together.

NOTE

Ensure all three test points are shorted together using a digital voltmeter or ohmmeter. The Protection board A2 has been sprayed with a conformal coating.

CAUTION

The bus wire used to short the test points must not touch the Protection board circuit wiring.

   c. Ensure that the installed shorting bus wire does not touch the circuit wiring on the Protection board.

   d. Reinstall the Protection board A2 in the card cage assembly.

900881A

SOLDER SIDE OF PROTECTION BOARD
SHOWING TEST POINTS

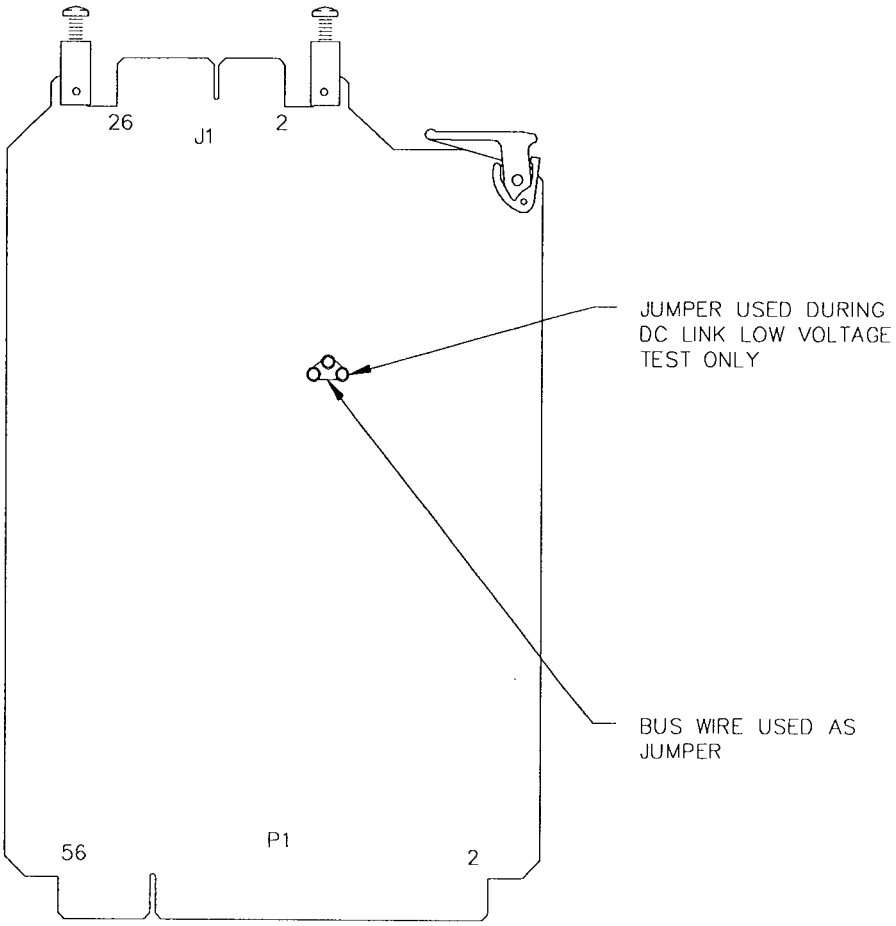


FIGURE 5-3. PROTECTION BOARD A2 TEST POINTS

7. Confirm that the DC Link Simulator Test Set power switch is OFF. Plug the DC Link Simulator Test Set into a 120 VAC power outlet for P/N 150–85005–1 or 220 VAC power outlet for P/N 150–85005–2. However, DO NOT turn the test set on at this time.

8. Pull the access door interlock switch to the extended (override) position. Refer to Figure 3–1, sheet 3, Index 25.

9. Reapply input voltage to the frequency converter. Ensure that the green ready light is illuminated and the alarm is off.

WARNING

Lethal voltage is present within the frequency converter. DO NOT perform continuity checks, touch, or remove/replace any component while input power is applied or DC link voltage is present. Observe all safety precautions.

10. See Figure 5–1. Position the DC Link Simulator Test Set power switch to ON. The test set DC power indicator should illuminate.

NOTE

If the DC Link Simulator Test Set DC power indicator does not illuminate, reset (press) the 2.5 ampere circuit breaker. If the test set 2.5 ampere circuit breaker trips or the DC power indicator turns off at any time during this test, the frequency converter inverter section is still malfunctioning.

11. At the frequency converter control panel press the Unit Control ON switch A50S4, Figure 3–1, Index 2. This turns the frequency converter ON. The alarm should sound for 3-to-5 seconds and then extinguish. Observe that the Test Set DC power indicator is still on. If the Test Set DC power indicator is still on, proceed to the next step. If the Test Set DC power indicator goes off (test set 2.5 ampere circuit breaker trips), a fault still exists in the frequency converter inverter section. Proceed to paragraph 5.3.5 to further isolate the malfunction.

12. Use a multimeter to measure the frequency converter output line–to–neutral voltage at the output terminals (A22TB3) or the output power cable. The output contactor must be closed to make this measurement. A reading of approximately 18 VAC should be obtained at each measurement. The magnitude of the reading is not critical; however, the same reading should be obtained at each phase-to-neutral measurement; otherwise, a malfunction still exists in the inverter sections of the frequency converter. If a proper reading is obtained, proceed to the next step. If an improper reading is obtained, a Drive board (A17Al or A18A1) is malfunctioning, or an output transformer A36T1–T2 or output filter A16A3 is probably shorted. Correct the problem and repeat this test.

13. Position the DC Link Simulator Test Set power switch to OFF.

14. Press the Unit Control OFF switch S1.

15. Open the input power external circuit breaker.

16. After the DC link has discharged to a safe level, disconnect the DC Link Simulator Test Set.

17. Reconnect the wires (previously disconnected) to terminals A39TB1–1 and 3.

18. Remove the bus wire that was previously installed to short the test points on the Protection board A2. Reinstall the Protection board.

19. Confirm that all wires are reconnected. Close the access door. Proceed to paragraph 5.5 to test the frequency converter at full DC link voltage.

5.3.4 DC Link Simulator Test Set Circuit Breaker Trips During Reduced DC Link Voltage Test

1. Press the Unit Control OFF switch A50S1.

2. Position the DC Link Simulator Test Set power switch to OFF.

3. Open the external input power circuit breaker.

4. Isolate both inverters by disconnecting their outputs. Remove the wires from TB1–3, 4, and 5 on both inverter assemblies. This removes the output transformers and output filter from the output of the inverters.

5. Close the external input power circuit breaker.

WARNING

Lethal voltage is present within the frequency converter. DO NOT perform continuity checks, touch, or remove/replace any component while input power is applied or DC link voltage is present. Observe all safety precautions.

6. Confirm that the DC Link Simulator Test Set power switch is OFF. Plug the DC Link Simulator Test Set into a 120 VAC power outlet for P/N 150–85005–1 or 220 VAC power outlet for P/N 150–85005–2. However, DO NOT turn the test set on at this time.

7. Pull the access door interlock switch to the extended (override) position. Refer to Figure 3–1, sheet 3, Index 25.

8. See Figure 5–1. Position the DC Link Simulator Test Set power switch to ON. The test set DC power indicator should illuminate.

NOTE

If the DC Link Simulator Test Set DC power indicator does not illuminate, reset (press) the 2.5 ampere circuit breaker. If the test set 2.5 ampere circuit breaker trips or the DC power indicator turns off at any time during this test, the frequency converter inverter section is still malfunctioning.

9. At the frequency converter control panel press the Unit Control ON switch S4. This turns the frequency converter ON. The alarm should sound for 3-to-5 seconds and then extinguish. Observe that the Test Set DC power indicator is still on. If the Test Set DC power indicator is still on, proceed to the next step. If the Test

Set DC power indicator goes off (test set 2.5 ampere circuit breaker trips), a fault still exists in the frequency converter inverter section.

10. Use a multimeter to measure the output of the inverter assemblies. Measure the AC inverter output from TB1–3 to 4, 4 to 5, and 3 to 5 on both inverter assemblies. The absolute magnitude of the readings is not critical, however, all phase-to-phase voltages should be almost identical.

11. If all phase-to-phase voltages are identical, the problem is located in the output transformer or output filter assemblies.

12. Disconnect the output filter assembly by removing the wiring from A16-A3TB1–1, 2, and 3. See Figure 6–2, sheet 4. The filter can then be checked for shorts using an ohmmeter.

13. Contact the factory for assistance in isolating any possible transformer failures.

14. If the phase-to-phase voltages on only one inverter are unbalanced, that inverter is malfunctioning. If both inverters show an unbalance the Control board is malfunctioning.

15. If the inverter assemblies trip off the DC power supply disconnect, one at a time, the DC power into the inverters at TB1–1 and 2 to isolate the bad inverter.

16. Perform a resistance check on the bad inverter as follows:

    a. Remove Voltage Clamp board A17A2 or A18A2.

    b. Remove bus bar assemblies from the transistor modules.

    c. Unplug the drive connector P1 from the transistor module.

    d. Measure the resistance across the power terminals in both directions, comparing measurements between modules. Change any module that shows readings that differ from the other two. No short conditions will be detected on a good transistor module.

17. If no short circuit or bad transistor module is detected reconnect the drive cable and bus bars, leaving off the Voltage Clamp board A17A2 or A18A2.

18. Reapply power and determine if the fault condition still exists. If the inverter now operates replace the defective Voltage Clamp board.

19. If the fault condition is still present with the Voltage Clamp board removed, exchange the Drive boards between the operational inverter and the faulted inverter. If the problem has not been isolated to the Drive board contact the factory for further assistance.

5.4 REPAIR

WARNING

Lethal voltages are present within the frequency converter. DO NOT perform continuity checks, touch, or remove components within the unit with input power applied or if the DC Link Voltage Meter A16A4 indicates that DC link voltage is present.

WARNING

Wiring errors can cause personnel injury and severe damage to the equipment. Appendices A–F provide wiring lists in reference designator order. Consult the wiring lists if there is any doubt about a connection. See paragraph 5.6.

Repair consists of removal and replacement of components identified in Tables 6–1 through 6–3. Part and assembly location views are provided in Figures 6–1 through 6–3. To locate a part on Figure 6–1, refer to Table 6–1 first. Table 6–1 references the sheet number of Figure 6–1 for each part.

Removal/replacement procedures that are not obvious are provided in the following paragraphs. The procedures are arranged in reference designator order except for opening the front panel (door).

CAUTION

The frequency converter circuit cards contain Electrostatic Sensitive Devices (ESD). Use ESD precautionary procedures to prevent damage to the components.

5.4.1 Opening Front Panel

Loosen the screws holding the clips at the top and bottom of the front panel on the right edge. Do not remove the screws. Pull the clips to the right to release the panel.

5.4.2 Circuit Boards A1, A2, A3, A5 (Option), A6 (Option)

Refer to Table 6–2 and Figure 6–2. These boards are inserted in the logic (center) card cage A16A1, but are not part of the card cage assembly.

5.4.2.1 Removal

1. Loosen the two screws holding the ribbon connector retainers 1/2 turn. Rotate the top retainer upward and the bottom retainer downward. Pull the connector straight out. Label the cable for ease of reconnection if more than one board is removed.

2. At the upper edge of the board, lift the board release outward to release the board. Pull the board out.

3. Control board A3 has two switches (or three, depending on board configuration): S1, S2 (and S3). Record the positions of these switches.

5.4.2.2 Replacement

1. If the Control board is being replaced, set switches S1–1, S1–2 and S2 the same as the settings on the removed card. If the settings are not known, set the switches as follows:

   a. S1–1 with fixed output frequency: Closed. S1–1 with variable output frequency: Open.

b. S1–2: Open or Closed.

c. S–2: Set to position 1.

2. Insert the board in the correct position as determined by the board reference designator (A1–A6). Press in firmly and lower the board release.

3. Connect the ribbon cable to the board. Position the upper and lower cable connector retainers so that the screws are in the slots in the connector. It may be necessary to pull the connector outward slightly to position the retainers. Tighten the screws.

5.4.3 Door Interface Board A15

See Table 6–1 and Figure 6–1, sheet 2, for connector/cable identification and location. This board is mounted inside the front panel A50 assembly. Proceed as follows:

5.4.3.1 Removal

1. Disconnect the ribbon cable A16A2A2 from the connector J1.

2. Disconnect cable A50A37 from connector J2.

3. Remove the four sets of meter terminal hardware (A50M3, A50M4) and remove the board. Reinstall the hardware temporarily.

5.4.3.2 Replacement

1. Remove the nuts, lock washers, and flat washers from the AC voltmeter (A50M3) and AC ammeter (A50M4) terminals. Leave the remaining nuts (with flat washers on top) in place.

2. Position the Door Interface board A15 on the meter terminals with the board connector J2 at the upper left.

3. Install the flat washers, lock washers, and nuts on the four meter terminals.

4. Connect ribbon cable A16A2A2 to the board connector, A15J1.

5. Connect cable A50A37 to the board connector A15J2.

6. With power applied to the unit, *very carefully* adjust the output voltage at A15R54 (see Figure 6–1, sheet 2) while monitoring the front panel Output Volts meter.

5.4.4 AC Filter Assembly Capacitors A16A3C1–C18

5.4.4.1 Removal

1. Use a long Phillips head screwdriver to remove the four 10–32 x 3/8 inch screws holding the filter assembly to the back panel. Do not disconnect any wires.

2. Locate the capacitor to be removed.

3. Remove the connecting bus bars and interconnecting wires, as applicable. Mark the wires for correct reconnection.

4. Remove the two 6–32 x 1/4 inch screws, lock washers and flat washers holding the capacitor clamp to the base plate.

5. Remove and save the clamp. Save the bus bars.

5.4.4.2 Replacement

1. Mount the capacitor clamp on the capacitor. Position the clamp to agree with the illustration on Figure 6–2, sheet 4 and flush with the bottom of the capacitor. Tighten the clamp screw.

2. Mount the capacitor to the base plate with two 6–32 x 1/4 inch screws, lock washers and flat washers.

3. Connect the bus bars and interconnecting wires.

4. Fasten the filter assembly to the back panel using four 10–32 x 3/8 inch screws, lock washers and flat washers.

5.4.5 Voltage Clamp Board A17A2, A18A2

See Figure 6–2, sheet 5.

5.4.5.1 Removal

Remove the nine hex head/Phillips head screws, lock washers and flat washers holding the Voltage Clamp board to the nine standoffs on the associated transistors A17Q1–Q3 or A18Q1–Q3. Do not remove the standoffs. Disconnect the six wires connected to E10 through E15.

5.4.5.2 Replacement

1. See Figure 6–2, sheet 5. Position the board on the nine standoffs as shown. The resistors on the board are toward the bottom of the inverter.

2. Install the nine hex head/Phillips head screws, lock washers and flat washers through the board into the standoffs. Tighten the screws securely. These screws are originally furnished with the transistor. Reconnect the six wires to E10 through E15.

5.4.6 Transistor Assembly A17A3–A5, A18A3–A5

See Figure 6–2, sheet 5.

5.4.6.1 Removal

1. Remove the Voltage Clamp board A17A2 or A18A2, from the transistor to be removed.

2. Remove the hex standoffs and bus bars from the transistors. Save the standoffs, bus bars and hardware.

3. Remove the drive connector P1 from Drive board.

4. Hold the transistor and remove the two 10–32 x 5/8 screws, lock washers and flat washers holding the transistor to the heatsink. Remove the transistor. Clean away any thermal compound left on the heatsink.

5.4.6.2 Replacement

1. Apply thermal compound to the bottom surface of the transistor and to the mounting surface of the heatsink panel prior to installation of the transistor. Apply compound liberally, then wipe surfaces with a rubber spatula to remove the excess.

2. Place the transistor on the heatsink and move from side to side to eliminate air pockets.

3. Install the two 10–32 x 5/8 inch screws, lock washers and flat washers

to hold the transistor to the heatsink panel.

4. Reconnect drive connector P1 to Drive board.

5. Secure the bus bars to the transistors using the nine standoffs.

6. Mount the Voltage Clamp board on the standoffs.

5.4.7 DC Link Rectifier, DC Link Soft Start SCR Assembly and Magnetics, A36A1D1, A36A1D2, A36L1–L8, A36T1–T2

See Figure 6–2, sheets 2, 7, 8 and 9.

5.4.7.1 Removal

1. Open the front door and remove the bottom plate covering the rectifier, SCR and magnetic components as follows:

   a. Disconnect the following wires (cut cable ties as required):

Disconnect At	Wire Description
A39TB1–1 Front Side	8 AWG from left inverter TB1–1
A39TB1–5 Front Side	8 AWG from left inverter TB1–2
A39TB1–3 Front Side	8 AWG from right inverter TB1–1
A39TB1–7 Front Side	8 AWG from right inverter TB1–2
A39TB1–4 Front Side	6 AWG from middle access hole to magnetic compartment on right side
A39TB1–6 Front Side	6 AWG from middle access hole to magnetic compartment on right side
A39C2–E1 (+)	8 AWG from middle access hole to magnetic compartment on the right side
A39TB12 Back Side	20 AWG from rear access hole to magnetic compartment on right side
A39A1TB1–11	20 AWG from rear access hole to magnetic compartment on right side
A39A1TB1–9	20 AWG from rear access hole to magnetic compartment on right side
A39R3–1	20 AWG from rear access hole to magnetic compartment on right side

   b. Disconnect connector A39J1 from connector A16A4P1 from the DC Link Voltage Meter A16A4.

   c. Disconnect connector A39P1 from the A36A1J1 from the front access hole to the magnetic compartment on the right side.

   d. Cut the cable ties only holding the 8AWG wires to the base plate on the left side.

   e. Remove the two 10–32 x 1/2 inch screws, lock washers and flat washers holding the front of the base plate to the frequency converter. Save the hardware.

f. Remove the two 10–32 nuts, lock washers and flat washers holding the rear of the base plate to the back panel.

g. Slide the base plate out of the frequency converter.

2. Disconnect and label the applicable wires from the component to be removed.

3. Remove the mounting hardware and remove the component. Save the hardware. Remove the louvered lower panel from the frequency converter, if necessary.

5.4.7.2 Replacement

1. Install the component using the hardware shown as attaching parts in Table 6–2.

2. Connect the wires as labeled. Verify that the wires are connected correctly using the wire list appendices and the schematics in Section VII.

3. Install the louvered panel if it was removed.

4. Install the base plate with two 10–32 x 1/2 inch screws, lock washers and flat washers at the front, and two 10–32 nuts, lock washers and flat washers at the rear. The base plate rear angle mounts over studs in the back plate.

5. Connect the wires and cable ties using paragraph 5.4.9.1 as a guide.

5.4.8 Input Cable A42

5.4.8.1 Removal

1. Remove the 12 screws, lock washers and flat washers from the back panel of the Input/Output Enclosure A22. Remove the back panel from the frequency converter.

2. Disconnect the input cable wires from the XF5 terminals (at the top of the fuses).

3. Remove the large nut (on the inside) which holds the cable bushing and strain relief to the back enclosure. Save the nut.

4. Pull the cable through the hole in the back enclosure.

5. If a new cable is to be installed, remove the strain relief assembly from the old cable as follows:

   a. Unscrew and separate the two threaded parts of the strain relief assembly. Push the threaded part holding the braid further onto the cable.

   b. A neoprene tapered ring clamp extends from within the threaded part with the hex fitting. Separate the neoprene clamp and threaded part by forcing the threaded part toward the cable end. Remove the threaded part.

   c. Remove the neoprene clamp from the cable.

d. Remove the braid and its retainer from the cable. Push the braid from its upper end to expand the braid enough to slide off the cable.

e. Reassemble loosely and save all the parts.

6. If an input cable is not to be installed immediately, remount the back panel.

5.4.8.2 Replacement

1. If not already done, remove the 12 screws, lock washers and flat washers from the back panel of the Input/Output Enclosure A22. Remove the back panel from the frequency converter.

2. Assemble the strain relief assembly onto the new cable that is being installed.

   a. Slide the braid into its threaded retainer.

   b. Push the braid into itself to open it up.

   c. Slide the braid and then its retainer, onto the cable.

   d. Slide the tapered neoprene clamp onto the cable with the larger end toward the braid retainer. Position the neoprene clamp 12 inches from the end of the cable.

   e. Slide the bushing with the hex fitting onto the cable against the neoprene clamp. The larger end goes on first.

   f. Slide the braid retainer and braid over the neoprene clamp and screw the retainer into the bushing with the hex fitting. Tighten the two parts to compress the clamp.

3. Insert the cable wires and bushing into the hole labeled INPUT 480 VOLTS (or, INPUT xxx VOLTS with alternate input voltage option) in the back enclosure.

4. Reinstall the large nut over the wires and screw it onto the bushing on the inside of the back enclosure. Tighten the nut securely.

5. Connect the cable wires to ground and to the XF5 terminals (TB1) at the top of the fuses as follows:

Wire Color	Terminal
Black	A (1)
Red	B (2)
White or Tan	C (3)
Green	Ground

6. Fasten the back panel to the Input/Output Enclosure A22 using twelve 10–32 x 3/8 inch screws, lock washers and flat washers.

5.4.9 Output Cables A43, A44

5.4.9.1 Removal

1. Remove the 12 screws, lock washers and flat washers from the back panel of the Input/Output Enclosure A22. Remove the back panel from the frequency converter.

2. Disconnect the output cable wires from A22TB2 or TB3, as applicable.

3. Remove the large nut (on the inside) which holds the cable bushing and strain relief to the back enclosure. Save the nut.

4. Pull the cable through the hole in the back enclosure. Do not damage the labels on the wires if the cable is to be used again. If a new cable is to be installed, remove the strain relief assembly from the old cable as follows:

   a. Unscrew and separate the two threaded parts of the strain relief assembly. Push the threaded part and collar holding the braid further onto the cable.

   b. A neoprene tapered clamp extends from within the threaded part with the hex fitting. Separate the neoprene clamp and threaded part by forcing the threaded part toward the cable end. Remove the threaded part.

   c. Remove the neoprene clamp from the cable.

   d. Remove the braid and its retainer from the cable. Push the braid from its upper end to expand the braid enough to slide off the cable.

   e. Reassemble loosely and save all the parts.

5. Remount the back panel if an output cable will not be installed at this time.

5.4.9.2 Replacement

1. If not already done, remove the twelve screws, lock washers and flat washers from the back panel of the Input/Output Enclosure A22. Remove the back panel from the frequency converter.

2. If a new cable is being installed, assemble the strain relief assembly onto the cable:

   a. Slide the braid into its threaded retainer.

   b. Push the braid into itself to open it up.

   c. Slide the braid and then its retainer, onto the cable.

   d. Slide the tapered neoprene clamp onto the cable with the larger end toward the braid retainer. Position the neoprene clamp 12 inches from the end of the cable.

   e. Slide the bushing with the hex fitting onto the cable against the neoprene clamp. The larger end goes on first.

   f. Slide the braid retainer and braid over the neoprene clamp and screw the retainer into the bushing with the hex fitting. Tighten the two parts to compress the clamp.

3. Insert the cable wires and bushing into the hole labeled OUTPUT NO. 1 (or NO. 2) in the back enclosure.

4. Reinstall the large nut over the wires and screw it onto the bushing on the

inside of the back enclosure. Tighten the nut securely.

5. Connect the cable wires to A22TB3 or TB4, as applicable as follows:

Wire Label	TB Terminal
Phase A	A
Phase B	B
Phase C	C
Grounded Neutral	D
28 VDC Output	E
28 VDC Input	F

6. Fasten the back panel to the Input/ Output Enclosure A22 using twelve 10–32 x 3/8 inch screws, lock washers and flat washers.

5.5 TEST AFTER REPAIR

Perform the Equipment Turn-On procedures provided in Section III of this manual.

5.6 WIRE LISTS

5.6.1 General

Appendices A through F provide wire lists for the wiring within the frequency converter chassis. See the Table of Contents for the desired appendix letter. The appendices are in reference designator order by assembly except Appendix A which covers standard wiring between assemblies, and Appendix F which covers the wiring of the input/output circuitry with options, if any. All other appendices are standard for all Pwr–Kart units. Each appendix has a cover sheet with applicable instructions and notes.

5.6.2 Wire Number Columns

Wire numbers are stamped on the wires to aid in identification.

5.6.3 Gage Columns

These columns identify the wire size by AWG. The identifier SELF indicates the two parts mate together without interconnecting wiring. For example, terminal wires on inductors that connect directly to another terminal, etc.

5.6.4 Color Columns

All wires are white unless otherwise noted. Some NOTES are shown in the COLOR columns.

5.6.5 Length Columns

Selected wire lengths are identified by an inch (") symbol. Some NOTES are shown in the LENGTH columns.

5.6.6 To/Terminal Columns

These columns indicate the reference designators and terminal destinations of the wires as identified by the FROM columns.

5.6.7 From/Terminal Columns

These wire terminations are arranged in sequence by reference designators. The TERMINAL columns indicate the associated terminal numbers for the items identified in the FROM columns.

5.6.8 Notes

The notes associated with a particular wire are identified in the COLOR columns and the LENGTH columns. The applicable notes start on sheet 2 of each wire list. The NOTE numbers are contained in a triangle.

SECTION VI
ILLUSTRATED PARTS BREAKDOWN

6.1 GENERAL

This section provides an illustrated parts breakdown (IPB) for the Pwr-Kart frequency converter identified in Table 6–1. The input/output power components and any options are identified in Figure 6–1 and Table 6–1.

The IPB is organized as follows:

Table/Figure 6–1. Frequency Converter Top Assembly and Options.

Table/Figure 6–2. Basic Frequency Converter.

Table/Figure 6–3. Mobile Cart Assembly.

Table/Figure 6–1 defines the specific frequency converter covered by this manual. All parts included in the options are also defined. Table/Figure 6–2 defines the parts and assemblies common to all models of the Pwr-Kart frequency converters. Table/Figure 6–3 defines the replaceable parts of the mobile cart on which the frequency converter is mounted.

The illustrated parts breakdown is arranged in reference designator sequence. The sheets in Figure 6–2 are arranged in reference designator sequence. This arrangement permits the user to locate a particular replaceable assembly or part quickly.

6.2 PARTS LISTS

The information provided in the parts list columns is described in the following paragraphs.

6.2.1 Figure and Reference Designator Column

This column identifies the reference designator of the replaceable part and the sheet number of the figure for multiple sheet figures. The referenced figure is also keyed with the associated reference designator.

6.2.2 Part Number Column

This column provides the identifying part number for the part.

6.2.3 MFR Code Column

This column provides the Commercial and Government Entity (CAGE) code for

the manufacturer of the part (formerly FSCM). If a manufacturer's code is not available (N/A), the name of the manufacturer is provided in the description column and the name and address of the manufacturer is provided at the end of the following manufacturer's code-to-name cross-reference list. The manufacturer's code-to-name cross-reference is in numerical order as follows:

MFR CODE	NAME
00779	Amp Inc. 2800 Fulling Mill P.O. Box 3608 Harrisburg, PA 17105
01002	General Electric Co. G.E. Transmission Systems 381 Upper Broadway Fort Edward, NY 12828-0121
01121	Rockwell International Allen-Bradley Co. 1201 S. 2nd Street Milwaukee, WI 53201-9814
01139	General Electric Co. G.E. Silicones 260 Hudson River Road Waterford, NY 12188
01940	Westinghouse Electric Corp. Specialty Transformer Division Greenville, PA
06383	Panduit Corp. 17303 S. Ridgeland Avenue Tinley Park, IL 60477-0981
09214	General Electric Co. Semiconductor Products Div. W. Genesee Street Auburn, NY 13021
0DCK9	Gentron Corporation 6667 N. Sidney Place Milwaukee, WI 53209
12175	Unitron Incorporated 10925 Miller Road P.O. Box 38902 Dallas, TX 75238-1350
12697	Clarostat Mfg. Co. Inc. 1 Washington Street Dover, NH 03820
14655	Cornell Dubilier Electronics One Interchange Plaza Wayne, NJ 07470
1L965	Lord Corp. Industrial Products Division 124 Grant Street Cambridge Springs, PA 16403-1014
21574	Gould Shawmut Co. 88 Horner Avenue Toronto, Ontario, Canada, M8Z 5Y3
25140	Globe Motors 2275 Stanley Avenue Dayton, OH 45404
26935	Hamilton Caster & Mfg. Co. 1637 Dixie Highway Hamilton, OH 45011-4041

MFR CODE	NAME
27191	Cutler-Hammer Inc. Power Distribution & Control Division 4201 N. 27th Street Milwaukee, WI 53216
27193	Eaton Corp. Aerospace & Commercial Controls Division 4201 N. 27th Street Milwaukee, WI 53216
27264	ETC–Molex, Inc. 4820 Park Boulevard Pinellas Park, FL 34665
44655	Ohmite Mfg. Co. 3601 W. Howard Street Skokie, IL 60076-4014
54343	Reidel, M.W. and Co. Riedon Division 300 Cypress Avenue Alhambra, CA 91802
56493	Floyd Bell Associates, Inc. 899 Higgs Avenue Box 12327 Columbus, OH 43212-3838
56699	Mepco/Centralab 6071 St. Andrews Road Columbia, SC 29210-3119
59465	Paraline Transformer Specialists 515 S. Palm Avenue Alhambra, CA 91803-1423
59792	TRW Inc. TRW Universal Capacitors 1400 W. Fourth Street Ogallala, NE 69153-2302
5Y407	Phoenix Terminal Blocks Inc. 1900 Greenwood Street Harrisburg, PA 17104-2341
60495	Atlantic Tubing Co. 107 E. 17th Street Paterson, NJ 07544
62607	Philips Lighting Co., A North American Philips Corp. 200 Franklin Square Drive P.O. Box 6800 Somerset, NJ 08875-6800
6Z382	Weschler Division of Hughes Corp. 4000 NW 121st Avenue Coral Springs, FL 33065-7612
71400	Bussmann Manufacturing 502 Earth City Plaza Earth City, MI 63045
72076	Federal Pacific Co. 1 Goodson Street P.O. Box 8200 Bristol, VA 24203-8200
73631	Curtis Industries, Inc. 7400 W. Douglas Avenue Milwaukee, WI 53218-0699
74400	Stewart-Warner Hobbs Corp. Yale Boulevard & Ash Street Springfield, IL 62705

MFR CODE	NAME
74840	Illinois Capacitor, Inc. 3757 W. Touhy Avenue Lincolnwood, IL 60645-2626
75915	Littelfuse Tracor, Inc. Subdivision of Tracor, Inc. 800 E. Northwest Highway Des Plaines, IL 60016-3049
81349	Military specifications promulgated by military departments/ agencies under authority of Defense Standardization Manual 4120 3-M
81439	Therm-O-Disc, Inc. Subd. of Emerson Electric Co. 1320 S. Main Street P.O. Box 3538 Mansfield, OH 44907-2516
81992	Hubbell Harvey Inc. Kellems Division Rt. 1 Lords Hill Stonington, CT 06378-9801
83330	Dialight Corp. Manasquan Division 1913 Atlantic Avenue Manasquan, NJ 08736-1005
89265	Potter & Brumfield Inc. A Siemens Co. 200 S. Richland Creek Drive Princeton, IN 47671-0001
90201	Mallory Capacitor Co. 4760 Kentucky Avenue Indianapolis, IN 46206
91637	Dale Electronics Inc. 1122 23rd Street Columbus, NE 68601-3632
91929	Honeywell Inc. Micro Switch Division 11 W. Spring Street Freeport, IL 61032
96272	Brown Boveri Corp. 1460 Livingston Avenue North Brunswick, NJ 08902-1832
96906	Military standards promulgated by military departments under authority of Defense Standardization Manual 4120 3-M
N/A	Albion Industries, Inc. 800 N. Clark Street P.O. Box 411 Albion, MI 49224
N/A	Toshiba Corp. International Operations – Electronic Components 1–1, Shibaura 1–Chome, Minato–Ku, Tokyo, 105–01, Japan

6.2.4 Description Column

This column provides a brief description of the part or assembly. The dot(s) (..) preceding the description identifies the assembly relationship of the part or assembly.

Attaching parts for the major assemblies and parts are identified immediately fol-

lowing the part description. The beginning of the attaching parts is noted by the phrase: *(attaching parts)*. The end of the attaching parts for that item is identified by the symbol: – – – * – – –.

The name of the manufacturer of the part is also provided in this column when their CAGE code is not known.

6.2.5 QTY Column

This column identifies the quantity of parts within the frequency converter or next higher assembly (as represented by the dot(s) (..) preceding the description). The quantity listed for attaching parts is the number of parts required to attach one item (not the total parts usage).

6.2.6 Usable On Code Column

This column identifies that some parts are not used on all configurations of the frequency converter. The number directly relates to the part number for the particular frequency converter as indicated at the beginning of Table 6–1 and 6–2. If the column is blank, the part is used on all configurations.

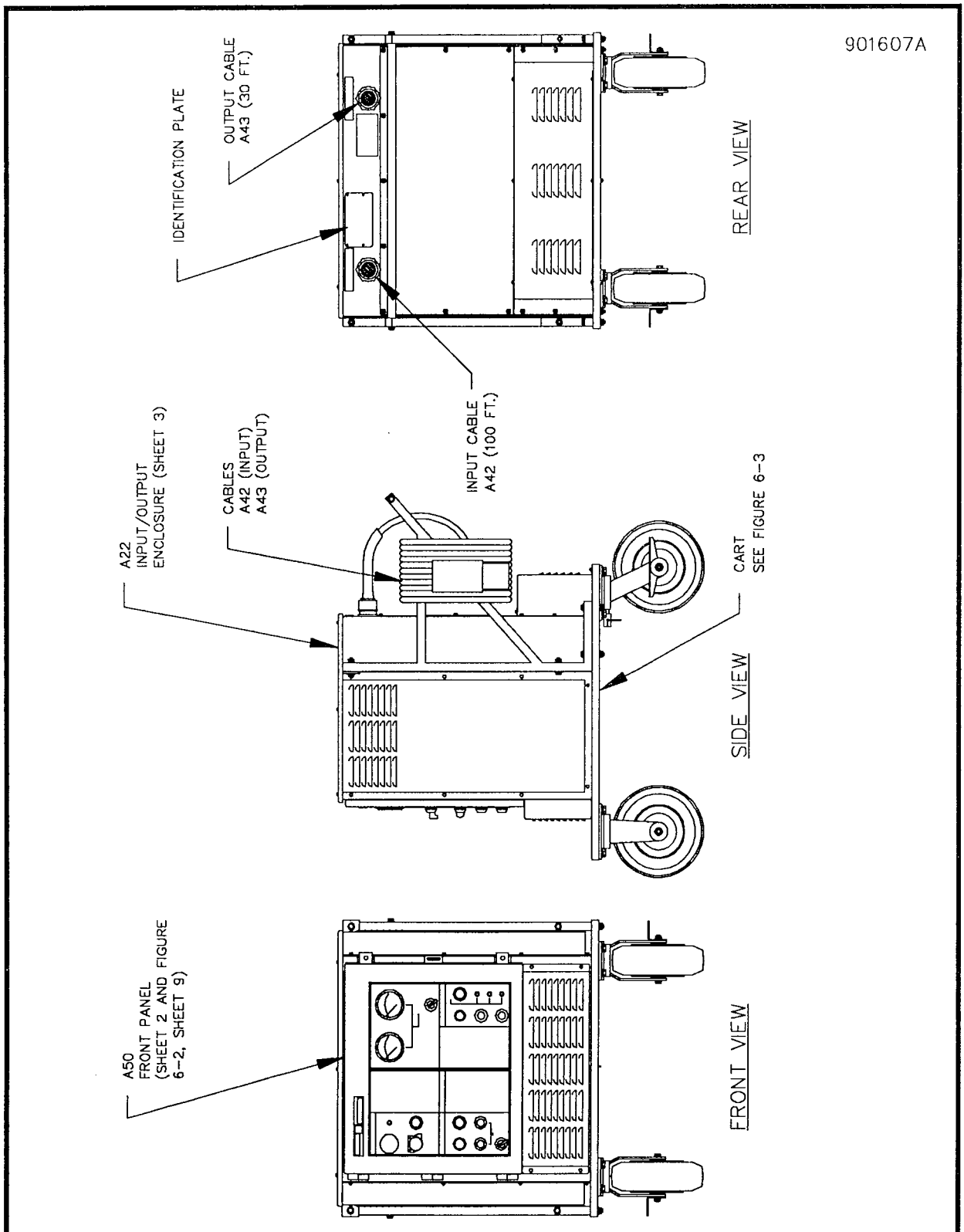


FIGURE 6-1. FREQUENCY CONVERTER WITH OPTIONS (SHEET 1 OF 3)

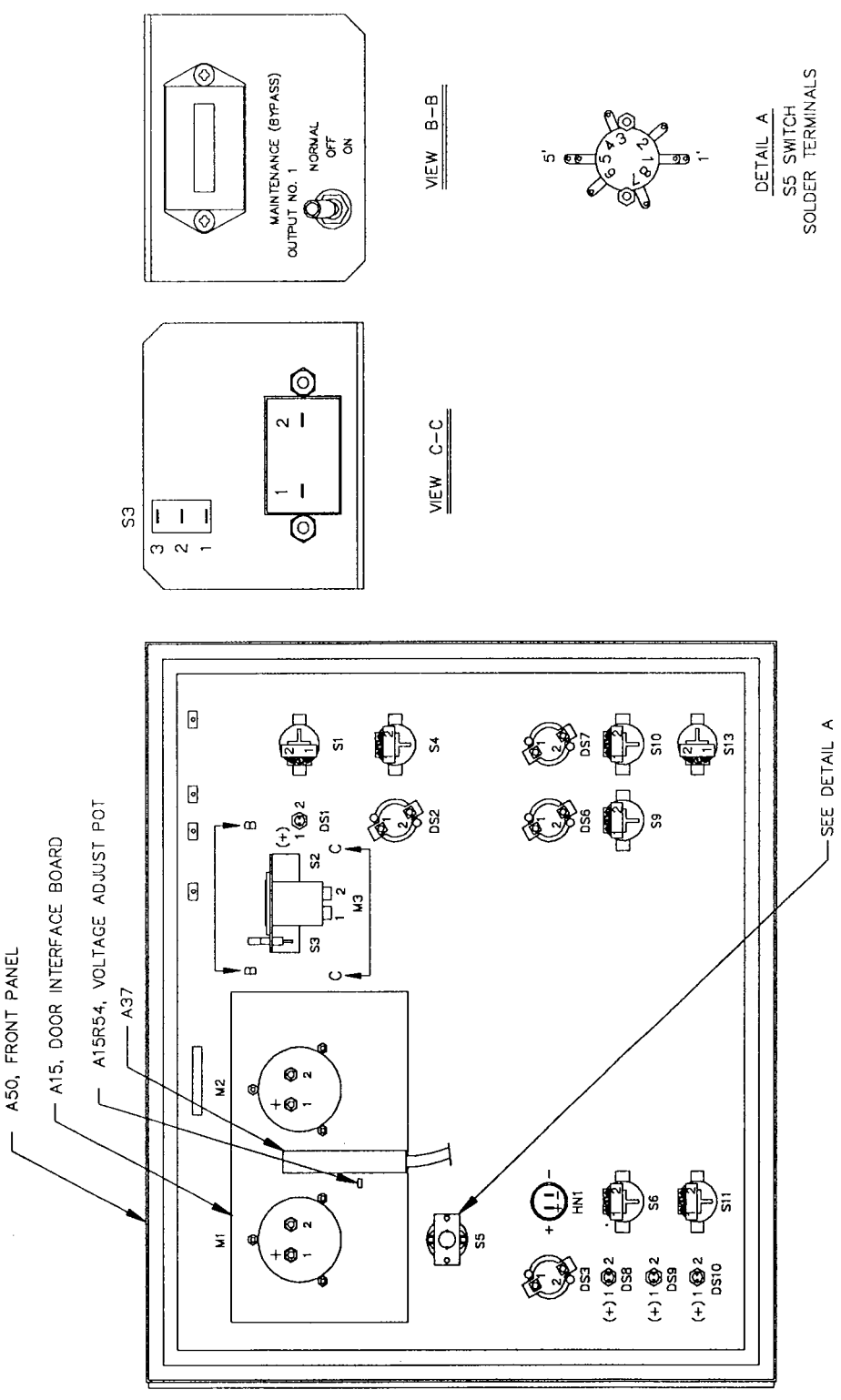
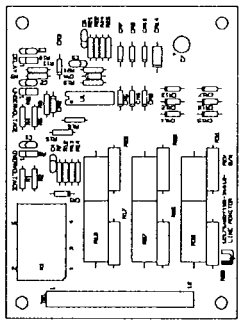


FIGURE 6–1. FREQUENCY CONVERTER WITH OPTIONS (SHEET 2)

900369D



DETAIL D
A53, LINE MONITOR BOARD

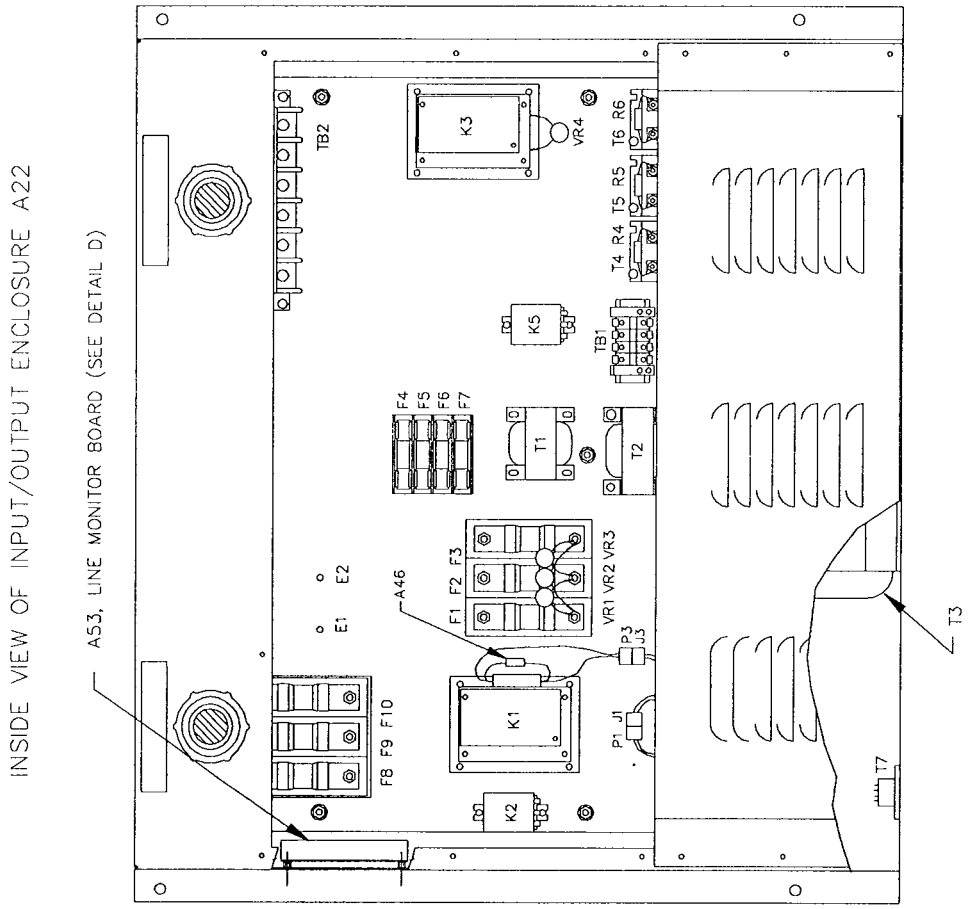


FIGURE 6–1. FREQUENCY CONVERTER, WITH OPTIONS, IF ANY. (SHEET 3)

Table 6–1. Frequency Converter with Options

Reference Designator (Fig. 6–1)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
	195–39000–58	12175	FREQUENCY CONVERTER, GFC–25M, 25.0 kVA, with options S–2, C–3 and T–3 (208V).	1	GFC–25
	195–39015–2	12175	. GFC–25 MOBILE BASIC ASSY.	REF	GFC–25
	195–39016–B25	12175	.. GFC–25 BASIC FREQUENCY CONVERTER. See Table 6–2 and Figure 6–2 for breakdown.	1	
	195–34014–1	12175	.. GFC MOBILE CART ASSY. See Table 6–3 and Figure 6–3 for breakdown.	1	
A15 (Sh 2)	195–34006–1	12175	.. DOOR INTERFACE BOARD ASSY.	1	
A22 (Sh 3)	195–34009–1	12175	.. OPTIONS PANEL ASSY.	1	
A22E1, E2 (Sh 3)	TA–O	74840	... TERMINAL, Solderless, 14–1/0 AWG.	1	
			(attaching parts)		
	MS51958–63	96906	... SCREW, PPH, 10–32 × 1/2.	1	
	MS35338–138	96906	... WASHER, Lock, No. 10.	1	
	MS15795–808	96906	... WASHER, Flat, No. 10.	1	
			– – – * – – –		
A22F1–F3	A70Q100–4	21574	... FUSE, 700 V, 100 Amp.	3	
Alternate (Sh 3)	FWP–100	71400	... FUSE, 700 V, 100 Amp.	ALT	
			(attaching parts)		
	MS15795–410	96906	... WASHER, Lock, 1/4, NiCu.	2	
	MS35338–101	96906	... WASHER, Lock, 1/4, Tin-Brass.	2	
	MS35649–2255T	96906	... NUT, Hex, 1/4–20, Brass.	2	
			– – – * – – –		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–1. Frequency Converter with Options (continued)

Reference Designator (Fig. 6–1)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A22F4 (Sh 3)	FLQ–3/10	75915	... FUSE, 500 V, 0.3 Amp.	1	
A22F5 (Sh 3)	FLQ–2	75915	... FUSE, 500 V, 2 Amp.	1	
A22F6, F7 (Sh 3)	FLQ–4/10	75915	... FUSE, 500 V, 0.4 Amp.	2	
A22F8–10 (Sh 3)	AJT80	21574	... FUSE, Type J, 80 Amp.	3	
A22K1 (Sh 3)	100–A38NB3	01121	... INPUT CONTACTOR, 3-Pole, 480 VAC. (Requires auxiliary contacts.)	1	
			(attaching parts)		
	195–GA01	01121	... CONTACT, Auxiliary, N.C.	1	
	MS51957–46	96906	... SCREW, PPH, 8–32 × 5/8.	4	
	MS35338–137	96906	... WASHER, Lock, No. 8.	4	
	MS15795–807	96906	... WASHER, Flat, No. 8.	4	
			---*---		
A22K2 (Sh 3)	KUP11A55	89265	... RELAY, 24 VAC Coil, DPDT.	1	
			(attaching parts)		
	MS51957–28	96906	... SCREW, PPH, 6–32 × 3/8.	2	
	MS35338–136	96906	... WASHER, Lock, No. 6.	2	
	MS15795–806	96906	... WASHER, Flat, No. 6.	2	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–1. Frequency Converter with Options (continued)

Reference Designator (Fig. 6–1)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A22K3 (Sh 3)	100–A38NB3	01121	... OUTPUT CONTACTOR, 3-Pole, 480 VAC.	1	
			(attaching parts)		
	MS51958–61	96906	... SCREW, PPH, 10–32 × 3/8.	4	
	MS35338–138	96906	... WASHER, Lock, No. 10.	4	
	MS15795–808	96906	... WASHER, Flat, No. 10.	4	
			---*---		
A22K5 (Sh 3)	KUP11A55	89265	... RELAY, 24 VAC Coil, DPDT.	1	
			(attaching parts)		
	MS51957–28	96906	... SCREW, PPH, 6–32 × 3/8.	2	
	MS35338–136	96906	... WASHER, Lock, No. 6.	2	
	MS15795–806	96906	... WASHER, Flat, No. 6.	2	
			---*---		
A22R4–R6	RWR78SR400FR	81349	... RESISTOR, 0.4Ω, 10W, 1%.	3	
Alternate (Sh 3)	UT-10-0.4-1%	54343	... RESISTOR, 0.4Ω, 10W, 1%.	ALT	
			(attaching parts)		
	MS20659–102	96906	... LUG, 22/18 AWG, No. 10 stud.	2	
			---*---		
A22TB1 (Sh 3)	08–03–01–6	5Y407	... TERMINAL BLOCK, Input.	1	
			(attaching parts)		
	MS35338–138	96906	... WASHER, Lock, No. 10.	4	
	MS15795–808	96906	... WASHER, Flat, No. 10.	4	
	MS35650–304	96906	... NUT, Hex, 10–32.	4	
			---*---		
A22TB2 (Sh 3)	L–6	73631	... TERMINAL BLOCK, Output, 6-Position.	1	
			(attaching parts)		
	MS35338–138	96906	... WASHER, Lock, No. 10.	4	
	MS15795–808	96906	... WASHER, Flat, No. 10.	4	
	MS35650–304	96906	... NUT, Hex, 10–32.	4	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–1. Frequency Converter with Options (continued)

Reference Designator (Fig. 6–1)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A22T1 (Sh 3)	150–87065	59465	... TRANSFORMER, 480:26:16 VAC.	1	
			(attaching parts)		
	MS51957–43	96906	... SCREW, PPH, 8–32 × 3/8.	1	
	MS35338–137	96906	... WASHER, Lock, No. 8.	1	
	MS15795–807	96906	... WASHER, Flat, No. 8.	1	
			---*---		
A22T2 (Sh 3)	195–30027–1	12175	... FAN TRANSFORMER ASSY.	1	
			(attaching parts)		
	MS51957–45	96906	... SCREW, PPH, 8–32 × 1/2.	4	
	MS35338–137	96906	... WASHER, Lock, No. 8.	4	
	MS15795–807	96906	... WASHER, Flat, No. 8.	4	
			---*---		
A22T4–T6 (Sh 3)	2FST201	6Z382	... TRANSFORMER, Current, 200/5.	3	
			(attaching parts)		
	MS51958–63	96906	... SCREW, PPH, 10–32 × 1/2.	2	
	MS35338–138	96906	... WASHER, Lock, No. 10.	2	
	MS15795–808	96906	... WASHER, Flat, No. 10.	2	
			---*---		
A22VR1-VR5	V480LA80B	09214	... VARISTOR, 480V.	5	
Alternate (Sh 3)	ENB801D–20A	N/A	... VARISTOR, 480V. (Mfr. by Toshiba.)	ALT	
			(attaching parts)		
	TFT–20	60495	... TUBING, Teflon.	A/R	
	MS25036–150	96906	... LUG, 22/18 AWG, 1/4 stud.	2	
			---*---		
A42 (Sh 1)	195–60136–3	12175	.. INPUT CABLE ASSY, 100 ft.	1	
			(attaching parts)		
	CG1220	81992	.. CORD GRIP.	1	
	003–22–005	81992	.. LOCKNUT, 1–1/2 NPT.	1	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–1. Frequency Converter with Options (continued)

Reference Designator (Fig. 6–1)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A43 (Sh 1)	195–60044–1	12175	.. OUTPUT CABLE ASSY, 30 ft. (attaching parts)	1	
	CG1223	81992	.. CORD GRIP.	1	
	003–22–005	81992	.. LOCKNUT, 1–1/2 NPT.	1	
			– – – * – – –		
A45 (Figure 7–1)	195–34013–1	12175	.. CABLE ASSY. (From Door Cable Assy A37 to Input/Output Enclosure A22J4.)	1	
A46 (Sh 3)	195–32018–1	12175	.. SNUBBER ASSY.	1	
A50 (Sh 2)	195–34007–1	12175	.. DOOR ASSY. (Not a replacement assembly. For controls and indicators not listed here, see Table 6–2 and Figure 6–2.)	REF	
A53 (Sh 3)	195–34012–1	12175	.. LINE MONITOR ASSY.	1	
J1 (Sh 3)	03–09–2032	27264	.. CONNECTOR, Receptacle, 3-Pin, Door Interlock Switch Circuit.	1	
J3 (Sh 3)	03–09–1038	27264	.. CONNECTOR, Receptacle, DC Link Rapid Discharge Circuit.	1	
P1 (Sh 3)	03–09–1032	27264	.. CONNECTOR, Plug, Door Interlock Switch Circuit.	1	
P3 (Sh 3)	03–09–2038	27264	.. CONNECTOR, Plug, DC Link Rapid Discharge Circuit.	1	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–1. Frequency Converter with Options (continued)

Reference Designator (Fig. 6–1)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
T3	150–87078	12175	.. TRANSFORMER, Auto, 208:480.	1	
Alternate (Sh 3)	195–20516–1	12175	.. TRANSFORMER, Auto, 208:480.	ALT	
			(attaching parts)		
	MS51957–80	96906	.. SCREW, 1/4–20 × 5/8, PPH.	9	
	MS35338–139	96906	.. WASHER, Lock, 1/4.	9	
	MS15795–810	96906	.. WASHER, Flat, 1/4.	9	
	MS35649–2254	96906	.. NUT, Hex, 1/4–20.	9	
			---*---		
T7	150–87064	12175	.. TRANSFORMER, 208:480.	1	
(Sh 3)			(attaching parts)		
	MS51957–45	96906	.. SCREW, 8–32 × 1/2 PPH.	4	
	MS35338–137	96906	.. WASHER, Lock, No. 8.	4	
	MS15795–807	96906	.. WASHER, Flat, No. 8.	4	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

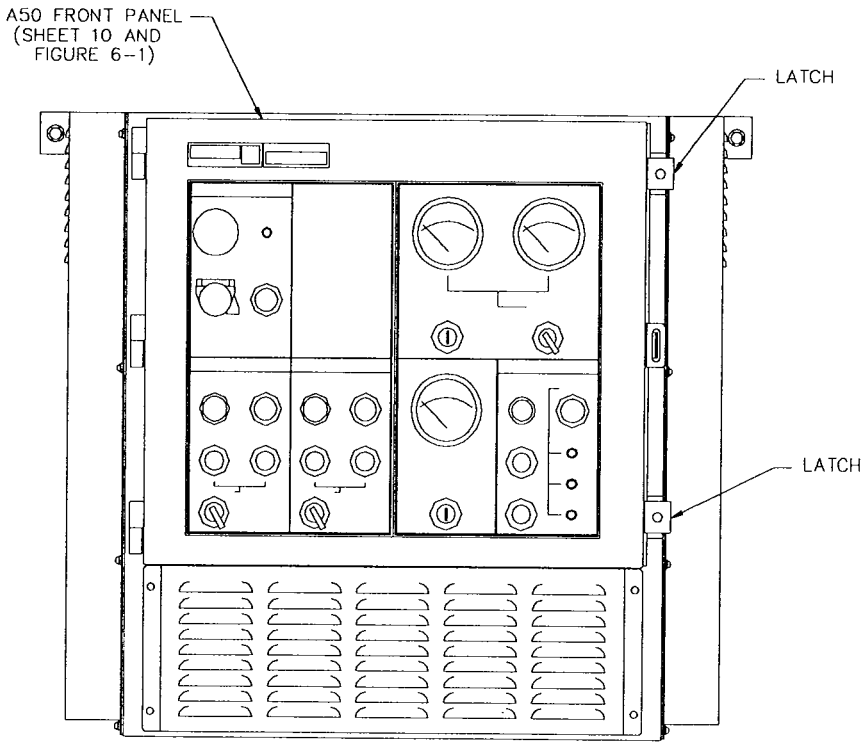


FIGURE 6--2. BASIC FREQUENCY CONVERTER (SHEET 1 OF 10)

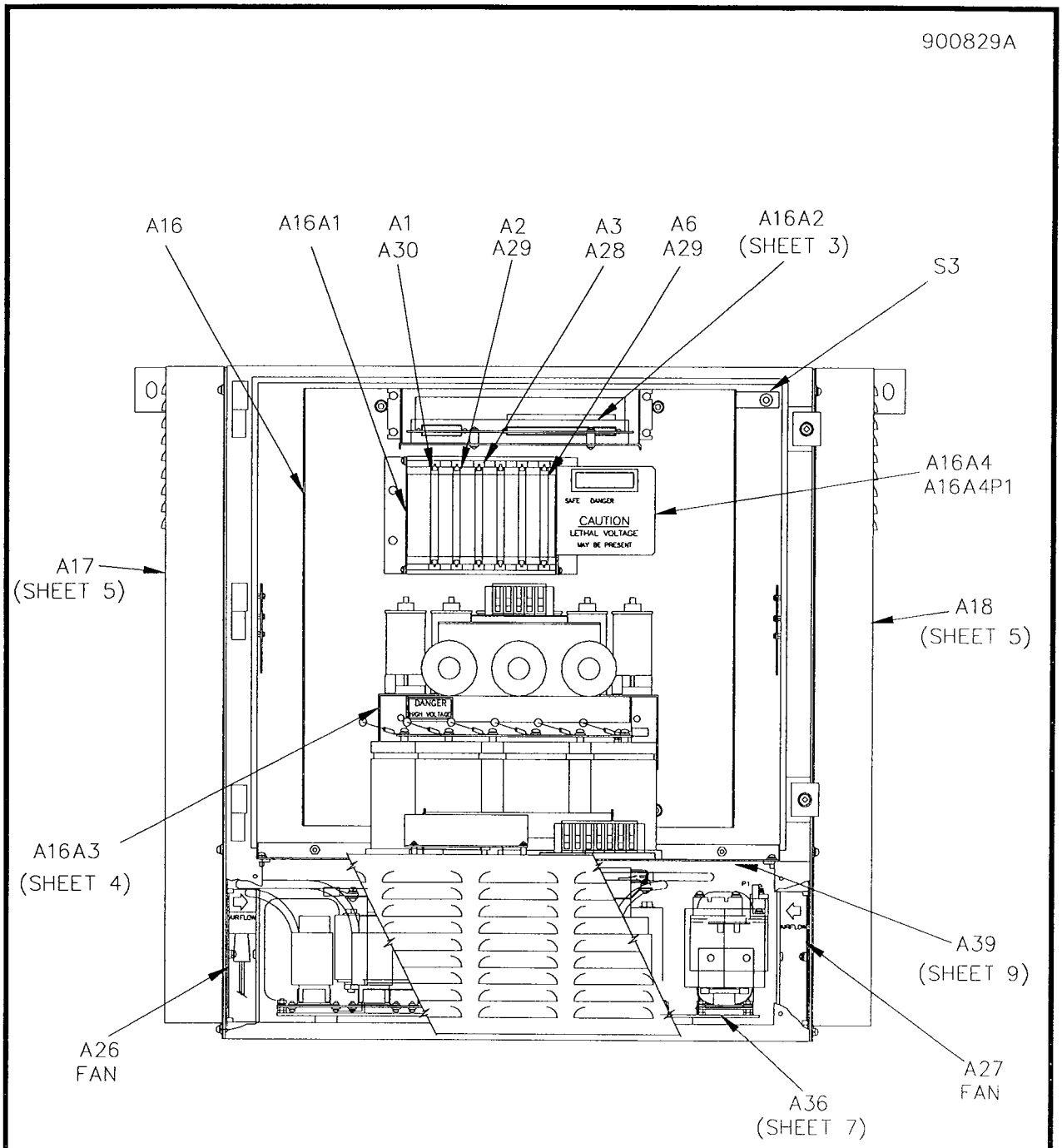


FIGURE 6-2. BASIC FREQUENCY CONVERTER (SHEET 2).

900103D

WIRE TERMINATION		
WIRE NO.	TERM NO.	DIM "A"
300	1	68"
301	2	61"
302	3	61"
303	4	61"
304	6	15"
305	7	15"
306	8	15"
307	10	53"
308	11	53"
309	12	53"
310	13	53"
311	14	53"
312	15	53"
313	18	61"
314	21	61"
315	24	61"

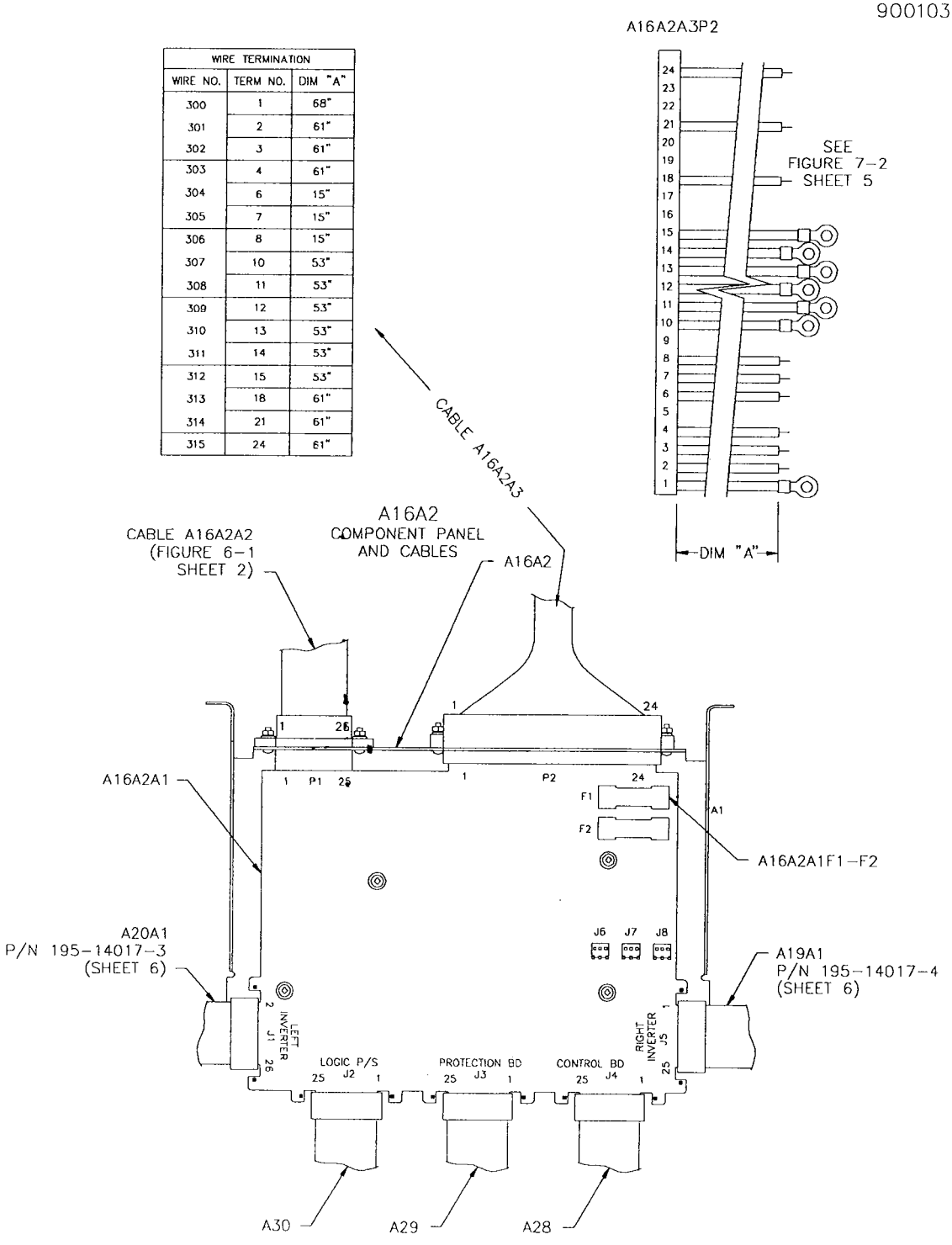
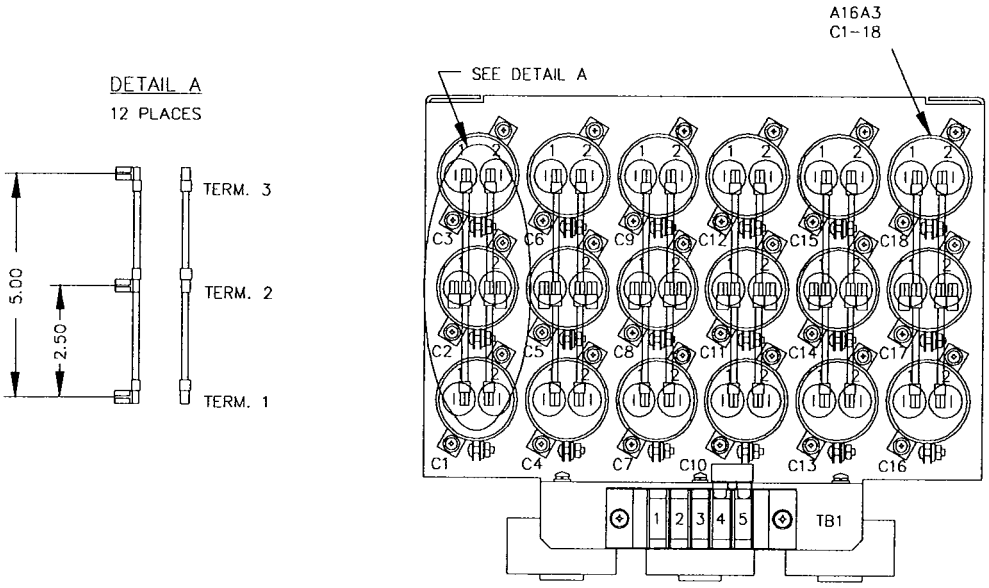


FIGURE 6-2. BASIC FREQUENCY CONVERTER. (SHEET 3)

A16A3
AC FILTER ASSEMBLY



DETAIL A
12 PLACES

WIRING CHART		
TERM. 1	TERM. 2	TERM. 3
C1-1	C2-1	C3-1
C1-2	C2-2	C3-2
C4-1	C5-1	C6-1
C4-2	C5-2	C6-2
C7-1	C8-1	C9-1
C7-2	C8-2	C9-2
C10-1	C11-1	C12-1
C10-2	C11-2	C12-2
C13-1	C14-1	C15-1
C13-2	C14-2	C15-2
C16-1	C17-1	C18-1
C16-2	C17-2	C18-2

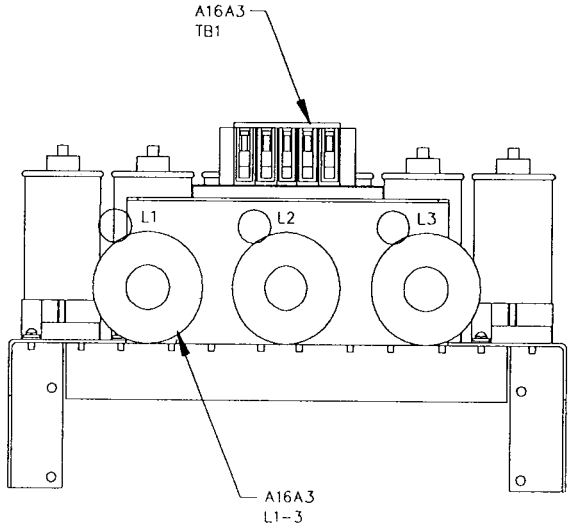


FIGURE 6-2. BASIC FREQUENCY CONVERTER. (SHEET 4)

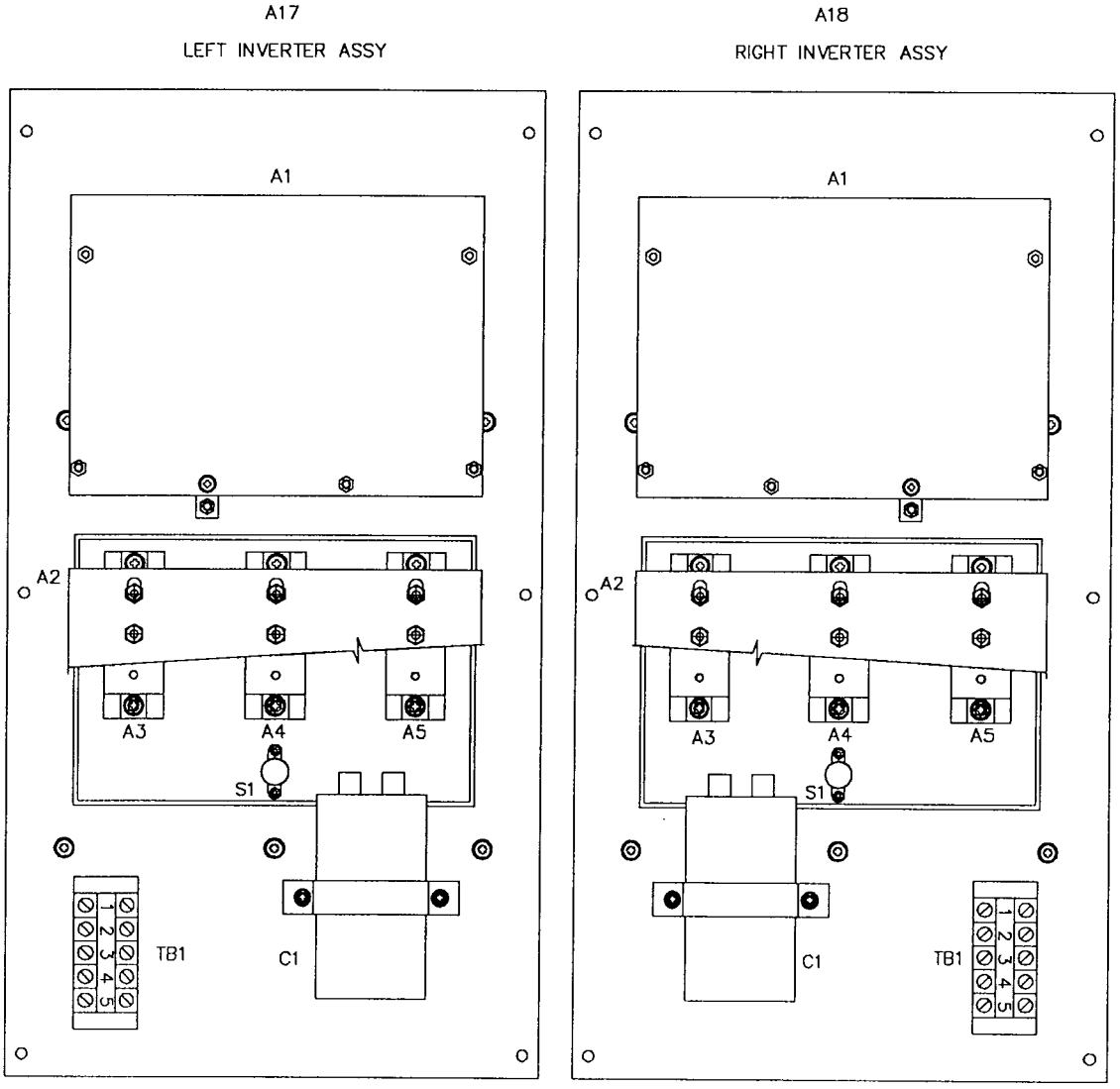


FIGURE 6–2. BASIC FREQUENCY CONVERTER (SHEET 5)

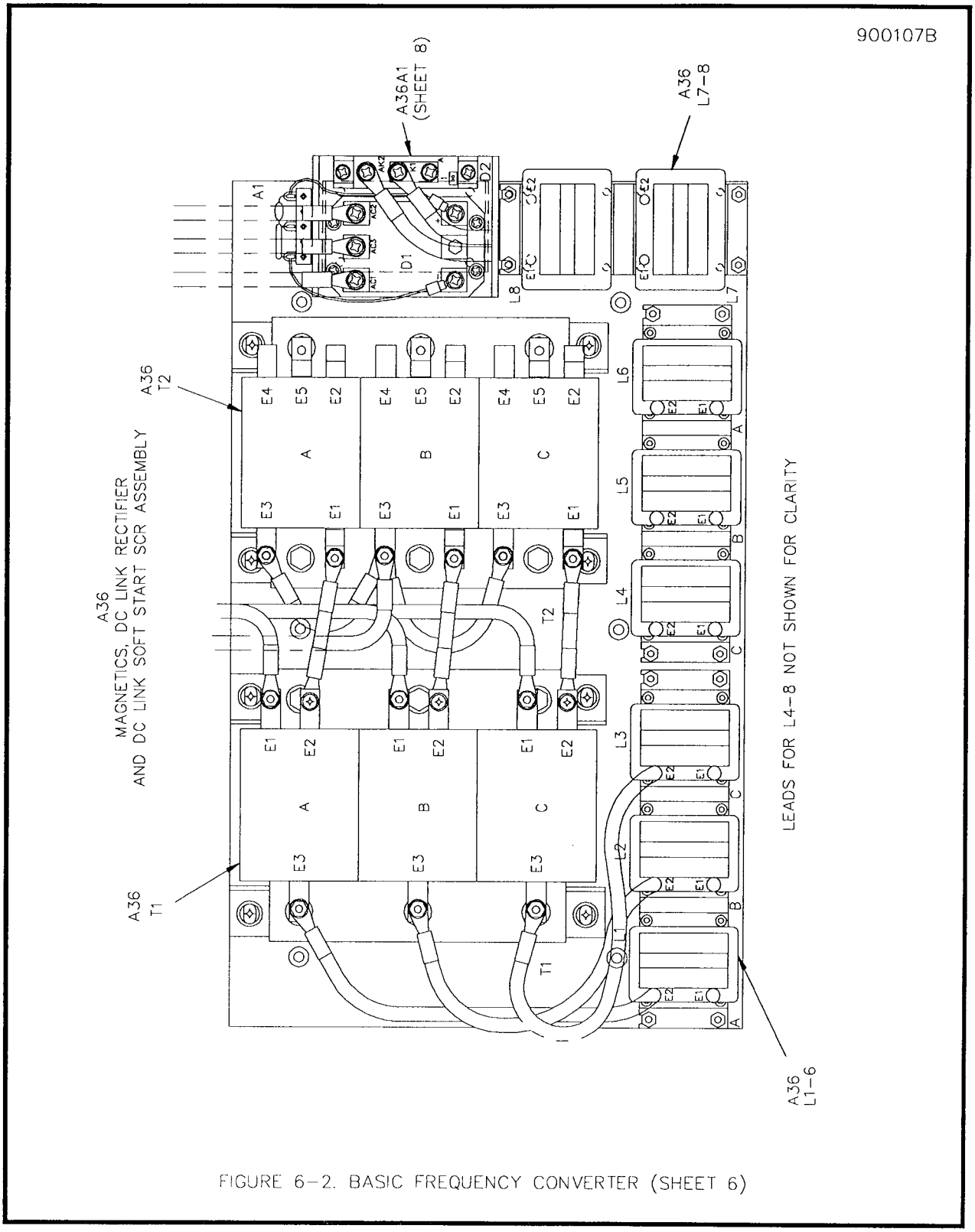
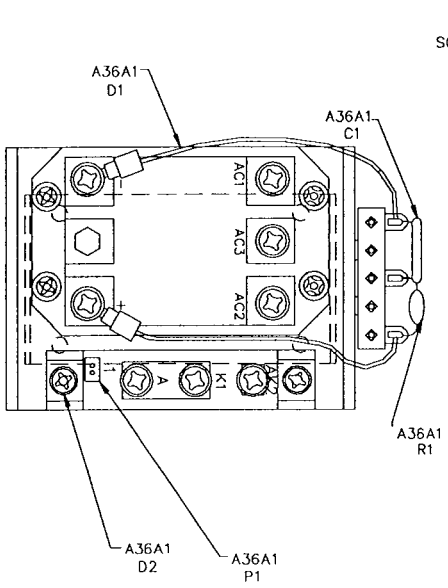


FIGURE 6-2. BASIC FREQUENCY CONVERTER (SHEET 6)



WIRING CHART					
GAGE	LENGTH	FROM	TERM	TO	TERM
18	24 ± 2 IN.	J1	1	D2	A
18		P1		D2	1
18	24 ± 2 IN.	J1	2	P1	1
18		D1	+	TB1	1
		D1	–	TB1	3

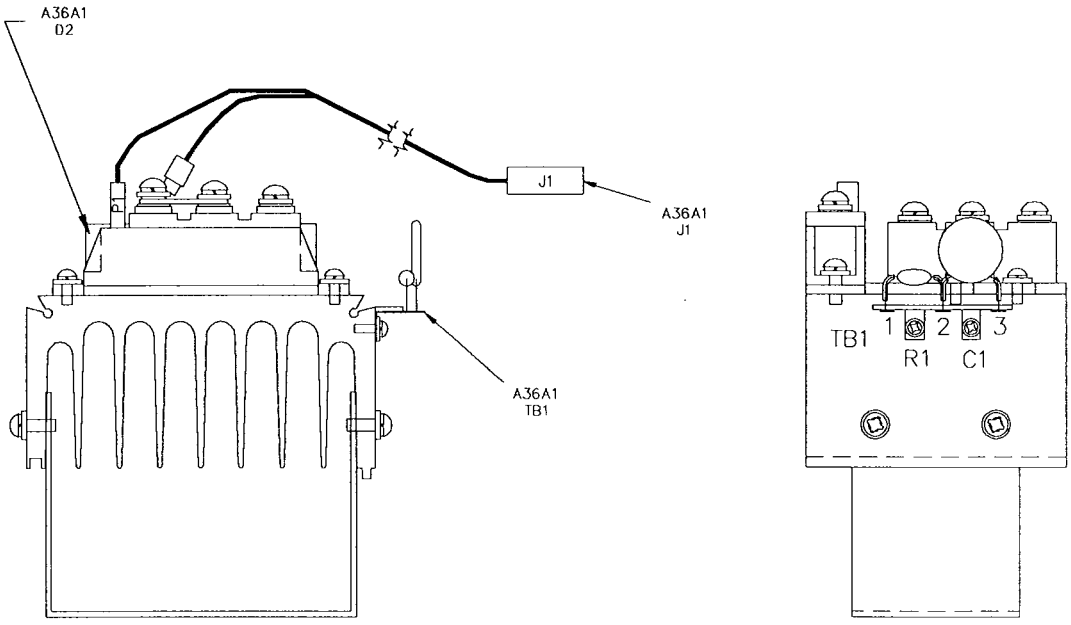


FIGURE 6–2. BASIC FREQUENCY CONVERTER.
(SHEET 7)

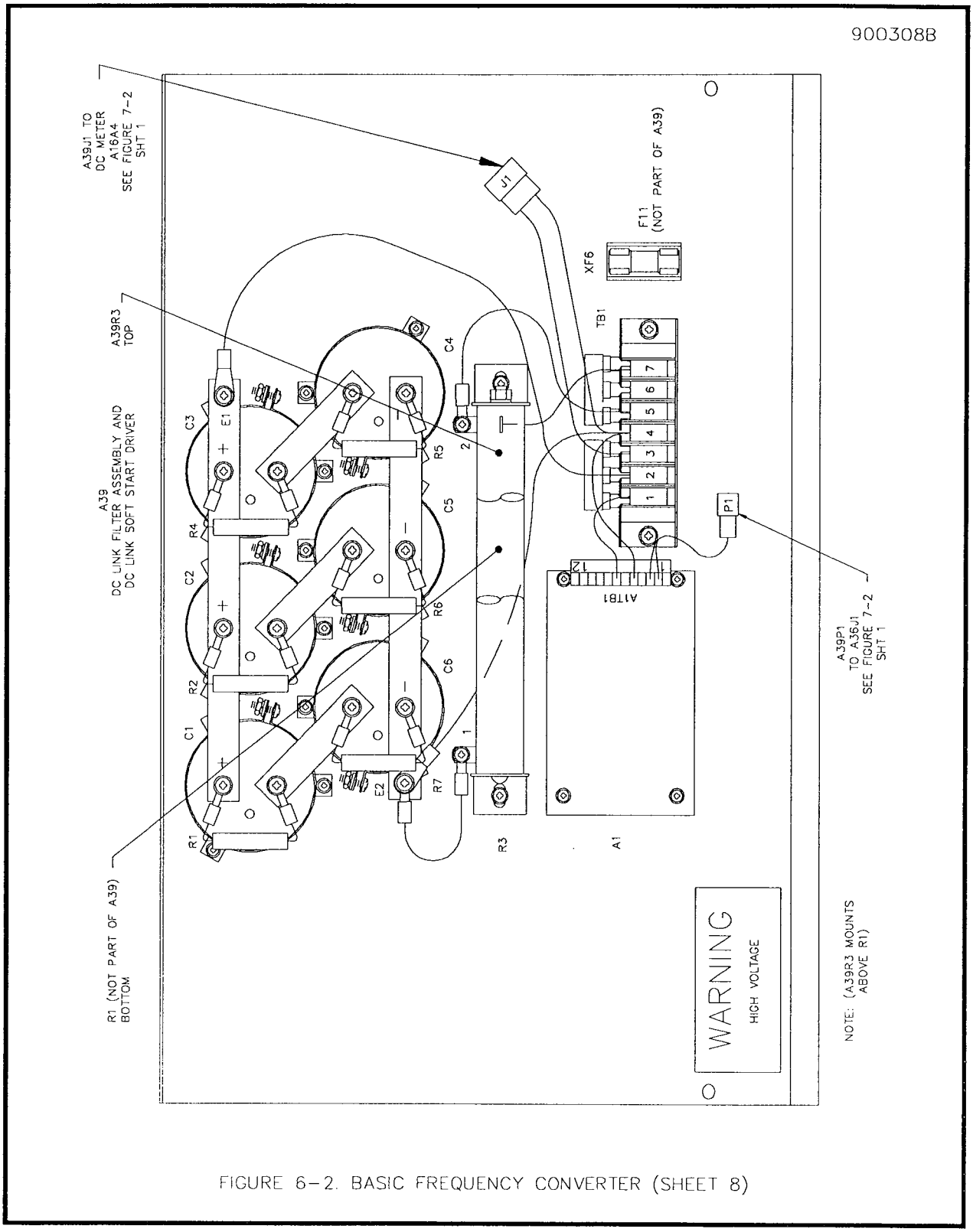
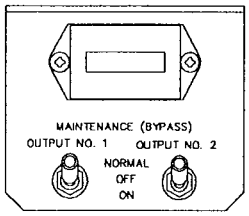
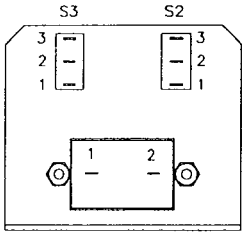


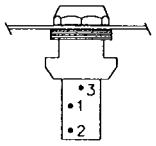
FIGURE 6-2. BASIC FREQUENCY CONVERTER (SHEET 8)



VIEW B–B

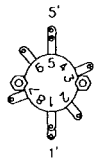


VIEW C–C



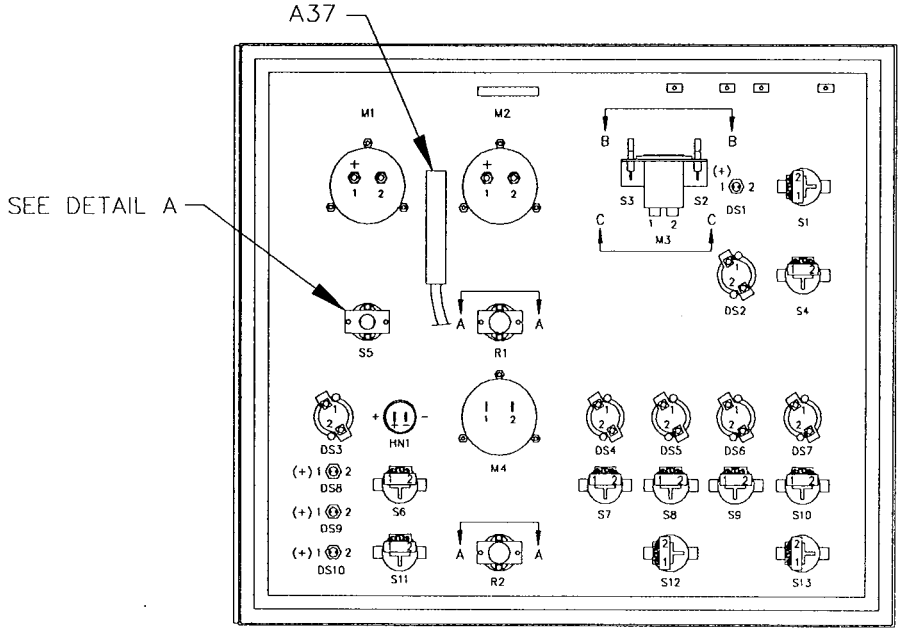
VIEW A–A

(R1 AND R2 POTENTIOMETER TERMINAL DETAILS)



DETAIL A

S5 SWITCH SOLDER TERMINALS

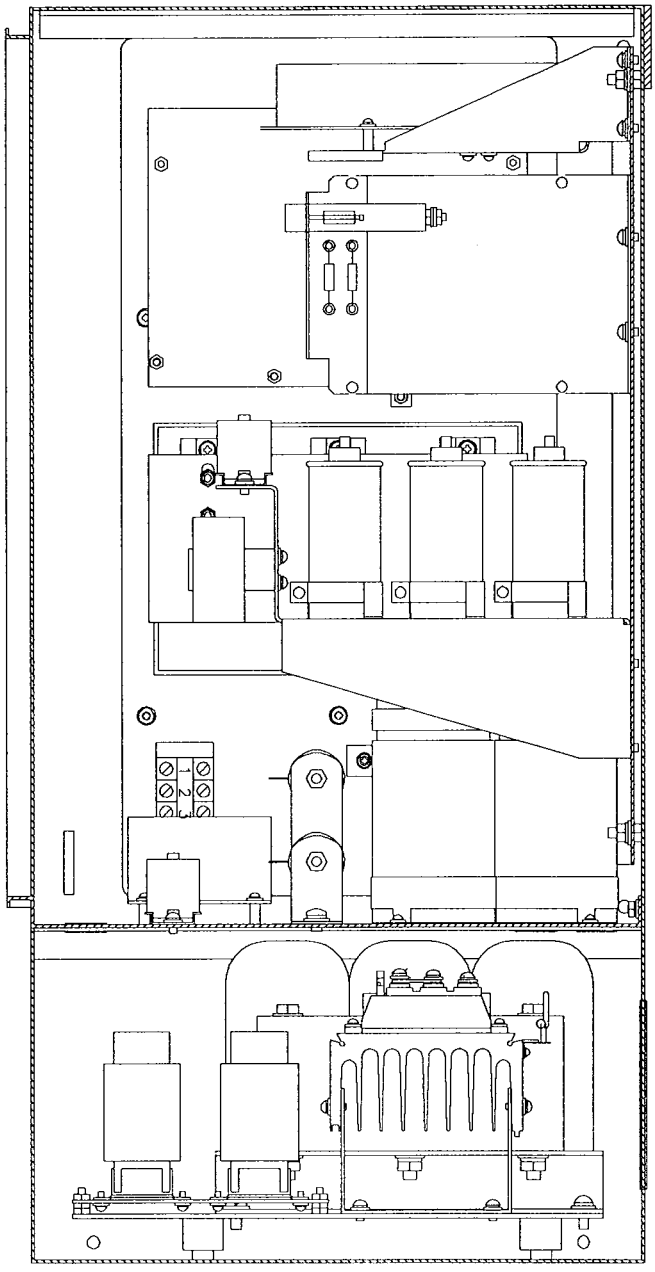


DOOR INTERFACE BOARD A15
REMOVED FOR CLARITY
SEE FIGURE 6–1, SHEET 2

FIGURE 6–2. BASIC FREQUENCY CONVERTER (SHEET 9)

900831A

INSIDE VIEW, LOOKING TOWARD RIGHT SIDE



EXHAUST COVER, DOOR & CARD CAGE ASSYS
REMOVED FOR CLARITY

FIGURE 6-2. BASIC FREQUENCY CONVERTER (SHEET 10).

Table 6–2. Basic Frequency Converter

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
	195–39016–B15	12175	GFC–15M BASIC FREQUENCY CONVERTER. See Table 6–1 and Figure 6–1 for next higher assy (NHA).	REF	GFC–15
	195–39016–B25	12175	GFC–25M BASIC FREQUENCY CONVERTER. See Table 6–1 and Figure 6–1 for next higher assy (NHA).	REF	GFC–25
	195–39016–B37	12175	GFC–37M BASIC FREQUENCY CONVERTER. See Table 6–1 and Figure 6–1 for next higher assy (NHA).	REF	GFC–37
A1 (Sh 1)	195–11030–5	12175	. LOGIC POWER SUPPLY BOARD.	1	
A2 (Sh 2)	195–16039–2	12175	. PROTECTION BOARD.	1	GFC–15
A2 (Sh 2)	195–16039–4	12175	. PROTECTION BOARD.	1	GFC–25
A2 (Sh 2)	195–16039–6	12175	. PROTECTION BOARD.	1	GFC–37
A3 (Sh 2)	195–16053–2	12175	. CONTROL BOARD. Set replacement board switch S3 to variable or fixed frequency depending on options; set switch S2 to desired line compensation setting as described in Section III. Switch S1, both sections, should be set closed on all configurations.	1	
A6 (Sh 2)	195–15074–2	12175	. BITE BOARD. Required for troubleshooting the unit. Not supplied as part of the basic unit unless specified on order.	1	
A7–A11, A14			NOT USED.		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A12, A13			NOT USED.		
A15			. DOOR INTERFACE BOARD ASSY. (See Table 6–1.)	REF	
A16 (Sh 2)	195–39033–1	12175	. COMPONENT PANEL ASSY. (attaching parts)	1	
	MS15795–809	96906	. WASHER, Flat, 1/4.	4	
	MS35338–139	96906	. WASHER, Lock, 1/4.	4	
	MS35649–2254	96906	. NUT, Hex, 1/4–20.	4	
			---*---		
A16A1 (Sh 2)	195–11021–1	12175	.. LOGIC CARD CAGE ASSY. (Houses circuit boards A1–A6.) (attaching parts)	1	
	MS51958–61	96906	.. SCREW, PPH 10–32 × 3/8.	4	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	4	
	MS15795–808	96906	.. WASHER, Flat, No. 10.	4	
			---*---		
A16A2 (Sh 2, 3)	195–39034–1	12175	.. POWER INTERFACE MOUNTING ASSY. (attaching parts)	1	
	MS51958–61	96906	.. SCREW, PPH 10–32 × 3/8.	4	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	4	
	MS15795–808	96906	.. WASHER, Flat, No. 10.	4	
			---*---		
A16A2A1 (Sh 3)	195–39053–1	12175	... POWER INTERFACE BOARD.	1	
A16A2A1F1–A16A2A1F2	FLQ 2/10	75915	....FUSE, 500V, 2/10A, Slo-Blo.	2	
Alternate	ATQ 2/10	21574	....FUSE, 500V, 2/10A, Slo-Blo.	ALT	
Alternate (Sh 3)	MEQ 2/10	72076	....FUSE, 500V, 2/10A, Slo-Blo.	ALT	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A16A2A2 (Sh 3)	195–14036–4	12175	... CABLE ASSY. (To front panel Door Interface board A15J1.)	1	
A16A2A3 (Sh 3)	195–12032–5	12175	... CABLE ASSY. (See wire list.)	1	
A16A3 (Sh 2, 4)	195–30022–1	12175	.. AC FILTER ASSY. (attaching parts)	1	
	MS51958–61	96906	.. SCREW, PPH 10–32 × 3/8.	4	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	4	
	MS15795–808	96906	.. WASHER, Flat, No. 10.	4	
			– – – * – – –		
A16A3C1–C18	CRP24U256–90	14655	... CAPACITOR, 25 μF, 240 VAC. (attaching parts)	18	
(Sh 4)	1YRPU	14655	... BRACKET, w/Mtg. Hardware.	1	
			– – – * – – –		
A16A3L1–L3	195–11535–1	12175	... INDUCTOR, Trap, 12th Harmonic. (attaching parts)	3	
(Sh 4)	MS51957–46	96906	... SCREW, PPH, 8–32 × 5/8.	2	
	MS35338–137	96906	... WASHER, Lock, No. 8.	2	
	MS15795–841	96906	... WASHER, Flat, No. 8.	2	
			– – – * – – –		
A16A3TB1 (Sh 4)	08–03–01–6	5Y407	... TERMINAL BLOCK. (attaching parts)	5	
	12–01–44–2	5Y407	... END CLAMP. (2 clamps hold all TBs together.)	2	
	08–01–69–4	5Y407	... CLAMP. (6 clamps for 5 TBs.)	6	
	150–84003–1	12175	... INSERTION BRIDGE. (1 bridge for all TBs.)	1	
			– – – * – – –		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A16A4 (Sh 2)	195–17028–1	12175	.. VOLTMETER, DC LINK (WARNING METER).	1	
			(attaching parts)		
	MS51957–31	96906	.. SCREW, PPH, 6–32 × 5/8.	2	
	MS35338–136	96906	.. WASHER, Lock, No. 6.	2	
	MS15795–806	96906	.. WASHER, Flat, No. 6.	2	
			---*---		
A17 (Sh 2, 5)	195–39011–1	12175	. LEFT INVERTER ASSY.	1	
A17A1 (Sh 5)	195–39051–1	12175	.. DRIVE BOARD.	1	
A17A2 (Sh 5)	195–39030–1	12175	.. VOLTAGE CLAMP BOARD.	1	
A17A3–A5 (Sh 5)	195–39019–1	12175	.. TRANSISTOR ASSY.	3	
			(attaching parts)		
	MS51958–66	96906	.. SCREW, PPH, 10–32 × 7/8.	2	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	2	
	MS15795–808	96906	.. WASHER, Flat, No. 10.	2	
	G–641	01139	.. COMPOUND, Thermal Insul-grease.	A/R	
			---*---		
A17C1 (Sh 5)	CRT44U456–90	14655	.. CAPACITOR, 45 μF, 440 VAC.	1	
			(attaching parts)		
	279A7235–23	01002	.. BRACKET.	1	
	MS51957–43	96906	.. SCREW, PPH, 8–32 × 3/8.	2	
	MS35338–137	96906	.. WASHER, Lock, No. 8.	2	
	MS15795–807	96906	.. WASHER, Flat, No. 8.	2	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A17S1 (Sh 5)	11362	81439	.. SWITCH, Thermal, N.O. (Contacts close at 175°F and reopen at 140°F.)	1	
			(attaching parts)		
	DNFR14–250FI	06383	.. DISCONNECT, Right Angle.	2	
	MS51957–14	96906	.. SCREW, PPH, 4–40 × 5/16.	2	
	MS35338–135	96906	.. WASHER, Lock, No. 4.	2	
	MS15795–804	96906	.. WASHER, Flat, No. 4.	2	
			---*---		
A17TB1 (Sh 5)	08–03–01–6	5Y407	.. TERMINAL BLOCK, Modular.	5	
			(attaching parts)		
	08–01–69–4	5Y407	.. CLAMP. (4 clamps hold all TBs to rail.)	4	
	12–01–44–2	5Y407	.. END CLAMP. (2 clamps hold all TBs together.)	2	
			---*---		
A18 (Sh 2, 5)	195–39011–2	12175	. RIGHT INVERTER ASSY.	1	
A18A1 (Sh 5)	195–39051–1	12175	.. DRIVE BOARD.	1	
A18A2 (Sh 5)	195–39030–1	12175	.. VOLTAGE CLAMP BOARD.	1	
A18A3–A5 (Sh 5)	195–39019–1	12175	.. TRANSISTOR ASSY.	3	
			(attaching parts)		
	MS51958–66	96906	.. SCREW, PPH, 10–32 × 7/8.	2	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	2	
	MS15795–808	96906	.. WASHER, Flat, No. 10.	2	
	G–641	01139	.. COMPOUND, Thermal Insul-grease.	A/R	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A18C1 (Sh 5)	CRT44U456–90	14655	.. CAPACITOR, 45 μF, 440 VAC.	1	
			(attaching parts)		
	279A7235–23	01002	.. BRACKET.	1	
	MS51957–43	96906	.. SCREW, PPH, 8–32 × 3/8.	2	
	MS35338–137	96906	.. WASHER, Lock, No. 8.	2	
	MS15795–807	96906	.. WASHER, Flat, No. 8.	2	
			---*---		
A18S1 (Sh 5)	11362	81439	.. SWITCH, Thermal, N.O. (Contacts close at 175°F and reopen at 140°F.)	1	
			(attaching parts)		
	DNFR14–250FI	06383	.. DISCONNECT, Right Angle.	2	
	MS51957–14	96906	.. SCREW, PPH, 4–40 × 5/16.	2	
	MS35338–135	96906	.. WASHER, Lock, No. 4.	2	
	MS15795–804	96906	.. WASHER, Flat, No. 4.	2	
			---*---		
A18TB1 (Sh 5)	08–03–01–6	5Y407	.. TERMINAL BLOCK, Modular.	5	
			(attaching parts)		
	08–01–69–4	5Y407	.. CLAMP. (4 clamps hold all TBs to rail.)	4	
	12–01–44–2	5Y407	.. END CLAMP. (2 clamps hold all TBs together.)	2	
			---*---		
A19A1	195–14036–6	12175	.. CABLE ASSY. (To Power Interface board A16A2A1J5.)	1	
			(attaching parts)		
	MS35649–244	96906	.. NUT, Hex, 4–40.	2	
	MS35338–135	96906	.. WASHER, Lock, No. 4.	2	
	MS15795–804	96906	.. WASHER, Flat, No. 4.	2	
	MS51957–17	96906	.. SCREW, PPH, 4–40 × 1/2.	2	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A20A1	195–14036–5	12175	.. CABLE ASSY. (To Power Interface board A16A2A1J1.)	1	
			(attaching parts)		
	MS35649–244	96906	.. NUT, Hex, 4–40.	2	
	MS35338–135	96906	.. WASHER, Lock, No. 4.	2	
	MS15795–804	96906	.. WASHER, Flat, No. 4.	2	
	MS51957–17	96906	.. SCREW, PPH, 4–40 × 1/2.	2	
			---*---		
A22			. INPUT/OUTPUT ENCLOSURE. See Table 6–1 and Figure 6–1.	REF	
A26, A27 (Sh 2)	195–15024–1	12175	. FAN ASSY.	2	
			(attaching parts)		
	MS51958–63	96906	. SCREW, PPH, 10–32 × 1/2.	4	
	MS35338–138	96906	. WASHER, Lock, No. 10.	4	
	MS15795–808	96906	. WASHER, Flat, No. 10.	4	
			---*---		
A28 (Sh 2)	195–14016–1	12175	. CABLE ASSY, Control. (From Control board A3J1 to Power Interface board A16A2A1J4.)	1	
A29 (Sh 2)	195–14016–2	12175	. CABLE ASSY. (From Protection board A2J1 to Power Interface board A16A2A1J3.)	1	
A30 (Sh 2)	195–14016–3	12175	. CABLE ASSY, Logic Power Supply. (From Logic Power Supply board A1J1 to Power Interface board A16A2A1J2.)	1	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A36 (Sh 2, 6)	195–34010–1	12175	. MAGNETICS, DC Link Rectifier and DC Link Soft Start SCR Assy.	1	
			(attaching parts)		
	MS51959–77	96906	. SCREW, PPH, 1/4–20 × 3/8.	6	
	MS15795–809	96906	. WASHER, Flat, 1/4.	6	
	J–4624–10	1L965	. SHOCK MOUNT/VIBRATION ISOLATOR.	6	
			– – – * – – –		
A36A1 (Sh 6, 7)	195–30026–1	12175	.. RECTIFIER and SOFT START SCR ASSY.	1	
			(attaching parts)		
	MS16996–9	96906	.. SCREW, Skt Hd, 10–32 × 3/8.	4	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	4	
	MS15795–808	96906	.. WASHER, Flat, No. 10.	4	
			– – – * – – –		
A36A1C1 (Sh 7)	663F.082, 10% 1000kV	59792	... CAPACITOR, .082 μF, 1kV, 10%.	1	
			(attaching parts)		
	TFT20	60495	... SLEEVING, Teflon.	AR	
			– – – * – – –		
A36A1D1 (Sh 7)	EFG15G	0DCK9	... RECTIFIER, 1400V, 100A.	1	
			(attaching parts)		
	MS51957–29	96906	... SCREW, PPH, 6–32 × 7/16.	4	
	02281	0DCK9	... WASHER, Belleville, No. 6.	4	
	MS15795–806	96906	... WASHER, Flat, No. 6.	4	
	G–641	01139	... THERMAL COMPOUND.	A/R	
			– – – * – – –		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A36A1D2 (Sh 7)	MCD 55–12io8	96272	... DIODE, SCR SOFT START. (attaching parts)	1	
	MS51957–46	96906	... SCREW, PPH, 8–32 × 5/8.	2	
	MS35338–137	96906	... WASHER. Lock, No. 8.	2	
	MS15795–807	96906	... WASHER, Flat, No. 8.	2	
	195–17136–1	12175	... STRAP, Diode.	1	
	F–641	01139	... THERMAL COMPOUND. ---*---	A/R	
A36A1J1 (Sh 7)	03–09–1028	27264	... CONNECTOR HOUSING. (Connects to SCR Driver A39P1). (attaching parts)	1	
	02–09–1118	27264	... PIN, Crimp, Female, 18-22 AWG. ---*---	2	
A36A1P1 (Sh 7)	1–480417–0	00779	... CONNECTOR HOUSING. (Connects to terminal 1 of SCR A36A1D2.) (attaching parts)	1	
	42470–1	00779	... TERMINAL, Crimp. ---*---	1	
A36A1R1 (Sh 7)	RN65D51R1F	81349	... RESISITOR, 51.1Ω, 3/4W, 1%. (attaching parts)	1	
	TFT20	60495	... SLEEVING, Teflon. ---*---	A/R	
A36A1TB1 (Sh 7)	865	83330	... TERMINAL STRIP. (attaching parts)	1	
	MS51957–15	96906	... SCREW, PPH, 4–40 × 3/8.	2	
	MS35338–135	96906	... WASHER, Lock, No. 4.	2	
	MS15795–804	96906	... WASHER, Flat, No. 4. ---*---	2	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A36L1–L6 (Sh 6)	195–30502–1	12175	.. INDUCTOR, AC.	6	
			(atatching parts)		
	MS51957–28	96906	.. SCREW, PPH, 6–32 × 3/8.	4	
	MS35338–136	96906	.. WASHER, Lock, No. 6.	4	
	MS15795–806	96906	.. WASHER, Flat, No. 6.	4	
			---*---		
A36L7–L8 (Sh 6)	195–30502–2	12175	.. INDUCTOR, DC.	2	
			(attaching parts)		
	MS51957–28	96906	.. SCREW, PPH, 6–32 × 3/8.	4	
	MS35338–136	96906	.. WASHER, Lock, No. 6.	4	
	MS15795–806	96906	.. WASHER, Flat, No. 6.	4	
			---*---		
A36T1 (Sh 6)	195–30500–1	12175	.. TRANSFORMER, Type I, Output Power.	1	
			(attaching parts)		
	MS51957–80	96906	.. SCREW, PPH, 1/4–20 × 5/8.	4	
	MS35338–139	96906	.. WASHER, Lock, 1/4.	4	
	MS15795–810	96906	.. WASHER, Flat, 1/4.	4	
			---*---		
A36T2 (Sh 6)	195–30501–1	12175	.. TRANSFORMER, Type II, Output Power.	1	
			(attaching parts)		
	MS51957–80	96906	.. SCREW, PPH, 1/4–20 × 5/8.	4	
	MS35338–139	96906	.. WASHER, Lock, 1/4.	4	
	MS15795–810	96906	.. WASHER, Flat, 1/4.	4	
			---*---		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A39 (Sh 2, 8)	195–32021–1	12175	. DC LINK FILTER ASSY and DC LINK SOFT START SCR DRIVER.	1	
			(attaching parts)		
	MS51958–63	96906	. SCREW, PPH, 10–32 × 1/2.	2	
	MS51958–59	96906	. SCREW, PPH, 10–32 × 1/4.	2	
	MS35338–138	96906	. WASHER, Lock, No. 10.	4	
	MS15795–808	96906	. WASHER, Flat, No. 10.	4	
			– – – * – – –		
A39A1 (Sh 8)	195–17001–1	12175	.. DC LINK SOFT START SCR DRIVER BOARD.	1	
			(attaching parts)		
	MS51957–28	96906	.. SCREW, PPH, 6–32 × 3/8.	4	
	MS35338–136	96906	.. WASHER, Lock, No. 6.	8	
	MS15795–805	96906	.. WASHER, Flat, No. 6.	8	
			– – – * – – –		
A39C1–C6	CGS202T450X5C	90201	.. CAPACITOR, 2k μF, 450 VDC.	6	
Alternate (Sh 8)	3186GG202T450 AMA1	56699	.. CAPACITOR, 2k μF, 450 VDC.	ALT	
			(attaching parts)		
	195–32101–1	12175	.. BUS BAR, #1 (for 6 capacitors).	2	
	MS51958–61	96906	.. SCREW, PPH, 10–32 × 3/8.	2	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	2	
	MS15796–808	96906	.. WASHER, Flat, No. 10.	2	
	195–32102–1	12175	.. BUS BAR, #2 (for 6 capacitors).	3	
	MS51958–61	96906	.. SCREW, PPH, 10–32 × 3/8.	2	
	MS35338–138	96906	.. WASHER, Lock, No. 10.	2	
	MS15796–808	96906	.. WASHER, Flat, No. 10.	2	
			– – – * – – –		

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A39J1 (Sh 8)	03–09–1118	27264	.. CONNECTOR HOUSING. (Connects to DC Link Voltage Meter A16A4P1).	1	
			(attaching parts)		
	02–09–1119	27264	.. PIN, Crimp, Female.	2	
			– – – * – – –		
A39P1 (Sh 8)	03–09–2028	27264	.. CONNECTOR HOUSING. (Connects to Rectifier and Soft Start SCR Assy A36A1J1, pin 2.)	1	
			(attaching parts)		
	02–09–2118	27264	.. PIN, Crimp, Male.	2	
			– – – * – – –		
A39R1, R2 (Sh 8)	RS–10–20K–1%	91637	... RESISTOR, 20kΩ, 10W, 1%.	4	
			(attaching parts)		
	MS25036–103	96906	... LUG, 18–22 AWG, #10 stud.	2	
			– – – * – – –		
A39R3 (Sh 8)	L175J10R	44655	.. RESISTOR, 10Ω, 175W, 10%.	1	
			(attaching parts)		
	6126–P8.5	44655	.. KIT, Mtg, Thru-bolt.	1	
			– – – * – – –		
A39R4–R7 (Sh 8)	RS–10–20K–1%	91637	.. RESISTOR, 20kΩ, 10W, 1%.	4	
			(attaching parts)		
	MS20536–103	96906	.. LUG, 18–22 AWG, #10 stud.	2	
			– – – * – – –		
A39TB1 (Sh 8)	08–03–01–6	5Y407	.. TERMINAL BLOCK.	7	
			(attaching parts)		
	12–01–44–2	5Y407	.. CLAMP, End. (for 7 TBs)	2	
	08–01–69–4	5Y407	.. CLAMP. (for 7 TBs)	6	
	150–84003–2	12175	.. BRIDGE, Insertion. (for 7 TBs)	2	
			– – – * – – –		
A42–A44			. INPUT/OUTPUT CABLE ASSYs. See Table 6–1 and Figure 6–1.	REF	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A45			. OUTPUT CONTACTOR CABLE ASSY. See Table 6–1 and Figure 6–1.	REF	
A50 (Sh 1, 9)	195–34007–2	12175	. DOOR ASSY. (Not a replacement assembly.) For controls and indicators associated with options, if any, see Table 6–1.	1	
A50A37 (Sh 9)	195–34011–1	12175	.. DOOR CABLE ASSY.	1	
A50DS1 (Sh 9)	249–7971–3732–504	83330	.. LIGHT, LED, Green. ---*---	1	
			NOTE Westinghouse indicators and switches are no longer available. These indicators and switches are replaced with Cutler-Hammer type indicators and switches. Replacement bulbs for the Westinghouse indicators are part number 31D5316P4.		
A50DS2–DS7 (Sh 9)	10250T208N	27191	.. LIGHT, Indicating. (attaching parts)	6	
	10250TC2N	27191	.. LENS, Green. (For DS2, DS5 and DS7.)	2	
	10250TC1N	27191	.. LENS, Red. (For DS3, DS4 and DS6.)	2	
	TYPE 1835	62607	.. BULB, 55V, Miniature. (See note above.) ---*---	1	
A50DS8–DS10 (Sh 9)	249–7871–3731–504	83330	.. LIGHT, LED, Red.	3	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A50HN1 (Sh 9)	MW09–550–Q	56493	.. HORN, 15–36V AC/DC.	1	
A50M1 (Sh 9)	150–60009–1	12175	.. AMMETER, 0–150A. (Mounts on A15.)	1	
A50M2 (Sh 9)	150–60010–1	12175	.. VOLTMETER, 0–150A. (Mounts on A15.)	1	
A50M3	20085–16	74400	.. METER, Elapsed Time, 24 VAC.	1	
Alternate (Sh 9)	20085–17	74400	.. METER, Elapsed Time, 24 VAC.	ALT	
A50S1 (Sh 9)	10250T172–47	27191	.. SWITCH, Momentary, Mushroom.	1	
A50S2, S3 (Sh 9)	M83731/11–711	27193	.. SWITCH, Toggle.	2	
A50S4, S8, S10 (Sh 9)	10250T103–47	27191	.. SWITCH, Momentary, Green.	3	
A50S5 (Sh 9)	195–11026–1	12175	.. SWITCH ASSY, Selector.	1	
A50S6, S7, S9, S11 (Sh 9)	10250T102–47	27191	.. SWITCH, Momentary, Red.	4	
A50S12, S13 (Sh 9)	10250T3011–47	27191	.. SWITCH, Rotary, 2-Position.	2	
A53			. LINE MONITOR ASSY. See Table 6–1 and Figure 6–1.	REF	
A57 (Figure 7–2)	195–34017–3	12175	. CABLE ASSY, Air Flow Sensor.	1	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

Table 6–2. Basic Frequency Converter (continued)

Reference Designator (Fig. 6–2)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
A58 (Figure 7–2)	195–34017–1	12175	. CABLE ASSY, Air Flow Sensor.	1	
CR1–CR6	195–30032–1	12175	. DIODE ASSY.	6	
F11 (Sh 8)	FLQ2	75915	. FUSE, 2A, 500V.	1	
R1	L175J150R	44655	. RESISTOR, 150Ω, 175W, 5%, Rapid Discharge.	1	
Alternate	HL–175–04Z 150 OHM, 5%	91637	. RESISTOR, 150Ω, 5%.	ALT	
Alternate (Sh 8, 10)	VK160W–150	12697	. RESISTOR, 150Ω, 5%.	ALT	
S3 (Sh 2)	2AC59	91929	. SWITCH, Interlock, SPDT, 15A, 250V.	1	

N/A = Not Available
A/R = As Required

All dimensions are in inches unless otherwise specified.

900116B

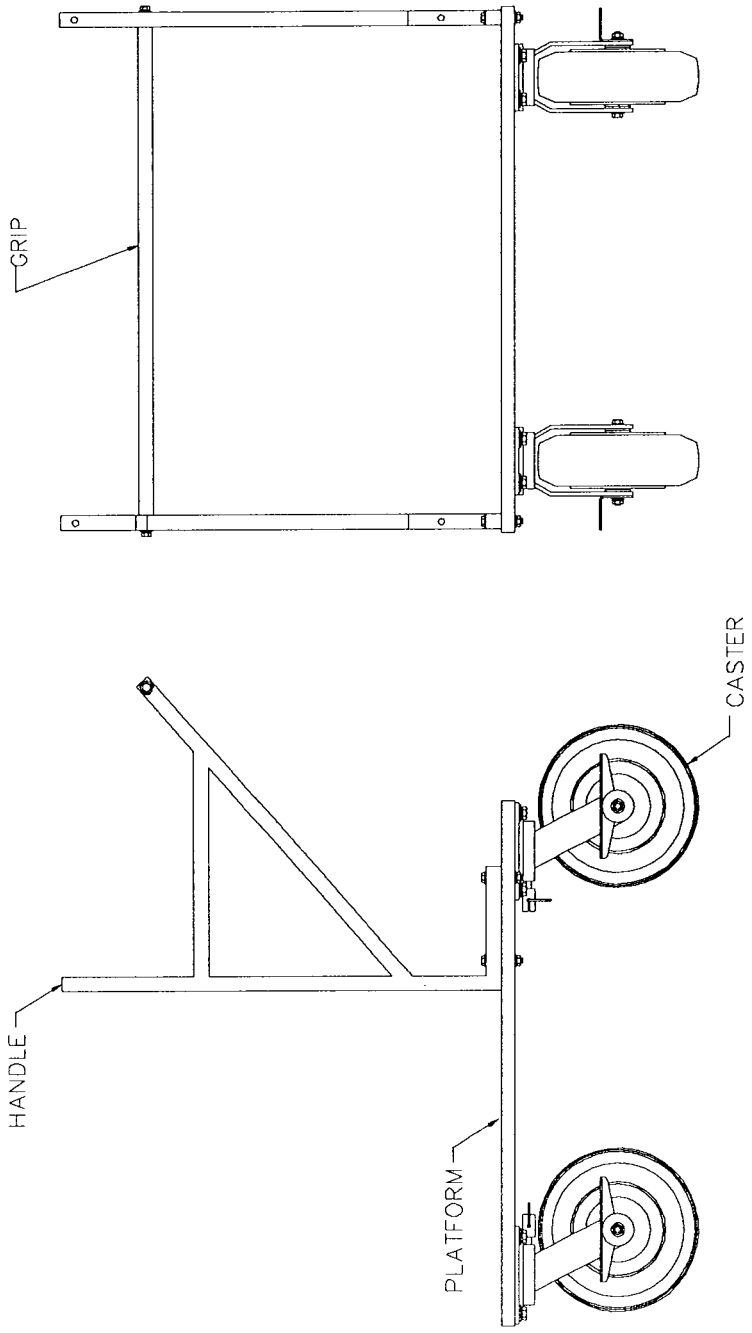


FIGURE 6-3. MOBILE CART ASSEMBLY

Table 6–3. Mobile Cart Assembly

Reference Designator (Fig. 6–3)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
	195–34014–1	12175	GFC MOBILE CART ASSY. See Table 6–1 for next higher assy (NHA).	REF	
	195–34118–1	12175	. PLATFORM, CART.	1	
			---*---		
	195–20159	12175	. HANDLE, CART.	2	
			(attaching parts)		
	MS35307–368	96906	. SCREW, Hex, 3/8–16 x 2.5.	2	
	MS35338–141	96906	. WASHER, Lock, 3/8.	4	
	MS15795–814	96906	. WASHER, Flat, 3/8.	4	
	MS35649–2384	96906	. NUT, Hex, 3/8–16.	2	
			---*---		
	195–20160–1	12175	. GRIP, HANDLE.	1	
			(attaching parts)		
	MS35307–366	96906	. SCREW, Hex, 3/8–16 x 2.	2	
	MS35338–141	96906	. WASHER, Lock, 3/8.	2	
	MS15795–814	96906	. WASHER, Flat, 3/8.	2	
			---*---		
	195–34019–1	12175	. KIT, CASTER.	1	
			(attaching parts)		
	72–SF–10601–R	N/A	. CASTER, Rigid. (Mfr by Albion Industries.)	2	
	72–SF–10601–S–SSB–72	N/A	. CASTER, Swivel, w/ Brake. (Mfr by Albion Industries.)	2	
			---*---		
Alternate	195–34019–2	12175	. KIT, CASTER.	ALT	
			(attaching parts)		
	72–SF–10601–R	N/A	. CASTER, Rigid. (Mfr by Albion Industries.)	2	
	72–SF–10601–S–SL–SSB–72	N/A	. CASTER, Swivel, Pneumatic Wheel, w/ Brake and Lock. (Mfr by Albion Industries.)	2	
			---*---		

N/A = Not Available

Table 6–3. Mobile Cart Assembly (continued)

Reference Designator (Fig. 6–3)	Part Number	Mfr Code	Description	Qty Per Assy	Usable On Code
Alternate	195–34019–3	12175	. KIT, CASTER. (attaching parts)	ALT	
	72–SF–10601–S–SSB–72	N/A	. CASTER, Swivel, w/ Brake. (Mfr by Albion Industries.)	2	
	72–SF–10601–S–SL–SSB–72	N/A	. CASTER, Swivel, Pneumatic Wheel, w/ Brake and Lock. (Mfr by Albion Industries.)	2	
			---*---		
Alternate	195–34019–4	12175	. KIT, CASTER. (attaching parts)	ALT	
	72–SF–10601–S–SL–SSB–72	N/A	. CASTER, Swivel, Pneumatic Wheel, w/ Brake and Lock. (Mfr by Albion Industries.)	4	
			---*---		
Alternate	195–34019–5	12175	. KIT, CASTER. (attaching parts)	ALT	
	R–7010–BK	26935	. CASTER, Rigid.	2	
	S–7010–IB–BK	26935	. CASTER, Swivel, w/ Brake.	2	
			---*---		
Alternate	195–34019–6	12175	. KIT, CASTER. (attaching parts)	ALT	
	R–7010–BK	26935	. CASTER, Rigid.	2	
	S–7010–2SL–IB–BLK	26935	. CASTER, Swivel, Pneumatic Wheel, w/ Brake and Lock.	2	
			---*---		
Alternate	195–34019–7	12175	. KIT, CASTER. (attaching parts)	ALT	
	S–7010–IB–BK	26935	. CASTER, Swivel, w/ Brake.	2	
	S–7010–2SL–IB–BLK	26935	. CASTER, Swivel, Pneumatic Wheel, w/ Brake and Lock.	2	
			---*---		
Alternate	195–34019–8	12175	. KIT, CASTER. (attaching parts)	ALT	
	S–7010–2SL–IB–BLK	26935	. CASTER, Swivel, Pneumatic Wheel, w/ Brake and Lock.	4	
			---*---		

N/A = Not Available

SECTION VII
SCHEMATIC DIAGRAMS

7.1 GENERAL

This section provides schematic diagrams for the Pwr-Kart™ frequency converter and its component assemblies. The assembly schematic diagrams are provided for reference information only. See Table 7–1.

Simplified functional diagrams are provided as Figure 4–1 through Figure 4–15 in Section IV of this manual. These simplified diagrams provide a rapid means for identifying interconnect cabling/wiring for the assemblies.

Appendices provide interconnect wiring information for the frequency converter.

Table 7–1. Schematic Diagrams

Figure No.	Title
7–1	Input/Output Circuits. Includes any input/output options, if applicable.
7–2	Overall Schematic Diagram. a. Sheet 1 illustrates the Input Rectifier circuit. b. Sheet 2 illustrates the Left Inverter A17. c. Sheet 3 illustrates the Right Inverter A18. d. Sheet 4 illustrates the output transformer and filter circuits. e. Sheet 5 provides the control circuit cabling. f. Sheet 6 illustrates the Logic Card Cage Mother Board A16A1.
7–3	AC Filter Assembly A16A3.
7–4	Inverter Assembly, Left A17/Right A18.
7–5	Power Interface Assembly A16A2A1.
7–6	Magnetics, DC Link Rectifier and DC Link Soft Start SCR Assembly A36.
7–7	DC Filter Assembly A39.
7–8	Door Assembly A50.

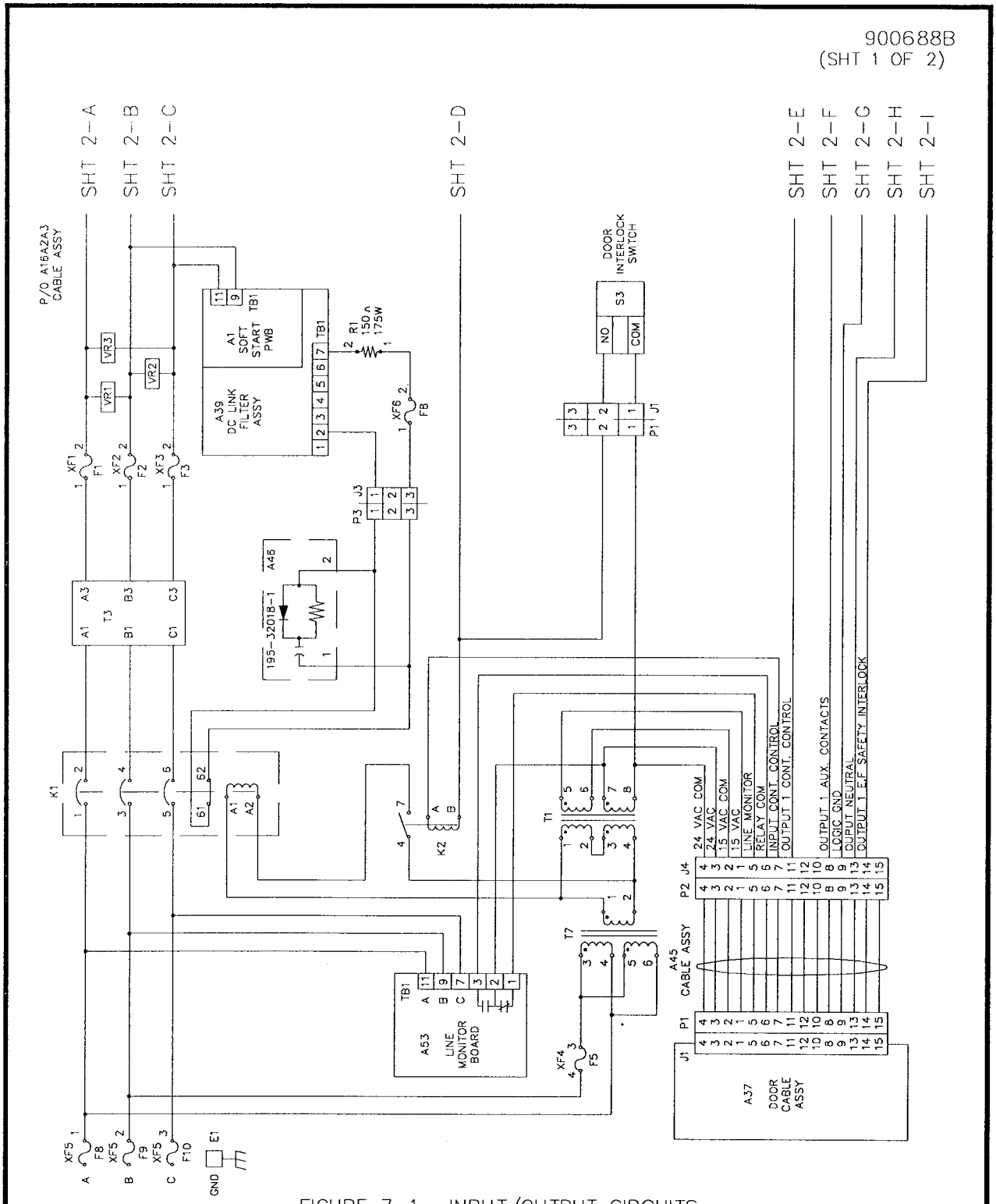


FIGURE 7-1. INPUT/OUTPUT CIRCUITS.
(SHEET 1 OF 2)

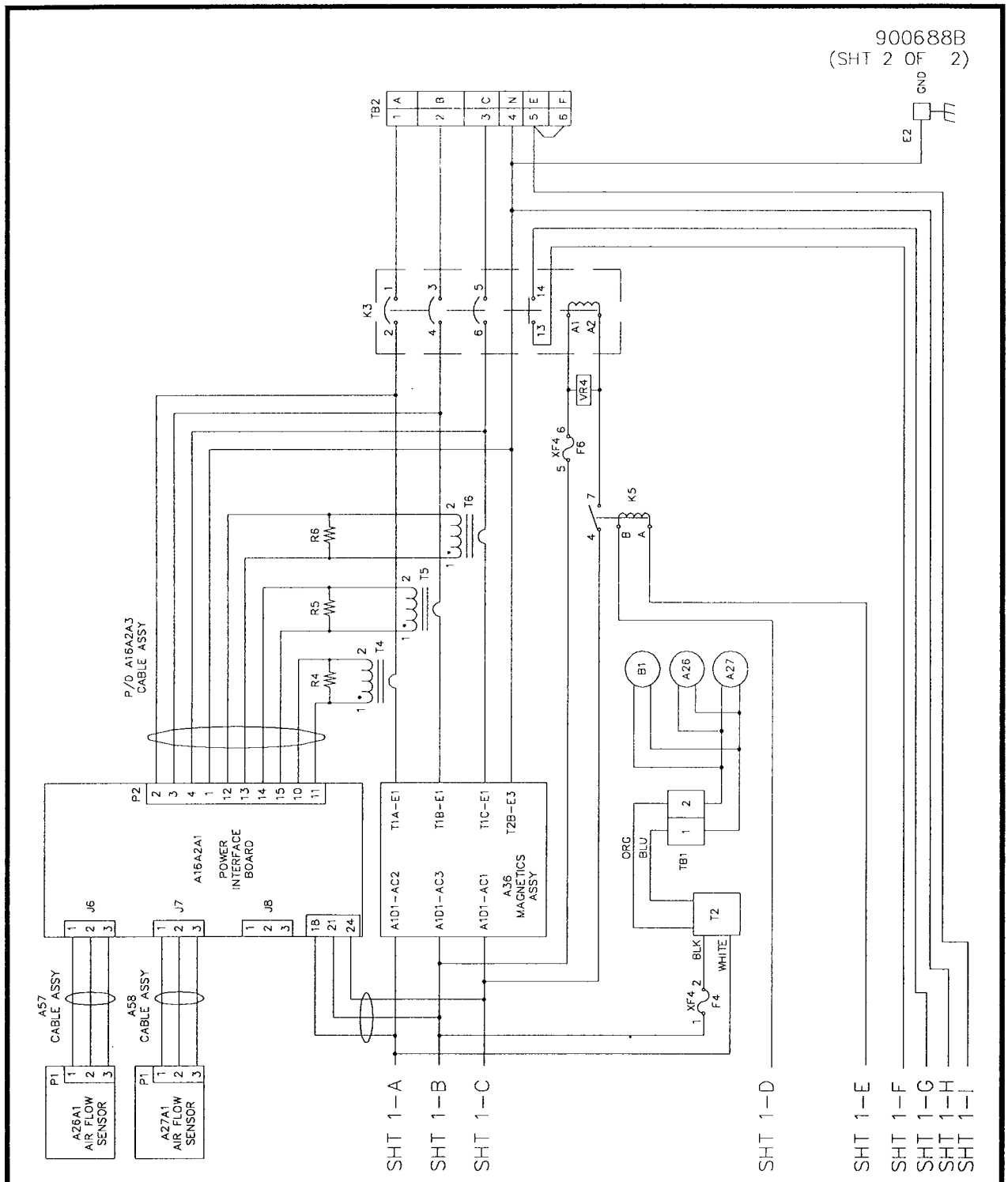


FIGURE 7-1. INPUT/OUTPUT CIRCUITS.
(SHEET 2)

900298B

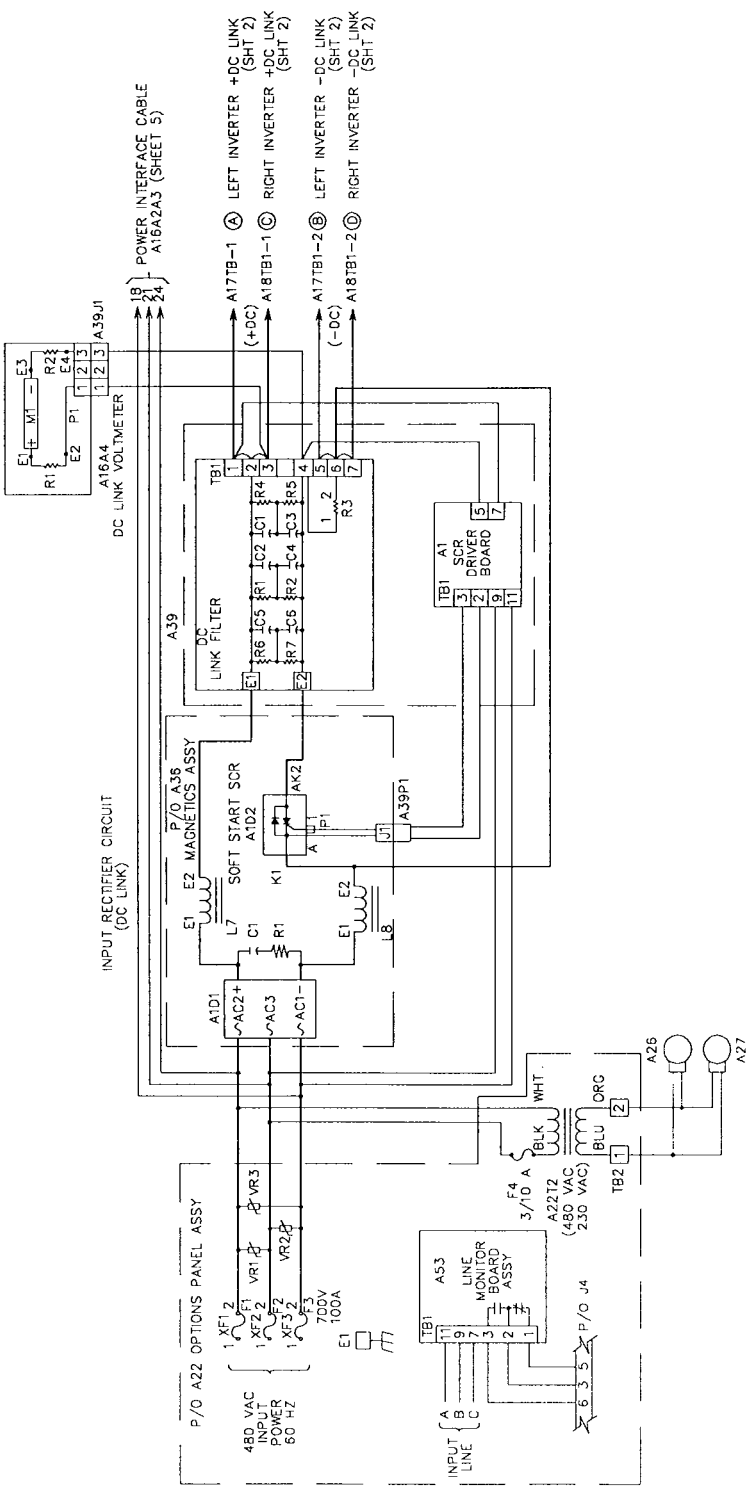


FIGURE 7–2. OVERALL SCHEMATIC DIAGRAM. (SHEET 1 OF 6)

900832B

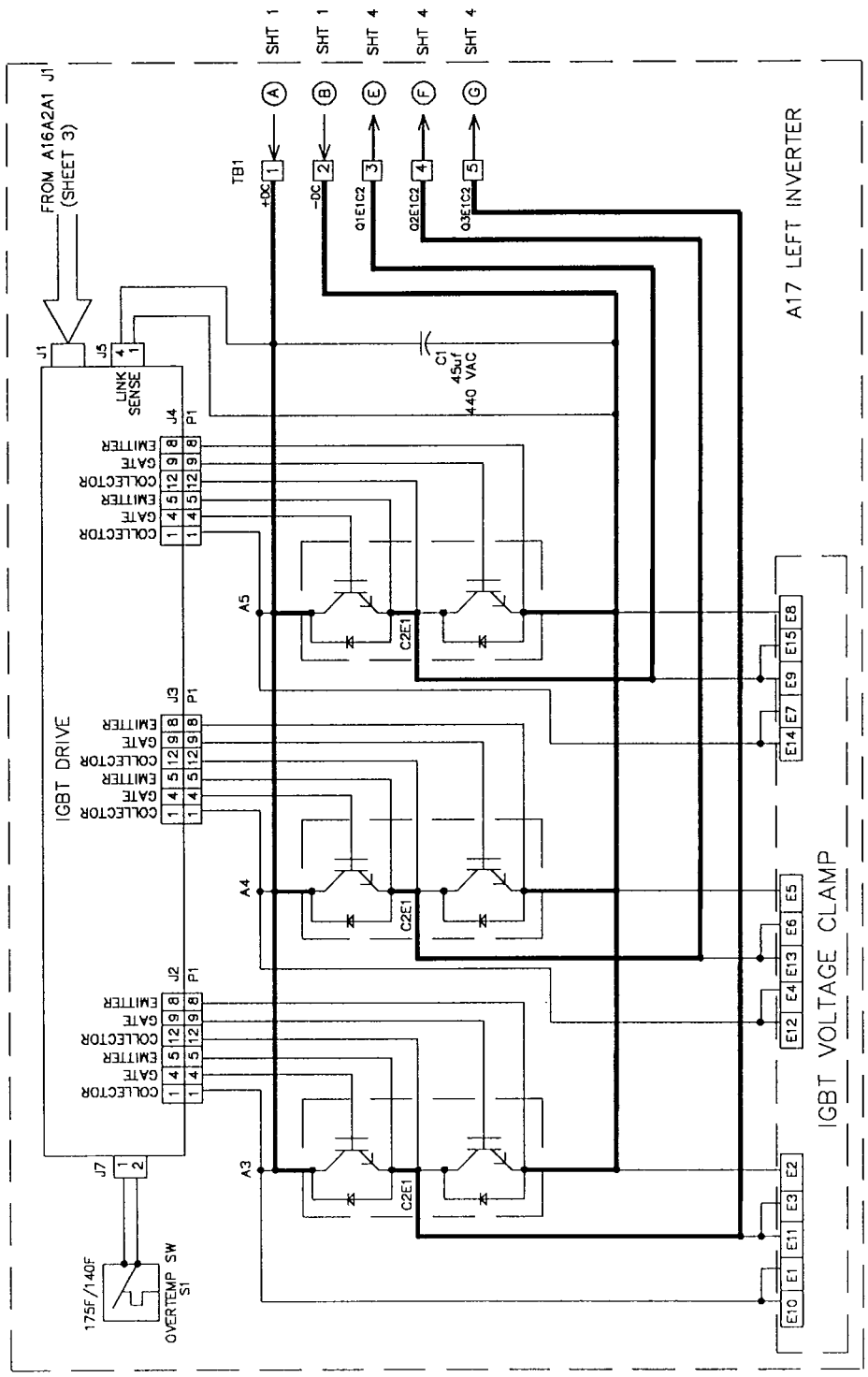


FIGURE 7-2. OVERALL SCHEMATIC DIAGRAM (SHEET 2)

900833B

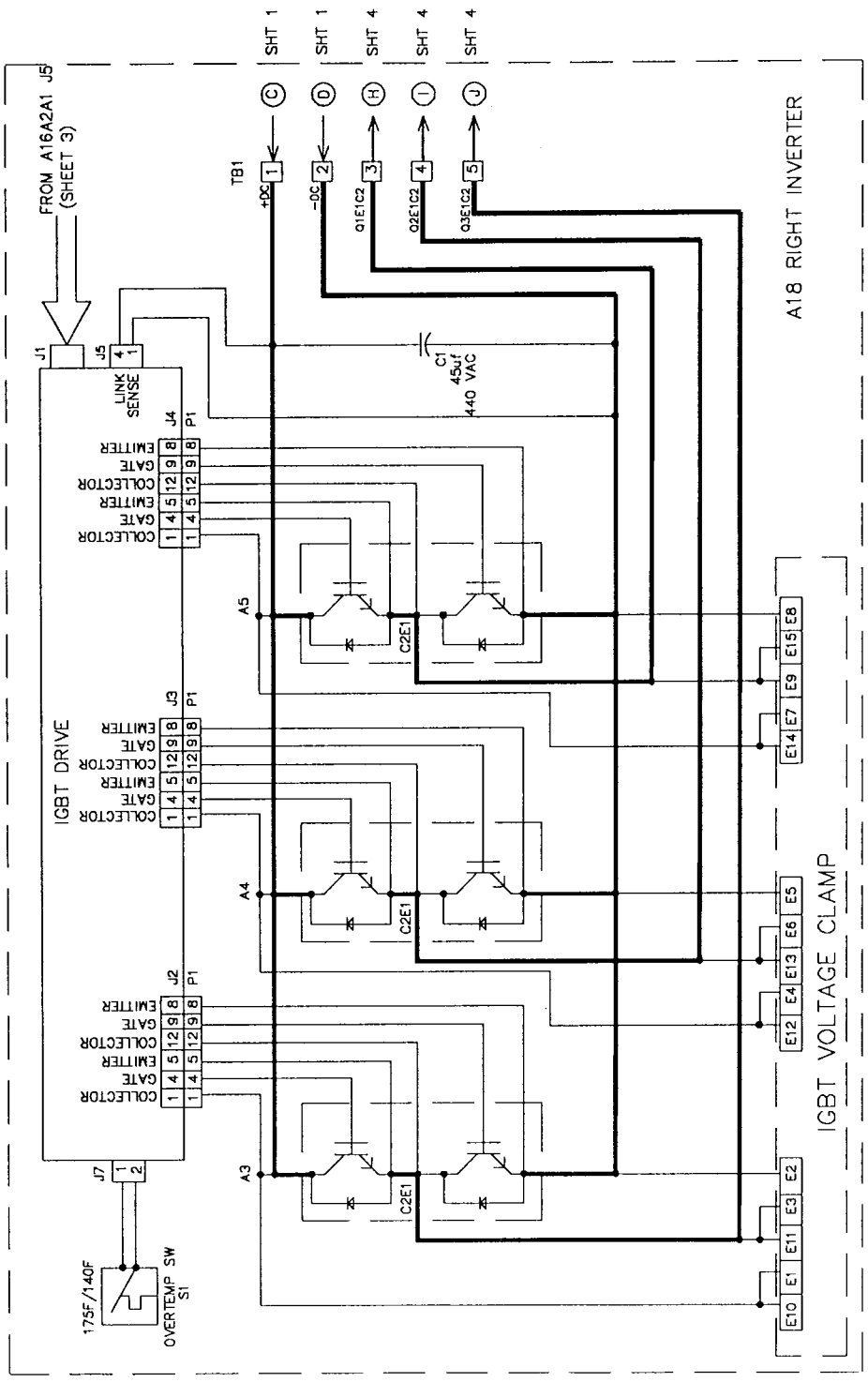


FIGURE 7-2. OVERALL SCHEMATIC DIAGRAM (SHEET 3)

900296C

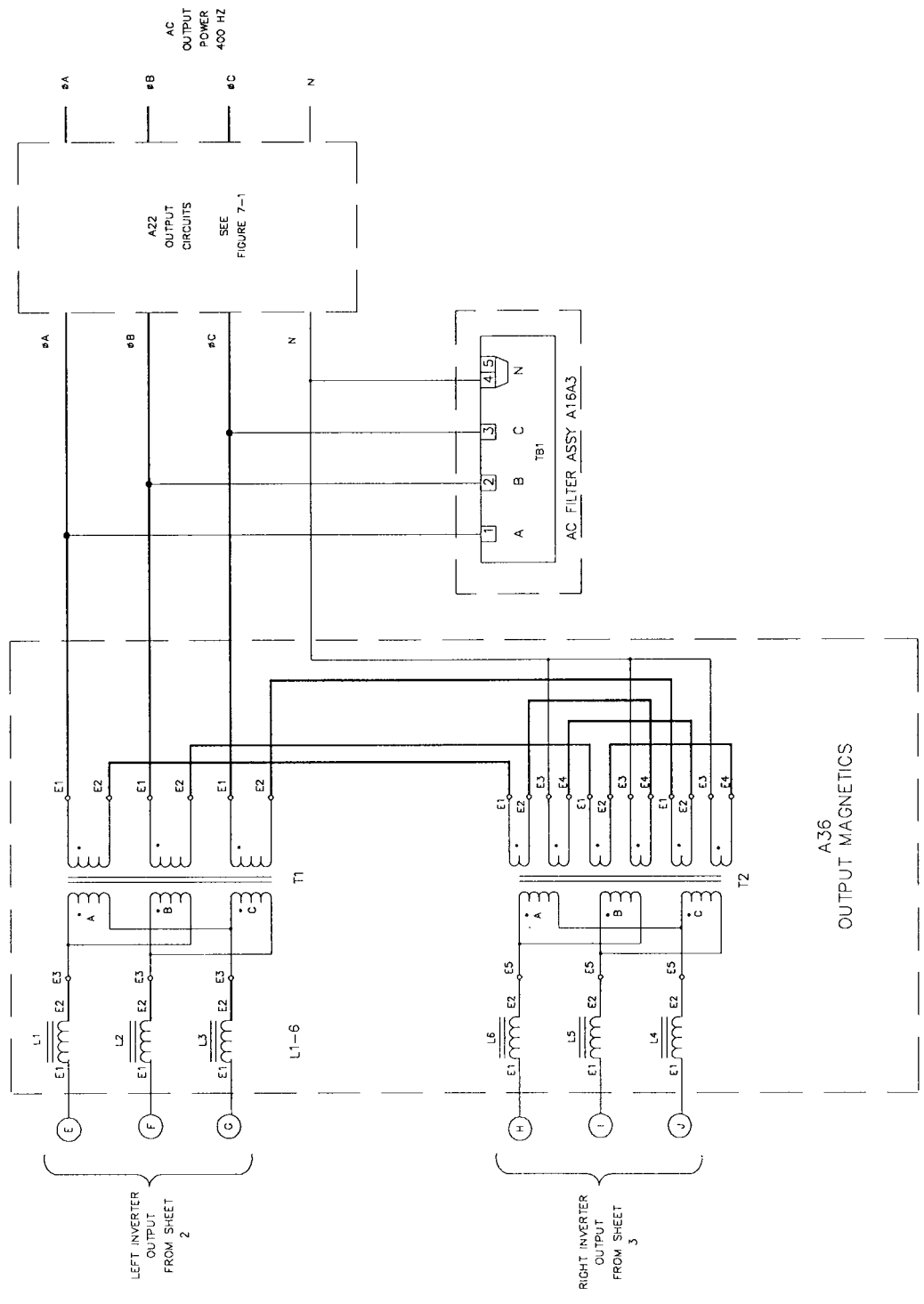


FIGURE 7-2. OVERALL SCHEMATIC DIAGRAM.
(SHEET 4)

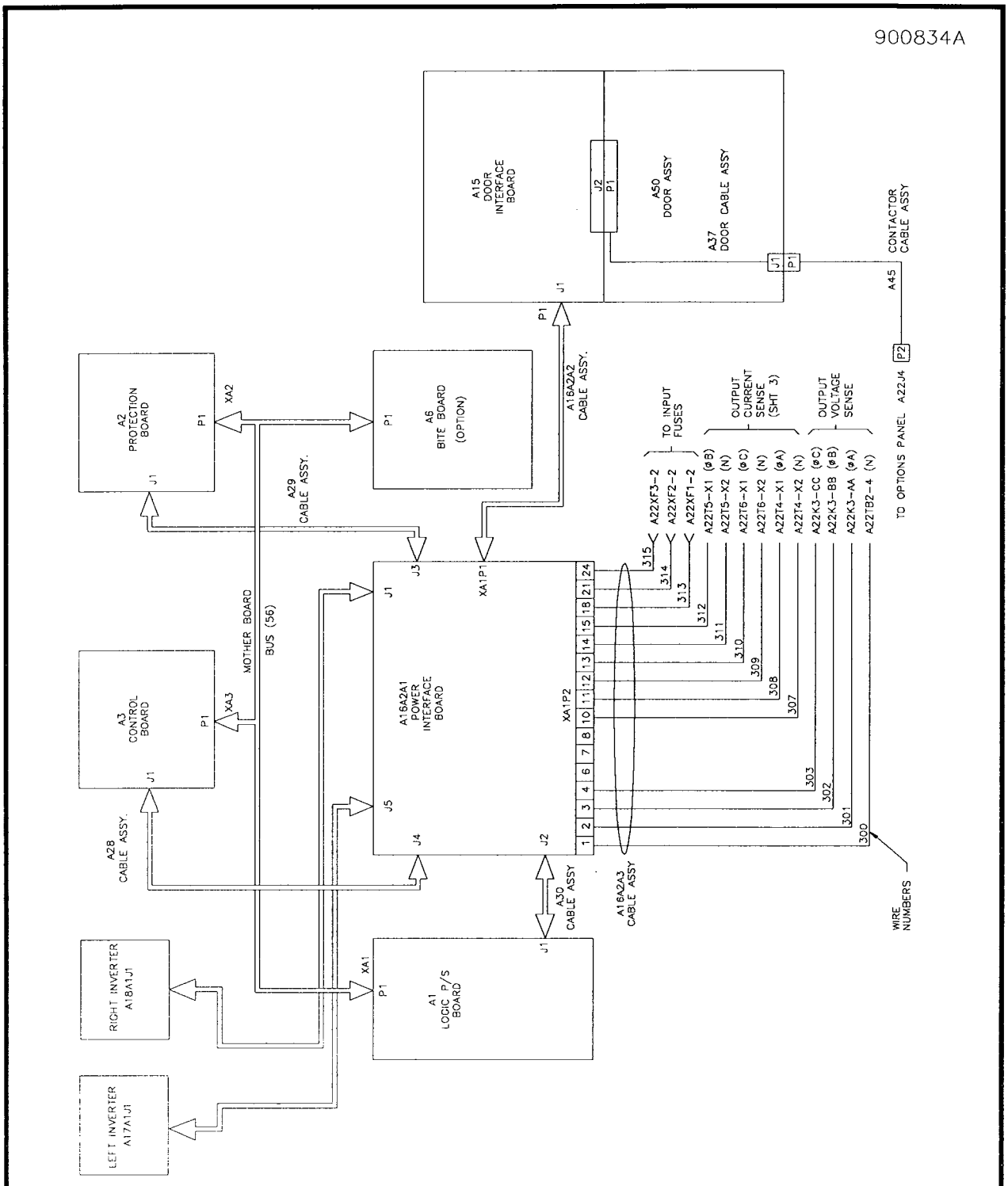


FIGURE 7-2. OVERALL SCHEMATIC DIAGRAM (SHEET 5).

900288C

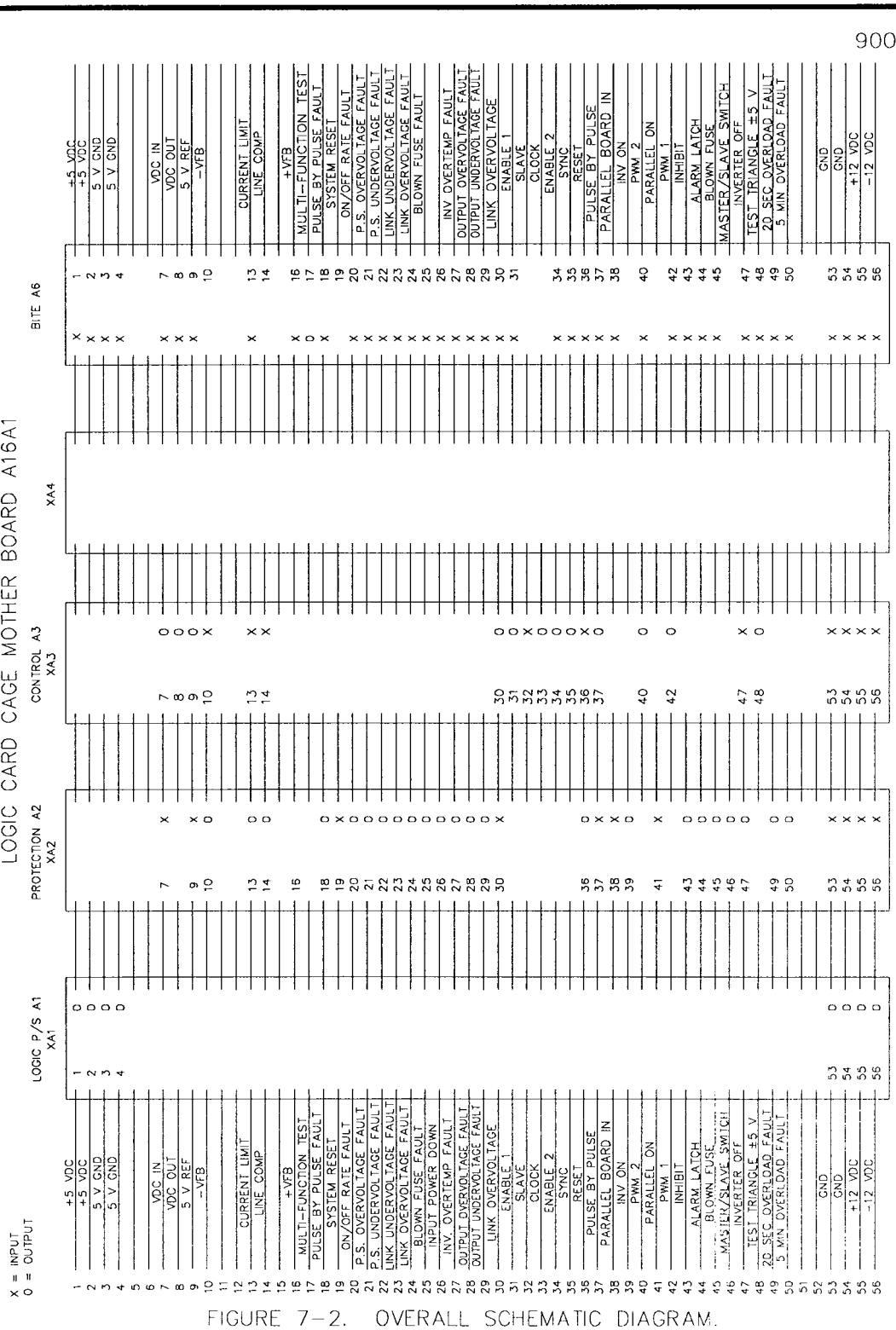


FIGURE 7-2. OVERALL SCHEMATIC DIAGRAM.
(SHEET 6)

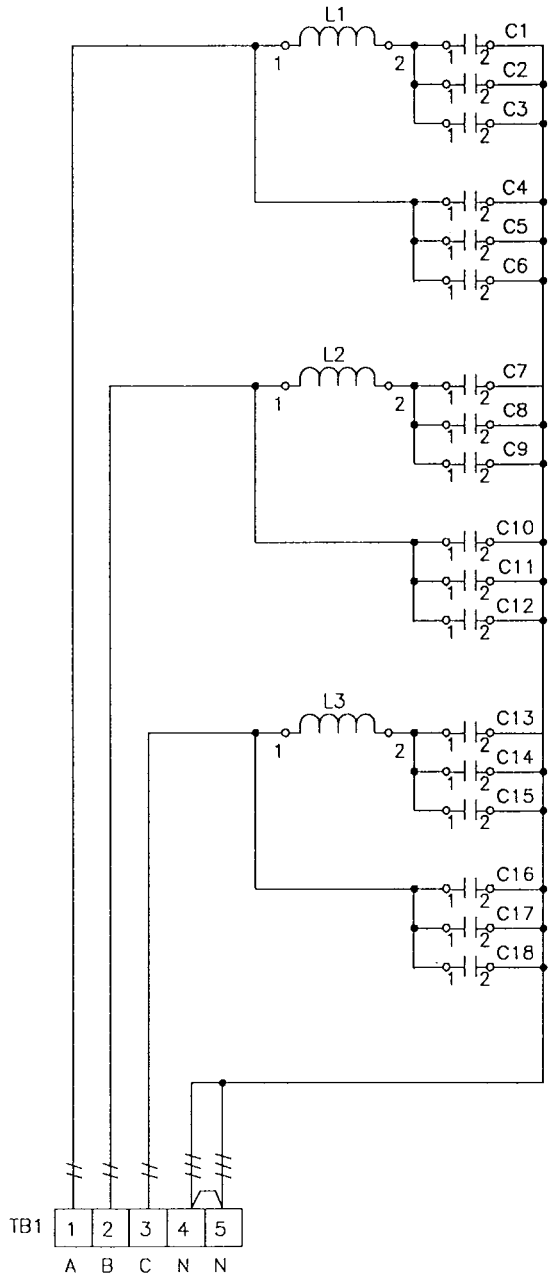


FIGURE 7–3. AC FILTER ASSEMBLY A16A3

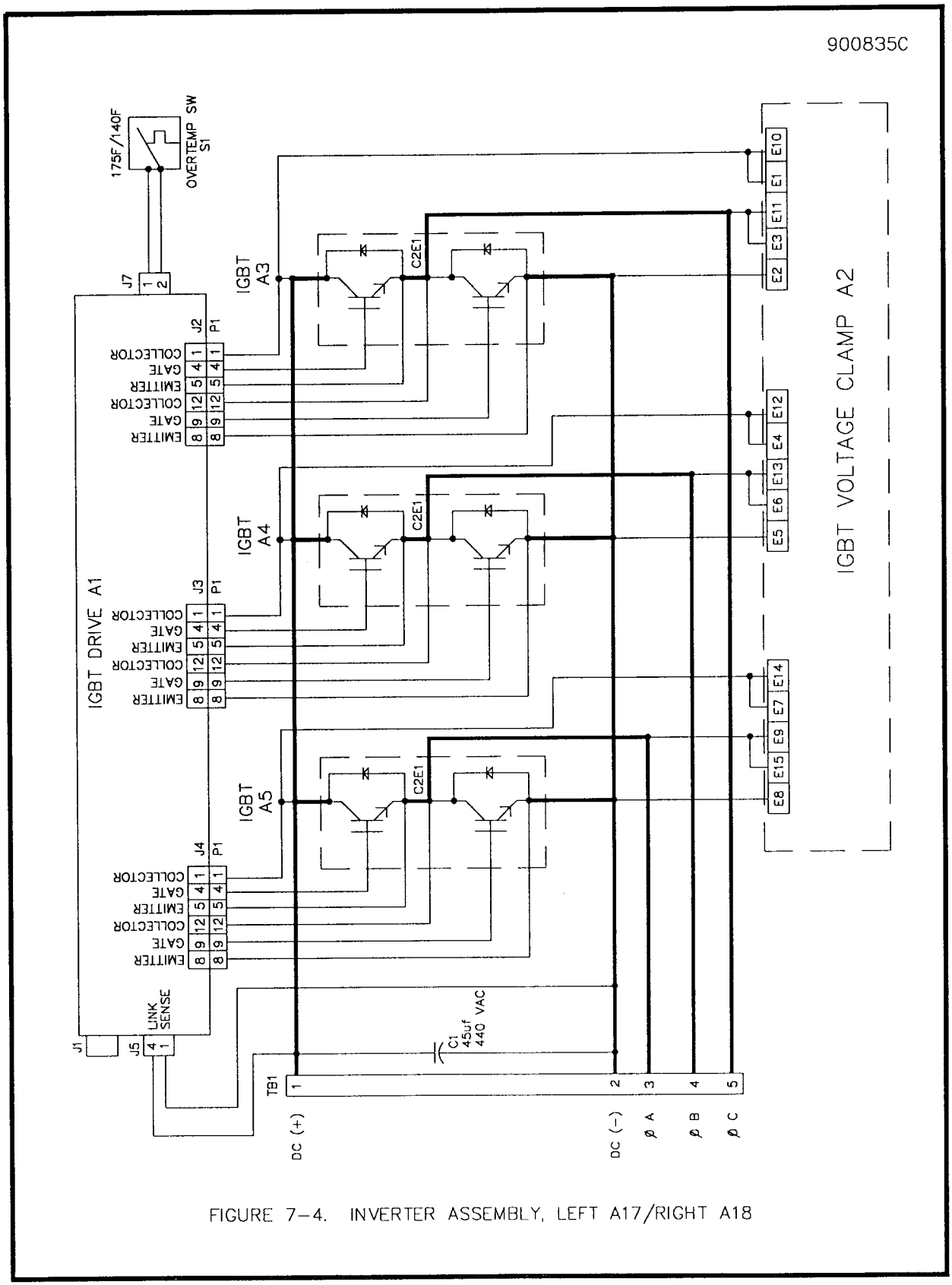


FIGURE 7–4. INVERTER ASSEMBLY, LEFT A17/RIGHT A18

(SCH195-15373)

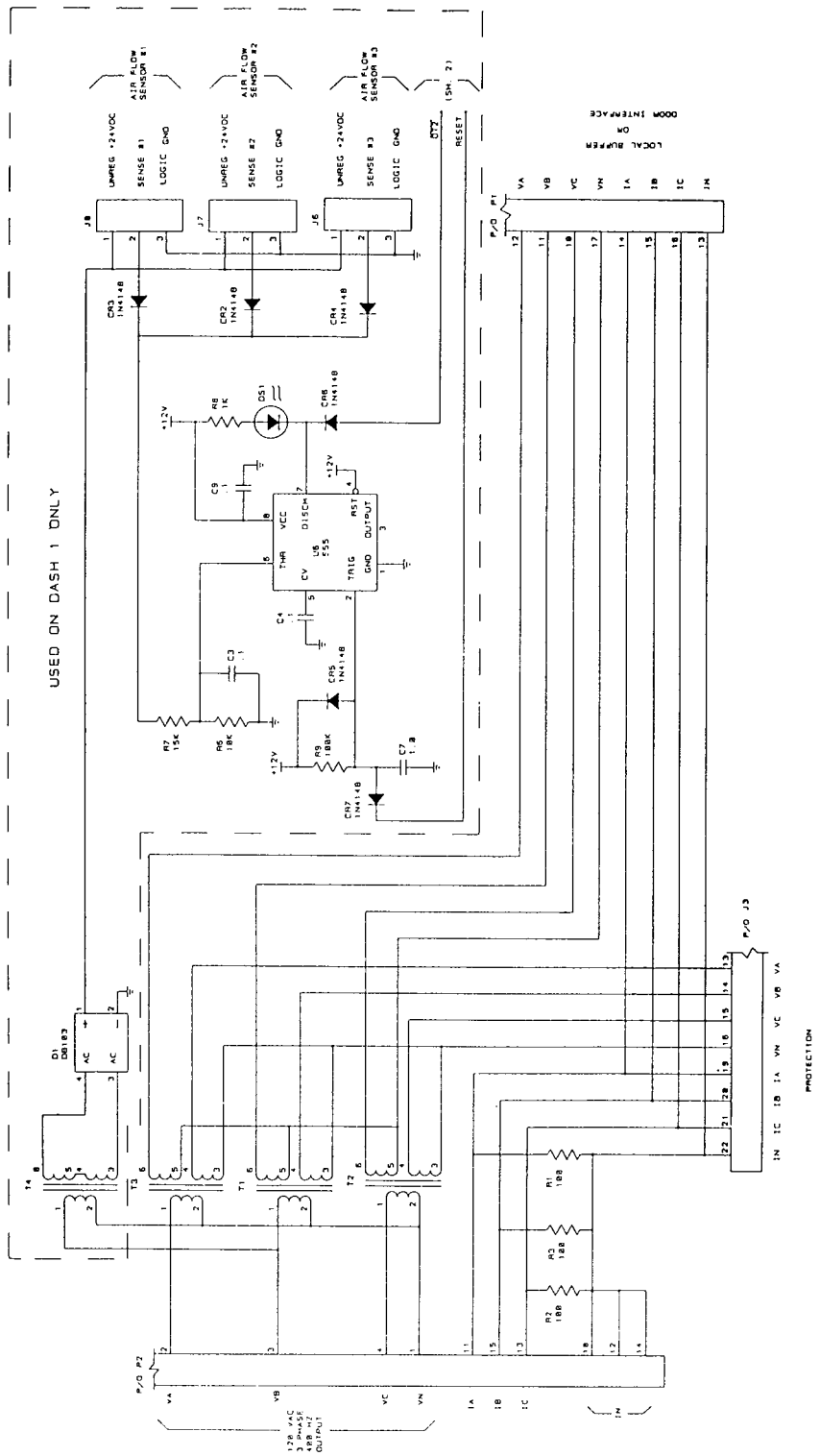


FIGURE 7–5. POWER INTERFACE ASSEMBLY A16A2A1. (SHEET 1 OF 2)

(SCH195-15373)

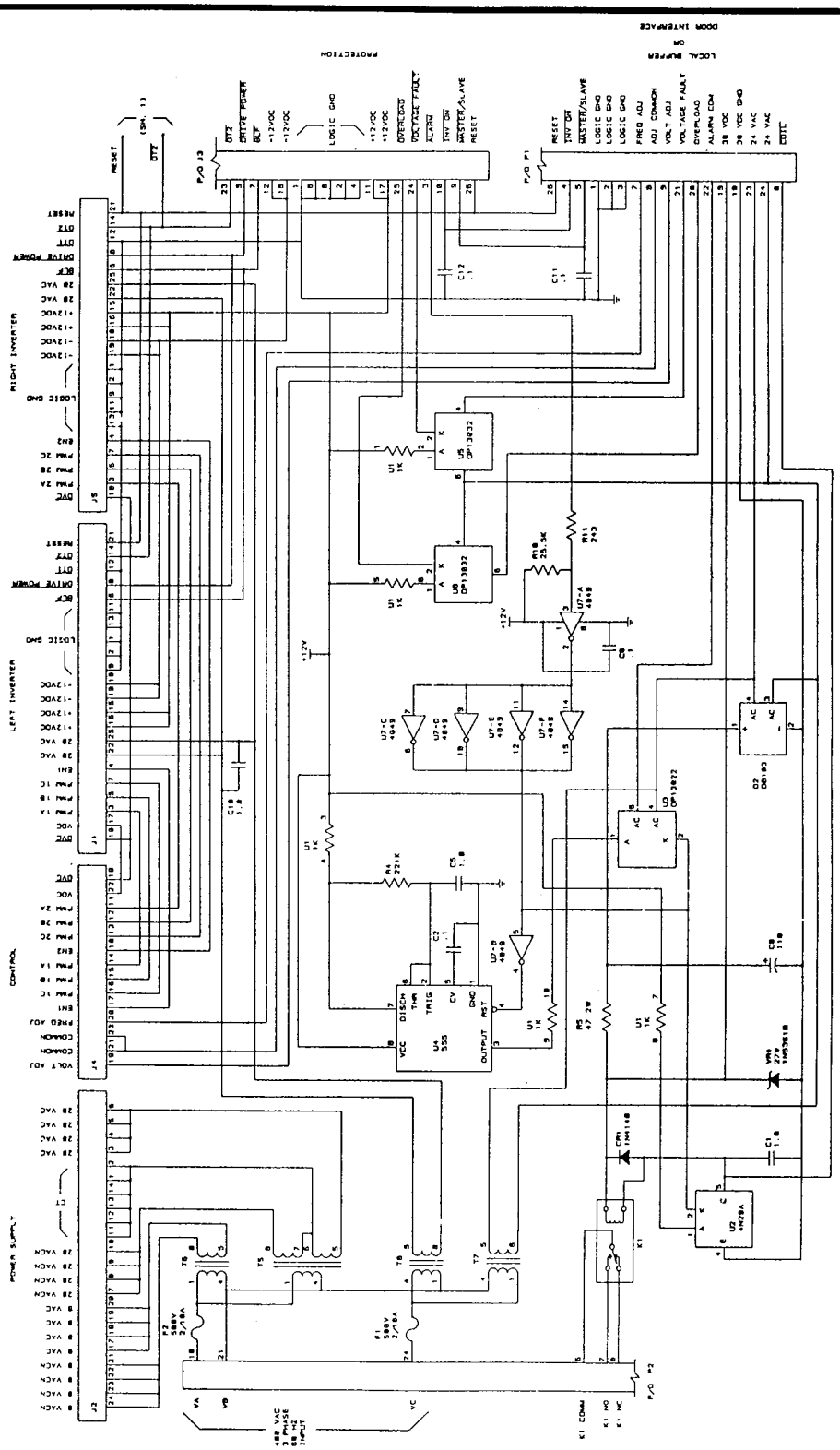


FIGURE 7–5. POWER INTERFACE ASSEMBLY A16A2A1. (SHEET 2)

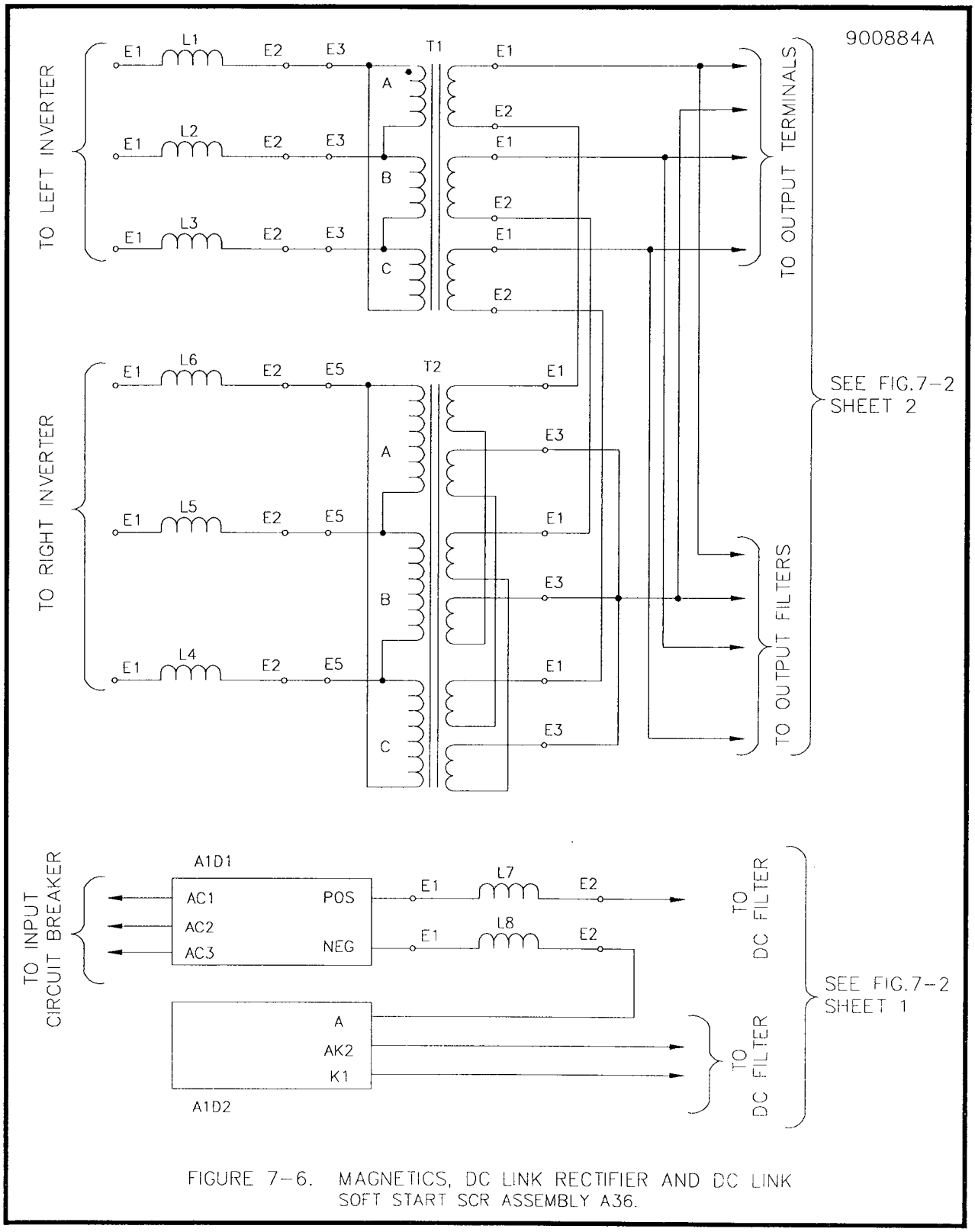


FIGURE 7-6. MAGNETICS, DC LINK RECTIFIER AND DC LINK SOFT START SCR ASSEMBLY A36.

900209B

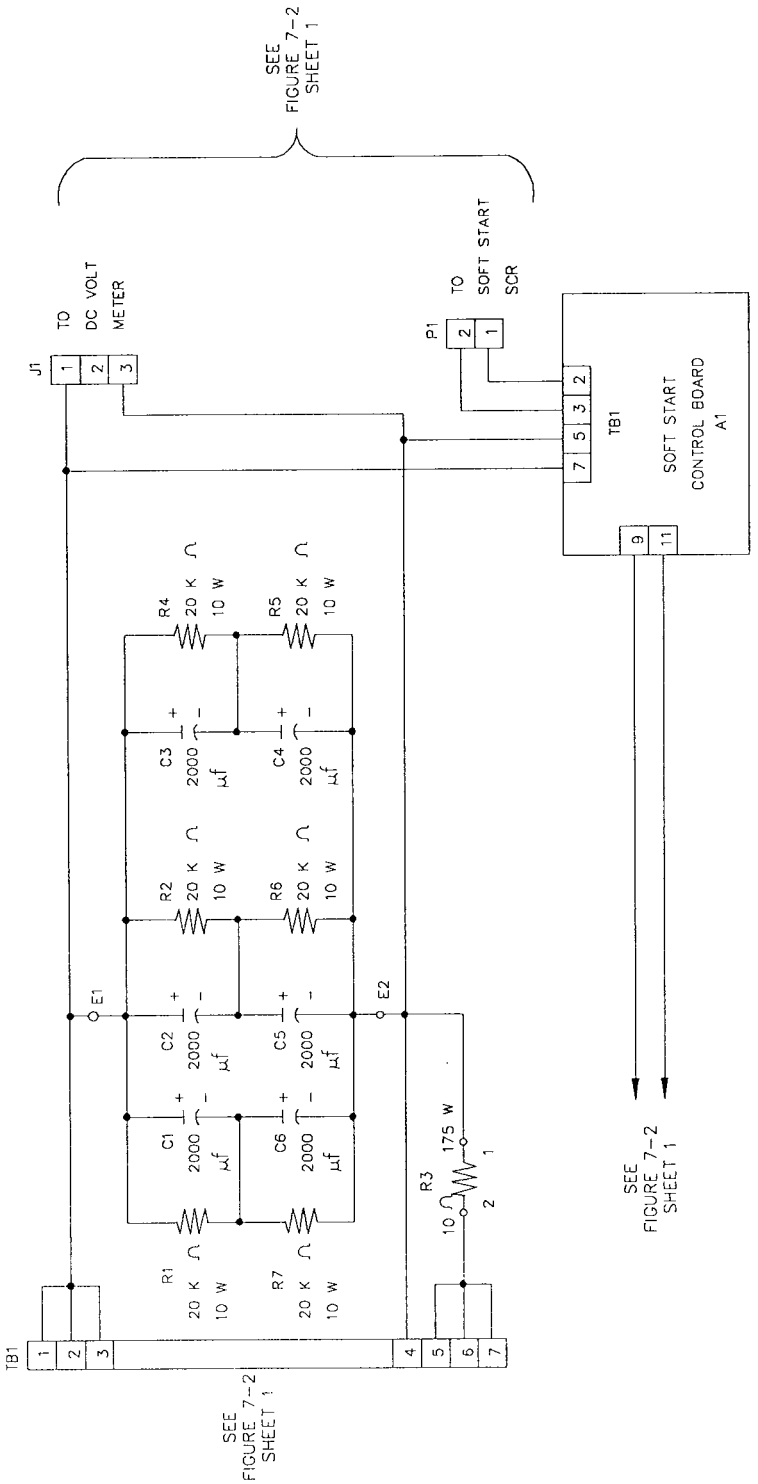


FIGURE 7-7. DC FILTER A39.

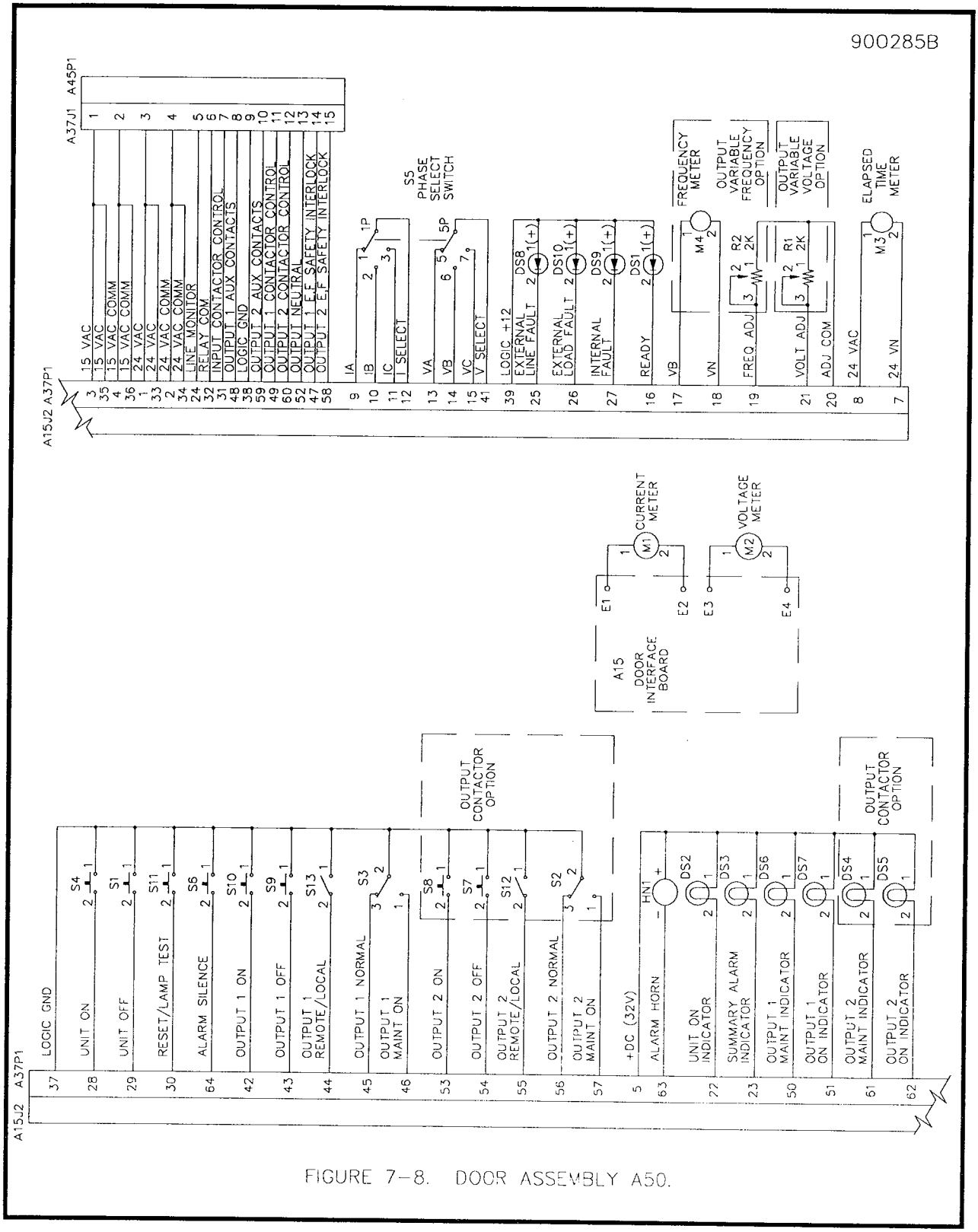


FIGURE 7–8. DOOR ASSEMBLY A50.

SECTION VIII
RECOMMENDED SPARE PARTS

8.1 GENERAL

To facilitate service on your Pwr-Kart™, it is recommended that a spare parts stock be maintained on-site. A spares stock will ensure immediate parts availability and help to reduce system downtime when service is required.

Appendix G provides a listing of recommended spare parts for the Pwr-Kart™ frequency converter described in this manual.

8.2 SPARE PARTS ORDERING INFORMATION

Unitron Incorporated can supply any of several recommended spare parts levels to meet your requirements, or can assist in tailoring a spare parts package to your specific on-site needs. For more information concerning spare parts package, or to order any replacement part, please contact:

Unitron Incorporated
ATTN: Customer Service Dept.
10925 Miller Road
Dallas, Texas 75238
Phone: (800) 527-1279
(214) 340-8600
Fax: (214) 341-2099

8.3 RECOMMENDED SPARES LIST, PL195–52061 (APPENDIX G)

8.3.1 Item/Quantity (Kit Level) Column

This column identifies the quantity of parts included in the specified level of spare parts kit. The quantity of parts included in each kit is listed adjacent to the item number and in the same column as the "X" for the associated kit. Each spares level is coded as follows:

8.3.1.1 LEVEL 1 **Spare Parts Kit**

Spare Parts Kit Level 1 contains the minimum of spares recommended to be maintained on-site. These parts have been identified as those that can provide a "quick fix" in the majority of instances when the frequency converter requires repair.

8.3.1.2 LEVEL 2 **Spare Parts Kit**

Spare Parts Kit Level 2 is a partial or intermediate level of recommended parts for on-site maintainability. It contains all the parts of the Level 1 kit, plus additional selected parts to effect repairs in a greater number of eventualities.

8.3.1.3 LEVEL 3 **Spare Parts Kit**

Spare Parts Kit Level 3 contains all the parts of the Level 2 kit plus additional selected parts. The Level 3 kit provides those parts necessary to effect repairs in virtually any instance normally encountered on-site.

8.3.2 Code Ident Column

This column provides the Commercial and Government Entity (CAGE) code for the part (formerly FSCM). See Section VI, paragraph 6.2.3 for those CAGE codes most frequently used herein. If a manufacturer's code is not assigned or known, the name of the manufacturer is provided in the description column of this parts list.

8.3.3 Part Number Column

This column provides the identifying part number for the specific part.

8.3.4 Description Column

This column provides a brief description of the part or assembly.

8.3.5 Reference Designator Column

This column identifies the reference designator of replaceable boards. Reference designators are not specified for all fuses, lamp bulbs, transistors, etc.

APPENDIX A

WIRE LIST
for
BASIC FREQUENCY CONVERTER

WL195–39300–B

NOTES:

1. The wire connections are in reference designator order in the "FROM" column.
2. The word "FLYING" indicates that the wire terminates on assemblies covered by Appendix F. Refer to the associated schematic diagram, Figure 7–2.

APPLICATION	
NEXT ASSY	USED ON
195-39016-B	195-39015

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
-	FORMAL RELEASE	9/28/93	

LIMITED RIGHTS DATA

THIS TECHNICAL DATA SHALL NOT, WITHOUT THE WRITTEN PERMISSION OF UNITRON INC., MFR CODE 12175, BE EITHER (A) USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART OUTSIDE THE GOVERNMENT, (B) USED IN WHOLE OR IN PART BY THE GOVERNMENT FOR MANUFACTURE OR (C) USED BY A PARTY OTHER THAN THE GOVERNMENT EXCEPT FOR (I) EMERGENCY REPAIR OR OVERHAUL WORK ONLY, BY OR FOR THE GOVERNMENT WHERE THE ITEM OR PROCESS CONCERNED IS NOT OTHERWISE REASONABLY AVAILABLE TO ENABLE TIMELY PERFORMANCE OF THE WORK, PROVIDED THAT THE RELEASE OR DISCLOSURE HEREOF OUTSIDE THE GOVERNMENT SHALL BE MADE SUBJECT TO A PROHIBITION AGAINST FURTHER USE, RELEASE, OR DISCLOSURE; OR (II) RELEASE TO A FOREIGN GOVERNMENT, AS THE INTEREST OF THE UNITED STATES MAY REQUIRE, ONLY FOR INFORMATION OR EVALUATION WITHIN SUCH GOVERNMENT OR FOR EMERGENCY REPAIR OR OVERHAUL WORK BY OR FOR SUCH GOVERNMENT UNDER THE CONDITIONS OF (I) ABOVE. THIS LEGEND SHALL BE MARKED ON ANY REPRODUCTION HEREOF IN WHOLE OR IN PART.

REV																								
SHEET																								
REV STATUS OF SHEETS	REV	-	-	-	-	-	-	-	-	-	-	-	-											
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12											

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
2 PLACE DECIMALS ± 03
3 PLACE DECIMALS ± 010
REMOVE BURRS & SHARP EDGES
HOLE TOL PER AND 10387

MATERIAL
N/A

FINISH
N/A

SIGNATURE		DATE
DRAWN	K. HALL	9/93
CHECKED		9/93
PROJ	R. MINSER	9/93
APPVD		9/28
APPVD		9/28/93
CONTRACT NUMBER		

Unitron Incorporated
10925 MILLER ROAD
DALLAS, TEXAS 75238
214/340-8600
TELEX 88-2511

WIRE LIST, BASIC,
GFC-15/25/37 MOBILE

9

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-39300-B	-

SCALE N/A | DISK #41 | SHEET 1 OF 12

NOTES:

1. "*" DENOTES SECOND APPEARANCE OF THIS LINE TERMINATION.

2. WIRE SIZES AND NUMBERS ARE GROUPED AS FOLLOWS:

WIRE GAUGE	WIRE NUMBER LIMITS
18	300 - 399
8	800 - 849
6	850 - 899
4	900 - 949

3. WIRE NUMBERS USED ARE:

300 - 318
800 - 803, 815 - 818
850 - 854
900 - 903

4. WIRE NUMBERS NOT USED ARE:

319 - 399
804 - 814, 819 - 849
855 - 899
904 - 949

5. ALL WIRE IS WHITE IN COLOR UNLESS OTHERWISE SPECIFIED.

6. STAMP WIRES WITH WIRE NUMBERS APPROX. 3" FROM EACH END.

7. BEFORE INSTALLING THE DC FILTER ASSEMBLY (A39) ALL WIRE ROUTING THROUGH ACCESS HOLES MUST BE COMPLETED.

8. ASSEMBLY, PROTECTION CABLE (A29), 195-14016-2

9. ASSEMBLY, CONTROL CABLE (A28), 195-14016-1

10. CABLE ASSEMBLY, FRONT PANEL (A16 A2 A2), 195-14036-4

11. CABLE ASSEMBLY, LEFT INVERTER (A17 A1), 195-14036-5

12. CABLE ASSEMBLY, RIGHT INVERTER (A18 A1), 195-14036-6

13. ROUTE THIS WIRE THROUGH THE ACCESS HOLE LOCATED IN THE LEFT REAR CORNER OF THE UNIT (BETWEEN THE ELECTRONIC AND MAGNETIC COMPARTMENTS).

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-39300-B	-
SCALE		SHEET 2	

14 ROUTE THIS WIRE THROUGH THE MAGNETIC COMPARTMENT ACCESS HOLE LOCATED ON THE BACK SIDE OF THE UNIT AT THE RIGHT CORNER.

15 ROUTE THIS WIRE THROUGH THE MAGNETIC COMPARTMENT ACCESS HOLE LOCATED ON THE BACK SIDE OF THE UNIT AT THE LEFT CORNER.

16 ROUTE THIS WIRE THROUGH THE ACCESS HOLE LOCATED IN THE RIGHT FRONT CORNER OF THE UNIT (BETWEEN THE ELECTRONIC AND MAGNETIC COMPARTMENTS).

17 ROUTE THIS WIRE THROUGH THE ACCESS HOLE LOCATED IN THE LEFT FRONT CORNER OF THE UNIT (BETWEEN THE ELECTRONIC AND MAGNETIC COMPARTMENTS).

18 ROUTE THIS WIRE THROUGH THE ACCESS HOLE LOCATED IN THE RIGHT REAR CORNER OF THE UNIT (BETWEEN THE ELECTRONIC AND MAGNETIC COMPARTMENTS).

19 ASSEMBLY, LOGIC P/S CABLE (A30) 195-14016-3

20 ROUTE THIS WIRE THROUGH THE ACCESS HOLE LOCATED ON THE RIGHT SIDE JUST BEHIND THE HOLE IN THE FRONT RIGHT CORNER (BETWEEN THE ELECTRONIC AND MAGNETIC COMPARTMENTS).

21 THIS TERMINATION NOT USED, FOLD BACK AND SECURE WITH A "TY-WRAP."

22 CABLE ASSEMBLY (A57), 195-34017-3

23 CABLE ASSEMBLY (A58), 195-34017-1

24 ALL A22 CONNECTIONS ARE MADE AT MOBILE BASIC ASSEMBLY LEVEL.

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-39300-B	-
SCALE		SHEET 3	

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM
			19	A16 A2 A1 J2		A1 J1	
			8	A16 A2 A1 J3		A2 J1	
			9	A16 A2 A1 J4		A3 J1	
			11	A17 A1 J1		A16 A2 A1 J1	
			19	A1 J1		A16 A2 A1 J2	*
			8	A2 J1		A16 A2 A1 J3	*
			9	A3 J1		A16 A2 A1 J4	*
			12	A18 A1 J1		A16 A2 A1 J5	
			10	A50 A15 J1		A16 A2 A2 P1	
	SELF		14 22	A57 P1		A16 A2 A3 J6	
	SELF		14 23	A58 P1		A16 A2 A3 J7	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM
300	SELF		13 15	FLYING		A16 A2 A3 P2	1
301	SELF		13 15	FLYING		A16 A2 A3 P2	2
302	SELF		13 15	FLYING		A16 A2 A3 P2	3
303	SELF		13 15	FLYING		A16 A2 A3 P2	4
304	SELF	13	15 21	FLYING		A16 A2 A3 P2	6
305	SELF	13	15 21	FLYING		A16 A2 A3 P2	7
306	SELF	13	15 21	FLYING		A16 A2 A3 P2	8
307	SELF	13	15 24	A22 T4	X2	A16 A2 A3 P2	10
308	SELF	13	15 24	A22 T4	X1	A16 A2 A3 P2	11
309	SELF	13	15 24	A22 T6	X2	A16 A2 A3 P2	12
310	SELF	13	15 24	A22 T6	X1	A16 A2 A3 P2	13
311	SELF	13	15 24	A22 T5	X2	A16 A2 A3 P2	14
312	SELF	13	15 24	A22 T5	X1	A16 A2 A3 P2	15
313	SELF	14	18 24	A22 XF1	2	A16 A2 A3 P2	18
314	SELF	14	18 24	A22 XF2	2	A16 A2 A3 P2	21
315	SELF	14	18 24	A22 XF3	2	A16 A2 A3 P2	24
800	8		13	A36 T1A	E1	A16 A3 TB1	1
801	8		13	A36 T1B	E1	A16 A3 TB1	2
802	8		13	A36 T1C	E1	A16 A3 TB1	3
803	8		13	A36 T2B	E3	A16 A3 TB1	4

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
				A39	J1	A16 A4	P1	
			11	A16 A2 A1 J2		A17 A1 J1		*
816	8		23"	A39 TB1	1	A17 TB1	1	
818	8		23"	A39 TB1	5	A17 TB1	2	
	SELF		17	A36 L1	E1	A17 TB1	3	
	SELF		17	A36 L2	E1	A17 TB1	4	
	SELF		17	A36 L3	E1	A17 TB1	5	
			12	A16 A2 A1 J5		A18 A1 J5		*
817	8		16"	A39 TB1	3	A18 TB1	1	
815	8		16"	A39 TB1	7	A18 TB1	2	
	SELF		16	A36 L6	E1	A18 TB1	3	
	SELF		16	A36 L5	E1	A18 TB1	4	
	SELF		16	A36 L4	E1	A18 TB1	5	
	SELF		24	A22 XF4	2	A22 T2	BLK	
	SELF		24	A22 TB1	1	A22 T2	BLU	
	SELF		24	A22 TB1	2	A22 T2	ORG	
	SELF		24	A22 XF1	2	A22 T2	WHT	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
308	SELF		13 15 24	A16 A2 A3 P2	11	A22 T4	X1	*
307	SELF		13 15 24	A16 A2 A3 P2	10	A22 T4	X2	*
312	SELF		13 15 24	A16 A2 A3 P2	15	A22 T5	X1	*
311	SELF		13 15 24	A16 A2 A3 P2	14	A22 T5	X2	*
310	SELF		13 15 24	A16 A2 A3 P2	13	A22 T6	X1	*
309	SELF		13 15 24	A16 A2 A3 P2	12	A22 T6	X2	*
	SELF	BLU	24	A22 T2	BLU	A22 TB1	1	*
	SELF		14 24	A26 P1	1	A22 TB1	1	
	SELF		14 24	A27 P1	1	A22 TB1	1	
	SELF	ORG	24	A22 T2	ORG	A22 TB1	2	*
	SELF		14 24	A26 P1	2	A22 TB1	2	
	SELF		14 24	A27 P1	2	A22 TB1	2	
	SELF			A22 XF1	2	A22 VR1	1	
	SELF			A22 XF2	2	A22 VR1	2	
	SELF			A22 XF2	2	A22 VR2	1	
	SELF			A22 XF3	2	A22 VR2	2	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
	SELF			A22 XF1	2	A22 VR3	1	
	SELF			A22 XF3	2	A22 VR3	2	
313	SELF	14	18 24	A16 A2 A3 P2	18	A22 XF1	2	*
	SELF	WHT	24	A22 T2	WHT	A22 XF1	2	*
	SELF			A22 VR1	1	A22 XF1	2	*
	SELF			A22 VR3	1	A22 XF1	2	*
852	8		14 24	A36 A1 D1	AC2	A22 XF1	2	
314	SELF	14	18 24	A16 A2 A3 P2	21	A22 XF2	2	*
	SELF			A22 VR1	2	A22 XF2	2	*
	SELF			A22 VR2	1	A22 XF2	2	*
318	18		24	A22 XF4	1	A22 XF2	2	
853	8		14 24	A36 A1 D1	AC3	A22 XF2	2	
316	SELF	14	18 24	A39 A1 TB1	9	A22 XF2	2	
315	SELF	14	18 24	A16 A2 A3 P2	24	A22 XF3	2	*
	SELF			A22 VR2	2	A22 XF3	2	*
	SELF			A22 VR3	2	A22 XF3	2	*
854	8		14 24	A36 A1 D1	AC1	A22 XF3	2	
317	SELF	14	18 24	A39 A1 TB1	11	A22 XF3	2	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
318	18		24	A22 XF2	2	A22 XF4	1	*
	SELF	BLK	24	A22 T2	BLK	A22 XF4	2	*
	SELF		14 22	A57 J1		A26 A1 P1		
	SELF		14 24	A22 TB1	1	A26 P1	1	*
	SELF		14 24	A22 TB1	2	A26 P1	2	*
	SELF		14 23	A58 J1		A27 A1 P1		
	SELF		14 24	A22 TB1	1	A27 P1	1	*
	SELF		14 24	A22 TB1	2	A27 P1	2	*
854	8		14 24	A22 XF3	2	A36 A1 D1	AC1	*
852	8		14 24	A22 XF1	2	A36 A1 D1	AC2	*
853	8		14 24	A22 XF2	2	A36 A1 D1	AC3	*
850	6		20	A39 TB1	4	A36 A1 D2	AK2	
			16	A39 A1	P1	A36 A1 D2	J1	
851	6		20	A39 TB1	6	A36 A1 D2	K1	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
	SELF		17	A17 TB1	3	A36 L1	E1	*
	SELF		17	A17 TB1	4	A36 L2	E1	*
	SELF		17	A17 TB1	5	A36 L3	E1	*
	SELF		16	A18 TB1	5	A36 L4	E1	*
	SELF		16	A18 TB1	4	A36 L5	E1	*
	SELF		16	A18 TB1	3	A36 L6	E1	*
	SELF		20	A39 TB1	2	A36 L7	E2	
800	8		13	A16 A3 TB1	1	A36 T1A	E1	*
900	4		15	FLYING		A36 T1A	E1	
801	8		13	A16 A3 TB1	2	A36 T1B	E1	*
901	4		15	FLYING		A36 T1B	E1	
802	8		13	A16 A3 TB1	3	A36 T1C	E1	*
902	4		15	FLYING		A36 T1C	E1	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
803	8		13	A16 A3 TB1	4	A36 T2B	E3	*
903	4		15	FLYING		A36 T2B	E3	
				A16 A4	P1	A39	J1	*
			16	A36 A1 D2	J1	A39 A1	P1	*
316	SELF	14	18 24	A22 XF2	2	A39 A1 TB1	9	*
317	SELF	14	18 24	A22 XF3	2	A39 A1 TB1	11	*
816	8		23"	A17 TB1	1	A39 TB1	1	*
	SELF		20	A36 L7	E2	A39 TB1	2	*
817	8		16"	A18 TB1	1	A39 TB1	3	*
850	6		20	A36 A1 D2	AK2	A39 TB1	4	*
818	8		23"	A17 TB1	2	A39 TB1	5	*
851	6		20	A36 A1 D2	K1	A39 TB1	6	*
815	8		16"	A18 TB1	2	A39 TB1	7	*
			10	A16 A2 A2 P1		A50 A15 J1		*
	SELF		14 22	A26 A1 P1		A57 J1		*
	SELF		14 22	A16 A2 A3 J6		A57 P1		*

	CODE IDENT NO	SIZE	DWG NO	REV.
	12175	A	WL195-39300-B	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
	SELF		14 23	A27 A1 P1		A58 J1		*
	SELF		14 23	A16 A2 A3 J7		A58 P1		*
300	SELF		13 15	A16 A2 A3 P2	1	FLYING		*
301	SELF		13 15	A16 A2 A3 P2	2	FLYING		*
302	SELF		13 15	A16 A2 A3 P2	3	FLYING		*
303	SELF		13 15	A16 A2 A3 P2	4	FLYING		*
304	SELF	13	15 21	A16 A2 A3 P2	6	FLYING		*
305	SELF	13	15 21	A16 A2 A3 P2	7	FLYING		*
306	SELF	13	15 21	A16 A2 A3 P2	8	FLYING		*
900	4		15	A36 T1A	E1	FLYING		*
901	4		15	A36 T1B	E1	FLYING		*
902	4		15	A36 T1C	E1	FLYING		*
903	4		15	A36 T2B	E3	FLYING		*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-B	-

APPENDIX B

WIRE LIST
for
INVERTER ASSEMBLIES
A17 and A18

WL195–39311

NOTES:

1. For the Left Inverter assembly prefix the wire termination reference designators with A17.
2. For the Right Inverter assembly prefix the wire termination reference designators with A18.
3. The wire connections are in reference designator order in the "FROM" column.
4. The word "FLYING" indicates that the wire terminates on another assembly as covered by Appendix A. Refer to the associated schematic diagram, Figure 7–2.

APPLICATION	
NEXT ASSY	USED ON
195-39011	195-39016-B

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
-	FORMAL RELEASE	9/23/93	
A	REVISED PER ECO C5329	10/26/93	
B	REVISED PER ECO C5418	12/15/93	
C	REVISED PER ECO C7031	5/16/96	

REV																									
SHEET																									
REV STATUS OF SHEETS	REV	C	C	C	C																				
	SHEET	1	2	3	4																				

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
2 PLACE DECIMALS ± .03
3 PLACE DECIMALS ± .010
REMOVE BURRS & SHARP EDGES
HOLE TOL PER AND 10387

MATERIAL
N/A

FINISH
N/A

SIGNATURE		DATE
DRAWN	K. HALL	9/93
CHECKED		9/93
PROJ	R. MINSER	9/93
APPVD		5-96
APPVD		9/23/93
CONTRACT NUMBER		

Unitron Incorporated
10925 MILLER ROAD
DALLAS, TEXAS 75238
214/340-8600
TELEX 88-2511

WIRE LIST, INVERTER ASSEMBLY, IGBT

9

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-39311	C

SCALE	DISK	SHEET
N/A	#41	1 OF 4

NOTES:

1. "*" DENOTES SECOND APPEARANCE OF THIS LINE TERMINATION.

2. WIRE SIZES AND NUMBERS ARE GROUPED AS FOLLOWS:

WIRE GAUGE	WIRE NUMBER LIMITS
20	200 - 299
10	700 - 799
8	800 - 849

3. WIRE NUMBERS USED ARE:

   200-203
   700, 701
   800-804

4. WIRE NUMBERS NOT USED ARE:

   204-299
   702-799
   805-849

5. ALL WIRE IS WHITE IN COLOR UNLESS OTHERWISE SPECIFIED.

6. STAMP WIRES WITH WIRE NUMBERS.

7. CRIMP DISCONNECT (ITEM 58) ONTO WIRE. INSTALL WIRE TO APPROPRIATE TERMINAL OF C1 (ITEM 24). SOLDER DISCONNECT TO WIRE AND TERMINAL OF C1. THESE WIRES MUST BE AS SHORT AS POSSIBLE.

8. THIS CONNECTION IS MADE ONLY ON DASH 1 AND 2.

9. THIS CONNECTION IS MADE ONLY ON DASH 3 AND 4.

NO.	GAGE	COLOR	LENGTH	NOTES	TO	TERM	FROM	TERM	
			FLYING		A3	P1	A1	J2	
			FLYING		A4	P1	A1	J3	
			FLYING		A5	P1	A1	J4	
					P5		A1	J5	
					P6		A1	J7	
			FLYING	8	A5 P1	1	A2	E10	
			FLYING	8	A5 P1	12	A2	E11	
			FLYING	8	A4 P1	1	A2	E12	
			FLYING	8	A4 P1	12	A2	E13	
			FLYING	8	A3 P1	1	A2	E14	
			FLYING	8	A3 P1	12	A2	E15	
			FLYING	9	A3 P1	12	A3	C2E1(1)	
802	8				TB1	5	A3	C2E1(1)	
			FLYING		A1	J2	A3	P1	*
			FLYING	8	A2	E14	A3 P1	1	*
			FLYING	9	W26	E1(+)	A3 P1	1	
			FLYING	8	A2	E15	A3 P1	12	*
			FLYING	9	A3	C2E1(1)	A3 P1	12	*
			FLYING	9	A4 P1	12	A4	C2E1(1)	
801	8				TB1	4	A4	C2E1(1)	
			FLYING		A1	J3	A4	P1	*
			FLYING	8	A2	E12	A4 P1	1	*
			FLYING	9	W26	E1(+)	A4 P1	1	
			FLYING	8	A2	E13	A4 P1	12	*
			FLYING	9	A4	C2E1(1)	A4 P1	12	*
			FLYING	9	A5 P1	12	A5	C2E1(1)	
800	8				TB1	3	A5	C2E1(1)	
			FLYING		A1	J4	A5	P1	*
			FLYING	8	A2	E10	A5 P1	1	*
			FLYING	9	W26	E1(+)	A5 P1	1	
			FLYING	8	A2	E11	A5 P1	12	*
			FLYING	9	A5	C2E1(1)	A5 P1	12	*
700	10			7	W25	E1(-)	C1	1	
701	10			7	W26	E1(+)	C1	2	

NO.	GAGE	COLOR	LENGTH	NOTES	TO	TERM	FROM	TERM	
					A1	J5	P5		*
200	20				W25	E1(-)	P5	1	
201	20				W26	E1(+)	P5	4	
					A1	J7	P6		*
202	20				S1	1	P6	1	
203	20				S1	2	P6	2	
202	20				P6	1	S1	1	*
203	20				P6	2	S1	2	*
803	8				W26	E2(+)	TB1	1	
804	8				W25	E2(-)	TB1	2	
800	8				A5	C2E1(1)	TB1	3	*
801	8				A4	C2E1(1)	TB1	4	*
802	8				A3	C2E1(1)	TB1	5	*
700	10			7	C1	1	W25	E1(-)	*
200	20				P5	1	W25	E1(-)	*
804	8				TB1	2	W25	E2(-)	*
			FLYING	9	A3 P1	1	W26	E1(+)	*
			FLYING	9	A4 P1	1	W26	E1(+)	*
			FLYING	9	A5 P1	1	W26	E1(+)	*
701	10			7	C1	2	W26	E1(+)	*
201	20				P5	4	W26	E1(+)	*
803	8				TB1	1	W26	E2(+)	*

APPENDIX C

WIRE LIST
for
MAGNETICS ASSEMBLY
A36

WL195–30316

NOTES:

1. Prefix the wire termination reference designators with A36.
2. The wire connections are in reference designator order in the "FROM" column.
3. The word "FLYING" indicates that the wire terminates on another assembly as covered by Appendices A and F. Refer to the associated schematic diagram, Figure 7–2.

APPLICATION	
NEXT ASSY	USED ON
195-30016-1	195-30000
195-34010-1	195-31000
	195-32000
	195-33000
	195-34000

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
–	FORMAL RELEASE	9/21/88	BK
A	REVISED PER ECO C0454	10/31/88	BK
B	REVISED PER ECO C0915	2/28/89	BK
C	REVISED PER ECO C1767	10/5/89	BK
D	REVISED PER ECO C2942	10-26-90	BK

REV																								
SHEET																								
REV STATUS OF SHEETS	REV	D	D	D	D	D																		
	SHEET	1	2	3	4	5																		

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
2 PLACE DECIMALS ± 03
3 PLACE DECIMALS ± 010
REMOVE BURRS & SHARP EDGES
HOLE TOL PER AND 10387

MATERIAL
N/A

FINISH
N/A

SIGNATURE		DATE
DRAWN	K. HALL	9/88
CHECKED	W. SHELL	9/88
PROJ	J. McDONALD	8/88
APPVD		21 SEP 88
APPVD		9/21/88
CONTRACT NUMBER		

Unitron Incorporated
10925 MILLER ROAD
DALLAS, TEXAS 75238
214/340-8600
TELEX 88-2511

WIRE LIST, MAGNETICS ASSEMBLY

(9)

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-30316	D

SCALE NONE | DISK #25 | SHEET 1 OF 5

FORM U-500 8/76

N37002

NOTES:

1. "*" DENOTES SECOND APPEARANCE OF THIS LINE TERMINATION.
2. WIRE SIZES AND NUMBERS ARE GROUPED AS FOLLOWS:

WIRE GAUGE	WIRE NUMBER LIMITS
8	800 - 849
6	850 - 899
4	900 - 949

3. WIRE NUMBERS USED ARE:

   800 - 803, 808 - 810

   850 - 854

   900 - 908

4. WIRE NUMBERS NOT USED ARE:

   804 - 807, 811 - 849

   855 - 899

   909 - 949

5. ALL WIRE IS WHITE IN COLOR UNLESS OTHERWISE SPECIFIED.
6. STAMP WIRES WITH WIRE NUMBERS.
7. THIS WIRE IS USED WITH ASSEMBLY 195-30016 ONLY.
8. THIS WIRE IS USED WITH ASSEMBLY 195-34010 ONLY.

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-30316	D
SCALE		SHEET 2	

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM
	SELF			L7	E1	A1 D1	+
	SELF			L8	E1	A1 D1	-
808	8	7	65"	FLYING		A1 D1	AC1
854	6	8	65"	FLYING		A1 D1	AC1
809	8	7	65"	FLYING		A1 D1	AC2
852	6	8	65"	FLYING		A1 D1	AC2
810	8	7	65"	FLYING		A1 D1	AC3
853	6	8	65"	FLYING		A1 D1	AC3
	SELF			L8	E2	A1 D2	A
850	6		36"	FLYING		A1 D2	AK2
851	6		36"	FLYING		A1 D2	K1
	SELF			FLYING		L1	E1
	SELF			T1A	E3	L1	E2
	SELF			FLYING		L2	E1
	SELF			T1B	E3	L2	E2
	SELF			FLYING		L3	E1
	SELF			T1C	E3	L3	E2

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-30316	D

SHEET 3 OF

FORM U501 7-79

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
	SELF			FLYING		L4	E1	
	SELF			T2C	E5	L4	E2	
	SELF			FLYING		L5	E1	
	SELF			T2B	E5	L5	E2	
	SELF			FLYING		L6	E1	
	SELF			T2A	E5	L6	E2	
	SELF			A1 D1	+	L7	E1	*
	SELF			FLYING		L7	E2	
	SELF			A1 D1	-	L8	E1	*
	SELF			A1 D2	A	L8	E2	*
800	8		60"	FLYING		T1A	E1	
900	4		75"	FLYING		T1A	E1	
904	4		3"	T2A	E1	T1A	E2	
	SELF			L1	E2	T1A	E3	*
801	8		60"	FLYING		T1B	E1	
901	4		75"	FLYING		T1B	E1	
905	4		3"	T2B	E1	T1B	E2	
	SELF			L2	E2	T1B	E3	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-30316	D

SHEET 4 OF

FORM U501 7-79

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
902	4		75"	FLYING		T1C	E1	
802	8		60"	FLYING		T1C	E1	
906	4		3"	T2C	E1	T1C	E2	
	SELF			L3	E2	T1C	E3	*
904	4		3"	T1A	E2	T2A	E1	*
907	4		JUMPER	T2B	E3	T2A	E3	
	SELF			L6	E2	T2A	E5	*
905	4		3"	T1B	E2	T2B	E1	*
903	4		75"	FLYING		T2B	E3	
803	8		60"	FLYING		T2B	E3	
907	4		JUMPER	T2A	E3	T2B	E3	*
908	4		JUMPER	T2C	E3	T2B	E3	
	SELF			L5	E2	T2B	E5	*
906	4		3"	T1C	E2	T2C	E1	*
908	4		JUMPER	T2B	E3	T2C	E3	*
	SELF			L4	E2	T2C	E5	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-30316	D

SHEET 5 OF

FORM U501 7-79

APPENDIX D

WIRE LIST
for
DC FILTER ASSEMBLY
A39

WL195–30321

NOTES:

1. Prefix the wire termination reference designators with A39.
2. The wire connections are in reference designator order in the "FROM" column.
3. The word "FLYING" indicates that the wire terminates on another assembly as covered by Appendix F. Refer to the associated schematic diagram, Figure 7–2.

APPLICATION	
NEXT ASSY	USED ON
195-30021	

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
-	FORMAL RELEASE	9/21/88	
A	REVISED PER ECO C0456	10/31/88	
B	REVISED PER ECO C0973	2/28/89	
C	REVISED PER ECO C1729	10/4/89	
D	REVISED PER ECO C2870	10/2/90	

REV																									
SHEET																									
REV STATUS OF SHEETS	REV	D	D	D	D																				
	SHEET	1	2	3	4																				

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
2 PLACE DECIMALS ± 03
3 PLACE DECIMALS ± 010
REMOVE BURRS & SHARP EDGES
HOLE TOL PER AND 10387

MATERIAL
N/A

FINISH
N/A

SIGNATURE		DATE
DRAWN	K. HALL	9/88
CHECKED	W. SHELL	9/88
PROJ	J. MCDONALD	9/88
APPVD	M. Kalustian	21 Sep 88
APPVD		9/21/88
CONTRACT NUMBER		

Unitron Incorporated
10925 MILLER ROAD
DALLAS, TEXAS 75238
214/340-8600
TELEX 88-2511

WIRE LIST, DC FILTER ASSEMBLY, 15/25/37 KVA (9)

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-30321	D

SCALE NONE | DISK #25 | SHEET 1 OF 4

FORM U-500 8/76

N37002

NOTES:

1. "*" DENOTES SECOND APPEARANCE OF THIS LINE TERMINATION.

2. WIRE SIZES AND NUMBERS ARE GROUPED AS FOLLOWS:

WIRE GAUGE	WIRE NUMBER LIMITS
18	300 - 399
10	700 - 799
6	850 - 899

3. WIRE NUMBERS USED ARE:

   300 - 305, 316, 317
   700 - 701
   850 - 851

4. WIRE NUMBERS NOT USED ARE:

   306 - 315, 318 - 399
   702 - 799
   852 - 899

5. ALL WIRE IS WHITE IN COLOR UNLESS OTHERWISE SPECIFIED.

6. STAMP WIRES WITH WIRE NUMBERS.

△7. USE ITEM 29 OF PL195-30021 FOR TERMINATION THIS JUMPER.

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-30321	D
SCALE		SHEET 2	

FORM UE-112 8/76

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
300	18		6"	P1	1	A1 TB1	2	
301	18		6"	P1	2	A1 TB1	3	
302	18		8"	TB1	4	A1 TB1	5	
303	18		6-1/2"	TB1	1	A1 TB1	7	
316	18		51"	FLYING		A1 TB1	9	
317	18		51"	FLYING		A1 TB1	11	
850	6		20"	TB1	2	E1		
700	10		12"	R3	1	E2		
851	6		14"	TB1	4	E2		
316	18		51"	A1 TB1	9	FLYING		*
317	18		51"	A1 TB1	11	FLYING		*
304	18		18"	TB1	3	J1	1	
305	18		18"	TB1	4	J1	3	
300	18		6"	A1 TB1	2	P1	1	*
301	18		6"	A1 TB1	3	P1	2	*

	CODE IDENT NO	SIZE	DWG NO	REV.
	12175	A	WL195-30321	D

SHEET 3 OF

FORM U501 7-79

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
700	10		12"	E2		R3	1	*
701	10		10-1/2"	TB1	5	R3	2	
303	18		6-1/2"	A1 TB1	7	TB1	1	*
		7	JUMPER	TB1	2	TB1	1	
850	6		20"	E1		TB1	2	*
		7	JUMPER	TB1	1	TB1	2	*
		7	JUMPER	TB1	3	TB1	2	
304	18		18"	J1	1	TB1	3	*
		7	JUMPER	TB1	2	TB1	3	*
302	18		8"	A1 TB1	5	TB1	4	*
851	6		14"	E2		TB1	4	*
305	18		18"	J1	3	TB1	4	*
701	10		10-1/2"	R3	2	TB1	5	*
		7	JUMPER	TB1	6	TB1	5	
		7	JUMPER	TB1	5	TB1	6	*
		7	JUMPER	TB1	7	TB1	6	
		7	JUMPER	TB1	6	TB1	7	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-30321	D

SHEET 4 OF

FORM U501 7-79

APPENDIX E

WIRE LIST
for
DOOR ASSEMBLY
A50

WL195–34307–1

NOTES:

1. Prefix the wire termination reference designators with A50.
2. The wire connections are in reference designator order in the "FROM" column.
3. Refer to the associated schematic diagram, Figure 7–2.

NOTES:

1. "*" DENOTES SECOND APPEARANCE OF THIS LINE TERMINATION.

2. WIRE SIZES AND NUMBERS ARE GROUPED AS FOLLOWS:

WIRE GAUGE	WIRE NUMBER LIMITS
24	001 - 199

3. WIRE NUMBERS USED ARE:

   001-005, 007-015, 017, 018, 022-039, 041-052, 058-060, 063-065, 067, 068, 070-073, 077-078, 081, 082, 085-088

4. WIRE NUMBERS NOT USED ARE:

   006, 016, 019-021, 040, 053-057, 061, 062, 066, 069, 074-076, 079, 080, 083, 084, 089-199

5. ALL WIRE IS WHITE IN COLOR UNLESS OTHERWISE SPECIFIED.

6. STAMP WIRES WITH WIRE NUMBERS.

7. ALL WIRES NOT CALLED OUT SHOULD BE COILED AND SECURED WITH A TY-WRAP.

8. ALL LENGTHS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-34307-1	C
SCALE		SHEET 2	

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
				P1		A15 J2		
				J1		A45 P1		
065	24		34	DS10	1(+)	DS1	1(+)	
088	24		10	S4	1	DS1	2	
067	24		12	DS7	1	DS2	1	
022	24		30	P1	22	DS2	2	
068	24		9	HN1	+	DS3	1	
005	24		17	P1	5	DS3	1	
023	24		17	P1	23	DS3	2	
070	24		8	DS7	1	DS6	1	
071	24		24	HN1	+	DS6	1	
050	24		28	P1	50	DS6	2	
067	24		12	DS2	1	DS7	1	*
070	24		8	DS6	1	DS7	1	*
051	24		28	P1	51	DS7	2	
072	24		14	DS9	1(+)	DS8	1(+)	
039	24		20	P1	39	DS8	1(+)	
025	24		20	P1	25	DS8	2	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	C

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
072	24		14	DS8	1(+)	DS9	1(+)	*
073	24		8	DS10	1(+)	DS9	1(+)	
027	24		22	P1	27	DS9	2	
065	24		34	DS1	1(+)	DS10	1(+)	*
073	24		8	DS9	1(+)	DS10	1(+)	*
026	24		22	P1	26	DS10	2	
068	24		9	DS3	1	HN1	+	*
071	24		24	DS6	1	HN1	+	*
063	24		17	P1	63	HN1	-	
				A45 P1		J1		*
003	24		17	P1	3	J1	1	
035	24		17	P1	35	J1	1	
004	24		17	P1	4	J1	2	
036	24		17	P1	36	J1	2	
001	24		17	P1	1	J1	3	
033	24		17	P1	33	J1	3	
002	24		17	P1	2	J1	4	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	-

SHEET 4 OF

FORM U501 7-79

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
034	24		17	P1	34	J1	4	
024	24		17	P1	24	J1	5	
032	24		17	P1	32	J1	6	
031	24		17	P1	31	J1	7	
048	24		17	P1	48	J1	8	
038	24		17	P1	38	J1	9	
049	24		17	P1	49	J1	11	
052	24		17	P1	52	J1	13	
047	24		17	P1	47	J1	14	
008	24		28	P1	8	M3	1	
007	24		28	P1	7	M3	2	
017	24		19	P1	17	M4	1	
018	24		19	P1	18	M4	2	
				A15 J2		P1		*
001	24		17	J1	3	P1	1	*
002	24		17	J1	4	P1	2	*
003	24		17	J1	1	P1	3	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	-

SHEET 5 OF

FORM U501 7-79

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
004	24		17	J1	2	P1	4	*
005	24		17	DS3	1	P1	5	*
007	24		28	M3	2	P1	7	*
008	24		28	M3	1	P1	8	*
009	24		21	S5	1	P1	9	
010	24		21	S5	2	P1	10	
011	24		21	S5	3	P1	11	
012	24		21	S5	1P	P1	12	
013	24		21	S5	5	P1	13	
014	24		21	S5	6	P1	14	
015	24		21	S5	7	P1	15	
017	24		19	M4	1	P1	17	*
018	24		19	M4	2	P1	18	*
022	24		30	DS2	2	P1	22	*
023	24		17	DS3	2	P1	23	*
024	24		17	J1	5	P1	24	*
025	24		20	DS8	2	P1	25	*
026	24		22	DS10	2	P1	26	*
027	24		22	DS9	2	P1	27	*
028	24		32	S4	2	P1	28	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	C

SHEET 6 OF

FORM U501 2-91

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
029	24		33	S1	2	P1	29	
030	24		21	S11	2	P1	30	
031	24		17	J1	7	P1	31	*
032	24		17	J1	6	P1	32	*
033	24		17	J1	3	P1	33	*
034	24		17	J1	4	P1	34	*
035	24		17	J1	1	P1	35	*
036	24		17	J1	2	P1	36	*
037	24		18	S6	1	P1	37	
038	24		17	J1	9	P1	38	*
039	24		20	DS8	1(+)	P1	39	*
041	24		21	S5	5P	P1	41	
042	24		27	S10	2	P1	42	
043	24		27	S9	2	P1	43	
044	24		32	S13	2	P1	44	
045	24		30	S3	3	P1	45	
046	24		30	S3	1	P1	46	
047	24		17	J1	14	P1	47	*
048	24		17	J1	8	P1	48	*
049	24		17	J1	11	P1	49	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	C

FORM U501 2-91

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
050	24		28	DS6	2	P1	50	*
051	24		28	DS7	2	P1	51	*
052	24		17	J1	13	P1	52	*
063	24		17	HN1	-	P1	63	*
064	24		18	S6	2	P1	64	
077	24		30	S3	2	S1	1	
078	24		10	S4	1	S1	1	
029	24		33	P1	29	S1	2	*
046	24		30	P1	46	S3	1	*
077	24		30	S1	1	S3	2	*
045	24		30	P1	45	S3	3	*
088	24		10	DS1	2	S4	1	*
078	24		10	S1	1	S4	1	*
081	24		15	S10	1	S4	1	
028	24		32	P1	28	S4	2	*
009	24		21	P1	9	S5	1	*
012	24		21	P1	12	S5	1P	*
010	24		21	P1	10	S5	2	*
011	24		21	P1	11	S5	3	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	C

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
013	24		21	P1	13	S5	5	*
041	24		21	P1	41	S5	5P	*
014	24		21	P1	14	S5	6	*
015	24		21	P1	15	S5	7	*
037	24		18	P1	37	S6	1	*
082	24		11	S11	1	S6	1	
064	24		18	P1	64	S6	2	*
085	24		29	S11	1	S9	1	
086	24		10	S13	1	S9	1	
043	24		27	P1	43	S9	2	*
081	24		15	S4	1	S10	1	*
087	24		10	S13	1	S10	1	
042	24		27	P1	42	S10	2	*
082	24		11	S6	1	S11	1	*
085	24		29	S9	1	S11	1	*
030	24		21	P1	30	S11	2	*
086	24		10	S9	1	S13	1	*
087	24		10	S10	1	S13	1	*
044	24		32	P1	44	S13	2	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-34307-1	A

APPENDIX F

WIRE LIST
for
TOP LEVEL FREQUENCY CONVERTER
GFC–25M w/ S–2, C–3, T–3 (208V)

WL195–39300–58

NOTES:

1. Prefix the wire termination reference designator with A22 except R1, S3 and S4, and those designators which begin with "A", such as A16A2A3P2. The listing "A1" in the "FROM" column is also prefixed A22. It is listed in the parts List A22A1T2. All A22 parts are in the Options Enclosure.

2. The wire connections are in reference designator order in the "FROM" column, ignoring the A22 prefix.

3. Refer to the associated schematic diagrams, Figure 7–1 for the Input/Output circuit connections.

APPLICATION	
NEXT ASSY	USED ON
195-39000-58	FINAL

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
-	FORMAL RELEASE	1/17/94	

REV																									
SHEET																									
REV STATUS OF SHEETS	REV	-	-	-	-	-	-	-	-	-	-														
	SHEET	1	2	3	4	5	6	7	8	9	10														

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
2 PLACE DECIMALS ± 03
3 PLACE DECIMALS ± 010
REMOVE BURRS & SHARP EDGES
HOLE TOL PER AND 10387

MATERIAL
N/A

FINISH
N/A

SIGNATURE		DATE
DRAWN	K. HALL	1/94
CHECKED	J. Allen	1/94
PROJ	J.K. ALLEN	1/94
APPVD		
APPVD		1/17/94
CONTRACT NUMBER		

Unitron Incorporated
10925 MILLER ROAD
DALLAS, TEXAS 75238
214/340-8600
TELEX 88-2511

WIRE LIST, TOP LEVEL, GFC-25M, S-2, C-3, T-3 (208V)

9

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-39300-58	-

SCALE N/A | DISK #42 | SHEET 1 OF 10

FORM U-500 8/76

N37002

NOTES:

1. "*" DENOTES SECOND APPEARANCE OF THIS LINE TERMINATION.

2. WIRE SIZES AND NUMBERS ARE GROUPED AS FOLLOWS:

WIRE GAUGE	WIRE NUMBER LIMITS
18	300 - 399
6	850 - 899
4	900 - 949

3. WIRE NUMBERS USED ARE:

300-303, 320-330, 332-336, 340-343, 345-351, 353, 354, 358, 361-368
850-856
900-903, 906, 908, 910, 919-921

4. WIRE NUMBERS NOT USED ARE:

304-319, 331, 337-339, 344, 352, 355-357, 359, 360, 369-399
857-899
904, 905, 907, 909, 911-918, 922-949

5. ALL WIRE IS WHITE IN COLOR UNLESS OTHERWISE SPECIFIED.

6. STAMP WIRES WITH WIRE NUMBERS.

7. THIS WIRE SHOULD PASS THROUGH T4.

8. THIS WIRE SHOULD PASS THROUGH T5.

9. THIS WIRE SHOULD PASS THROUGH T6.

10. THIS CONNECTION IS MADE WITH TWO CONDUCTOR TWISTED SHIELDED CABLE, ITEM 31; SHIELD IS CUT OFF EVEN WITH OUTER INSULATION AND SLEEVED WITH ITEM 33.

11. THIS WIRE IS USED ONLY WHEN ALTERNATE T-3 KIT, 195-52003-1, IS USED.

12. THIS WIRE IS USED ONLY WHEN T-3 KIT, 195-52073-1, IS USED.

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	WL195-39300-58	-
SCALE		SHEET 2	

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
300	SELF			TB2	4	A16 A2 A3 P2	1	
301	SELF			K3	2	A16 A2 A3 P2	2	
302	SELF			K3	4	A16 A2 A3 P2	3	
303	SELF			K3	6	A16 A2 A3 P2	4	
900	SELF		7	K3	2	A36 T1 A	E1	
901	SELF		8	K3	4	A36 T1 B	E1	
902	SELF		9	K3	6	A36 T1 C	E1	
903	SELF			TB2	4	A36 T2 B	E3	
320	18			J3	1	A39 TB1	2	*
321	18			R1	2	A39 TB1	7	
	SELF			J4		A45	P2	
322	18			J4	5	A53 TB1	1	
323	18			T1	7	A53 TB1	2	
324	18			J4	6	A53 TB1	3	
325	18			XF5	3	A53 TB1	7	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

SHEET 3 OF

FORM U501 2-91

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
326	18			XF5	2	A53 TB1	9	
327	18			XF5	1	A53 TB1	11	
850	6			TB2	4	E2	GND	
	SELF			P1		J1		
328	18			S3	COM	J1	1	
329	18			S3	NO	J1	2	
	SELF			P3		J3		
320	18			A39 TB1	2	J3	1	*
330	18			XF6	1	J3	3	
	SELF			A45	P2	J4		*
332	18			T1	5	J4	1	
333	18			T1	6	J4	2	
334	18			T1	7	J4	3	
335	18			T1	8	J4	4	
322	18			A53 TB1	1	J4	5	*
324	18			A53 TB1	3	J4	6	*
336	18			K2	A	J4	7	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

SHEET 4 OF

FORM U501 2-91

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
	22	WHT	10	K3	13	J4	8	
	22	BLK	10	K3	14	J4	9	
340	18			K5	A	J4	11	
342	18			TB2	4	J4	13	
343	18			TB2	5	J4	14	
851	6			XF5	1	K1	1	
906	4			T3	A1	K1	2	
852	6			XF5	2	K1	3	
908	4			T3	B1	K1	4	
853	6			XF5	3	K1	5	
910	4			T3	C1	K1	6	
345	18			P3	1	K1	61	
346	18			P3	3	K1	62	
347	18			T1	1	K1	A1	
348	18			K2	7	K1	A2	
349	18			T1	4	K2	4	
348	18			K1	A2	K2	7	*
336	18			J4	7	K2	A	*
350	18			K5	B	K2	B	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

SHEET 5 OF

FORM U501 2-91

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
351	18			P1	2	K2	B	
854	6			TB2	1	K3	1	
301	SELF			A16 A2 A3 P2	2	K3	2	*
900	SELF		7	A36 T1 A	E1	K3	2	*
855	6			TB2	2	K3	3	
302	SELF			A16 A2 A3 P2	3	K3	4	*
901	SELF		8	A36 T1 B	E1	K3	4	*
856	6			TB2	3	K3	5	
303	SELF			A16 A2 A3 P2	4	K3	6	*
902	SELF		9	A36 T1 C	E1	K3	6	*
	22	WHT	10	J4	8	K3	13	*
	22	BLK	10	J4	9	K3	14	*
	SELF			VR4	1	K3	A1	
353	18			XF4	6	K3	A1	
354	18			K5	7	K3	A2	
	SELF			VR4	2	K3	A2	
358	18			XF3	2	K5	4	
354	18			K3	A2	K5	7	*
340	18			J4	11	K5	A	*
350	18			K2	B	K5	B	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

SHEET 6 OF

FORM U501 2-91

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
	SELF			J1		P1		*
361	18			T1	8	P1	1	
351	18			K2	B	P1	2	*
	SELF			J3		P3		*
345	18			K1	61	P3	1	*
346	18			K1	62	P3	3	*
362	18			XF6	2	R1	1	
321	18			A39 TB1	7	R1	2	*
328	18			J1	1	S3	COM	*
329	18			J1	2	S3	NO	*
347	18			K1	A1	T1	1	*
363	18		11	T7	1	T1	1	
363	18		12	T7	8	T1	1	
	18		JUMPER	T1	3	T1	2	
	18		JUMPER	T1	2	T1	3	*
349	18			K2	4	T1	4	*
364	18		12	T7	1	T1	4	
364	18		11	T7	2	T1	4	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
332	18			J4	1	T1	5	*
333	18			J4	2	T1	6	*
323	18			A53 TB1	2	T1	7	*
334	18			J4	3	T1	7	*
335	18			J4	4	T1	8	*
361	18			P1	1	T1	8	*
906	4			K1	2	T3	A1	*
919	4			XF1	1	T3	A3	
908	4			K1	4	T3	B1	*
920	4			XF2	1	T3	B3	
910	4			K1	6	T3	C1	*
921	4			XF3	1	T3	C3	
363	18		11	T1	1	T7	1	*
364	18		12	T1	4	T7	1	*
366	18		12	XF5	1	T7	1	
364	18		11	T1	4	T7	2	*
365	18		12	XF4	3	T7	2	
	18	11	JUMPER	T7	5	T7	3	
365	18		11	XF4	3	T7	3	
	18	11	JUMPER	T7	6	T7	4	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
366	18		11	XF5	1	T7	4	
	18	11	JUMPER	T7	3	T7	5	*
	18	11	JUMPER	T7	4	T7	6	*
363	18		12	T1	1	T7	8	*
854	6			K3	1	TB2	1	*
855	6			K3	3	TB2	2	*
856	6			K3	5	TB2	3	*
300	SELF			A16 A2 A3 P2	1	TB2	4	*
903	SELF			A36 T2 B	E3	TB2	4	*
342	18			J4	13	TB2	4	*
850	6			E2	GND	TB2	4	
343	18			J4	14	TB2	5	*
	18		JUMPER	TB2	6	TB2	5	
	18		JUMPER	TB2	5	TB2	6	*
	SELF			K3	A1	VR4	1	*
	SELF			K3	A2	VR4	2	*
919	4			T3	A3	XF1	1	*
920	4			T3	B3	XF2	1	*
367	18			XF4	5	XF2	2	

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

NO.	GAGE	COLOR	LENGTH	TO	TERM	FROM	TERM	
921	4			T3	C3	XF3	1	*
358	18			K5	4	XF3	2	*
365	18		12	T7	2	XF4	3	*
365	18		11	T7	3	XF4	3	*
368	18			XF5	2	XF4	4	
367	18			XF2	2	XF4	5	*
353	18			K3	A1	XF4	6	*
327	18			A53 TB1	11	XF5	1	*
851	6			K1	1	XF5	1	*
366	18		12	T7	1	XF5	1	*
366	18		11	T7	4	XF5	1	*
326	18			A53 TB1	9	XF5	2	*
852	6			K1	3	XF5	2	*
368	18			XF4	4	XF5	2	*
325	18			A53 TB1	7	XF5	3	*
853	6			K1	5	XF5	3	*
330	18			J3	3	XF6	1	*
362	18			R1	1	XF6	2	*

CODE IDENT NO	SIZE	DWG NO	REV.
12175	A	WL195-39300-58	-

APPENDIX G

SPARE PARTS KIT
for
GFC–25M FREQUENCY CONVERTER

PL195–52061

APPLICATION	
NEXT ASSY	USED ON
	195-39000

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
-	FORMAL RELEASE	8/13/93	
A	REVISED PER ECO C5384	11/24/93	
B	REVISED PER ECO C5543	3/15/94	

REV																								
SHEET																								
REV STATUS OF SHEETS	REV	B	A	B	A																			
	SHEET	1	2	3	4																			

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
2 PLACE DECIMALS ± .03
3 PLACE DECIMALS ± .010
REMOVE BURRS & SHARP EDGES
HOLE TOL PER ANO 10387

MATERIAL
N/A

FINISH
N/A

SIGNATURE		DATE
DRAWN	K. HALL	8/93
CHECKED		8/93
PROJ	J.K. ALLEN	8/93
APPVD		
APPVD		8/13/93
CONTRACT NUMBER		

Unitron Incorporated
10925 MILLER ROAD
DALLAS, TEXAS 75238
214/340-8600
TELEX 88-2511

KIT, SPARE PARTS,
GFC-25M, LEVEL VII

4

SIZE	CODE IDENT NO	DRAWING NO	REV
A	12175	PL195-52061	B

SCALE	DISK	SHEET
N/A	#41	1 OF 4

NOTES:

1. ITEM 26 IS AN ALTERNATE FOR ITEM 5.
2. DELETED
3. DELETED

ITEM NO.	-1	-2	-3	CODE IDENT	PART NUMBER	DESCRIPTION	REF.DES.	VENDOR/SPEC	REMARKS
1	X				195-52061-1	KIT, SPARE PARTS, MINIMUM			
2		X			195-52061-2	KIT, SPARE PARTS, PARTIAL			
3			X		195-52061-3	KIT, SPARE PARTS, COMPLETE			
4									
5	3	3	3	21574	A70Q100-4	FUSE, 100 A, 700 V		GOULD	NOTE 1
6									
7	1	1	1	75915	FLQ-3/10	FUSE, 0.3 A, 500 Vac		LITTELFUSE	
8	1	1	1	75915	FLQ-4/10	FUSE, 0.4 A, 500 Vac			
9	2	2	2		FLQ 2	FUSE, 2 A, 250 V, Slo-Blo			
10	4	4	4	01940	31D5316P4	BULB, 50 V		WESTINGHOUSE	
11	2	2	2		195-39019-1	TRANSISTOR ASSY, IGBT			
12									
13	1	1	1		EFG15G	RECTIFIER, 1400 V, 100 A		GENTRON	
14	1	1	1		A59-B15A-23T3-000	FAN, TUBEAXIAL, 230 Vac, 50/60 Hz, 215 CFM		GLOBE	
15									
16	1	1	1		195-39051-1	PWA, DRIVE			
17	1	1	1		195-39053-1	PWA, POWER INTERFACE			

ITEM NO.	-1	-2	-3	CODE IDENT	PART NUMBER	DESCRIPTION	REF.DES.	VENDOR/SPEC	REMARKS
18	1	1	1		195-39030-1	PWA, CLAMP, IGBT			
19		1	1		195-17011-2	PWA, SCR DRIVER			
20									
21			1		195-11030-5	PWA, LOGIC POWER SUPPLY			
22			1		195-16039-4	PWA, PROTECTION			
23			1		195-16053-2	PWA, CONTROL			
24									
25									
26	ALT	ALT	ALT	71400	FWP-100	FUSE, 100 A, 700 V		BUSSMAN	NOTE 1
27									
28									
29						DELETED			