
HA3000

HA3000
Uninterruptible Power System
Technical Manual

Prepared by Educational Services
of
Digital Equipment Corporation

1st Edition, May 1990

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Contents

3 INITIAL STARTUP

4 TECHNICAL DESCRIPTION

Figures

Tables

About This Manual

OVERVIEW

This technical manual is intended for use by Digital Customer Services personnel who have been trained in the operation, installation, troubleshooting, and maintenance of the HA3000 Uninterruptible Power System (UPS).

This manual consists of the following:

- Chapter 1, "Introduction," provides an overview of the HA32A UPS, the HA32B UPS Battery Cabinet, the HA32C/D/E UPS Auxiliary Cabinet, the HA32J/K UPS Distribution Cabinet, the HA320-Ax Remote Status Panel, and the Remote Emergency Power Off (REPO).
- Chapter 2, "Operation," provides a description of the HA32A UPS electromechanical and programmable controls, the automatic and manual operating sequences, the system status and control panel (SS&CP), and the UPS monitor and available menus.
- Chapter 3, "Startup," provides the procedure for the initial startup of the HA32A UPS, the HA32B UPS Battery Cabinet, the HA32C/D/E UPS Auxiliary Cabinet, the HA32J/K UPS Distribution Cabinet, the HA320-Ax Remote Status Panel, and the Remote Emergency Power Off (REPO) switch.
- Chapter 4, "Technical Description," provides a technical description of the components that make up the power section of the HA32A UPS. This chapter also contains a description of the printed circuit boards contained in the HA32A UPS.
- Chapter 5, "Troubleshooting and Maintenance," provides troubleshooting and preventive maintenance procedures.
- Appendix A, "Parts List," provides illustrations for locating parts and parts lists for the HA32A UPS.
- Appendix B, "Power and Logic Diagrams," provides a power flow and a logic flow diagram that should be used with Chapter 4 and when troubleshooting the HA32A UPS.

RELATED DOCUMENTATION

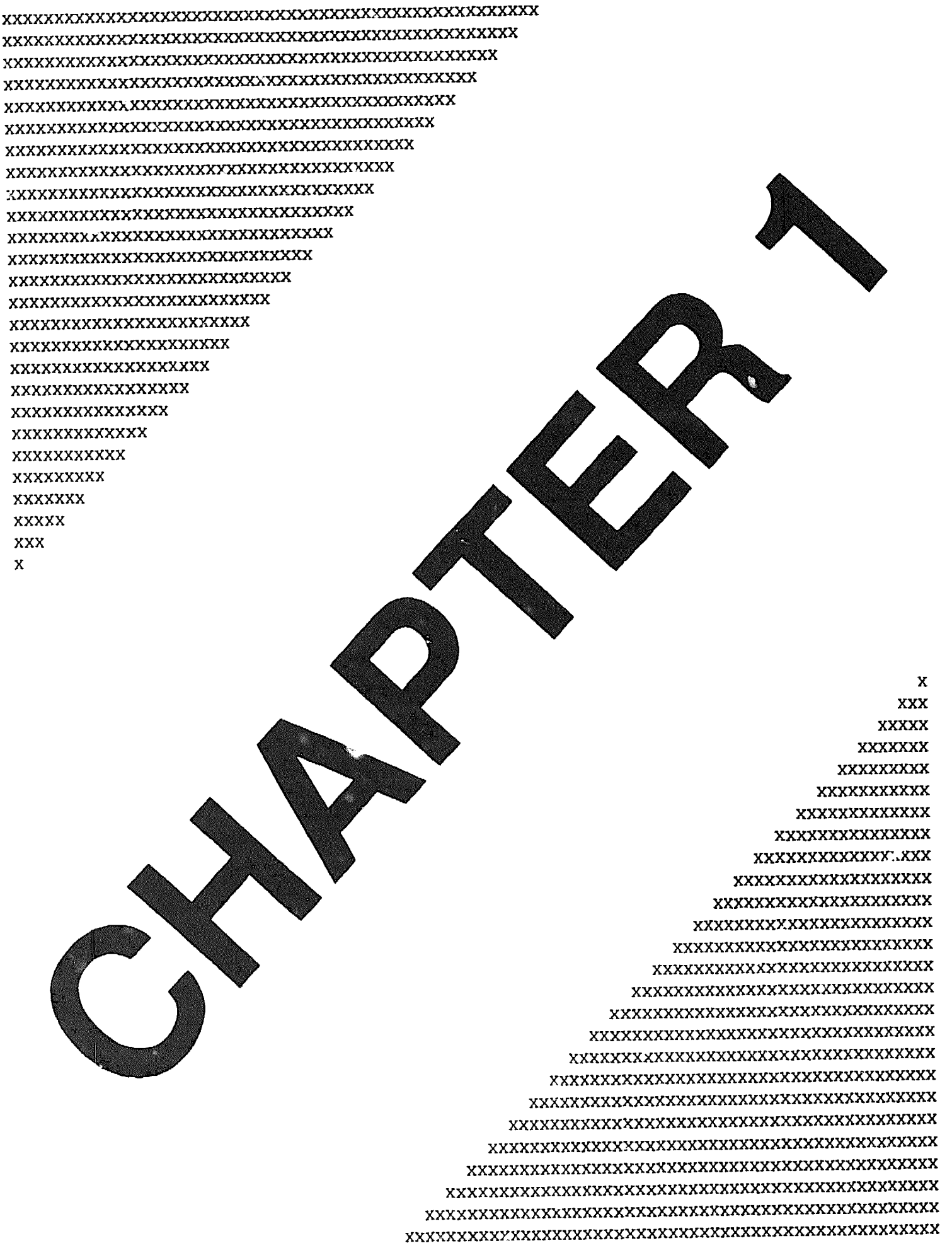
The following documents may be helpful for maintaining the HA32A UPS:

TITLE	PART NUMBER
HA3000 Uninterruptible Power System User Guide	EK-HA32X-UG
HA3000 Uninterruptible Power System Installation Manual	EK-HA32X-IN
HA3000 Uninterruptible Power System Installation Drawings	EK-HA32X-ID

CONVENTIONS

This section describes the special symbols used in this manual.

NOTES	Calls attention to information in text that may be of special importance.
CAUTIONS	Calls attention to information in text that is essential in avoiding system or equipment damage.
WARNINGS	Calls attention to information in text that is essential to the safety of personnel.


CHAPTER 1

1
INTRODUCTION

1.1 SAFETY

The HA3000 series Uninterruptible Power System cabinets contain HIGH VOLTAGE. Formal training on the HA3000 series UPS *is required* for all maintenance personnel. All appropriate safety precautions *must be* taken to ensure the safety of personnel troubleshooting and repairing this equipment.

Before any covers or panels, except the allen key locked door, can be opened for troubleshooting or repair, the HA32A UPS must be placed in maintenance bypass (see Section 2.3.2.5).

During troubleshooting and repairing, keep all covers and panels in place whenever possible. Remove all rings and jewelry, and wear safety glasses at all times when working in the UPS cabinets. DO NOT wear an ESD wriststrap when working on the UPS equipment.

WARNING

The HA3000 series UPS cabinets contain HIGH VOLTAGE. Only authorized Digital Customer Services representatives who have received formal, authorized training on the HA3000 series UPS product will be certified to work on this product. There will be no exceptions to this policy.

1.2 GENERAL DESCRIPTION

The HA3000 series Uninterruptible Power System (UPS) is a three-phase on-line interface between a building's utility power distribution system and the customer's critical load. The UPS is designed to ensure a continuous flow of clean electrical power to critical loads by addressing common power problems associated with utility ac power such as spikes, electrical noise, sags, brownouts, surges, dropouts, and frequency variations. In the event of a power outage, the UPS will provide battery power that is adequate to complete an orderly shutdown of equipment or to turn on a generator.

The HA3000 series UPS is available in kVA ratings of 20, 40, 60, and 80 kVA and can accept three-phase input power of 208, 220, 480, and 600 Vac.

The basic HA3000 series UPS consists of a HA32A-xx UPS and a HA32B-xx UPS Battery Cabinet. Options available to expand the HA3000 series UPS include the HA32C/D/E-xx UPS Auxiliary Cabinet, the HA32J/K-xx UPS Distribution Cabinet, and the HA320-Ax Remote Status Panel. Figure 1–1 shows a typical layout diagram of the HA3000 series UPS.

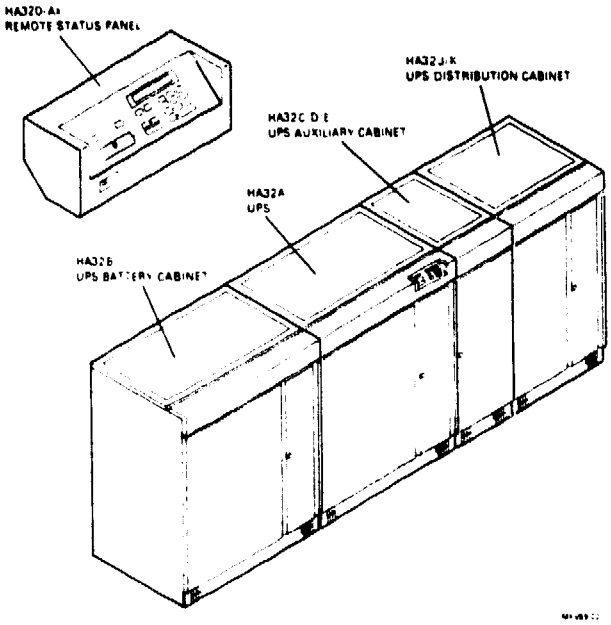


Figure 1–1 HA3000 UPS Layout Diagram

1.3 HA32A-xx UPS

The HA32A-xx UPS is the main component of the HA3000 series Uninterruptible Power System. The available model numbers, along with the output kVA/kW rating, the input and output voltage ratings, and the input circuit breaker ratings are listed in Table 1–1.

Two separate input power sources (MAINS1 and MAINS2) are utilized to provide normal utility power input through the UPS system (MAINS1) and input to the bypass circuitry in case of a UPS failure (MAINS2).

The major components of the HA32A-xx UPS are:

- A system status and control panel (SS&CP)
- A rectifier/battery charger
- A transistorized pulse-width modulated static inverter
- A continuous-duty rated static switch that automatically transfers the load to and from the bypass ac input source and the UPS inverter output
- An internal manual bypass function consisting of three separate switches that allows the critical load to be operated from the utility source

Table 1–1 Standard HA32A UPS Models

Model Number	Output Rating kVA/kW	Nominal Input Voltage (Volts)	Output Voltage (Volts)	Input CB Rating (Amps)
HA32A-AH	20/16	208	208Y/120	90
HA32A-BH	20/16	480	208Y/120	40
HA32A-CH	20/16	480	480Y/277	40
HA32A-DH	20/16	220	220Y/127	90
HA32A-AK	40/32	208	208Y/120	175
HA32A-BK	40/32	480	208Y/120	90
HA32A-CK	40/32	480	480Y/277	90
HA32A-DK	40/32	220	220Y/127	175
HA32A-AM	60/48	208	208Y/120	250
HA32A-BM	60/48	480	208Y/120	100
HA32A-CM	60/48	480	480Y/277	100
HA32A-DM	60/48	220	220Y/127	250
HA32A-AN	80/64	208	208Y/120	350
HA32A-BN	80/64	480	208Y/120	150
HA32A-CN	80/64	480	480Y/277	150
HA32A-DN	80/64	220	220Y/127	350

A single-line diagram of the HA32A-xx UPS is shown in Figure 1–2.

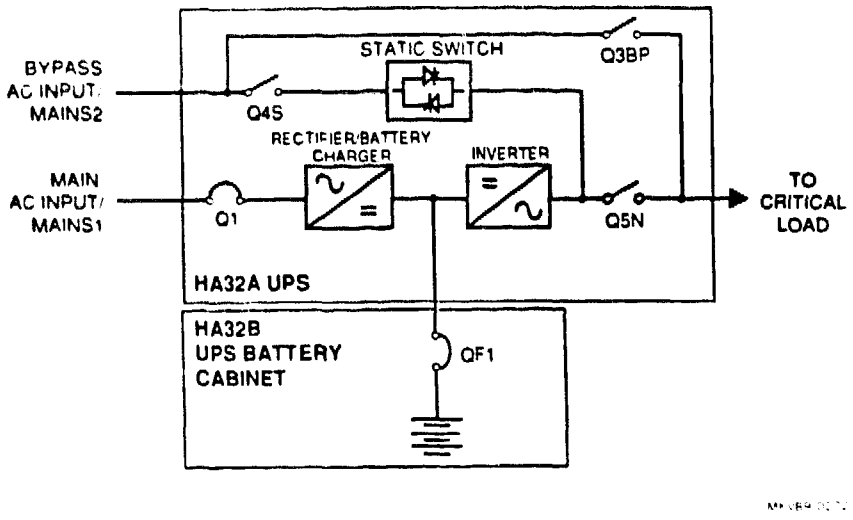


Figure 1–2 HA32A-xx UPS Single-Line Diagram

The HA32A-xx UPS uses microprocessors to control the operation of the rectifier/battery charger, the static inverter, and the static switch. This ensures optimum performance for all line, load, and operating conditions. The HA32A-xx UPS also contains a microprocessor-based diagnostic system that assists in locating faulty assemblies that need to be replaced.

1.3.1 System Status and Control Panel (SS&CP)

The system status and control panel provides controls to select system operation and indicators that allow system performance to be monitored. A liquid crystal display (LCD) is used to display system operating parameters, provide step-by-step operating instructions for the system operator, and provide diagnostic messages to aid in troubleshooting. The UPS monitor software is programmed to display messages in one of five selectable languages (English, French, German, Spanish, or Italian).

1.3.2 Rectifier/Battery Charger

The rectifier/battery charger consists of:

- An ac input circuit breaker (Q1) to provide mechanical isolation and electrical protection for the input of the UPS.
- An input autotransformer to match the external ac input source to that required internally for the UPS.
- A plug-in power module that converts incoming ac power to a regulated dc output voltage. The regulation is carried out by controlling the SCR conduction angles, allowing the rectifier/battery charger to supply a stable dc voltage (±1%).
- A dc shunt that is used to monitor the battery charge current and provide data for regulating the dc voltage at the desired level.

1.3.3 Static Inverter

The static inverter consists of:

- A plug-in power module that chops the incoming dc voltage to obtain the pulse-width modulated waveform at the primary of the output transformer. A single power module is used for 20 kVA HA32A UPS units. The HA32A UPS units rated above 20 kVA use three power modules—one module per phase.
- A full isolation inverter transformer that provides input/output electrical isolation for the UPS, the required output voltage, and the required inductance for the ac output filter.
- An ac output filter that is used to achieve a computer-grade sine wave output voltage waveform with a Total Harmonic Distortion (THD) of 5% maximum.

1.3.4 Static Switch

The static switch transfers the load from the UPS inverter output to the bypass ac input source, or from the bypass ac input source to the UPS inverter output without any interruption to the load (provided that the UPS inverter output is synchronized to the bypass ac input source). These transfers take place automatically upon inverter startup or shutdown.

A Delta-RC circuit network protects the static switch against high voltage spikes and surges by absorbing the excess energy. This Delta-RC circuit network is protected by fuses and a failure of these fuses is displayed on the SS&CP LCD.

1.3.5 Manual Bypass

The internal manual bypass function consists of three switches. When operated as specified, these switches provide a make-before-break transfer of the load from the UPS inverter output to the bypass ac input source, or from the bypass ac input source to the UPS inverter output.

The three manual bypass switches are:

- Bypass (MAINS2) Input (Q4S)
- UPS Output Isolation (Q5N)
- Manual Bypass (Q3BP)

The instructions for the correct operation of these switches are obtained by accessing the BYPASS PROCEDURE menu.

1.4 HA32B-xx UPS BATTERY CABINET

Each HA32A-xx UPS requires a separate HA32B-xx UPS Battery Cabinet that contains batteries that have a sufficient ampere-hour capacity to support the UPS and its intended load for the protection time specified. The UPS Battery Cabinet is designed to accommodate multiple combinations of batteries in order to match the requirements of a particular load.

A 12 volt battery, made up of six series-connected lead-calcium cells, forms the basic building block for all UPS Battery Cabinets. The batteries are series-connected to form a "string" of batteries that provide the dc voltage level required to operate with the HA32A-xx UPS. The batteries are sealed, maintenance-free, lead-calcium, recombination type batteries that do not release gas under normal operating conditions. The batteries have a safe low-pressure venting system that releases excess gas if the internal gas pressure rises above the normal level and seals automatically when the internal gas pressure returns to the normal level.

The batteries inside the UPS Battery Cabinet are mounted on pull-out rack assemblies for easy access. The 80.0 cm (31.5 in.) wide cabinet has a single pull-out rack assembly and the 114.3 cm (45 in.) wide cabinet has two pull-out rack assemblies of equal width.

The available UPS Battery Cabinet model numbers, along with the kVA ratings, the approximate protection time in minutes, and the circuit breaker ratings, are listed in Table 1–2.

Table 1–2 HA32B UPS Battery Cabinet Models

Model Number	kVA Rating	Approximate Protection Time In Minutes[1]	CB (QF1) Rating In Amperes
HA32B-AH	20	5	90
HA32B-CH	20	15	90
HA32B-FH	20	30	90
HA32B-AK	40	5	125
HA32B-CK	40	15	125
HA32B-FK[2]	40	30	125
HA32B-AM	60	5	175
HA32B-CM	60	15	175
HA32B-FM[2]	60	30	175
HA32B-AN	80	5	225
HA32B-CN[2]	80	15	225
HA32B-FN[2]	80	30	225

[1]Protection time can be increased by adding additional cabinets in parallel, but the add-on cabinet must have the same battery rating and model number. Only two cabinets can be connected in parallel due to the shunt-trip power supply limitations.

[2]Consists of two battery cabinets that are connected in parallel.

1.5 HA3000 SERIES OPTIONS

The three main options available for use with the HA3000 series Uninterruptible Power System are the HA32C/D/E UPS Auxiliary Cabinet, the HA32J/K UPS Distribution Cabinet, and the HA320-AA/AB Remote Status Panel.

1.5.1 HA32C/D/E-xx UPS Auxiliary Cabinet

The HA32C/D/E-xx UPS Auxiliary Cabinet attaches to the right side of the HA32A UPS and provides the means to incorporate two features into the HA3000 series Uninterruptible Power System. These features are an input isolation transformer and an input harmonic current filter. The available UPS Auxiliary Cabinet model numbers, along with the output kVA rating, the input and output voltage ratings, and the input circuit breaker ratings are listed in Table 1–3.

WARNING

A UPS Auxiliary Cabinet that contains an input isolation transformer and/or an input harmonic current filter contains HIGH VOLTAGE. Ensure that all power has been removed before any service is performed.

The input isolation transformer provides complete electrical isolation between the utility line and the input of the HA32A UPS. The transformer also provides extra protection against electrical noise and ground faults. The UPS Auxiliary Cabinets that contain an input isolation transformer also have an input circuit breaker (CB1). This input circuit breaker provides overcurrent protection and mechanical isolation for maintenance purposes.

NOTE

Systems with a 600 Vac input require an HA32C-Ex or HA32D-Ex UPS Auxiliary Cabinet with an isolation/step-down transformer to step down the 600 Vac to 208 Vac for use with the HA32A-Ax UPS. The output of the UPS Auxiliary Cabinet transformer must supply both the main ac input (MAINS1) and the bypass ac input (MAINS2) of the UPS (see Figure 1–5).

The input harmonic current filter limits the amount of harmonic current fed back into the input ac power source to less than 10% when the HA32A UPS is operating at full load.

The UPS Auxiliary Cabinet is available in three different configurations for use with the HA32A UPS.

1.5.1.1 UPS Auxiliary Cabinet with Input Isolation Transformer Only (HA32D-xx)

The UPS Auxiliary Cabinet with an input isolation transformer can be connected in one of three ways to the HA32A UPS. The three ways are described below.

- The output of the input isolation transformer can be connected to the main ac input (MAINS1) (see Figure 1–3). This provides complete electrical isolation between the utility ac input source and main ac input of the HA32A UPS.

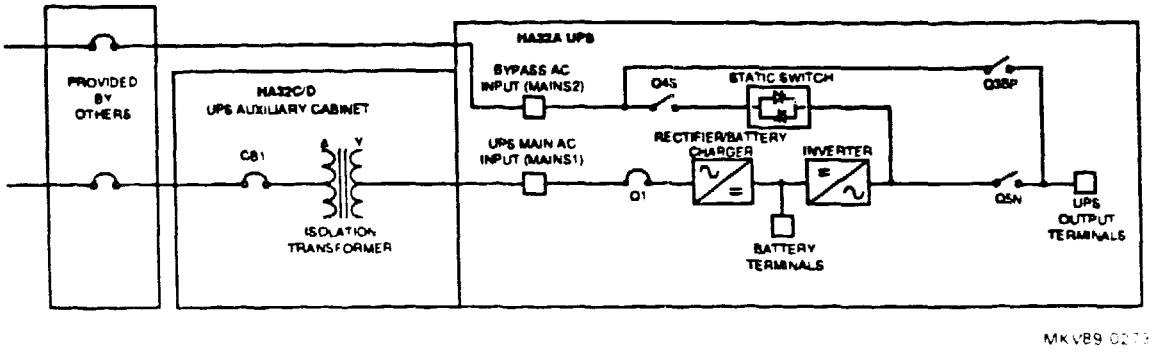


Figure 1–3 Input Isolation Transformer to Main UPS Input Configuration

- The output of the input isolation transformer can be connected to the bypass ac input (MAINS2) (see Figure 1–4). This provides complete electrical isolation between the utility ac input source and the critical load when the UPS is operating on static bypass or manual bypass.

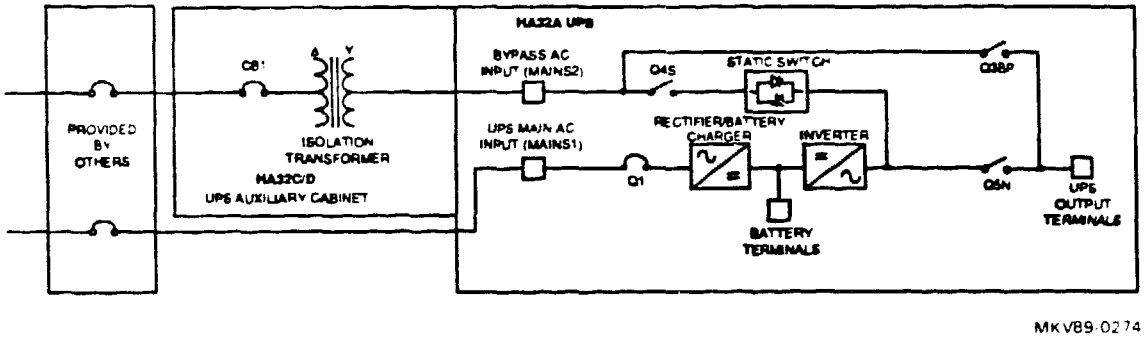


Figure 1–4 Input Isolation Transformer to Bypass UPS Input Configuration

- The output of the isolation transformer can be connected to both the main ac input (MAINS1) and the bypass ac input (MAINS2) (see Figure 1–5). This provides complete electrical isolation between the utility ac input and both the main ac input (MAINS1) and the bypass ac input (MAINS2).

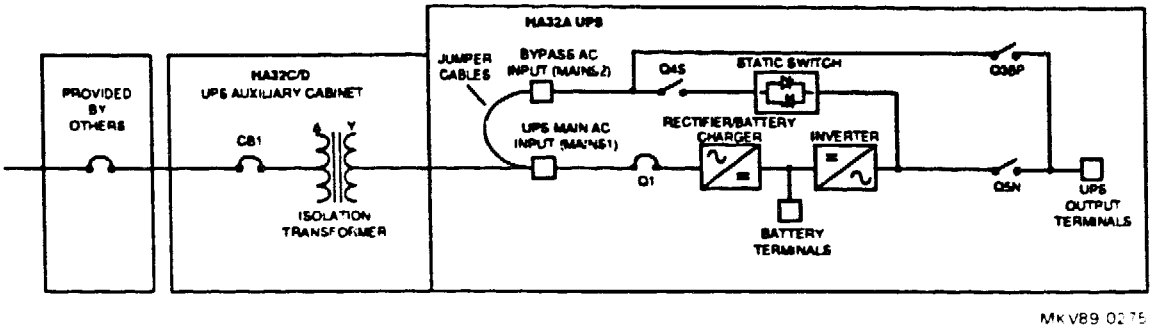


Figure 1–5 Input Isolation Transformer to Main and Bypass UPS Inputs

1.5.1.2 UPS Auxiliary Cabinet with Input Harmonic Current Filter Only (HA32E-Px)

The UPS Auxiliary Cabinet with an input harmonic current filter is used to limit the amount of current distortion fed back into the ac input source to less than 10% when the HA32A UPS is operating at full load.

1.5.1.3 UPS Auxiliary Cabinet with Input Isolation Transformer and Input Harmonic Current Filter (HA32C-xx)

The UPS Auxiliary Cabinet can contain both an input isolation transformer and an input harmonic current filter. The input isolation transformer can provide complete electrical isolation between the utility ac input and the main ac input (MAINS1), or the bypass ac input (MAINS2), or both. The input harmonic current filter limits the amount of current distortion fed back into the input ac source.

Table 1–3 HA32C/D/E UPS Auxiliary Cabinet Models

Model Number	Output Rating (kVA)	Input Voltage (Vac)	Output Voltage (Vac)	Input CB Rating (Amperes)
		With Input Isolation Transformer and Harmonic Current Filter		
HA32C-AH	20	208	208	90
HA32C-BH	20	480	208	40
HA32C-CH	20	480	480	40
HA32C-DH	20	220	220	90
HA32C-EH	20	600	208	40
HA32C-AK	40	208	208	175
HA32C-BK	40	480	208	90
HA32C-CK	40	480	480	90
HA32C-DK	40	220	220	175
HA32C-EK	40	600	208	60
HA32C-AM	60	208	208	250
HA32C-BM	60	480	208	100
HA32C-CM	60	480	480	100
HA32C-DM	60	220	220	250
HA32C-EM	60	600	208	80
HA32C-AN	80	208	208	350
HA32C-BN	80	480	208	150
HA32C-CN	80	480	480	150
HA32C-DN	80	220	220	350
HA32C-EN	80	600	208	100
		With Input Isolation Transformer Only		
HA32D-AH	20	208	208	90
HA32D-BH	20	480	208	40
HA32D-CH	20	480	480	40
HA32D-DH	20	220	220	90
HA32D-EH	20	600	208	40

Table 1–3 (Cont.) HA32C/D/E UPS Auxiliary Cabinet Models

Model Number	Output Rating (kVA)	Input Voltage (Vac)	Output Voltage (Vac)	Input CB Rating (Amperes)
HA32D-AK	40	208	208	175
HA32D-BK	40	480	208	90
HA32D-CK	40	480	480	90
HA32D-DK	40	220	220	175
HA32D-EK	40	600	208	60
HA32D-AM	60	208	208	250
HA32D-BM	60	480	208	100
HA32D-CM	60	480	480	100
HA32D-DM	60	220	220	250
HA32D-EM	60	600	208	80
HA32D-AN	80	208	208	350
HA32D-BN	80	480	208	150
HA32D-CN	80	480	480	150
HA32D-DN	80	220	220	350
HA32D-EN	80	600	208	100
		With Input Harmonic Current Filter Only		
HA32E-PH	20	NA	NA	NA
HA32E-PK	40	NA	NA	NA
HA32E-PM	60	NA	NA	NA
HA32E-PN	80	NA	NA	NA

NOTES:

1. NA = Not applicable.
2. The input harmonic current filter is not voltage dependent. It does not increase the input or output current.
3. The UPS Auxiliary Cabinet models with an input isolation transformer (HA32C and HA32D) contain an input circuit breaker (CB1).

1.5.2 HA32J/K-xx UPS Distribution Cabinet

The HA32J/K-xx UPS Distribution Cabinet attaches to the right side of the HA32A UPS or the right side of the UPS Auxiliary Cabinet (if one is installed). The UPS Distribution Cabinet provides a means for distributing power from the HA32A UPS to the user's intended equipment. A single-line diagram of the HA32A UPS and the HA32J/K UPS Distribution Cabinet is shown in Figure 1–6.

The UPS Distribution Cabinet can contain an optional isolation/step-down transformer to provide complete electrical isolation between the equipment that the HA32A UPS is supplying power to and the HA32A UPS output, or to step down the 480 Vac output of a HA32A-Cx UPS to 208 Vac for distribution. The available UPS Distribution Cabinet model numbers, along with the UPS output kVA ratings, the input and output voltage ratings, and the maximum input and output current ratings are listed in Table 1–4.

The HA32J-xx UPS Distribution Cabinet contains one 42-pole panelboard that is rated for 225 amperes, and a 225 ampere branch circuit breaker (CB2). The branch circuit breaker provides extra protection against overload conditions and provides a manual means of connecting the panelboard to or disconnecting the panelboard from the output of the HA32A UPS.

The HA32K-xx UPS Distribution Cabinet contains two 42-pole panelboards that are each rated for 225 amperes, and two 225 ampere branch circuit breakers (CB2 for panelboard #1 and CB3 for panelboard #2). The branch circuit breakers provide extra protection against overload conditions and provide a manual means of connecting the panelboards to or disconnecting the panelboards from the output of the HA32A UPS.

The output circuit breakers that connect to the panelboards protect the individual loads against overload conditions and provide a means of connecting a load to or disconnecting a load from the UPS Distribution Cabinet without affecting the other loads.

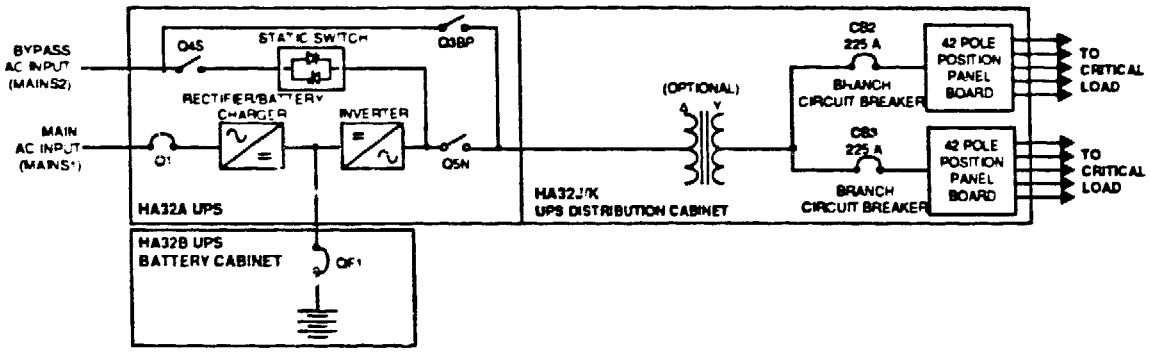


Figure 1–6 Single-Line Diagram of the HA32A and the HA32J/K

Table 1–4 HA32J/K UPS Distribution Cabinet Models

Model Number	UPS Output Rating (kVA)	Input Voltage (Vac)	Maximum Input Current (Amps)	Output Voltage (Vac)	Maximum Output Current (Amps)
HA32J-AT †	20 - 80	208/220	222	208/220	222
HA32K-AT †	20 - 80	208/220	222	208/220	222
HA32J-AH	20	208	55.5	208	55.5
HA32J-BH	20	480	24.1	208	55.5
HA32J-DH	20	220	55.5	220	55.5
HA32J-AK	40	208	111	208	111
HA32J-BK	40	480	48.1	208	111
HA32J-DK	40	220	111	220	111
HA32K-AM	60	208	166.5	208	166.5
HA32K-BM	60	480	72.2	208	166.5
HA32K-DM	60	220	166.5	220	166.5
HA32K-AN	80	208	222	208	222
HA32K-BN	80	480	96.2	208	222
HA32K-DN	80	220	222	220	222

†These models DO NOT contain an isolation/step-down transformer.

NOTES:

1. The HA32J-xx models contain one 42-pole panelboard.
2. The HA32K-xx models contain two 42-pole panelboards.

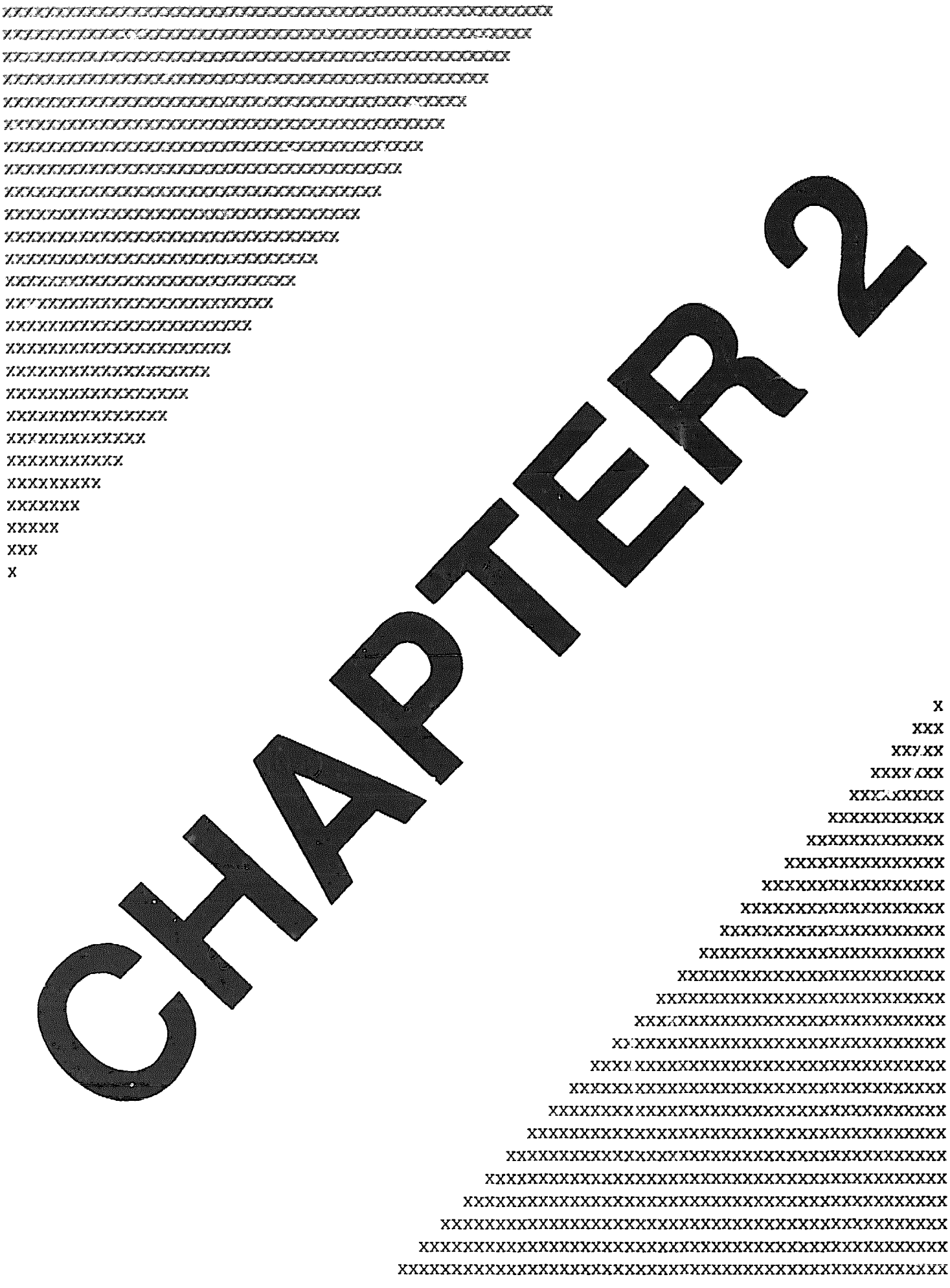
1.5.3 HA320-Ax Remote Status Panel

The HA320-Ax Remote Status Panel allows the operation of the HA32A UPS to be monitored from a remote location. The Remote Status Panel can be wall or desk mounted and uses basically the same system status and control panel (SS&CP) as the HA32A UPS. The Remote Status Panel includes the mimic panel to indicate the flow of power; an LCD for displaying status, alarms, and parameters measured; and the keys for requesting current and voltage data.

The HA320-AA model comes with a 150-ft cable for connecting to the HA32A UPS while the HA320-AB model comes with a 300-ft cable.

1.6 Remote Emergency Power Off (REPO)

The Remote Emergency Power Off circuit is used to remove power from the HA32A UPS in emergency situations from a remote location. Activating the REPO circuit causes the main ac input (MAINS1) circuit breaker (Q1), the bypass ac input (MAINS2) switch (Q4S), and the UPS Battery Cabinet circuit breaker(s) (QF1) to open and disconnect all power from the load(s). The REPO circuit will not disconnect all power from the load(s) if the UPS is in manual or maintenance bypass.


CHAPTER 2

2
HA32A UPS OPERATION

2.1 GENERAL

This chapter describes the electromechanical and programmable controls of the HA32A UPS, the automatic and manual operating modes of the HA32A UPS, the system status and control panel (SS&CP), and the UPS monitor and available menus.

2.2 CONTROLS

There are two types of controls for the HA32A UPS, electromechanical and programmable.

2.2.1 Electromechanical Controls

The circuit designator for the five electromechanical controls of the HA32A UPS, and the function of each, are listed below. See Figure 1–2 for the circuit location of these controls.

Circuit Designator	Function
Q1	Main ac input (MAINS1) circuit breaker. Applies input voltage to the rectifier/battery charger and provides input current protection.
Q3BP	Manual bypass nonautomatic switch. Allows the bypass ac input to bypass the UPS and is used in conjunction with Q4S and Q5N.
Q4S	Bypass ac input (MAINS2) ON/OFF switch. Applies power to or isolates the static switch. Used in conjunction with Q3BP and Q5N.
Q5N	UPS output isolation switch. Isolates the UPS output and is used in conjunction with Q4S and Q3BP.
K3N	Inverter output contactor. Mechanically isolates the UPS inverter from the static switch. When the static switch is ON, K3N is open. When the static switch is OFF, K3N is closed.

2.2.2 Programmable Controls

The programmable controls are covered in detail in Section 2.5 and include such control functions as:

- Rectifier/battery charger start and stop
- Inverter start and stop
- Clearing faults
- Synchronized/nonsynchronized UPS inverter operation

- Output ac voltage adjustment
- DC voltage and battery charger current limit adjustments
- Boost or equalization charge on battery
- Selecting display language
- Diagnostic and test routines
- Adjusting display contrast

2.3 OPERATING MODES

The HA32A UPS has both automatic and manual operating modes. These modes of operation are described in more detail in the following sections.

2.3.1 Automatic Operating Sequences

The four automatic operating sequences are described in the following sections.

2.3.1.1 Normal Operation

Normal operation is when main ac input (MAINS1) power and bypass ac input (MAINS2) power are available and are within the prescribed tolerances. The critical load is being supplied by the inverter output, which is being supplied by the rectifier/battery charger output. The UPS Battery Cabinet is on float charge condition. The flow of power during normal operation is shown in Figure 2–1.

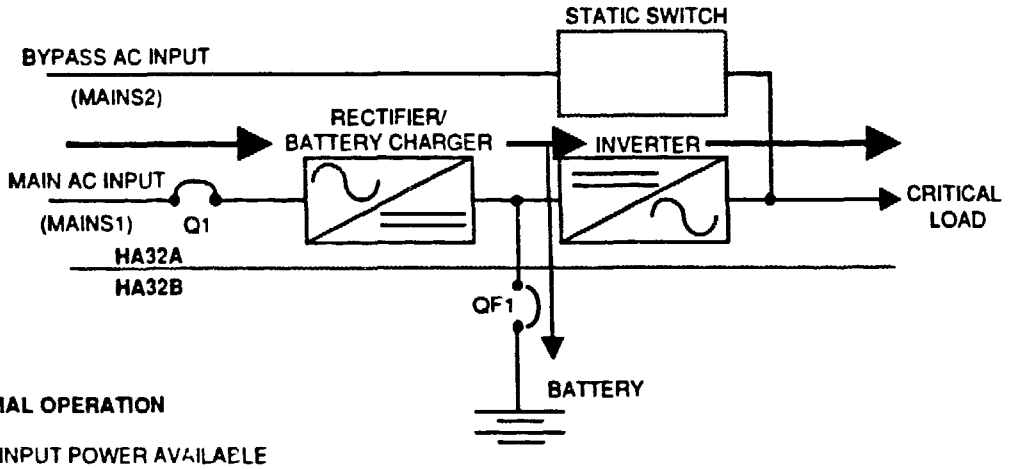


Figure 2–1 Normal Operation Power Flow

2.3.1.2 On Battery Operation

On battery operation occurs when main ac input (MAINS1) power is lost, if the main ac input (MAINS1) power drops more than 15% below nominal value, or if the rectifier/battery charger circuit fails. The flow of power during on battery operation is shown in Figure 2–2.

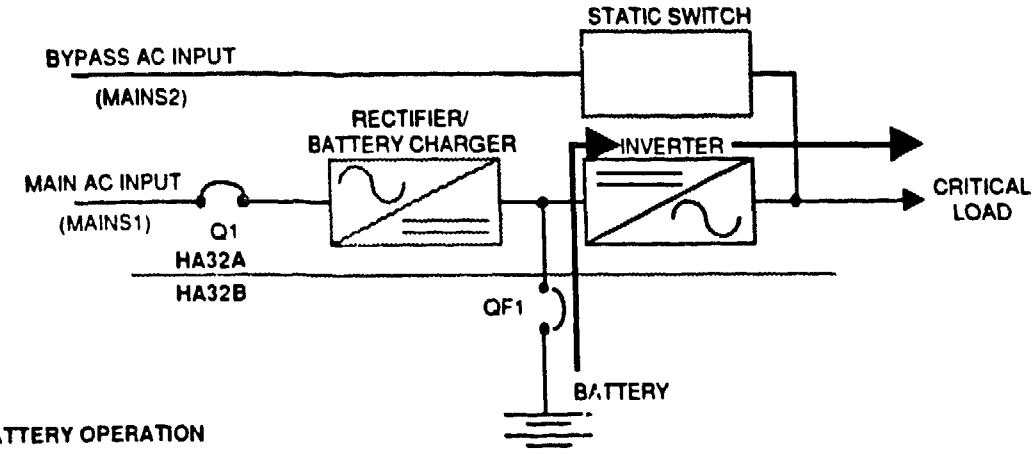


Figure 2–2 On Battery Operation Power Flow

Battery protection time depends on the the ampere-hour capacity of the installed batteries and the power consumed by the load. The specified nominal battery protection time for the installed UPS Battery Cabinet is the minimum duration when operating at 25°C (77°F) with the inverter output under full-rated load (rated kVA @ 0.8 Power Factor lagging). The actual protection time can be greater than the specified protection time if the inverter is operating at less than full load. During a main ac input (MAINS1) power failure, operation on battery power can be extended by reducing the load (noncritical equipment). By monitoring the battery protection time on the LCD, the predicted protection period based on present load conditions can be determined.

The battery protection period ends when the battery voltage reaches the inverter cut-off voltage. When the battery voltage is 10 Vdc above the inverter cut-off voltage, the LCD displays the message:

```
LOW BATTERY SHUTDOWN
```

This is a warning that the battery is approaching the end point of discharge and that the protection period has nearly expired.

2.3.1.3 Input Power Restored/Battery Charging

As soon as main ac input (MAINS1) power is restored, and the voltage and frequency are within specified tolerances, the UPS returns to normal operation (see Section 2.3.1.1). If the battery reaches its end point of discharge before the main ac input (MAINS1) power is restored, the UPS inverter will shut down and must be manually restarted by following the Start-Up menu in Section 2.5.1.

Under normal circumstances the rectifier/battery charger immediately begins recharging the battery. Initially the rectifier/battery charger provides maximum recharge current, then a two-step battery charge cycle as shown in Figure 2–3 is used.

During the first step of the two-step charge cycle, the charge current is limited to about 0.1 C 10 (1/10th of the battery capacity specified for a 10-hour discharge rate) and the dc voltage level gradually increases until the float charge voltage is reached.

During the second step of the two-step charge cycle, the battery is charging at the float charge voltage and the charging current gradually decreases to a value that maintains the battery in a fully-charged condition.

This two-step rectifier/battery charger operation is initiated only if the power has failed for longer than 15 seconds, or for longer than the time set for the Set Charge Masking Time item in the Personalization menu (see Section 2.5.8). Otherwise, the rectifier/battery charger operates at the float charge voltage only.

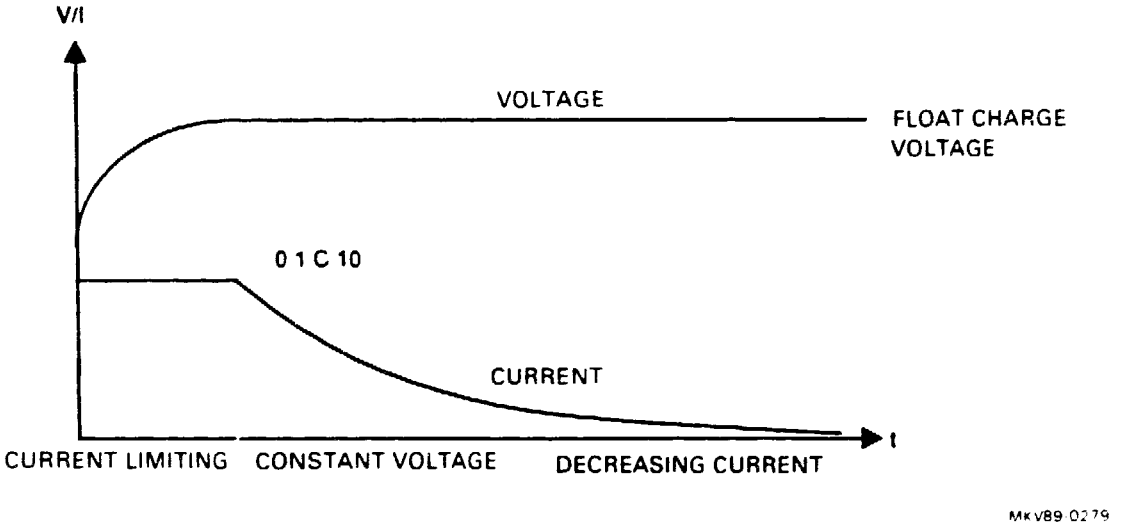
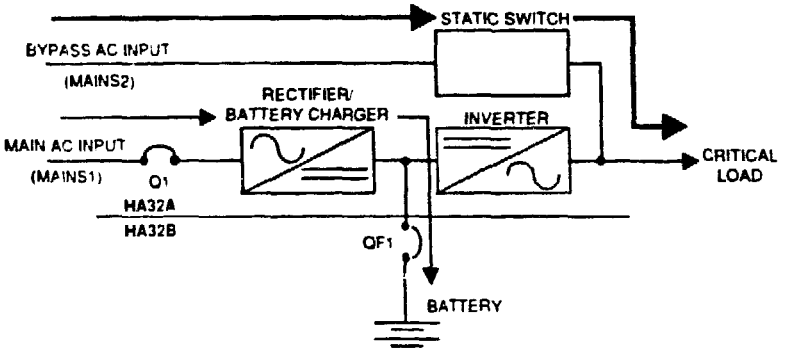


Figure 2–3 Two-Step Battery Charge Cycle

2.3.1.4 UPS Inverter Shutdown or Major Overload

In the event of a UPS inverter shutdown (either manually initiated by the user or caused by the UPS internal protective devices), the load is automatically transferred to the bypass ac input (MAINS2) power source without interruption of load power. The power flow for a UPS inverter shutdown or major overload is shown in Figure 2–4.



UPS INVERTER SHUTDOWN OR MAJOR OVERLOAD

- AC INPUT POWER AVAILABLE (1)
- OVERLOAD POWER SUPPLIED BY BYPASS AC INPUT (MAINS2) SOURCE VIA STATIC SWITCH
- INVERTER OFF
- INVERTER AUTOMATICALLY RESTARTS AS SOON AS OVERLOAD CLEARS
- TRANSFER OF LOAD TO AND FROM BYPASS AC INPUT (MAINS2) SOURCE OCCURS WITHOUT LOSS OF LOAD POWER

NOTE
IN THE EVENT THAT AN OVERLOAD OCCURS WHEN THE BYPASS AC INPUT (MAINS2) SOURCE IS NOT AVAILABLE THE UPS INVERTER WILL LIMIT THE OUTPUT CURRENT TO ITS 150% CURRENT RATING AT REDUCED VOLTAGE

Figure 2–4 UPS Inverter Shutdown or Major Overload Power Flow

In the event of a major overload transient (inrush condition) on the output of the UPS inverter, an immediate transfer of the load to the bypass ac input (MAINS2) power source takes place. The load is automatically returned to the UPS inverter output without interruption when the inrush condition is over. This operating mode allows startup of load devices demanding short-term, high inrush currents, provided that the UPS inverter is synchronized to the bypass ac input (MAINS2) power source.

The UPS inverter output is synchronized to the bypass ac input (MAINS2) power source when the following conditions are satisfied.

- Bypass voltage must be within ±10% of nominal value
- Bypass frequency must be within the frequency window selected (±0.25, ±0.5, ±0.75, or ±1.0 Hz)
- Bypass phase must be within 3° of the UPS inverter output

If an overload condition occurs and the UPS inverter output is not synchronized to the bypass ac input (MAINS2) power source, the UPS inverter will limit the output current at 150% of its full-load current rating for 0.2 seconds before shutting down and forcing an interrupted transfer of the load to the bypass ac input (MAINS2) power source.

For loads that exceed the UPS inverter full-load continuous rating (In), the time-current overload curve shown in Figure 2–5 applies. This curve is dependent upon the magnitude and duration of the overload. The UPS inverter provides full output voltage at 125% overload for 10 minutes or at 150% overload for 1 minute.

If a 125% overload still exists after 10 minutes or a 150% overload still exists after 1 minute, the static switch will transfer the load to the bypass ac input (MAINS2) power source. If the the 125% overload still exists after 10 minutes on bypass or the 150% overload still exists after 1 minute on bypass, the static switch will shut off and the load will be dropped.

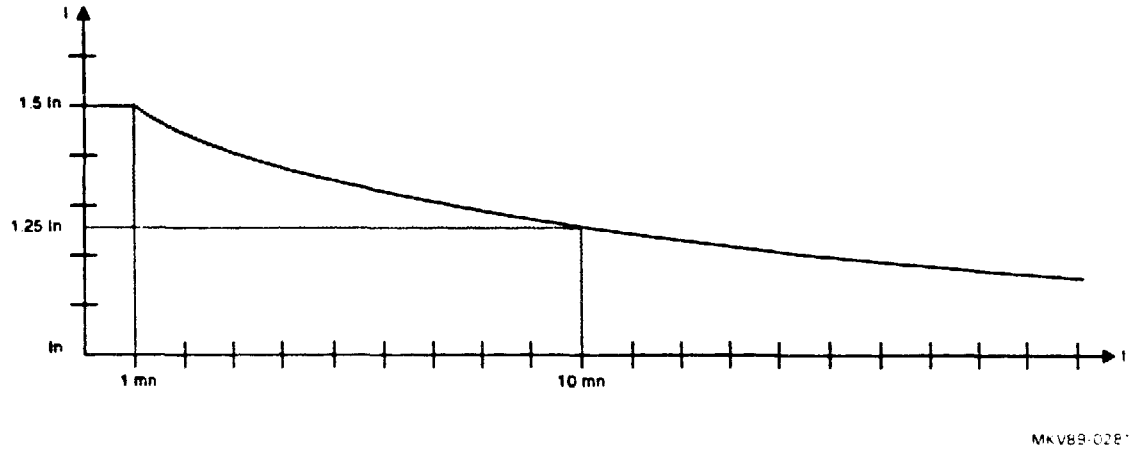


Figure 2–5 Overload Curve

2.3.2 Manual Operating Sequences

The six manual operating sequences are described in the following sections.

2.3.2.1 Rectifier/Battery Charger Start or Stop

This sequence is used to stop the rectifier/battery charger to force the UPS to on battery operation, and to start the rectifier/battery charger to return the UPS from on battery operation to normal operation. These operational sequences can be initiated by following the instructions in the Main Menu, item COMMANDS (see Section 2.5.6.1).

2.3.2.2 UPS Inverter Start or Stop

This sequence is used to stop the inverter to force the static switch to transfer the load to the bypass ac input (MAINS2) power source, and to start the inverter to return the UPS from bypass to normal operation. These operational sequences can be initiated by following the instructions in the Main Menu, item INVERTER ON/OFF (see Section 2.5.2).

2.3.2.3 UPS Manual Bypass

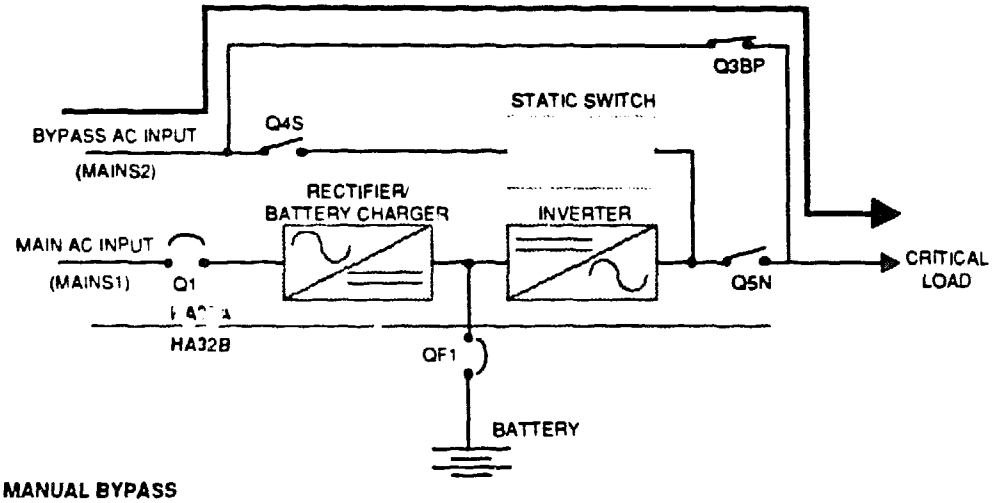
This sequence is used to manually transfer the load to the bypass ac input (MAINS2) power source to bypass the UPS circuits. This sequence should be initiated when problems with the rectifier/battery charger or static switch present the possibility of dropping power to the critical load. This operational sequence can be initiated by following the instructions in the Main Menu, item BYPASS PROCEDURE (see Section 2.5.5). The power flow for the UPS manual bypass is shown in Figure 2–6.

WARNINGS

The EPO keys and the REPO pushbutton will NOT remove output power from the UPS when the UPS is in manual bypass.

There are still high voltages present in the HA32A UPS cabinet with the UPS in manual bypass. DO NOT open the left door or remove any covers or protective panels when in manual bypass. In manual bypass, there is a difference of voltage potential between the modules mounted in the parasitic attenuator plate (static switch, rectifier/battery charger, inverter(s), and card module) and the UPS cabinet frame. Voltage is also present in the rectifier/battery charger circuits, on the cable entry area busbars (MAINS1, MAINS2, BATTERY, and OUTPUT), on the input and output terminals of circuit breaker Q1, on the input terminals of bypass switch Q4S, on the output terminals of output isolation switch Q5N, and on the input and output terminals of manual bypass switch Q3BP.

There is also high voltage present in the HA32B UPS Battery Cabinet when the UPS is in manual bypass. There is a difference of voltage potential between the battery circuit breaker QF1 terminals and the battery cabinet frame, and between the battery terminals and the UPS cabinet frame. There is also high voltage present on the input and output terminals of the battery circuit breaker QF1.



UPS MANUAL BYPASS

- AC INPUT POWER AVAILABLE
- LOAD POWER SUPPLIED BY BYPASS AC INPUT (MAINS2) POWER SOURCE

MKV89-0282

Figure 2–6 UPS Manual Bypass Power Flow

2.3.2.4 Returning the UPS to Normal Operation from Manual Bypass

To return to normal operation from manual bypass, press the Menu key and scroll down the menus available with the Scroll Down key until item number 5, BYPASS PROCEDURE, is displayed on the LCD. Press the 5 key and then select submenu number 2, RETURN TO UPS, by pressing the 2 key. Follow the instructions displayed on the LCD to transfer the UPS back on-line.

2.3.2.5 UPS Maintenance Bypass

This sequence is used to manually transfer the load to the bypass ac input (MAINS2) power source to bypass the UPS circuits when covers need to be removed for troubleshooting or repairing. This sequence should be initiated before the left door of the UPS or UPS Battery Cabinet is opened, and before any covers or protective panels are removed from the HA32A UPS or HA32B UPS Battery Cabinet. This sequence goes farther than manual bypass in removing voltage from the UPS cabinet. It eliminates the difference of voltage potential between the modules mounted in the parasitic attenuator plate (static switch, rectifier/battery charger, inverter(s), and card module) and the UPS cabinet frame, and the voltage in the rectifier/battery charger circuits.

This sequence also eliminates the difference of voltage potential between the battery circuit breaker QF1 terminals and the battery cabinet frame, the difference of voltage potential between the battery terminals and the UPS cabinet frame, and the voltage present on the output terminals of the battery circuit breaker QF1.

The power flow for the UPS maintenance bypass is the same as for manual bypass as shown in Figure 2–6.

WARNINGS

The EPO keys and the REPO pushbutton will NOT remove output power from the UPS when the UPS is in maintenance bypass.

There are still high voltages present in the HA32A UPS cabinet with the UPS in maintenance bypass. In maintenance bypass, there are high voltages on the cable entry area busbars (MAINS1, MAINS2, and OUTPUT), on the input terminals of circuit breaker Q1, on the input terminals of bypass switch Q4S, on the output terminals of output isolation switch Q5N, and on the input and output terminals of manual bypass switch Q3BP.

There is also high voltage present in the HA32B UPS Battery Cabinet on the battery terminals and on the input terminals of battery circuit breaker QF1.

Use the following procedure to place the UPS in maintenance bypass.

1. Press the Menu key to access the available menus.
2. Press the Scroll Down key four times and the LCD displays the following:

```
↑ 5    BYPASS PROCEDURE
↓ 6    COMMANDS
```

3. Press the 5 key to select menu item number five, BYPASS PROCEDURE, and the LCD displays the following:

```
1    SW TO MAN BY-PASS
2    RETURN TO UPS
```

4. Press the 1 key to start the process of switching to manual bypass and the LCD displays the following:

```
STOP THE INVERTER
0=STOP
```

5. Press the 0 key and then the Enter key to stop the inverter. The following screens are displayed on the LCD:

```
* * CHECKING * *
* * * * * *

COMMAND ACCEPTED
```

6. At this time the inverter turns off. The load is transferred to the bypass ac input (MAINS2) source. The green "inverter" LED goes off and the green "load on bypass" LED goes on. The audible alarm sounds and the red Alarm LED flashes. The LCD displays the following:

```
CLOSE BY-PASS SW.
ITEM:  Q3BP
```

7. Close the manual bypass switch Q3BP. The LCD displays the following:

```
OPEN MAINS2 SWITCH
ITEM:  Q4S
```

8. Open the bypass ac input (MAINS2) switch Q4S. The green "load on bypass" LED goes off and the LCD displays the following:

```
OPEN OUTPUT SWITCH
ITEM:  Q5N
```

9. Open the UPS output isolation switch Q5N and the LCD displays the following:

```
END OF PROCEDURE


1    SW TO MAN BY-PASS
2    RETURN TO UPS
```

10. Press the Enter key and then the Menu key to access the available menus.
11. Press the Scroll Down key four times and the LCD displays the following:

```
↑ 5    BYPASS PROCEDURE
↓ 6    COMMANDS
```

12. Press the 6 key to select menu item number six, COMMANDS, and the LCD displays the following:

```
  CHARGER
↓ 0=STOP   1=START ___
```

13. Press the 0 key and then the Enter key to stop the rectifier/battery charger. The LCD displays the following screens and the green "rectifier/battery charger" LED goes off when the second screen is displayed.

```
* * CHECKING * *
* * * * *


COMMAND ACCEPTED


CHARGER
0=STOP   1=START ___
```

14. Open the UPS Battery Cabinet circuit breaker QF1.

15. Open the UPS main ac input circuit breaker Q1.

The UPS is now in maintenance bypass and the left door can be opened, the top or rear covers can be removed, and the protective panels can be removed on the UPS or UPS Battery Cabinet for troubleshooting and repair purposes.

WARNINGS

There are still high voltages present in the HA32A UPS cabinet with the UPS in maintenance bypass. In maintenance bypass, there are high voltages on the cable entry area busbars (MAINS1, MAINS2, and OUTPUT), on the input terminals of circuit breaker Q1, on the input terminals of bypass switch Q4S, on the output terminals of output isolation switch Q5N, and on the input and output terminals of manual bypass switch Q3BP.

There is also high voltage present in the HA32B UPS Battery Cabinet on the battery terminals and on the input terminals of battery circuit breaker QF1.

2.3.2.6 Returning the UPS to Normal Operation from Maintenance Bypass

Before returning the UPS to normal operation from maintenance bypass, the left door, all covers, and all protective panels on the UPS and UPS Battery Cabinet should be closed and replaced to avoid exposure to high voltages.

Use the following procedures to return the UPS to normal operation from maintenance bypass.

1. Close the UPS main ac input circuit breaker Q1. This causes the HA32A UPS power supply to turn on and the UPS monitor to become active.
2. The red Alarm LED flashes and the following language selection screens scroll vertically on the LCD until one language is selected.

```
1    ENGLISH
2    FRANCAIS


2    FRANCAIS
3    DEUTSCH


3    DEUTSCH
4    ESPANOL


4    ESPANOL
5    ITALIANO
```

3 Press the number key that corresponds to the language desired (press the 1 key to select English) and the LCD displays the following:

```
* * CHECKING * *
* * * * *
```

4. After a few seconds the LCD displays the following:

```
↓    TEST POSITION
```

5. Press the Menu key and the LCD displays the following:

```
  1   START-UP
↓ 2   INVERTER ON/OFF
```

6. Press the 1 key to select menu item number one, START-UP, and the LCD displays the following:

```
CLOSE OUTPUT SWITCH
ITEM:  Q5N
```

7. Close the output isolation switch Q5N and the LCD displays the following:

```
CLOSE MAINS2 SWITCH
ITEM:  Q4S
```

8. Close the bypass ac input (MAINS2) switch Q4S. The green "load on bypass" LED goes on and the LCD displays the following:

```
OPEN BY-PASS SWITCH
ITEM:  Q3BP
```

9. Open the manual bypass switch Q3BP and the LCD displays the following:

```
START THE CHARGER
1 = START          ___
```

10. To start the rectifier/battery charger press the 1 key and then the Enter key. The following three screens are displayed on the LCD and the green "rectifier/battery charger" LED goes on when the third screen is displayed.

```
RESET FAULTS
```

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

11. After the command to start the charger is accepted and the green "rectifier/battery charger" LED goes on, the LCD displays the following:

```
CLOSE BAT. BREAKER
ITEM:  QF1
```

12. Close the battery circuit breaker QF1 located inside the UPS Battery Cabinet right door. The audible alarm sounds once every three seconds and the LCD displays the following:

```
START THE INVERTER
1 = START
```

13. To start the inverter press the 1 key and then the Enter key. The following five screens are displayed on the LCD:

```
RESET FAULTS
```

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

```
END OF PROCEDURE
```

```
  1     START-UP
↓ 2     INVERTER ON/OFF
```

14. After the command to start the inverter is accepted, the inverter starts, the green "inverter" LED goes on, the green "load on bypass" LED goes off, the audible alarm silences, and the flashing red Alarm LED goes off.

15. Press the Enter key and the LCD displays the following screen to indicate that the HA32A UPS has been returned to its normal operating condition.

```
NORMAL OPERATION
LOAD ON UPS
```

2.4 SYSTEM STATUS AND CONTROL PANEL (SS&CP)

The SS&CP is located on the upper right portion of the HA32A UPS enclosure. The SS&CP is shown in Figure 2–7, and its elements are described in the following text.

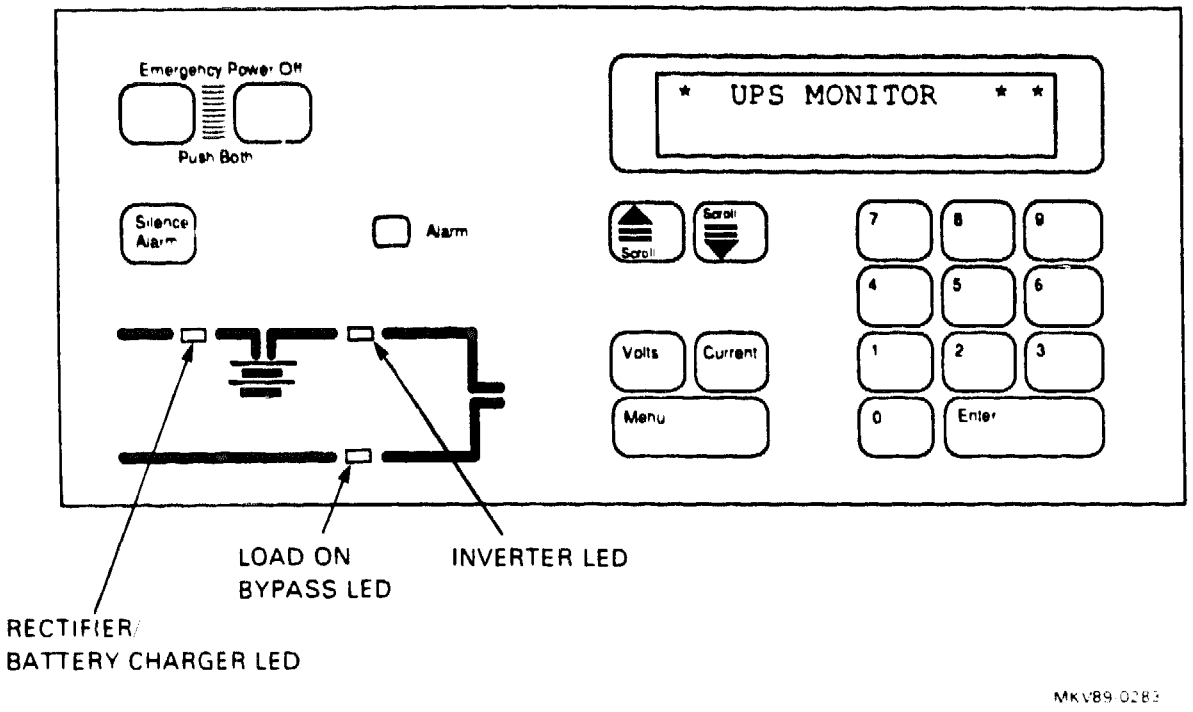


Figure 2–7 System Status and Control Panel (SS&CP)

Liquid Crystal Display (LCD)

The liquid crystal display (LCD) consists of two lines, 20 characters per line. It is used to display measurements, startup and operating procedures, diagnostics, and alarm messages. The LCD contrast can be adjusted to suit the viewing environment by accessing the DISPLAY CONTRAST Menu (Section 2.5.3).

Silence Alarm Key

The Silence Alarm key is used to silence the audible alarm.

Scroll Up/Down Keys

The Scroll Up/Down keys allow the operator to scroll up or down menus on the LCD. When arrows appear on the left side of the LCD, additional text is available that can be viewed by pressing either the Scroll Up or Scroll Down key.

Ten Digit (0 To 9) Keys

These ten digit keys are used to select menus, select items from menus, and to enter or change system settings. When the LCD prompt indicates that a number is to be entered, press the appropriate number key. The number appears on the right side of the LCD. All entries can be modified by re-entering the numbers as long as they have not been validated by pressing the Enter key. If the number has been validated by pressing the Enter key, then the operational sequence must be repeated to change the number.

Volts Key

The Volts key is used to display submenus that can be used to monitor:

- UPS input voltage (MAINS1)
- UPS inverter voltage (UPS output)
- DC bus voltage (battery)
- Bypass ac input voltage (MAINS2)

Figure 2–8 shows how to access the submenus and what data is displayed for each.

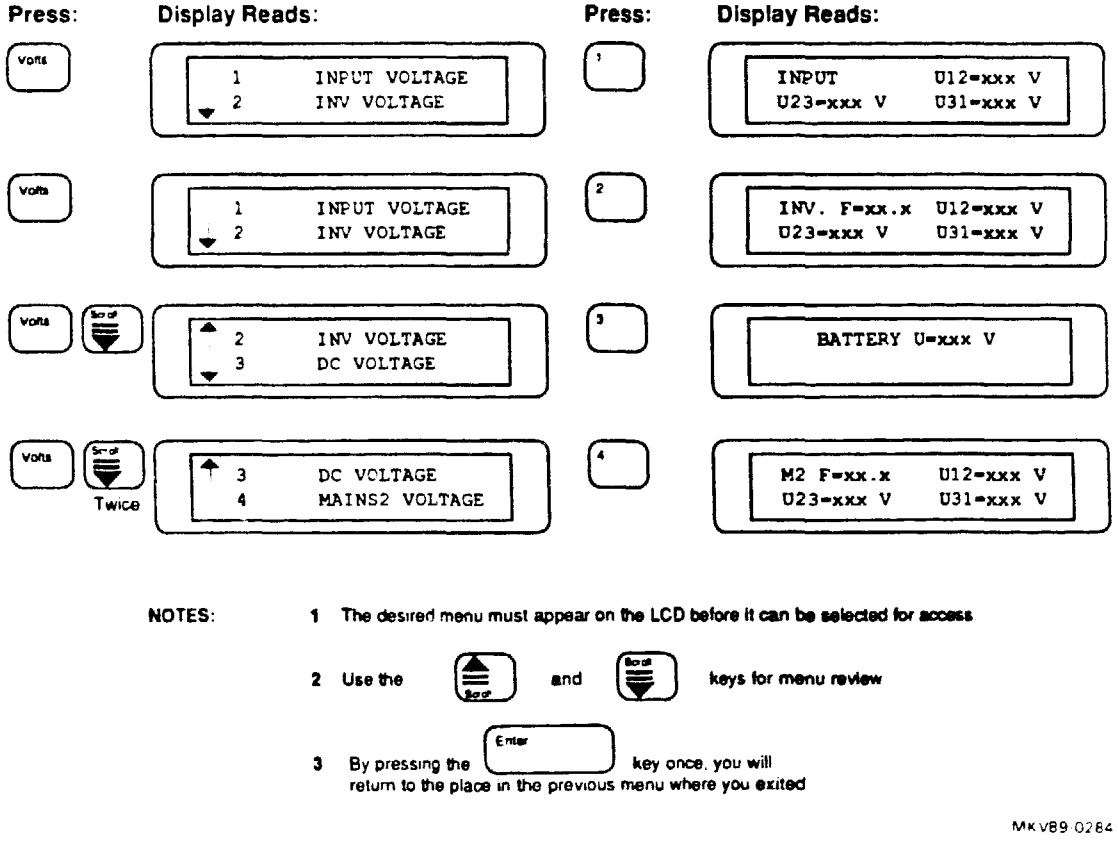


Figure 2–8 Voltage Measurements

Current Key

The Current key is used to display submenus that can be used to monitor:

- UPS input current (MAINS1)
- UPS inverter current (UPS output)
- Battery current [negative current (-) indicates battery discharging; positive current (+) indicates battery charging]
- Bypass ac input current (MAINS2)

Figure 2–9 shows how to access the submenus and what data is displayed for each.

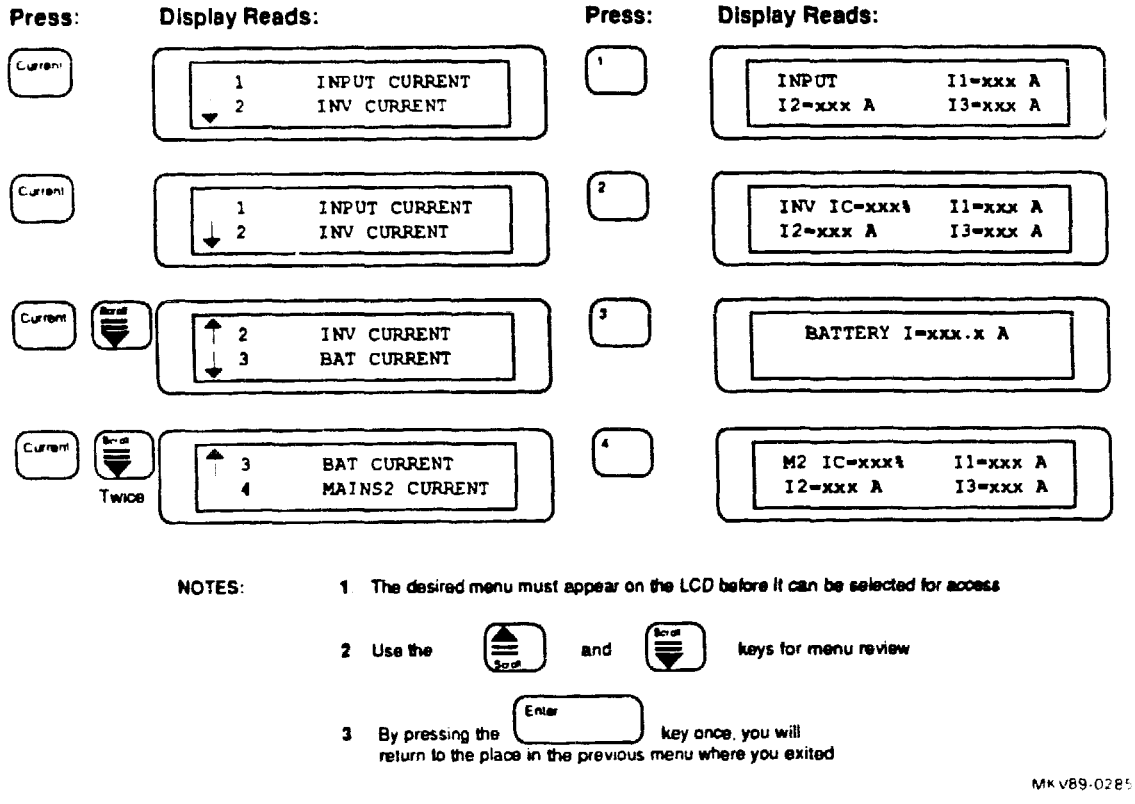


Figure 2–9 Current Measurements

Menu Key

The Menu key is used to return the operator to the Main Menu display. If an error is made while working with the HA32A UPS, pressing the Menu key twice always returns the operator to the Main Menu.

Enter Key

The Enter key is used to validate an entry or to return to the exited place in the previous menu.

Emergency Power Off (EPO) Keys

The two EPO keys must be pressed simultaneously to initiate an EPO shutdown. When an EPO shutdown is initiated, the main ac input (MAINS1) circuit breaker Q1 is opened, the bypass ac input (MAINS2) switch Q4S is turned off, the battery circuit breaker QF1 (located in the UPS Battery Cabinet) is opened, and the load power is disconnected.

Indicators

There are four LED indicators on the SS&CP that are used to monitor the status of the HA32A UPS. The LED indicators and their functions are given below.

Alarm LED (Red) – The red Alarm LED flashes to indicate that a major or minor alarm condition has occurred. The condition that caused the alarm is shown on the LCD. The Scroll Up and Scroll Down keys are used to review all alarm conditions.

Rectifier/Battery Charger LED (Green) – The green "rectifier/battery charger" LED is lit when the rectifier/battery charger is operating.

Inverter LED (Green) – The green "inverter" LED is lit when the inverter is supplying power to the load.

Load On Bypass LED (Green) – The green "load on bypass" LED is lit when the bypass ac input (MAINS2) source is supplying power to the load.

2.5 UPS MONITOR AND MENUS

The UPS monitor is a firmware package that allows the operator to interact with the HA32A UPS. The UPS monitor is menu driven to perform a function. The operator chooses the appropriate menu and then selects the desired function from the menu.

NOTE

If a UPS Auxiliary Cabinet with an input isolation transformer is installed, circuit breaker CB1 on the UPS Auxiliary Cabinet must be turned on before the UPS can be powered up.

When the HA32A UPS is powered up, the following language selection screens will scroll vertically on the LCD until one language is selected.

```
1     ENGLISH
2     FRANCAIS

2     FRANCAIS
3     DEUTSCH

3     DEUTSCH
4     ESPANOL

4     ESPANOL
5     ITALIANO
```

To select a language, press the number key that corresponds to the language desired (press the 1 key to select English). The desired language does not need to be shown on the LCD to make the selection, nor does the Enter key need to be pressed to validate the entry.

After the language selection is made, the LCD displays the following:

```
* * CHECKING * *
* * * * *
```

After a few seconds, the LCD automatically displays the following during startup:

```
↓     TEST POSITION
```

The UPS monitor consists of the nine menus that are listed below and described in the following sections.

- Menu 1 - START-UP
- Menu 2 - INVERTER ON/OFF
- Menu 3 - DISPLAY CONTRAST
- Menu 4 - BATT TRANS. TEST
- Menu 5 - BYPASS PROCEDURE
- Menu 6 - COMMANDS
- Menu 7 - DIAGNOSIS
- Menu 8 - PERSONALIZATION
- Menu 9 - COMMUNICATION

When the Menu key is pressed the first two menu items are displayed on the LCD. The Scroll Up and Scroll Down keys can be used to manually scroll through the available menus. To select a menu, press the number key that corresponds to the desired menu number (for example; press the 1 key for the START-UP menu) only when the desired menu is displayed on the LCD.

Use the following procedure to display and scroll through the available menu items.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the Scroll Down key twice and the LCD displays the following:

```
↑ 3    DISPLAY CONTRAST
↓ 4    BATT TRANS. TEST
```

3. Press the Scroll Down key twice more and the LCD displays the following:

```
↑ 5    BYPASS PROCEDURE
↓ 6    COMMANDS
```

4. Press the Scroll Down key twice more and the LCD displays the following:

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

5. Press the Scroll Down key once more and the LCD displays the following:

```
↑ 8    PERSONALIZATION
  9    COMMUNICATION
```

2.5.1 START-UP Menu

The START-UP menu is used to return the HA32A UPS to normal operation after it has been completely powered down or after it has been placed in maintenance bypass. The step-by-step procedure for returning the HA32A UPS to normal operation after being placed in maintenance bypass is given in Section 2.3.2.6.

The following procedure is for accessing and stepping through the START-UP menu.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the 1 key to select menu item number one, START-UP, and the LCD displays the following:

```
CLOSE OUTPUT SWITCH
ITEM:  Q5N
```

3. Close the output isolation switch Q5N and the LCD displays the following:

```
CLOSE MAINS2 SWITCH
ITEM:  Q4S
```

4. Close the bypass ac input (MAINS2) switch Q4S. The green "load on bypass" LED goes on and the LCD displays the following:

```
START THE CHARGER
1 = START          ___
```

5. To start the rectifier/battery charger press the 1 key and then the Enter key. The following three screens are displayed on the LCD and the green "rectifier/battery charger" LED goes on when the third screen is displayed

```
RESET FAULTS
```

```
* * CHEC ING * *
* * * * *
```

```
COMMAND ACCEPTED
```

6. After the command to start the charger is accepted and the green "rectifier/battery charger" LED goes on, the LCD displays the following:

```
CLOSE BAT. BREAKER
ITEM:  QF1
```

7. Close the battery circuit breaker QF1 located inside the UPS Battery Cabinet right door. The audible alarm sounds once every three seconds and the LCD displays the following:

```
START THE INVERTER
1 = START      ____
```

8. To start the inverter press the 1 key and then the Enter key. The following five screens are displayed on the LCD:

```
RESET FAULTS


* * CHECKING * *
* * * * *


COMMAND ACCEPTED


END OF PROCEDURE


  1     START-UP
↓ 2     INVERTER ON/OFF
```

9. After the command to start the inverter is accepted, the inverter starts, the green "inverter" LED goes on, the green "load on bypass" LED goes off, the audible alarm silences, and the flashing red Alarm LED goes off.

10. Press the Enter key and the LCD displays the following screen to indicate that the HA32A UPS has been returned to its normal operating condition.

```
NORMAL OPERATION
LOAD ON UPS
```

2.5.2 INVERTER ON/OFF Menu

The INVERTER ON/OFF menu is used to stop the inverter and force the static switch to transfer the load to the bypass ac input (MAINS2) power source, or to start the inverter and return the UPS from bypass to normal operation.

The following procedure is for accessing and going through the INVERTER ON/OFF menu.

1. Press the Menu key and the LCD displays the following:

```
  1     START-UP
↓ 2     INVERTER ON/OFF
```

2. Press the 2 key to select menu item number two, INVERTER ON/OFF, and the LCD displays the following:

```
INVERTER
0=STOP   1=START  ____
```

3. To start the inverter, press the 1 key and then the Enter key. The following three screens are displayed on the LCD and the green "inverter" LED goes on when the second screen is displayed.

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

```
INVERTER
0=STOP   1=START  ____
```

If the inverter is commanded to start with the rectifier/battery charger off, the LCD will display the following message and the rectifier/battery charger must be started (see Section 2.5.6) before the inverter can be started.

```
COMMAND REJECTED
CHARGER OFF
```

4. To stop the inverter, press the 0 key and then the Enter key. The following three screens are displayed on the LCD. The green "inverter" LED goes off and the green "load on bypass" LED goes on when the second screen is displayed.

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

```
INVERTER
0=STOP   1=START  ____
```

If the inverter is commanded to stop during nonsynchronous operation, the LCD will display the following screens and the inverter must be forced off (see Section 2.5.6). The static switch is inhibited during nonsynchronous operation. When the inverter is forced off, the load will transfer to the bypass ac input (MAINS2) with a 200 to 800 millisecond break.

```
MAINS2 OUT OF SPEC
INV STOP INHIBITED


INV FORCED STOP
0=NO    1=YES    ___
```

5. Press the Enter key to return to the menu display.

2.5.3 DISPLAY CONTRAST Menu

The DISPLAY CONTRAST menu allows the operator to adjust the contrast of the LCD so that it can be easily read under different room lighting conditions.

The following procedure is for accessing and going through the DISPLAY CONTRAST menu.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the Scroll Down key twice and the LCD displays the following:

```
↑ 3    DISPLAY CONTRAST
↓ 4    BATT TRANS. TEST
```

3. Press the 3 key to select menu item number three, DISPLAY CONTRAST, and the LCD displays the following:

```
↑ -    CONTRAST
↓ +
```

4. Press the Scroll Up key to decrease the contrast (lighten the LCD) or the Scroll Down key to increase the contrast (darken the LCD).
5. Press the Enter key to return to the menu display.

2.5.4 BATT TRANS. TEST Menu

The BATT TRANS. TEST menu allows the operator to simulate an input power failure by turning off the rectifier/battery charger and allowing the inverter to operate from battery power for two minutes, then returning the UPS to normal operation.

This test is only possible if the battery has been charged for at least 10 hours. The bypass ac input (MAINS2) source frequency and voltage must also be within the prescribed limits for a no-break transfer to the bypass ac input (MAINS2) source in case of a battery problem.

If this test is attempted and the battery has been discharged within the last 10 hours, the following message will be displayed on the LCD:

```
BATTERY RECHARGE
MINI AUTO = X MN
```

The following procedure is for accessing and going through the BATT TRANS. TEST menu.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the Scroll Down key twice and the LCD displays the following:

```
↑ 3    DISPLAY CONTRAST
↓ 4    BATT TRANS. TEST
```

3. Press the 4 key to select menu item number four, BATT TRANS. TEST, and the LCD displays the following:

```
STOP THE CHARGER
0 = STOP
```

4. Press the 0 key and then the Enter key. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *


COMMAND ACCEPTED


BATTERY TEST
AUTO=XX MN   Ub=XXX V
```

5. When the command to stop the rectifier/battery charger is accepted, the green "rectifier/battery charger" LED goes off and the time remaining on battery operation and the battery voltage are displayed on the LCD.

6. When the test has completed successfully the LCD displays the following:

```
BATTERY OK

RESET FAULTS


COMMAND ACCEPTED


* * CHECKING * *
* * * * *

↑ 3    DISPLAY CONTRAST
↓ 4    BATT TRANS. TEST
```

2.5.5 BYPASS PROCEDURE Menu

The BYPASS PROCEDURE menu is used to manually transfer the load to the bypass ac input (MAINS2) source without interruption to the load, and for the reverse transfer of the load back to the UPS inverter output.

If the bypass ac input (MAINS2) source is out of tolerance, these transfers will result in a 200 to 800 millisecond load interruption and can be performed only with a FORCED STOP command (see Section 2.5.6.4). The FORCEL STOP command can be issued only after entering the two-digit password.

The following procedure is for accessing and going through the BYPASS PROCEDURE menu.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the Scroll Down key four times and the LCD displays the following:

```
↑ 5    BYPASS PROCEDURE
↓ 6    COMMANDS
```

3. Press the 5 key to select menu item number five, BYPASS PROCEDURE, and the LCD displays the following:

```
1    SW TO MAN BY-PASS
2    RETURN TO UPS
```

To Transfer To Manual Bypass

4. To transfer to manual bypass, press the 1 key and the LCD displays the following:

```
STOP THE INVERTER
0 = STOP
```

5. Press the 0 key and then the Enter key. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *


COMMAND ACCEPTED

CLOSE BY-PASS SW
ITEM:  Q3BP
```

6. When the command to stop the inverter is accepted, the inverter turns off, the green "inverter" LED goes off, the green "load on bypass" LED goes on, the audible alarm activates, and the red Alarm LED flashes.

7. Close the manual bypass switch Q3BP. The LCD displays the following:

```
OPEN MAINS2 SWITCH
ITEM:  Q4S
```

8. Open the bypass ac input (MAINS2) switch Q4S. The green "load on bypass" LED goes off and the LCD displays the following:

```
OPEN OUTPUT SWITCH
ITEM:  Q5N
```

9. Open the output isolation switch Q5N. The LCD displays the following:

```
END OF PROCEDURE


1     SW TO MAN BY-PASS
2     RETURN TO UPS
```

To Return To Inverter

10. To return the UPS to normal (inverter) operation, press th 2 key and the LCD displays the following:

```
CLOSE OUTPUT SWITCH
ITEM:  Q5N
```

11. Close the output isolation switch Q5N. The LCD displays the following:

```
CLOSE MAINS2 SWITCH
ITEM:  Q4S
```

12. Close the bypass ac input (MAINS2) switch Q4S. The green "load on bypass" LED goes on and the LCD displays the following:

```
OPEN BY-PASS SWITCH
ITEM:  Q3BP
```

13. Open the manual bypass switch Q3BP. The audible alarm activates and the LCD displays the following:

```
START INVERTER
1 = START
```

14. Press the 1 key and then the Enter key. The LCD displays the following screens:

```
RESET FAULTS


* * CHECKING * *
* * * * *


COMMAND ACCEPTED


END OF PROCEDURE


1     SW TO MAN BY-PASS
2     RETURN TO UPS
```

15. When the command to start the inverter is accepted, the inverter turns on, the green "inverter" LED goes on, the green "load on bypass" LED goes off, the audible alarm silences, and the red Alarm LED goes off.

16. Press the Enter key and the LCD displays the following:

```
↑ 5     BYPASS PROCEDURE
↓ 6     COMMANDS
```

17. Press the Enter key again and the LCD displays the following screen to indicate that the UPS has returned to normal operation:

```
NORMAL OPERATION
LOAD ON UPS
```

2.5.6 COMMANDS Menu

The COMMANDS menu is used to initiate the following operations:

- Rectifier/battery charger start and stop
- Inverter start and stop
- Reset faults stored in memory
- Synchronous/nonsynchronous UPS inverter operation
- Boost charging of the battery
- Equalization charging of the battery
- Selection of the display language

After accessing the COMMANDS menu, use the Scroll Up and Scroll Down keys to select the desired command. While the selected command is being executed, the LCD displays the following two screens:

```
* * CHECKING * *
* * * * *


COMMAND ACCEPTED
```

The following procedure is for accessing and going through the COMMANDS menu.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the Scroll Down key four times and the LCD displays the following:

```
↑ 5    BYPASS PROCEDURE
↓ 6    COMMANDS
```

3. Press the 6 key to select menu item number six, COMMANDS, and the LCD displays the first available command operation.

2.5.6.1 Rectifier/Battery Charger Start and Stop

Use the following procedure to access the rectifier/battery charger start and stop command.

1. When the COMMANDS menu is accessed by pressing the 6 key, the first command available is the rectifier/battery charger start and stop command, and the LCD displays the following:

```
  CHARGER
↓ 0=STOP  1=START  ___
```

2. To start the rectifier/battery charger, press the 1 key and then the Enter key. To stop the rectifier/battery charger, press the 0 key and then the Enter key.

2.5.6.2 Inverter Start and Stop

Use the following procedure to access the inverter start and stop command.

1. After accessing the COMMANDS menu, press the Scroll Down key until the LCD displays the following:

```
↑ INVERTER
↓ 0=STOP  1=START  ___
```

2. To start the inverter, press the 1 key and then the Enter key. To stop the inverter, press the 0 key and then the Enter key.

2.5.6.3 Resetting Faults Stored In Memory

Use the following procedure to access the resetting faults stored in memory command.

1. After accessing the COMMANDS menu, press the Scroll Down key until the LCD displays the following:

```
↑ RESET FAULTS
↓ 1=YES  ___
```

2. To reset faults stored in memory, press the 1 key and then the Enter key.

2.5.6.4 Synchronous/Nonsynchronous Operation

Synchronizing and desynchronizing the inverter requires the entry of a two-digit password. If an error is made when entering the password, the UPS monitor will allow the password to be re-entered.

NOTE

The two-digit password will not appear on the LCD.

CAUTION

The !LOAD INTERRUPT! message indicates that the load power will be interrupted for a minimum of 200 milliseconds. Be certain that the load can tolerate this interruption.

NOTE

When the UPS inverter is operated in nonsynchronous mode in relation to the bypass ac input (MAINS2) source, operation of the static switch is inhibited.

Use the following procedure to access the synchronous/nonsynchronous operation command.

1. After accessing the COMMANDS menu, press the Scroll Down key until the LCD displays the following:

```
↑ MAINS2 UNSYNCHRON.
↓ PASSWORD?  _ _
```

2. Enter the password by pressing the 1 key, the 9 key, and then the Enter key. The LCD displays the following:

```
MAINS2 UNSYNCHRON.
0=NO  1=YES        ___
```

3. For synchronous operation, press the 0 key and then the Enter key. For nonsynchronous operation, press the 1 key and then the Enter key.
4. After the Unsync Decision screen appears, the LCD displays the following:

```
↑ MAINS2 UNSYNCHRON.
↓ PASSWORD?  _ _
```

2.5.6.5 Battery Boost Charge

Use the following procedure to access the boost charging of the battery command.

1. After accessing the COMMANDS menu, press the Scroll Down key until the LCD displays the following:

```
↑ BAT BOOSTING
↓ 1=YES        ___
```

2. To apply boost charge voltage to the battery, press the 1 key and then the Enter key.

2.5.6.6 Battery Equalization Charge

Use the following procedure to access the equalization charging of the battery command.

1. After accessing the COMMANDS menu, press the Scroll Down key until the LCD displays the following:

```
↑ BATT. EQUALIZATION
↓ 0=NO  1=YES      ___
```

2. To continue without applying an equalization charge voltage to the battery, press the 0 key and then the Enter key.

3. To apply an equalization charge voltage to the battery, press the 1 key and then the Enter key. Since the inverter must be shut down to apply an equalization charge voltage to the battery, the LCD displays the following.

```
STOP THE INVERTER
0=STOP          ___
```

4. Press the 0 key and then the Enter key. The inverter stops and equalization charging of the battery begins.

2.5.6.7 Language Selection

Use the following procedure to access the language selection command.

1. After accessing the COMMANDS menu, press the Scroll Down key until the LCD displays the following:

```
↑ LANGUAGE?
↓ 1=ENGLISH     ___
```

2. To select English as the display language, press the 1 key and then the Enter key. If English is not the desired language, press the Scroll Down key and the LCD displays the following:

```
↑ LANGUAGE?
↓ 2=FRANCAIS    ___
```

3. To select French as the display language, press the 2 key and then the Enter key. If French is not the desired language, press the Scroll Down key and the LCD displays the following:

```
↑ LANGUAGE?
↓ 3=DEUTSCH     ___
```

4. To select German as the display language, press the 3 key and then the Enter key. If German is not the desired language, press the Scroll Down key and the LCD displays the following:

```
↑ LANGUAGE?
↓ 4=ESPANOL     ___
```

5. To select Spanish as the display language, press the 4 key and then the Enter key. If Spanish is not the desired language, press the Scroll Down key and the LCD displays the following:

```
↑ LANGUAGE?
↓ 5=ITALIANO    ___
```

6. To select Italian as the display language, press the 5 key and then the Enter key.

2.5.7 DIAGNOSIS Menu

The DIAGNOSIS menu is used to initiate the standard self-test routine that is built into the UPS.

The following procedure is for accessing and going through the DIAGNOSIS menu.

1. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

2. Press the Scroll Down key six times and the LCD displays the following:

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

3. Press the 7 key to select menu item number seven, DIAGNOSIS, and the LCD displays the following:

```
STOP THE INVERTER
FOR SELF-TEST


STOP THE INVERTER
0 = STOP          ___
```

4. Press the 0 key and then the Enter key. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *


COMMAND ACCEPTED
```

5. When the command to stop the inverter is accepted, the inverter turns off, the green "inverter" LED goes off, the green "load on bypass" LED goes on, the audible alarm activates, the red Alarm LED flashes, and the LCD displays the following screens:

```
STOP THE CHARGER
FOR SELF-TEST


STOP THE CHARGER
0=STOP            ___
```

6. Press the 0 key and then the Enter key. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *


COMMAND ACCEPTED
```

7. When the command to stop the rectifier/battery charger is accepted, the rectifier/battery charger turns off, the green "rectifier/battery charger" LED goes off, and the LCD displays the following:

```
Q1 SWITCH CLOSED?
ITEM:  Q1  OK=1    _
```

8. If the main ac input (MAINS1) circuit breaker Q1 is closed, press the 1 key and then the Enter key. The LCD displays the following:

```
Q4S SWITCH CLOSED?
ITEM:  Q4S  OK=1    _
```

9. If the bypass ac input (MAINS2) switch Q4S is closed, press the 1 key and then the Enter key. The LCD displays the following:

```
NOTE THE ALARMS
THEN PUSH ON      ←┘

                ALARMS
↓          INVERTER OFF
```

10. Press the Scroll Down key twice and the LCD displays the following:

```
↑          INVERTER OV OR UV
↓          K3N IS OPEN
```

11. Press the Scroll Down key twice more and the LCD displays the following:

```
↑           CHARGER OFF
          INV PHASE OUT TOL
```

12. The five alarms shown in the previous three LCD screens are normal alarm conditions that should appear for the present status of the UPS (both the inverter and rectifier/battery charger are off). If any other alarm conditions are displayed, immediate action should be taken to correct them before continuing (see Chapter 5).

    After viewing all of the alarm conditions, press the Enter key. The LCD displays the following screens:

```
* * SELF-TESTING * *
* * * * *

SELF TEST RESULT:
LOGIC OK          ←┘
```

13. Press the Enter key and the LCD displays the following screens:

```
ANALOG TEST
PCB AQCX


ANALOG TEST
PCB AQOX


START THE CHARGER
1=START
```

14. Press the 1 key and then the Enter key to start the rectifier/battery charger. The LCD displays the following screens:

```
RESET FAULTS


* * CHECKING * *
* * * * *


COMMAND ACCEPTED
```

15. When the command to start the rectifier/battery charger is accepted, the rectifier/battery charger turns on, the green "rectifier/battery charger" LED goes on, and the LCD displays the following:

```
START THE INVERTER
1=START
```

16. Press the 1 key and then the Enter key to start the inverter. The LCD displays the following screens:

```
RESET FAULTS


* * CHECKING * *
* * * * *


COMMAND ACCEPTED
```

17. When the command to start the inverter is accepted, the inverter turns on, the green "inverter" LED goes on, the green "load on bypass" LED goes off, the audible alarm silences, the red Alarm LED goes off, and the LCD displays the following screens:

```
END OF PROCEDURE


↑ 6     COMMANDS
↓ 7     DIAGNOSIS
```

18. Press the Enter key and the LCD displays the following screen to indicate that the UPS has returned to normal operation.

```
NORMAL OPERATION
LOAD ON UPS
```

2.5.8 PERSONALIZATION Menu

The PERSONALIZATION menu allows access to routines that tailor the operation of the UPS to the specific installation. This menu contains two groups of items for configuring the UPS to the specific installation.

The first group consists of items 1 through 20 and can be accessed by using the keys on the SS&CP and the four-digit password (1024).

The second group consists of items 21 through 31 and can be accessed by using the keys on the SS&CP and the four-digit password (1024) only after connecting an HA32A service key to plug XM1306 on the FILO board. Connecting the HA32A service key requires that the UPS be placed in maintenance bypass, that the top cover of the HA32A UPS be removed, that the cable from the RS232 board to plug XM1306 on the FILO board be disconnected, that the HA32A service key be connected to plug XM1306 on the FILO board, and that the main ac input circuit breaker Q1 be turned back on.

After setting the first 20 items or the last 11 items, press the Enter key when the last item of the group is shown on the LCD to load the parameters that were changed.

When any board that contains a microprocessor (AQCx, AQOx, CHAP, ODUP, or CANU) is replaced, the PERSONALIZATION menu must be accessed, the first 20 items must be stepped through, and the Enter key must be pressed to refresh the new board. When the display module (containing the AFIP board) is replaced, the HA32A service key is required and all 31 items must be stepped through and set to the correct values for the specific installation.

NOTES

Items 21 through 31 in the PERSONALIZATION menu are preset at the factory and should only be accessed and changed if the display module is replaced. If the display module is replaced, items 21 through 31 must be set before setting items 1 through 20.

After making a change for a personalization item, the Enter key must be pressed to store the new value

Table 2–1 contains a list of all the personalization item names, their normal settings, and the available settings for each item.

Table 2–1 PERSONALIZATION Menu Items

Number	Name	Normal Setting	Available Settings
Accessed Through the SS&CP Using the Four-Digit Password			
1	Sealed Battery	1=Yes	0=No 1=Yes
2	Battery Autonomy	Nominal protection time of the UPS Battery Cabinet that is installed (see Table 2–2).	005 = 5 minutes 015 = 15 minutes 030 = 30 minutes
3	Float Voltage	Determined by the number of batteries per string in the UPS Battery Cabinet (see Table 2–2).	409 for 30 batteries 423 for 31 batteries 436 for 32 batteries
4	Boost Voltage	Determined by the number of batteries per string in the UPS Battery Cabinet (see Table 2–2).	409 for 30 batteries 423 for 31 batteries 436 for 32 batteries
5	Equalization Voltage	Determined by the number of batteries per string in the UPS Battery Cabinet (see Table 2–2).	409 for 30 batteries 423 for 31 batteries 436 for 32 batteries
6	Charge Time	24 hours	6 to 68 hours
7	Charge Masking Time	015 seconds	015 to 180 seconds
8	Boost Charge Current	Determined by the HA32B UPS Battery Cabinet model number.	See Table 2–2.
9	Inverter Voltage	Determined by the HA32A UPS output voltage rating.	208 Vac ±3% (202 to 214 Vac) 220 Vac ±3% (213 to 227 Vac) 480 Vac ±3% (465 to 495 Vac)
10 to 14	External Contact	0	0=Not Used (item 10) 1=Independent Inverter Frequency (item 11) 2=Generator Set Power Limit (item 12) 3=Gradual Charger Stop (item 13) 4=Inverter Forced (item 14)
15	Generator Set Power Limit	Determined by the output power rating of the backup generator or the UPS unit.	A kVA value determined by the output power rating of the backup generator if item 12 was selected for the external contact response. A kVA value determined by the output power rating of the UPS unit if item 12 was not selected for the external contact response.
16	Fan Type	1=Type 2	0=Type 1 1=Type 2
17	Remote Control	0=No	0=No 1=Yes
18	Telemonitor	Determined by whether or not a Remote Status Panel is installed.	0=No 1=Yes
19	Select RS232 (PCB DISO)	1=Yes	0=No 1=Yes
20	Options	0=No	0=No 1=Yes

Table 2–1 (Cont.) PERSONALIZATION Menu Items

Number	Name	Normal Setting	Available Settings
Accessed Through the SS&CP Using the Four-Digit Password with the HA32A Service Key Connected			
21	Charger Input Tolerance	1=-15%	0=-10% 1=-15%
22	Output Frequency	1=60 Hz	0=50 Hz 1=60 Hz
23	UPS Nominal Power	Determined by kVA rating of the HA32A UPS.	020, 040, 060, or 080 kVA
24	Limit Masked	1=3 ms	0=0 ms 1=3 ms
25	Battery Connected	1=Yes	0=No 1=Yes
26	Synchro Range	1=0.5 Hz	0=0.25 Hz 1=0.5 Hz 2=0.75 Hz 3=1.0 Hz
27	Bypass	1=Yes	0=No 1=Yes
28	MAINS2 208-600V	Determined by the output voltage rating of the HA32A UPS.	208 to 600 Vac
29	EPS	0=No	0=No 1=Yes
30	MAINS1 208-600V	Determined by the input voltage rating of the HA32A UPS.	208 to 600 Vac
31	Input Frequency	1=60 Hz	0=50 Hz 1=60 Hz

To use the PERSONALIZATION menu, both the inverter and the rectifier/battery charger must be shut down.

2.5.8.1 Accessing Items 1 Through 20

Access the PERSONALIZATION menu by pressing the Menu key and then pressing the Scroll Down key six times. The LCD displays the following:

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

Press the 8 key and the LCD displays the following:

```
PASSWORD?
— — — —
```

Enter the four-digit password (1024) by pressing the 1 key, the 0 key, the 2 key, the 4 key, and then the Enter key.

If the UPS has been placed in maintenance bypass and then Q1 has been turned back on, when the PERSONALIZATION menu is accessed the LCD will display the first personalization item (Sealed Battery) screen. If the PERSONALIZATION menu is accessed from a normal load on UPS condition, the LCD will step the operator through the process of shutting down the inverter and rectifier/battery charger by displaying the following:

```
STOP THE INVERTER
0=STOP          —
```

Press the 0 key and then the Enter key to stop the inverter. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

When the command to stop the inverter is accepted, the inverter turns off, the green "inverter" LED goes off, the green "load on bypass" LED goes on, the audible alarm activates, the red Alarm LED flashes, and the LCD displays the following screen:

```
STOP THE CHARGER
0=STOP          —
```

Press the 0 key and then the Enter key to stop the rectifier/battery charger. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

When the command to stop the rectifier/battery charger is accepted, the rectifier/battery charger turns off, the green "rectifier/battery charger" LED goes off, and the LCD displays the first personalization item (Sealed Battery) screen.

Select Sealed Battery

```
SEALED BATT. =1
↓ 0=NO  1=YES    _
```

Digital only uses sealed batteries, so sealed batteries should be selected by pressing the 1 key and then the Enter key. If wet cell batteries were being used, NO should be selected by pressing the 0 key and then the Enter key.

Set Battery Autonomy

After selecting sealed batteries, press the Scroll Down key and the LCD displays the following:

```
↑ BATTERY AUTONOMY
↓ TIME=xxx n  _ _ _ n
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys (005, 015, or 030) that correspond to the nominal protection time of the specific UPS Battery Cabinet that is installed, and then press the Enter key.

When the UPS goes on battery operation, the battery autonomy and countdown are displayed on the LCD. This is a display only and does not indicate the actual time remaining for battery operation. A more accurate indication of the time remaining for battery operation is obtained by using the Volts key to display the dc voltage (battery voltage). The inverter will shut down when the battery voltage drops to 325 Vdc. When the battery voltage drops to 335 Vdc, the time remaining for battery operation is approximately one minute.

Set Float Voltage

After entering the three-digit battery autonomy, press the Scroll Down key and the LCD displays the following:

```
↑ FLOAT VOLTAGE
↓ U=xxxV  U=_ _ _ V
```

The UPS monitor expects three digits to be entered on the numbered keys. Float voltage must be specified if wet cell batteries are being used.

If an attempt is made to set the float voltage when sealed batteries are being used (when the answer to personalization item 1, sealed batteries, was YES), the LCD will display the following:

```
ERROR ENTRY
U=xxxV   U=xxxV
```

Set Boost Voltage

After accessing the float voltage display, press the Scroll Down key and the LCD displays the following:

```
↑  BOOST VOLTAGE
↓  U=xxxV  U=_ _ _ V
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys that correspond to the voltage specified (see Table 2–1) for the number of batteries per string in the UPS Battery Cabinet that is installed, and then press the Enter key.

When using sealed batteries, the float, boost, and equalization voltage are all set for the same value. When the boost voltage is set, the float voltage and the equalization voltage automatically change to the boost voltage entry.

Set Equalization Voltage

After entering the three-digit boost voltage value, press the Scroll Down key and the LCD displays the following:

```
↑  EQUAL. VOLTAGE
↓  U=xxxV  U=_ _ _ V
```

The UPS monitor expects three digits to be entered on the numbered keys. Equalization voltage must be specified if wet cell batteries are being used.

If an attempt is made to set the equalization voltage when sealed batteries are being used (when the answer to personalization item 1, sealed batteries, was YES), the LCD will display the following:

```
  ERROR ENTRY
U=xxxV   U=xxxV
```

Set Charge Time

After accessing the equalization voltage display, press the Scroll Down key and the LCD displays the following:

```
↑  CHARGE  8-68 hrs
↓  TIM=xxh  TIM=_ _ h
```

The UPS monitor expects two digits to be entered on the numbered keys. Press the two number keys that correspond to the desired charge time, and then press the Enter key (Digital recommends that the charge time be set to 24 hours).

The charge time is the number of hours that the rectifier/battery charger maintains the batteries on boost voltage before returning to the normal float voltage.

Set Charge Masking Time

After entering the two-digit charge time value, press the Scroll Down key and the LCD displays the following:

```
↑  TIMER  15-180 s
↓  TIM=xxxs  TIM=_ _ _ s
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys (015) that correspond to the desired charge masking time, and then press the Enter key (Digital recommends that the charge masking time be set for 15 seconds).

The charge masking time is the time, in seconds, that an ac power outage can last without the rectifier/battery charger applying boost voltage to the batteries when the main ac input (MAINS1) power is restored. The time is selectable in 15 second increments.

Set Boost Charge Current

After entering the three-digit charge masking time value, press the Scroll Down key and the LCD displays the following:

```
↑  BOOST CHARGE I MAX
↓  Ib=xxA  Ib=_ _ A
```

The UPS monitor expects two digits to be entered on the numbered keys. Press the two number keys that correspond to the recommended boost charge current, and then press the Enter key. The boost charge current is determined by the HA32B UPS Battery Cabinet model number (see Table 2–2).

Set Inverter Voltage

After entering the two-digit boost charge current value, press the Scroll Down key and the LCD displays the following:

```
↑  INVERTER VOLTAGE
↓  U=xxxV  U=_ _ _ V
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys that correspond to the HA32A UPS output voltage rating, and then press the Enter key.

This entry is used to fine adjust the inverter output voltage. The entry made can be ±3% of the nominal UPS output voltage rating (see Table 2–1). If a value outside the ±3% range is entered, the LCD will display the following:

```
ERROR ENTRY
U=xxxV    U=xxxV
```

Table 2–2 Available Boost Charge Current Settings

UPS Battery Cabinet Model Number	kVA Rating	Approximate Protection Time In Minutes	Boost Charge Current In Amperes	No. of Batteries Per String YUASA (Johnson Control)
HA32B-AH	20	5	03	32 (32)
HA32B-CH	20	15	03	32 (32)
HA32B-FH	20	30	06	32 (32)
HA32B-AK	40	5	03	32 (32)
HA32B-CK	40	15	06	32 (32)
HA32B-FK[1]	40	30	11	32 (32)
HA32B-AM	60	5	06	32 (32)
HA32B-CM	60	15	07	31 (32)
HA32B-FM[1]	60	30	15	31 (32)
HA32B-AN	80	5	07	31 (32)
HA32B-CN[1]	80	15	11	32 (32)
HA32B-FN[1]	80	30	15	31 (32)

[1]Consists of two battery cabinets that are connected in parallel.

Select External Contact Response

After entering the three-digit inverter voltage value, press the Scroll Down key and the LCD displays the following:

```
↑ EXT. CONTACT=x __
↓ 0=NOT USED
```

If the customer has not connected an external dry (normally open) contact to TB2-9 and TB2-10 in the HA32A UPS cabinet, press the 0 key and then the Enter key.

If an external dry contact has been connected, one of the following four options can be selected to be performed when the contact is closed.

Pressing the Scroll Down key when the above screen is displayed causes the LCD to display the following:

```
↑ EXT. CONTACT=x __
↓ 1=INDEPEND INV FRE
```

To select inverter free running as the action that will occur when the external contact is closed, press the 1 key and then the Enter key.

The output frequency of the inverter normally follows the frequency of the bypass ac input (MAINS2) source. If this option is selected, when the external contact is closed, the inverter output frequency will be set to a constant 60 Hz.

If the inverter free running option is not desired, press the Scroll Down key and the LCD will display the following:

```
↑ EXT. CONTACT=x __
↓ 2=GEN SET POW LIMI
```

To select generator set power limit as the action that will occur when the external contact is closed, press the 2 key and then the Enter key. Selecting this option requires that an entry be made for PERSONALIZATION menu item 15, set generator power limit, to specify the amount of power that can be drawn from the generator.

This option limits the amount of power (kVA) that can be drawn from an external source such as a backup generator. If a 30 kVA backup generator is used to provide power to a 40 kVA UPS when electrical power is lost, this option could be selected and the external contact could be set to close when the generator comes on. Item 15, set generator power limit, would be set to 30 kVA. If power was lost, the generator would go on and the power drawn from the generator by the UPS would be limited to the 30 kVA entered for item 15. The remaining 10 kVA would be provided by the batteries if it was needed.

If the generator set power limit option is not desired, press the Scroll Down key and the LCD will display the following:

```
↑ EXT. CONTACT=x __
↓ 3=GRAD CHARG STOP
```

To select gradual charger shutdown as the action that will occur when the external contact is closed, press the 3 key and then the Enter key.

If this option is selected, when the external contact is closed, the rectifier/battery charger will gradually shut down and the UPS will run on the batteries.

If the gradual charger shutdown option is not desired, press the Scroll Down key and the LCD will display the following:

```
↑ EXT. CONTACT=x __
↓ 4=INVERTER FORCED
```

To select inverter forced transfer as the action that will occur when the external contact is closed, press the 4 key and then the Enter key.

If this option is selected, when the external contact is closed, the inverter will be forced to go on if the bypass ac input (MAINS2) is missing.

Set Generator Power Limit

After selecting one of the five options for the external contact response, press the Scroll Down key and the LCD displays the following:

```
↑ GEN SET POWER LIMI
↓ P=xxxKva P=_ _ _Kva
```

The UPS monitor expects three digits to be entered on the numbered keys. If option 2, generator set power limit, was chosen as the action for the external contact response, press the three number keys that correspond to the output power rating of the backup generator (for example; 030 for 30 kVA), and then press the Enter key.

If option 2, generator set power limit, was not chosen as the action for the external contact response, press the three number keys that correspond to the output power rating of the HA32A UPS (for example; 080 for a 80 kVA unit), and then press the Enter key.

Set Fan Type

After entering the three-digit kVA power value, press the Scroll Down key and the LCD displays the following:

```
↑ FAN TYPE =x __
↓ 0=TYPE1 1=TYPE2
```

Select fan TYPE2 by pressing the 1 key and then the Enter key.

Select Remote Control

After selecting fan TYPE2, press the Scroll Down key and the LCD displays the following:

```
↑ REM CONTROL = x
↓ 0=NO 1=YES __
```

Select the NO response by pressing the 0 key and then the Enter key.

Select Telemonitor

After selecting the NO response for remote control, press the Scroll Down key and the LCD displays the following:

```
↑ TELEMONITOR = x __
↓ 0=NO 1=YES
```

If a Remote Status Panel is installed, press the 1 key and then the Enter key. If a Remote Status Panel is not installed, press the 0 key and then the Enter key.

Select RS232

After selecting the correct response for telemonitor, press the Scroll Down key and the LCD displays the following:

```
↑ PCB DISC  x
↓ 0=NO  1=YES
```

To enable the RS-232 port option, press the 1 key and then the Enter key (Digital recommends that the RS-232 port option always be enabled).

Options

After selecting the correct response for RS232, press the Scroll Down key and the LCD displays the following:

```
↑ OPTIONS
  0=NO  1=YES
```

When this screen is displayed, press the Enter key to load the parameters that were changed, and the following screens are displayed on the LCD:

```
* * CHECKING * *
* * * * *
```

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

Press the 1 key to select the START-UP menu and bring the UPS back on-line.

2.5.8.2 Accessing Items 21 Through 31

To access items 21 through 31 of the PERSONALIZATION menu, an HA32A service key must be connected to plug XM1306 on the FILO board.

To connect the HA32A service key, place the HA32A UPS in maintenance bypass (see Section 2.3.2.5) and remove the top cover from the HA32A UPS cabinet.

Disconnect the cable attached to plug XM1306 on the FILO board and connect the cable from the HA32A service key to this plug.

Turn the main ac input circuit breaker Q1 on and select the language.

After the UPS has run self-tests, access the PERSONALIZATION menu by pressing the Menu key and then pressing the Scroll Down key six times. The LCD displays the following:

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

Press the 8 key and the LCD displays the following:

```
PASSWORD?
_ _ _ _
```

Enter the four-digit password (1024) by pressing the 1 key, the 0 key, the 2 key, the 4 key, and then the Enter key. The LCD displays the following first personalization item (Sealed Battery) screen:

```
SEALED BATT. =1
0=NO  1=YES   _
```

At this point there are two ways to access items 21 through 31.

The first way is to use the Scroll Down key to step through the first 20 items until item 20 (Options) is displayed, and then press the Enter key. The UPS loads the parameters for the first 20 items and then displays the screen for item 21.

The second way is to simply press the Enter key while the screen for item 1 is being displayed. The UPS loads the parameters for the first 20 items and then displays the screen for item 21.

With the HA32A service key connected, after loading the parameters for the first 20 items, the LCD displays the following:

Select Charger Input Tolerance

```
  CH. INPUT TOL=1 _
↓ 0=-10%  1=-15%
```

A charger input tolerance of -15% is selected by pressing the 1 key and then the Enter key. A charger input tolerance of -10% is selected by pressing the 0 key and then the Enter key.

The charger input tolerance determines the point at which the rectifier/battery charger will shut off when the main ac input (MAINS1) voltage decreases during a brownout or blackout. It also determines the point at which the rectifier/battery charger will come back on when the main ac input (MAINS1) voltage is restored. Digital recommends that -15% tolerance be selected. When the input voltage drops below -15% of the nominal input voltage value, the rectifier/battery charger will shut off and the UPS will go on battery operation. When the input voltage increases above -15% of the nominal input voltage value, the rectifier/battery charger will come back on and the UPS will go back to normal operation.

Select Output Frequency

After selecting -15% charger input tolerance, press the Scroll Down key and the LCD displays the following:

```
↑ OUTPUT FREQ. 60 _
↓ 0=50Hz  1=60Hz
```

Press the 1 key to select 60 Hz and then press the Enter key.

Set UPS Nominal Power

After selecting 60 Hz for the output frequency, press the Scroll Down key and the LCD displays the following:

```
↑  UPS NOMINAL POWER
↓  P=xxxKva P=_ _ _Kva
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys that correspond to the output power rating of the HA32A UPS that is installed, and then press the Enter key.

This entry determines and sets the input current limit, the quick overload setting, ($\geq$ 155%) the slow overload settings (125% for 10 minutes or 150% for 1 minute), the output load percentage indication, and the 101% to 124% overload alarm.

Set Limit Mask

After entering the UPS nominal power, press the Scroll Down key and the LCD displays the following:

```
↑  LIMIT MASKED = x  _
↓  0=0ms   1=3ms
```

A limit mask of 0 ms is selected by pressing the 0 key and then the Enter key. A limit mask of 3 ms is selected by pressing the 1 key and then the Enter key.

The limit mask selected determines the spike width that is tolerated on the output current waveform. This is normally set to 3 ms.

Select Battery Connected

After selecting the limit mask, press the Scroll Down key and the LCD displays the following:

```
↑  BATT. CONNECTED=1  _
↓  0=NO   1=YES
```

Since all UPS systems require a UPS Battery Cabinet, the yes answer (indicating that a UPS Battery Cabinet is connected) is selected by pressing the 1 key and then the Enter key.

Select Synchro Range

After selecting the YES answer for battery connected, press the Scroll Down key and the LCD displays the following:

```
↑ SYNCHRO RANGE = 1 _
↓ 0=0.25Hz  1=0.5Hz
```

This screen allows a synchro range choice of 0.25 Hz or 0.5 Hz. A synchro range of 0.5 Hz is the normal setting and is selected by pressing the 1 key and then the Enter key. If these selections are not desired, press the Scroll Down key and the LCD displays the following:

```
↑ SYNCHRO RANGE = 1 _
↓ 2=0.75Hz  3=1.0Hz
```

This screen allows a synchro range choice of 0.75 Hz or 1.0 Hz.

The synchro range determines the frequency window for the bypass ac input. The inverter output frequency is normally synchronized to the bypass ac input frequency. If the bypass ac input frequency goes outside the synchro range (±0.5 Hz), the inverter output frequency will synchronize to a free running oscillator frequency of 60 Hz.

Select By-Pass

After selecting the synchro range, press the Scroll Down key and the LCD displays the following:

```
↑ BY-PASS = 1 _
↓ 0=NO  1=YES
```

This display is asking whether a bypass ac input (MAINS2) source is connected to the UPS. Since a bypass ac input (MAINS2) source is required, the yes answer is selected by pressing the 1 key and then the Enter key.

Set Bypass Input Voltage

After selecting the YES answer for bypass, press the Scroll Down key and the LCD displays the following:

```
↑ MAINS2  208-600 V
↓ U=xxxV  U=_ _ _V
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys that correspond to the bypass ac input (MAINS2) voltage (same as the output voltage rating) of the HA32A UPS that is installed, and then press the Enter key.

This entry sets up the coarse bypass and inverter output voltage. It also sets the parameters for the bypass overvoltage and undervoltage detection. The inverter voltage entry (item 9) is used to fine adjust the bypass and inverter output voltage.

Select EPS

After entering the three-digit bypass input voltage value, press the Scroll Down key and the LCD displays the following:

```
↑ EPS = 0 _
↓ 0=NO  1=YES
```

The NO answer should always be selected for this item by pressing the 0 key and then the Enter key.

Set Main Input Voltage

After selecting the NO answer for EPS, press the Scroll Down key and the LCD displays the following:

```
↑ MAINS1  208-600 V
↓ U=xxxV  U=_ _ _V
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys that correspond to the main ac input (MAINS1) voltage of the HA32A UPS that is installed, and then press the Enter key.

This entry sets up the main ac input (MAINS1) voltage of the UPS unit. It also sets the parameters for the main ac input overvoltage (+10%) and undervoltage (-15%) detection. If a main ac input overvoltage or undervoltage condition is detected, the rectifier/battery charger will shut off and the UPS will go on battery operation.

Set Main Input Frequency

After entering the three-digit main input voltage value, press the Scroll Down key and the LCD displays the following:

```
↑ INPUT FREQ. = 60 _
  0=50Hz   1=60Hz
```

Press the 1 key to select 60 Hz and then press the Enter key.

This entry sets up the main ac input (MAINS1) frequency of the UPS unit. It also sets the parameters for the main ac input overfrequency and underfrequency detection. If a main ac input overfrequency or underfrequency condition is detected, the rectifier/battery charger will shut off and the UPS will go on battery operation.

When this screen is displayed, press the Enter key to load the parameters that were changed, and the following screen is displayed on the LCD:

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

Turn the main ac input circuit breaker Q1 off.

Disconnect the HA32A service key cable from plug XM1306 on the FILO board and reconnect the cable that was originally connected to plug XM1306.

Replace the top cover on the HA32A UPS.

Return the UPS to normal operation from maintenance bypass (see Section 2.3.2.6).

2.5.9 COMMUNICATION Menu

The COMMUNICATION menu is used to enter the interface parameters that allow the RS-232 option in the HA32A UPS to communicate with a computer system.

To use the COMMUNICATION menu, both the inverter and the rectifier/battery charger must be shut down.

Access the COMMUNICATION menu by pressing the Menu key and then pressing the Scroll Down key seven times. The LCD displays the following:

```
↑ 8     PERSONALIZATION
  9     COMMUNICATION
```

Press the 9 key and the LCD displays the following:

```
PASSWORD?
_ _ _ _
```

Enter the four-digit password (1024) by pressing the 1 key, the 0 key, the 2 key, the 4 key, and then the Enter key.

When the COMMUNICATION menu is accessed from a normal load on UPS condition, the LCD steps the operator through the process of shutting down the inverter and rectifier/battery charger by displaying the following:

```
STOP THE INVERTER
0=STOP          _
```

Press the 0 key and then the Enter key to stop the inverter. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *
```

```
COMMAND ACCEPTED
```

When the command to stop the inverter is accepted, the inverter turns off, the green "inverter" LED goes off, the green "load on bypass" LED goes on, the audible alarm activates, the red Alarm LED flashes, and the LCD displays the following screen:

```
STOP THE CHARGER
0=STOP          _
```

Press the 0 key and then the Enter key to stop the rectifier/battery charger. The LCD displays the following screens:

```
* * CHECKING * *
* * * * *

COMMAND ACCEPTED
```

When the command to stop the rectifier/battery charger is accepted, the rectifier/battery charger turns off, the green "rectifier/battery charger" LED goes off, and the LCD displays the first communication item (Select Channel) screen.

Select Channel

```
  1  CHANNEL  1
↓ 2  CHANNEL  2
```

Press the Scroll Down key and the LCD displays the following:

```
↑ 2  CHANNEL  2
  3  CHANNEL  3
```

The RS-232 option contains three channels for communication. To select the desired channel, press the 1 key for CHANNEL 1, or the 2 key for CHANNEL 2, or the 3 key for CHANNEL 3, and then the Enter key. Programming information is the same for all three channels. If using Remote Environmental Monitoring Software (REMS), CHANNEL 1 must be selected.

Select UPS Number

After selecting the desired channel, the LCD displays the following:

```
  UPS NUMBER 0-255
↓ NO=xxx  NO=_ _ _
```

The UPS monitor expects three digits to be entered on the numbered keys. Press the three number keys that correspond to the unit number that is to be assigned to the HA32A UPS, and then press the Enter key. If using Remote Environmental Monitoring Software (REMS), UPS NUMBER 001 must be selected.

Select Baud Rate

After entering the three-digit unit number value, press the Scroll Down key and the LCD displays the following:

```
↑ SPEED=xxxx BD __
↓ 0=75/1200
```

This screen and the following three screens are used to select the baud rate. Press the Scroll Down key and the LCD displays the following:

```
↑ SPEED=xxxx BD __
↓ 1=1200/75
```

Press the Scroll Down key and the LCD displays the following:

```
↑ SPEED=xxxx BD __
↓ 2=75     3=300
```

Press the Scroll Down key and the LCD displays the following:

```
↑ SPEED=xxxx BD __
↓ 4=600    5=1200
```

When the desired baud rate is displayed on the LCD, press the number key (0 through 5) that corresponds to the selected baud rate, and then press the Enter key. If using Remote Environmental Monitoring Software (REMS), item 5 must be selected to establish a baud rate of 1200.

Set Data Bits

After selecting the baud rate, press the Scroll Down key and the LCD displays the following:

```
↑ 7 OR 8 BITS ?
↓ NB BITS = x __
```

Select 7 data bits by pressing the 7 key and then the Enter key. Select 8 data bits by pressing the 8 key and then the Enter key. If using Remote Environmental Monitoring Software (REMS), 8 data bits must be selected.

Set Stop Bits

After selecting 7 or 8 data bits, press the Scroll Down key and the LCD displays the following:

```
↑ 1 OR 2 STOP BITS ?
↓ NB BITS = x __
```

Select 1 stop bit by pressing the 1 key and then the Enter key. Select 2 stop bits by pressing the 2 key and then the Enter key. If using Remote Environmental Monitoring Software (REMS), 1 stop bit must be selected.

Set Parity

After selecting the stop bits, press the Scroll Down key and the LCD displays the following:

```
↑ PARITY = x _
↓ 0=NO PARITY
```

If no parity is desired, press the 0 key and then the Enter key. If using Remote Environmental Monitoring Software (REMS), NO PARITY must be selected. If this is not the desired parity selection, press the Scroll Down key and the LCD displays the following:

```
↑ PARITY = x _
↓ 1=ODD PARITY
```

If odd parity is desired, press the 1 key and then the Enter key. If this is not the desired parity selection, press the Scroll Down key and the LCD displays the following:

```
↑ PARITY = x _
↓ 2=EVEN PARITY
```

If even parity is desired, press the 2 key and then the Enter key.

Set Modem Type

After selecting the desired parity, press the Scroll Down key and the LCD displays the following:

```
↑ MODEM TYPE = x _
↓ 0=MODEM NOT USED
```

If a modem is not used, press the 0 key and then the Enter key. If using Remote Environmental Monitoring Software (REMS), MODEM NOT USED must be selected. If a modem is used, use the Scroll Down key to display the following three screens:

```
↑ MODEM TYPE = x _
↓ 1=MANUAL MODEM
```

```
↑ MODEM TYPE = x _
↓ 2=AUTO CALL MODEM
```

```
↑ MODEM TYPE = x _
↓ 3=AUTO REPLY MODEM
```

If a modem is used, select the modem type by pressing the number key (1 through 3) that corresponds to the desired modem type, and then press the Enter key.

Set Dialogue Type

After selecting the modem type, press the Scroll Down key and the LCD displays the following:

```
↑ DIALOGUE TYPE=x _
↓ 0=FORCED DIAL
```

If forced dial dialogue is desired, press the 0 key and then the Enter key. If using Remote Environmental Monitoring Software (REMS), FORCED DIAL must be selected. If forced dial dialogue is not desired, press the Scroll Down key and the LCD displays the following:

```
↑ DIALOGUE TYPE=x _
↓ 1=DIAL ON EVENT
```

If dial on event dialogue is desired, press the 1 key and then the Enter key.

After selecting the dialogue type, press the Enter key and the LCD displays the following:

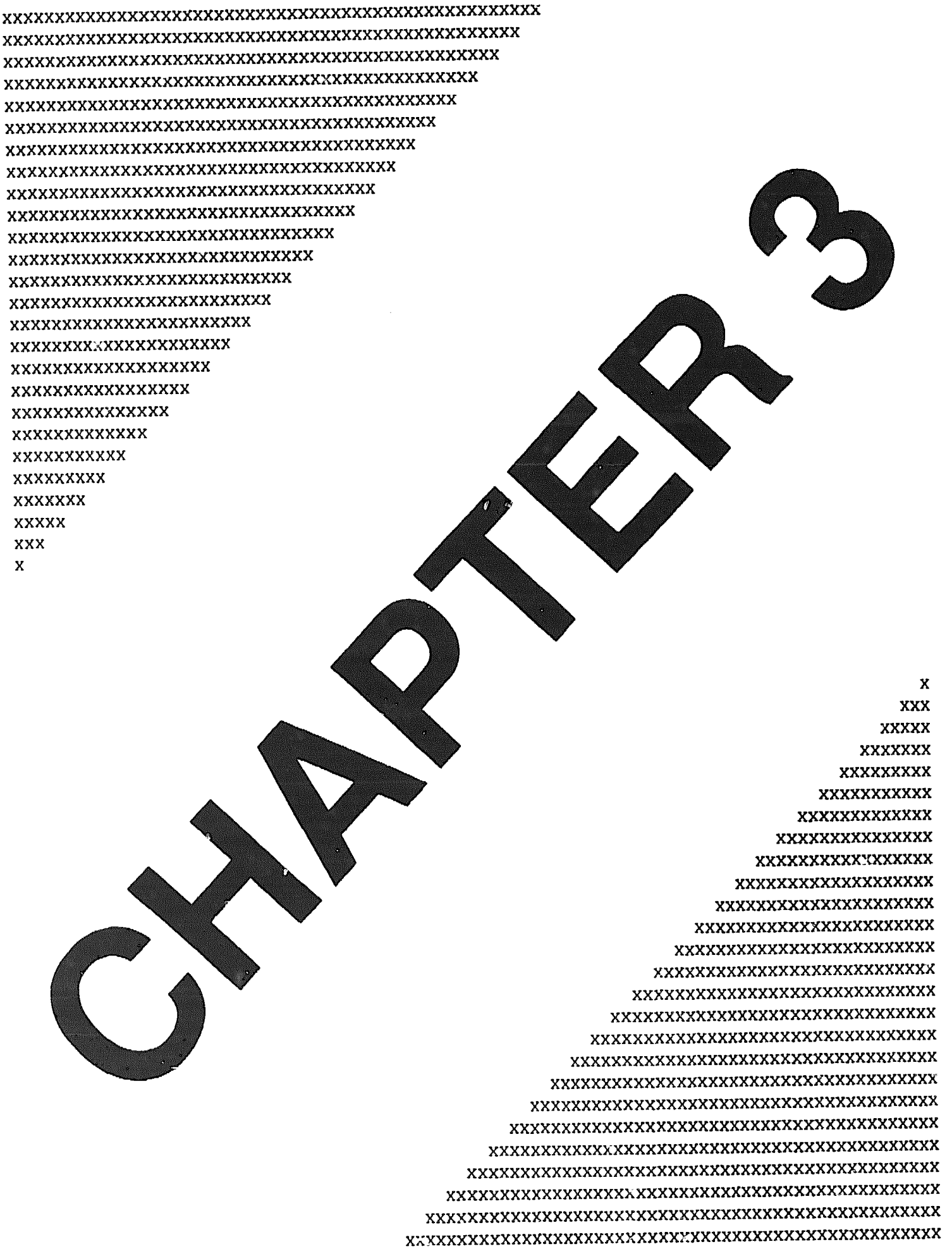
```
  1 CHANNEL 1
↓ 2 CHANNEL 2

↑ 8   PERSONALIZATION
  9   COMMUNICATION
```

Press the Menu key and the LCD displays the following:

```
  1   START-UP
↓ 2   INVERTER ON/OFF
```

Press the 1 key to select the START-UP menu and bring the UPS back on-line.


CHAPTER 3

3
INITIAL STARTUP

3.1 GENERAL

This chapter contains the initial startup procedure for the HA3000 Uninterruptible Power System and the optional UPS Auxiliary Cabinet, UPS Distribution Cabinet, Remote Status Panel, and Remote Emergency Power Off (REPO) switch. It contains the following information:

- The checks that must be made on each component of the HA3000 series UPS system prior to the HA32A UPS startup.
- The initial HA32A UPS startup procedure.
- The tests required after initial startup to ensure proper operation of the UPS system.

The checks before startup, the initial startup procedures, and the tests after startup that are given in this chapter should only be performed by a trained Digital Customer Services representative.

3.2 CHECKS BEFORE HA32A UPS STARTUP

The following sections contain the checks that should be made on the individual components of the HA3000 UPS system before applying power and performing the HA32A UPS startup procedures.

These checks are to be performed with all power removed.

WARNING

Before performing the checks in the following sections, have the customer's electrician ensure that all building source power has been removed from the UPS system.

Before making the checks on the individual components, make the following general checks:

- Ensure that the yellow caster assemblies have been removed from all of the installed cabinets.
- Ensure that there is a minimum two foot clearance between the rear of each cabinet and the wall.
- Ensure that there is a minimum four foot clearance in the front of the UPS Battery Cabinet, and a minimum three foot clearance in the front of all other cabinets.

- Ensure that the installation site temperature is in the recommended range of 0° to 40°C (32° to 104°F).
- Ensure that the bypass ac input (MAINS2) to the HA32A UPS is from a three phase Wye source.
- Ensure that proper grounding has been observed.

3.2.1 HA32A UPS Cabinet Checks

Use the following procedure to check the HA32A UPS before performing the startup procedures.

1. Use the allen key to open the right front door of the HA32A UPS.
2. Check the nameplate on the inside of the right front door of the HA32A UPS to ensure that the model number, input voltage rating, output voltage rating, and kVA rating are correct for the system being installed.
3. Ensure that circuit breaker Q1 and switches Q3BP, Q4S, and Q5N in the HA32A UPS cabinet are in the OFF position. Ensure that circuit breaker(s) QF1 behind the right front door of the UPS Battery Cabinet(s) is in the OFF position.
4. Remove the cable entry area cover panel in the HA32A UPS.
5. With a voltmeter on the ac voltage scale, measure between the phases on the main ac input (MAINS1), bypass ac input (MAINS2), and output bus bars to ensure that no voltage is present.
6. With a voltmeter on the dc voltage scale, measure between the positive and negative battery bus bars to ensure that no voltage is present.
7. Ensure that the main ac input (MAINS1) power cables have been properly connected and tightened.
8. Ensure that the bypass ac input (MAINS2) power cables have been properly connected and tightened.
9. Ensure that the output power cables have been properly connected and tightened.
10. Ensure that the positive, negative, and ground battery cables have been properly connected and tightened.
11. Ensure that the ground and neutral cables have been properly connected and tightened.
12. Ensure that the four control wires from TB1-1, TB1-2, TB1-4, and TB1-5 in the UPS Battery Cabinet are properly connected to TB1-1, TB1-2, TB1-4, and TB1-5 in the HA32A UPS cabinet and tightened.
13. If a UPS Auxiliary Cabinet with an input harmonic current filter or input isolation transformer is installed, ensure that the two control wires from TB3-1 and TB3-12 in the UPS Auxiliary Cabinet are properly connected to TB2-11 and TB2-12 in the HA32A UPS cabinet and tightened.
14. If a UPS Distribution Cabinet with an isolation/step-down transformer is installed, ensure that the two control wires from the temperature sensor in the UPS Distribution Cabinet transformer are properly connected to TB2-11 and TB2-12 in the HA32A UPS cabinet and tightened.

15. If a Remote Status Panel is installed, ensure that the wires from the Remote Status Panel are properly connected to TB3 in the HA32A UPS cabinet and tightened.
16. Ensure that the two wires from the Remote Emergency Power Off (REPO) switch are properly connected to TB2-7 and TB2-8 in the HA32A UPS cabinet and tightened.
17. If an external contact has been installed by the customer, ensure that the two wires from the contact are properly connected to TB2-9 and TB2-10 in the HA32A UPS cabinet and tightened.
18. Use a Phillips screwdriver to open the left front door on the HA32A UPS.
19. Remove the top and rear covers on the HA32A UPS.
20. Ensure that the air filter has been properly installed under the HA32A UPS.
21. Remove the circuit breaker/switch cover panel in the HA32A UPS.
22. Ensure that the input and output cables on circuit breaker Q1 and switches Q3BP, Q4S, and Q5N are properly tightened.
23. If a UPS Auxiliary Cabinet with an input harmonic current filter is installed, ensure that the six cables from TB1 and TB2 in the UPS Auxiliary Cabinet are properly connected to the series inductors on the input transformer in the HA32A UPS cabinet and tightened.

NOTE

If these connections have not been made by the customer's electrician, the Digital Customer Services engineer must make them before startup.

24. Perform a complete visual inspection of the inside of the HA32A UPS for dirt, debris, and signs of damaged components or cables.
25. Ensure that all ribbon cable connectors and multiwire cable connectors are properly seated on the FILO, TACO, AQOx, AQCx, DISP, DIFP, FALP, and FMUP boards.
26. Ensure that all fuses are properly seated on the FILO and TACO boards.
27. Ensure that the wires to the dc capacitors located on the back wall of the cabinet are properly connected.
28. Ensure that the wires to the ac capacitors located on the right side wall or back wall of the cabinet are properly connected.
29. Ensure that the delta-RC fuses (F4, F5, and F6) located on the right side wall are installed with the button end toward the front of the cabinet, and that the indicator switch (SW1) is closed.
30. Ensure that the wires to the inverter output fuses (F1, F2, and F3) and indicator switches (SW4, SW5, and SW6) located on the right side wall or back wall are properly connected, and that the indicator switches are all reset.

31. Use the following procedure to remove, inspect, and reinstall each inverter, charger, and static switch module.
    a. Disconnect the cable from the front of the module and ensure that it is properly labeled for reconnection.
    b. Remove the screw(s) and nut(s) that secure the module in place on the side edge(s).
    c. Pull the module out of its slot and inspect the inside for debris and visible damage.
    d. Plug the module back into its slot, ensuring that the connectors on the back of the module are properly seated.
    e. Replace the screw(s) and nut(s) that secure the module in place on the side edge(s).
    f. Reconnect the cable to the front of the module.

32. Disconnect the cables from the front of the card module and ensure that they are properly labeled for reconnection.
33. Remove the screw and nut that secures the card module in place on the side edge.
34. Pull the card module out of its slot just enough to access the ribbon cable connectors on the back of the cards.
35. Ensure that the ribbon cable connectors are properly seated on the SADP (if installed), ALIP, CHAP, ODUP, and CANU boards.
36. Slide the card module back into its slot.
37. Replace the screw and nut that secures the card module in place on the side edge.
38. Reconnect the cables to the front of the card module.
39. Use a Phillips screwdriver to close and secure the left front door on the HA32A UPS.
40. Replace the top and rear covers on the HA32A UPS.
41. Replace the circuit breaker/switch cover panel in the HA32A UPS.

NOTE

Do not replace the cable entry area cover panel at this time. Access to the main ac input (MAINS1), bypass ac input (MAINS2), and output bus bars is required during initial startup.

3.2.2 HA32B UPS Battery Cabinet Checks

Use the following procedure to check the HA32B UPS Battery Cabinet before performing the startup procedures.

WARNING

Use extreme care and observe all safety precautions when performing the checks on the UPS Battery Cabinet. High voltage is present on the battery terminals and on the line (battery) side of circuit breaker QF1. Wear insulated gloves and only use insulated tools when working in the UPS Battery Cabinet.

1. Use the allen key to open the right front door of the HA32B UPS Battery Cabinet.
2. Check the nameplate on the inside of the right front door of the HA32B UPS Battery Cabinet to ensure that the model number, kVA rating, and nominal protection time are correct for the system being installed.
3. Ensure that circuit breaker QF1 behind the right front door of the UPS Battery Cabinet is in the OFF position.
4. Use a Phillips screwdriver to open the left front door on the HA32B UPS Battery Cabinet.
5. Remove the top cover on the HA32B UPS Battery Cabinet.
6. Remove the front cover panel(s) in the HA32B UPS Battery Cabinet.
7. Ensure that the input and output cables on circuit breaker QF1 are properly tightened.
8. Ensure that the positive, negative, and ground cables that go to the HA32A UPS are properly connected to the positive, negative, and ground terminals on the back wall of the UPS Battery Cabinet and tightened.
9. Ensure that the four control wires that go to the HA32A UPS are properly connected to TB1-1, TB1-2, TB1-4, and TB1-5 on the back wall of the UPS Battery Cabinet and tightened.
10. Ensure that the interbattery link(s) that was removed during shipment has been connected. If not, connect the link(s).
11. Visually inspect the inside of the UPS Battery Cabinet for debris or damage.
12. Visually inspect each battery for cracks or signs of electrolyte leakage or seepage. Any battery that is cracked or shows signs of leakage or seepage should be replaced before performing the initial startup procedures.
13. With a voltmeter on the dc voltage scale, measure between the UPS Battery Cabinet chassis and the positive terminal on the line (battery) side of circuit breaker QF1. Measure between the UPS Battery Cabinet chassis and the negative terminal on the line (battery) side of circuit breaker QF1. Both measurements should be 0 Vdc. If a dc voltage is present for either measurement, a dc ground fault is indicated and must be corrected before continuing.

14. With a voltmeter on the dc voltage scale, measure between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1. A voltage reading of approximately 360 to 385 Vdc should be obtained.

    A voltage reading of 0 Vdc between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1 indicates an open battery. To locate the open battery, measure the voltage between the positive and negative terminal on each individual battery. A measurement of approximately 12 Vdc indicates a good battery while a measurement of 0 Vdc indicates an open battery.

    A voltage reading of less than 350 Vdc between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1 indicates shorted or severely discharged batteries. To locate the defective battery, measure the voltage between the positive and negative terminal on each individual battery. A measurement of approximately 12 Vdc indicates a good battery while a measurement of less than 10.5 Vdc indicates a defective battery that should be replaced.

15. Replace the top cover on the HA32B UPS Battery Cabinet.

16. If there are two front cover panels in the HA32B UPS Battery Cabinet, replace the left front cover panel and close the left front door.

NOTE

Do not replace the right front cover panel at this time. Access to the line and load terminals on circuit breaker QF1 is required during initial startup.

3.2.3 HA32C/D/E UPS Auxiliary Cabinet Checks

Use the following procedure to check a UPS Auxiliary Cabinet that contains an input isolation transformer and/or an input harmonic current filter before performing the startup procedures.

1. Use the allen key to open the front door of the UPS Auxiliary Cabinet.

2. Check the nameplate on the inside of the front door of the UPS Auxiliary Cabinet to ensure that the model number and kVA rating are correct for the system being installed. If the UPS Auxiliary Cabinet contains an input isolation transformer, also ensure that the input voltage rating and the output voltage rating are correct for the system being installed.

3. If the UPS Auxiliary Cabinet contains an input isolation transformer, ensure that circuit breaker CB1 is in the OFF position.

4. Remove the upper front cover panel in the UPS Auxiliary Cabinet.

5. If the UPS Auxiliary Cabinet contains an input isolation transformer, use a voltmeter on the ac voltage scale to measure between the phases on the line side of CB1 to ensure that no voltage is present.

6. If the UPS Auxiliary Cabinet contains an input isolation transformer, ensure that the three building source power cables are properly connected to the line side of circuit breaker CB1, and that the building source power ground cable is properly connected to the ground bus bar.

7. If the UPS Auxiliary Cabinet contains an input isolation transformer, ensure that the input and output cables on circuit breaker CB1 are properly tightened.
8. If the UPS Auxiliary Cabinet contains an input isolation transformer, ensure that the output cables from circuit breaker CB1 are properly connected to terminals H1, H2, and H3 on the input isolation transformer and tightened.
9. If the UPS Auxiliary Cabinet contains an input isolation transformer, ensure that output cables that go to the HA32A UPS are properly connected to terminals X3, X2, X1, and X0 on the input isolation transformer and tightened.
10. Ensure that the ground cable between the UPS Auxiliary Cabinet and the HA32A UPS has been properly connected to the ground bus bar in the UPS Auxiliary Cabinet and tightened.
11. Ensure that the two control wires that go to TB2-11 and TB2-12 in the HA32A UPS are properly connected to TB3-11 and TB3-12 in the UPS Auxiliary Cabinet and tightened.
12. If the UPS Auxiliary Cabinet contains an input harmonic current filter, ensure that the wires to the input harmonic current filter fuses (F1, F2, and F3 in the UPS Auxiliary Cabinet) and the fuse indicator switches located in the front of the cabinet are properly connected, and that the indicator switches are all reset.
13. If the UPS Auxiliary Cabinet contains an input harmonic current filter, ensure that the three cables coming from the input transformer in the HA32A UPS are properly connected to TB1-4, TB1-5, and TB1-6 in the UPS Auxiliary Cabinet and tightened.
14. If the UPS Auxiliary Cabinet contains an input harmonic current filter, ensure that the three cables going to the charger module in the HA32A UPS are properly connected to TB2-1, TB2-2, and TB2-3 in the UPS Auxiliary Cabinet and tightened.
15. If the UPS Auxiliary Cabinet does NOT contain an input isolation transformer, replace the upper front cover panel and close and lock the front door.
16. If the UPS Auxiliary Cabinet does contain an input isolation transformer, do NOT replace the upper front cover panel at this time. Access to the line side terminals on circuit breaker CB1 is required during initial startup.

3.2.4 HA32J/K UPS Distribution Cabinet Checks

Use the following procedure to check a UPS Distribution Cabinet before performing the startup procedures.

1. Use the allen key to open the right front door of the UPS Distribution Cabinet.
2. Check the nameplate on the inside of the right front door of the UPS Distribution Cabinet to ensure that the model number, kVA rating, input voltage rating, and output voltage rating are correct for the system being installed.
3. Open the left front door of the UPS Distribution Cabinet.
4. If the UPS Distribution Cabinet contains one output panelboard, ensure that circuit breaker CB2 is in the OFF position.
5. If the UPS Distribution Cabinet contains two output panelboards, ensure that circuit breakers CB2 and CB3 are in the OFF position
6. Remove the circuit breaker cover panel.

7. Remove the output panelboard cover panel(s).
8. Ensure that the input and output cables on the output panelboard circuit breaker(s) are properly tightened
9. If the UPS Distribution Cabinet does not contain an isolation/step-down transformer, ensure that the three phase cables from the HA32A UPS are properly connected to the line side of the output panelboard circuit breaker, and that the neutral and ground cables from the HA32A UPS are properly connected to their respective bus bars in the UPS Distribution Cabinet.
10. If the UPS Distribution Cabinet does contain an isolation/step-down transformer, ensure that the three phase cables from the HA32A UPS are properly connected to the input terminals of the isolation/step-down transformer, and that the ground cable from the HA32A UPS is properly connected to the ground bus bar in the UPS Distribution Cabinet.
11. If the UPS Distribution Cabinet does contain an isolation/step-down transformer, ensure that the three phase cables from the output terminals of the isolation/step-down transformer are properly connected to the line side of the output panelboard circuit breaker.
12. If the UPS Distribution Cabinet does contain an isolation/step-down transformer, ensure that the two control wires from the temperature sensor in the UPS Distribution Cabinet transformer are properly connected to TB2-11 and TB2-12 in the HA32A UPS cabinet and tightened.
13. Ensure that the cables from the load side of the output panelboard circuit breaker are properly connected to the output panelboard and tightened.
14. Ensure that any output circuit breakers on the output panelboard are properly installed, and that the output cables are properly installed and tightened.
15. Replace the circuit breaker cover panel.
16. Replace the output panelboard cover panel(s).

3.3 HA32A UPS INITIAL STARTUP PROCEDURE

Use the following procedure to perform the initial startup of the HA32A UPS.

WARNING

Use extreme care and observe all safety precautions when performing the startup procedures on the cabinets that have cover panels removed. High voltage is present in all cabinets during the startup procedure.

1. Have the customer's electrician apply building source power to the UPS system.
2. If a UPS Auxiliary Cabinet with an input isolation transformer is installed, perform the following procedure.
   a. With a voltmeter on the ac voltage scale, measure between the phases on the line side of circuit breaker CB1 in the UPS Auxiliary Cabinet to ensure that the correct voltage is being applied.
   b. With a phase meter, measure the phase rotation on the line side of circuit breaker CB1 in the UPS Auxiliary Cabinet to ensure that the phase rotation is correct. The phase rotation should be A, B, and C. If the phase rotation is not correct, have the customer's electrician remove the building source power and swap any two phase cables.
   c. Have the customer's electrician remove the building source power.
   d. Replace the upper front cover panel in the UPS Auxiliary Cabinet.
   e. Have the customer's electrician apply building source power to the UPS system.
   f. Place circuit breaker CB1 in the UPS Auxiliary Cabinet to the ON position.
   g. Close and lock the front door on the UPS Auxiliary Cabinet and continue with the next step.
3. With a voltmeter on the ac voltage scale, measure between the phases on the main ac input (MAINS1) and bypass ac input (MAINS2) bus bars in the HA32A UPS cabinet to ensure that the correct voltage is being applied.
4. With a phase meter, measure the phase rotation on the main ac input (MAINS1) and bypass ac input (MAINS2) bus bars in the HA32A UPS cabinet to ensure that the phase rotation is correct. The phase rotation should be A, B, and C. If the phase rotation is not correct, have the customer's electrician remove the building source power and swap any two phase cables.
5. Close the UPS main ac input circuit breaker Q1. This causes the HA32A UPS power supply to turn on and the UPS monitor to become active.

6. The red alarm LED flashes and the following language selection screens scroll vertically on the LCD until one language is selected.

```
1    ENGLISH
2    FRANCAIS

2    FRANCAIS
3    DEUTSCH

3    DEUTSCH
4    ESPANOL

4    ESPANOL
5    ITALIANO
```

7. Press the number key that corresponds to the language desired (press the 1 key to select English) and the LCD displays the following:

```
* * CHECKING * *
* * * * *
```

8. After a few seconds the LCD displays the following:

```
↓    TEST POSITION
```

9. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

10. Access the PERSONALIZATION menu by pressing the Scroll Down key six times. The LCD displays the following:

```
↑ 7    DIAGNOSIS
↓ 8    PERSONALIZATION
```

11. Press the 8 key and the LCD displays the following:

```
PASSWORD?
_ _ _ _
```

12. Enter the four-digit password (1024) by pressing the 1 key, the 0 key, the 2 key, the 4 key, and then the Enter key. The LCD displays the first personalization item (Sealed Battery) screen.

```
  SEALED BATT. =1
↓ 0=NO  1=YES   _
```

13. Use the procedures in Section 2.5.8.1 and the information in Table 2–1 to go through items 1 through 20 and configure them for the specific installation.

NOTE

If a Remote Status Panel is installed, ensure that item 18, Telemonitor, and item 19, Select RS232 (PCB DISO), are enabled.

14. After setting the first 20 items, press the Enter key when the last item is shown on the LCD to load the parameters that were changed.
15. Press the Menu key and the LCD displays the following:

```
  1    START-UP
↓ 2    INVERTER ON/OFF
```

16. Press the Scroll Down key five times and the LCD displays the following:

```
↑ 6    COMMANDS
↓ 7    DIAGNOSIS
```

17. Press the 7 key to select menu item number seven, DIAGNOSIS, and the LCD displays the following:

```
Q1 SWITCH CLOSED?
ITEM:  Q1  OK=1   _
```

18. If the main ac input (MAINS1) circuit breaker Q1 is closed, press the 1 key and then the Enter key. The LCD displays the following:

```
Q4S SWITCH CLOSED?
ITEM:  Q4S  OK=1   _
```

19. Close the bypass ac input (MAINS2) switch Q4S and then press the 1 key and the Enter key. The LCD displays the following:

```
NOTE THE ALARMS
THEN PUSH ON    ↵

↓     TEST POSITION
```

20. Press the Scroll Down key to display the alarms and the LCD displays the following:

```
      TEST POSITION
↓     QF1 IS OPEN
```

21. Press the Scroll Down key twice and the LCD displays the following:

```
↑       Q5N IS OPEN
↓       MIN BAT VOLTAGE
```

22. Press the Scroll Down key twice more and the LCD displays the following:

```
↑       INVERTER OV OR UV
↓       K3N IS OPEN
```

23. Press the Scroll Down key twice more and the LCD displays the following:

```
↑       CHARGER OFF
        INV PHASE OUT TOL
```

24. The seven alarms shown in the previous four LCD screens are normal alarm conditions that should appear for the present status of the UPS (both the inverter and rectifier/battery charger are off). If any other alarm conditions are displayed, immediate action should be taken to correct them before continuing (see Chapter 5).

    After viewing all of the alarm conditions, press the Enter key. The LCD displays the following screens:

```
* * SELF-TESTING * *
* * * * *


SELF-TEST RESULT:
LOGIC OK          ←┘
```

25. Press the Enter key and the LCD displays the following screens:

```
ANALOG TEST
PCB AQCX


ANALOG TEST
PCB AQOX


CLOSE OUTPUT SWITCH
ITEM: Q5N
```

26. Close the output switch Q5N and the LCD displays the following screen:

```
START THE CHARGER
1=START          ____
```

27. Press the 1 key and then the Enter key to start the rectifier/battery charger. The LCD displays the following screens:

```
RESET FAULTS


* * CHECKING * *
* * * * *


COMMAND ACCEPTED
```

28. When the command to start the rectifier/battery charger is accepted, the rectifier/battery charger turns on, the green "rectifier/battery charger" LED goes on, and the LCD displays the following:

```
CLOSE BAT BREAKER
ITEM.  QF1
```

29. With a voltmeter on the dc voltage scale, measure between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1. A voltage reading of approximately 360 to 385 Vdc should be obtained. Observe the polarity of this voltage reading.

30. With a voltmeter on the dc voltage scale, measure between the positive terminal and the negative terminal on the load side of circuit breaker QF1. A voltage reading of approximately 440 Vdc should be obtained, and the polarity of this voltage reading should be the same as the polarity on the line side of the circuit breaker.

    If the polarity is not the same on both sides of circuit breaker QF1, shut down the HA32A UPS completely. Have the customer's electrician remove the building source power and correct the negative and positive cable wiring between the UPS Battery Cabinet and the HA32A UPS.

31. If the polarity is the same on both sides of circuit breaker QF1, close the battery circuit breaker QF1 located inside the UPS Battery Cabinet right door. The audible alarm sounds once every three seconds and the LCD displays the following:

```
START THE INVERTER
1 = START
```

32. To start the inverter press the 1 key and then the Enter key. The following five screens are displayed on the LCD:

```
RESET FAULTS


* * CHECKING * *
* * * * *


COMMAND ACCEPTED


END OF PROCEDURE


↑ 6    COMMANDS
↓ 7    DIAGNOSIS
```

33. After the command to start the inverter is accepted, the inverter starts, the green "inverter" LED goes on, the green "load on bypass" LED goes off, the audible alarm silences, and the flashing red Alarm LED goes off.

34. Press the Enter key and the LCD displays the following screen to indicate that the HA32A UPS is operating in its normal operating condition.

```
NORMAL OPERATION
LOAD ON UPS
```

35. With a voltmeter on the ac voltage scale, measure between the phases on the output bus bars in the HA32A UPS cabinet to ensure that the output voltage is correct.

36. If a UPS Distribution Cabinet is installed, perform the following procedure.

    a. With a voltmeter on the ac voltage scale, measure between the phases on the line side of circuit breaker CB2 (and CB3 if installed) in the UPS Distribution Cabinet to ensure that the correct voltage is being applied.

    b. With a phase meter, measure the phase rotation on the line side of circuit breaker CB2 in the UPS Distribution Cabinet to ensure that the phase rotation is correct. The phase rotation should be A, B, and C. If the phase rotation is not correct, power the HA32A UPS down completely and have the customer's electrician swap any two phase cables between the HA32A UPS and the UPS Distribution Cabinet.

    c. If the voltage and phase rotation are correct in the UPS Distribution Cabinet, place CB2 (and CB3 if installed) to the ON position. This will apply power to the output panelboard(s) for distribution to the individual loads.

37. At this time the tests in Section 3.4 should be run to ensure proper operation of the HA32A UPS.

38. After running the tests in Section 3.4, power the HA32A UPS down completely.

39. Place circuit breaker QF1 in the UPS Battery Cabinet to the OFF position.

40. If a UPS Auxiliary Cabinet with an input isolation transformer is installed, place CB1 in the UPS Auxiliary Cabinet to the OFF position.
41. Have the customer's electrician remove the building source power from the UPS system.
42. Replace the cable entry area cover panel in the HA32A UPS.
43. Replace the right front cover panel in the UPS Battery Cabinet.
44. If a UPS Distribution Cabinet is installed, replace the circuit breaker cover panel and the output panelboard cover panel(s).
45. This completes the HA32A UPS initial startup procedure. Perform the following steps to bring the HA32A UPS back on-line for normal operation.
    a. Have the customer's electrician apply the building source power to the UPS system.
    b. If a UPS Auxiliary Cabinet with input isolation transformer is installed, place circuit breaker CB1 in the UPS Auxiliary Cabinet to the ON position.
    c. Place circuit breaker Q1 in the HA32A UPS to the ON position.
    d. After selecting a language, access and go through the START-UP menu (see Section 2.5.1) to place the HA32A UPS back on-line for normal operation.
    e. If a UPS Distribution Cabinet is installed, place circuit breaker CB2 (and CB3 if installed) to the ON position and place the individual output circuit breakers on the output panelboard(s) to the ON position. This will apply power to the individual loads.
    f. Follow normal power-up procedures for the individual loads.

3.4 INITIAL STARTUP TESTS

The tests described in the following sections should be performed during the initial startup process to ensure proper operation of the HA32A UPS. The start/stop tests, emergency power off (EPO) test, and the external contacts tests should be performed with no load on the UPS system. The battery transfer test should be performed with a load on the UPS system.

3.4.1 Start/Stop Tests

The start/stop tests are performed with the UPS operating normally and the output being supplied by the inverter. The start/stop tests consist of the rectifier/battery charger test and the inverter test.

3.4.1.1 Rectifier/Battery Charger Test

The rectifier/battery charger test ensures that when the rectifier/battery charger stops, the inverter continues to supply load power from the battery.

Use the following procedure to access the rectifier/battery charger start and stop command.

1. Press the Menu key and the LCD displays the following:

```
    1    START-UP
↓   2    INVERTER ON/OFF
```

2. Press the Scroll Down key four times and the LCD displays the following:

```
↑   5    BYPASS PROCEDURE
↓   6    COMMANDS
```

3. Press the 6 key to select menu item number six, COMMANDS, and the LCD displays the following:

```
    CHARGER
↓   0=STOP  1=START  ___
```

4. To stop the rectifier/battery charger, press the 0 key and then the Enter key. The LCD displays the following:

```
    * * CHECKING * *
    * * * * *

    COMMAND ACCEPTED

    CHARGER
↓   0=STOP  1=START  ___
```

5. When the command is accepted, the rectifier/battery charger turns off, the green "rectifier/battery charger" LED goes off, and the green "inverter" LED remains on to indicate that the inverter is still supplying load power from the battery.
6. To restart the rectifier/battery charger, press the 1 key and then the Enter key. The LCD displays the following:

```
* * CHECKING * *
* * * * *

COMMAND ACCEPTED


  CHARGER
↓ 0=STOP  1=START  ___
```

7. When the command is accepted, the rectifier/battery charger turns on and the green "rectifier/battery charger" LED goes on to indicate that the inverter is supplying load power from the rectifier/battery charger.

3.4.1.2 Inverter Test

The inverter test ensures that when the inverter stops, the load transfers from the inverter output to the bypass ac input (MAINS2) source.

Use the following procedure to access the inverter start and stop command.

1. After performing the rectifier/battery charger test, press the Scroll Down key and the LCD displays the following:

```
↑ INVERTER
↓ 0=STOP  1=START  ___
```

2. To stop the inverter, press the 0 key and then the Enter key. The LCD displays the following:

```
* * CHECKING * *
* * * * *

COMMAND ACCEPTED


↑ INVERTER
↓ 0=STOP  1=START  ___
```

3. When the command is accepted, the inverter turns off, the green "inverter" LED goes off, and the green "load on bypass" LED goes on to indicate that the load has been transferred from the inverter output to the bypass ac input (MAINS2) source.

4. To restart the inverter, press the 1 key and then the Enter key. The LCD displays the following:

```
* * CHECKING * *
* * * * *

COMMAND ACCEPTED


↑ INVERTER
↓ 0=STOP  1=START  ____
```

5. When the command is accepted, the inverter turns on, the green "inverter" LED goes on, and the green "load on bypass" LED goes off to indicate that the load has been transferred from the bypass ac input (MAINS2) back to the inverter output.

3.4.2 Emergency Power Off (EPO) Test

The emergency power off (EPO) test ensures that the UPS and UPS Battery Cabinet shut down when the two emergency power off (EPO) keys on the SS&CP are pushed.

To perform the emergency power off (EPO) test, push the two emergency power off (EPO) keys simultaneously.

The following actions take place:

- The main ac input (MAINS1) circuit breaker Q1 on the HA32A UPS trips off.
- The rectifier/battery charger turns off.
- The inverter turns off.
- The static switch turns off.
- The bypass ac input (MAINS2) switch Q4S on the HA32A UPS trips off.
- The battery disconnect circuit breaker QF1 in the UPS Battery Cabinet trips off.
- Power to the load drops.

After performing the emergency power off (EPO) test, return the UPS to normal operation by placing the main ac input (MAINS1) circuit breaker Q1 to the ON position, selecting a language, and accessing and stepping through the START-UP menu.

3.4.3 External Contacts Tests

The external contacts tests ensure that the remote emergency power off (REPO) option and/or the external contact installed by the customer are operating properly. These tests are only run if the REPO option and/or an external contact are installed.

3.4.3.1 Remote Emergency Power Off (REPO) Test

The remote emergency power off (REPO) test ensures that the remote emergency power off (REPO) option, if installed, is operating properly.

To perform the remote emergency power off (REPO) test, press the REPO pushbutton. This causes the same actions to occur that the emergency power off (EPO) test caused (see Section 3.4.2), except that it is initiated from a remote location.

After performing the remote emergency power off (REPO) test, return the UPS to normal operation by placing the main ac input (MAINS1) circuit breaker Q1 to the ON position, selecting a language, and accessing and stepping through the START-UP menu.

3.4.3.2 External Contact Test

If the customer has installed a normally open dry-contact closure, this test ensures that the external contact action, selected through the PERSONALIZATION menu (item 11, 12, 13, or 14), occurs.

To perform this test, close the normally open external contact and verify that the action selected does occur.

3.4.4 Battery Transfer Test

The battery transfer test ensures that the inverter continues to operate on battery power if the UPS ac input power is lost. The UPS should be operating in a normal manner with a load connected to the inverter output when this test is performed. This test is performed in two parts.

PART 1

The first part of the test simulates a loss of utility power but keeps the bypass ac input (MAINS2) power available. This prevents dropping the load if the batteries are bad since the UPS automatically transfers the load to the bypass input.

Use the following procedure to perform the first part of the battery transfer test.

1. With the UPS operating normally with the load on the inverter output, place the main ac input circuit breaker Q1 to the OFF position.
2. The green "rectifier/battery charger" LED should go off, the green "inverter" LED should stay on, and the LCD should display the following:

```
INV ON BATTERY
MIN BAT PROT=xxxMM
```

3. Check the inverter output voltages and frequency by pressing the Volts key and then the 2 key. The LCD displays the following:

```
INV. F=xx.x  U12=xxx V
U23=xxx V    U31=xxx V
```

4. Monitor the decrease in battery voltage by pressing the Enter key, the Scroll Down key, and then the 3 key. The LCD displays the following:

```
BATTERY   U=xxx V
```

5. Monitor the battery current by pressing the Current key, the Scroll Down key, and the 3 key. The LCD displays the following screen and a negative current should be shown to indicate that the batteries are discharging:

```
BATTERY I=xxx.x A
```

6. After approximately 30 seconds, place the main ac input circuit breaker Q1 to the ON position.
7. The green "rectifier/battery charger" LED should go on and the battery current display should change to a positive current, indicating that the rectifier/battery charger is providing power to the inverter and charging the batteries.
8. If this part of the battery transfer test runs successfully, allow the batteries to charge for about five minutes and then proceed to part 2 of the test.

PART 2

Repeat part 1 except, instead of turning the main ac input circuit breaker Q1 off, have the customer's electrician turn the main ac input (MAINS1) and the bypass ac input (MAINS2) source power off.

After the UPS goes on battery operation and the inverter output voltages and frequency, the battery voltage, and battery current have been checked, have the customer's electrician restore the main ac input (MAINS1) and the bypass ac input (MAINS2) power source. The green "rectifier/battery charger" LED should go on and the battery current display should change to a positive current, indicating that the rectifier/battery charger is providing power to the inverter and charging the batteries.


CHAPTER 4

4
TECHNICAL DESCRIPTION

4.1 GENERAL

This chapter contains a technical description of the main ac input power flow and components, the bypass ac input power flow and components, the logic signal flow, and logic printed circuit boards in the HA32A UPS. The power flow and logic flow diagrams in Appendix B should be used along with the information in this chapter.

4.2 HA32A UPS POWER FLOW

The power flow through the HA32A UPS is divided into two parts; main ac input and bypass ac input. Figure B–1 in Appendix B should be used to follow the main ac input and bypass ac input power flow through the HA32A UPS.

4.2.1 Main AC Input

The main ac input to the HA32A UPS comes in on the main ac input (MAINS1) bus bars. The MAINS1 bus bars accept a three phase Delta or Wye input that consists of three phase cables plus a ground cable.

The following sections describe the components that are involved in the main ac input power flow through the HA32A UPS.

4.2.1.1 Circuit Breaker Q1

The main ac input goes from the main ac input (MAINS1) bus bars to the main ac input circuit breaker Q1. Circuit breaker Q1 contains a 24 Vdc shunt trip coil (ST) that causes the breaker to trip open if there is a rectifier/battery charger fault, if the two EPO keys on the SS&CP are pushed simultaneously, or if the REPO option is installed and the REPO button is pushed. Circuit breaker Q1 also has a set of auxiliary contacts that allow the firmware to monitor whether the circuit breaker is open or closed.

4.2.1.2 Rectifier Transformer T1

The output of circuit breaker Q1 goes to the rectifier transformer T1. Transformer T1 is an autotransformer with three series line chokes on the secondary. The secondary voltage of transformer T1 is always 380 Vac phase-to-phase. Transformer T1 also has a normally closed thermostat that opens at 77°C (170°F), causing circuit breaker Q1 to trip open and a rectifier/battery charger fault to be indicated on the LCD.

4.2.1.3 Current Transformers CT1 and CT2

Current transformers CT1 and CT2 are the input current transformers that monitor the phase A and phase C output of transformer T1. The phase B current is extrapolated from the phase A and phase C readings. CT1 and CT2 are used to provide the input current readings that are displayed on the LCD when the Current key is used. They are also used for input current limitation to allow only a certain amount of current to be drawn by the rectifier/battery charger.

4.2.1.4 Rectifier/Battery Charger

The rectifier/battery charger is a phase-controlled full-wave bridge rectifier that uses SCRs for rectification and regulation. The rectifier/battery charger has a three-phase 380 Vac input and produces a 436 Vdc maximum output. The output is determined by the setting of the float, boost, and equalization voltage in the PERSONALIZATION menu.

4.2.1.5 DC Capacitors C1 and C2

The number of dc capacitors C1 and C2 on the rectifier/battery charger output is determined by the kVA rating of the HA32A UPS. There are four capacitors on a 20 kVA UPS; eight capacitors on a 40 kVA UPS; twelve capacitors on a 60 kVA UPS; and sixteen capacitors on an 80 kVA UPS. Resistors R1 and R2 are the bleed-off resistors for discharging the capacitors when the UPS is powered off. It takes approximately thirty seconds for the capacitors to fully discharge after the UPS is powered off.

4.2.1.6 DC Shunt SH1

The dc shunt SH1 is a calibrated piece of copper bus bar that is located in a plastic assembly behind the FILO board. The dc shunt is used to measure battery current only (not the total rectifier/battery charger current). A voltage measurement of 100 mVdc across the dc shunt indicates 100 A of current. The dc shunt is used to provide the battery current reading that is displayed on the LCD when the Current key is used (negative current indicates that battery is discharging; positive current indicates that battery is charging).

4.2.1.7 FILO Board

The FILO board is a high-voltage fuse interface board. The connections XC1 through XC13 are power cables that physically pass through the FILO board.

FU1 and FU2 on the FILO board provide the ac voltage source for the main power supply (ALIP) board through connector XM1301.

FU1, FU2, and FU3 on the FILO board provide rectifier/battery charger ac input voltage information for proper rectifier/battery charger rectification through connector XM1305.

FU4 on the FILO board provides noise filtering between the negative dc bus and the parasitic attenuator plate (PAP).

FU5 and FU8 on the FILO board provide rectifier/battery charger dc output voltage information for regulating the dc output of the rectifier/battery charger through connector XM1305.

FU6 and FU9 on the FILO board provide the dc voltage source for the main power supply (ALIP) board through connector XM1301.

FU7 and FU8 on the FILO board provide dc current information from the dc shunt SH1 through connector XM1305.

FU10, FU11, and FU12 on the FILO board provide ac voltage information for the regulation of the inverter ac output voltage through connector XM1303. They also provide for monitoring of the frequency and phasing in order to synchronize to the bypass ac input.

FU13 and FU14 on the FILO board provide power to the two fan assemblies through connectors XM1315 and XM1316.

FU15 and FU16 on the FILO board provide the power return path from the two fan assemblies through connectors XM1315 and XM1316.

FU17 and FU18 on the FILO board provide noise filtering between phase B and phase C of the UPS output and the parasitic attenuator plate (PAP).

FU19, FU20, and FU21 on the FILO board provide bypass ac input (MAINS2) voltage, frequency, and phase rotation sequence information for detecting bypass ac input over/undervoltage, bypass ac input over/underfrequency, phase rotation sequence, and for synchronizing the inverter output through connector XM1303.

FU22 and FU23 on the FILO board provide 120 Vac, 2 A, for the remote status panel option through connector XM1326 to TB3-2 and TB3-3.

4.2.1.8 Inverter

The inverter chops the dc voltage from the rectifier/battery charger or the UPS Battery Cabinet to produce the 380 Vac phase-to-phase output. In the 20 kVA UPS units, inverter 1, 2, and 3 are in one module. In the 40, 60, and 80 kVA UPS units, inverter 1, 2, and 3 are separate modules. Each inverter module has a normally closed thermostat that opens at 77°C (170°F), causing the inverter to shut down and the output to be switched to the bypass ac input (MAINS2) source.

4.2.1.9 Hall-effect Current Transformers CT3 and CT4

The hall-effect current transformers CT3 and CT4 measure both ac and dc current. They monitor dc current going to the inverter transformer T2 to prevent transformer saturation. They also monitor ac current to detect a "quick overload" (≥155% output overload). If a "quick overload" is detected, the inverter will shut down instantly and the load will go to the bypass ac input (MAINS2) source. Two seconds after a "quick overload" is detected and the inverter has shut down, the inverter will autostart once. If the overload is gone, the inverter will stay on and the load will be switched to the inverter output. If the overload is still present, the inverter will not go on and the load will stay on the bypass ac input (MAINS2) source.

4.2.1.10 Inverter Transformer T2

The primary input to the inverter transformer is 380 Vac phase-to-phase. The secondary output is 208 or 480 Vac phase-to-phase. This transformer is a Delta to Wye transformer that has two cores. The first core is for Delta to Wye conversion, while the second core is for the secondary line chokes. The secondary line chokes and the C3 output ac filter capacitors form an LC tank circuit tuned at 0.8 lagging power factor to help form the output sine wave. The number of output ac filter capacitors (silver) between phases depends upon the kVA and output voltage rating of the UPS. There are typically 3 to 12 output ac filter capacitors between phases.

4.2.1.11 Inverter Output Contactor K3N

The inverter output contactor K3N is controlled by a 220 Vdc contactor coil that is energized when the inverter is on. Resister R3 is in series with the contactor coil only on a 80 kVA UPS with 208 Vac output. When contactor K3N is energized, the auxiliary

contacts short out R3. The inverter output contactor works in conjunction with the static switch. When the inverter goes on, the K3N contactor coil energizes, the static switch turns off, and the inverter output is gated through the K3N contacts to the output bus bars. When the inverter goes off, the K3N contactor coil deenergizes, the static switch turns on, and the bypass ac input power is gated to the output bus bars. During transfers between the inverter output contactor and the static switch, there is a make-before-break connection for 2 to 3 cycles. The inverter output contactor also has a set of auxiliary contacts that allow the firmware to monitor whether the contactor is closed or open.

4.2.1.12 Inverter Output Fuses F1, F2, and F3

The three inverter output fuses are for isolating inverter problems from the output. They are not used for overload protection. These fuses are typically 63 to 315 Amp fuses. Each fuse has a blown fuse indicator switch (SW4, SW5, and SW6). The blown fuse indicator switches are in series and if one of the fuses blows, the corresponding blown fuse indicator switch contact will open. This will cause the inverter to shut off and the load to be transferred to the bypass ac input (MAINS2) source.

4.2.1.13 Output Current Transformers CT5, CT6, and CT7

The three output current transformers monitor the three-phase inverter or bypass output current for display metering. These output current transformers also monitor for slow overloads. A slow overload of 101% to 124% gives an alarm, and if it continues, the inverter will shut off and the load will transfer to the bypass ac input source. A slow overload of 125% for ten minutes or 150% for one minute causes the inverter to shut off, and the load transfers to the bypass ac input source. When the load transfers to the bypass ac input source the timer starts timing again. If the 125% overload continues for another ten minutes on bypass, or the 150% overload continues for another one minute on bypass, the static switch will turn off and the load will be dropped. These output current transformers are physically located in the plastic frame behind the FILO board.

4.2.1.14 Output Isolation Switch Q5N

This switch is used to isolate the UPS from the output when the UPS is in manual or maintenance bypass. It is also used to connect the inverter output or the bypass ac input to the output bus bars during normal operation. It is used in conjunction with switches Q4S and Q3BP. Switch Q5N also has a set of auxiliary contacts that allow the firmware to monitor whether the switch is open or closed.

4.2.1.15 Fan Assembly No. 1 and No. 2

The two fan assemblies are powered by single-phase 120 Vac that is picked off connections XC7 and XC10 between the output current transformers and the output isolation switch Q5N. The transformers T3 and T4 are found on UPS units that have a 480 Vac output in order to step down the single-phase 277 Vac to 120 Vac.

The power lines going through fuses FU13 and FU14 on the FILO board to the fan assemblies also go through a current sensor that detects the failure of one fan. If both fans are running, the currents through the current sensor will cancel each other out indicating normal operation. If one fan quits, the current sensor will detect current and cause a "UPS FAN FAILURE" alarm to be generated. If both fans quit, the current sensor will detect no current and assume that this is normal operation. FU15 and FU16 on the FILO board provide a return path for the fan assemblies. The current sensor signal leaves the FILO board and goes through the AQCx board to the CANU board.

The fans run on the inverter or bypass output. The only time the fans will be off is when the UPS is in manual or maintenance bypass.

4.2.2 Bypass AC Input

The bypass ac input to the HA32A UPS comes in on the bypass ac input (MAINS2) bus bars and goes to the manual bypass switch Q3BP and bypass ac input switch Q4S. The MAINS2 bus bars accept a three-phase Wye input that consists of three phase cables plus a neutral cable.

NOTE

The bypass ac input voltage must always be the same as the UPS output voltage rating.

The following sections describe the components that are involved in the bypass ac input power flow through the HA32A UPS.

4.2.2.1 Manual Bypass Switch Q3BP

The manual bypass switch Q3BP is a manual switch that is used to allow the bypass ac input voltage to bypass the UPS circuits and go directly to the output bus bars. Switch Q3BP also has a set of auxiliary contacts that allow the firmware to monitor whether the switch is open or closed. This switch is used in conjunction with switch Q4S and switch Q5N to place the UPS in manual bypass or maintenance bypass.

During normal operation, switch Q3BP is open, switch Q4S is closed, and switch Q5N is closed.

During manual bypass, the inverter is stopped, switch Q3BP is closed, switch Q4S is open, and switch Q5N is open.

Maintenance bypass is the same as manual bypass except that in maintenance bypass the battery circuit breaker QF1 and the main ac input circuit breaker Q1 are opened.

4.2.2.2 Bypass AC Input Switch Q4S

The bypass ac input goes from the bypass ac input (MAINS2) bus bars to the bypass ac input switch Q4S. Switch Q4S contains a 24 Vdc shunt trip coil (ST) that causes the switch to trip open if the two EPO keys on the SS&CP are pushed simultaneously, or if the REPO option is installed and the REPO button is pushed. Switch Q4S also has a set of auxiliary contacts that allow the firmware to monitor whether the switch is open or closed. During normal operation switch Q4S is closed to allow the bypass ac input to be gated to the static switch.

4.2.2.3 Bypass Surge Protector Network C4, C5, C6, R4, R5, and R6

The bypass surge protector network consists of three capacitors and three resistors. This network is used to shunt large voltage spikes on the bypass ac input, and provide protection for the SCRs in the static switch and the load when the UPS is on bypass.

Fuses F4, F5, and F6 are 25 Amp fuses for the bypass surge protector network. These fuses have a spring loaded button on one end that must be installed toward the blown fuse indicator switch SW1. When one of the fuses blows, the blown fuse indicator switch contact opens. This causes a "MAINS2 RC FU BLOWN" alarm to be displayed on the LCD. This causes an alarm only and does not affect the operation of the UPS.

4.2.2.4 Bypass Voltage and Frequency Sensing

As the three bypass ac input phases pass through the FILO board at XC11, XC12, and XC13, they are coupled through fuses FU19, FU20, and FU21 to the logic circuits for detecting bypass ac input over/undervoltage, bypass ac input over/underfrequency, phase rotation sequence, and for synchronizing the inverter output.

4.2.2.5 Static Switch

The static switch is an electronic switch that employs SCR gating logic. The static switch works in conjunction with the inverter output contactor K3N. When the inverter goes on, the K3N contactor coil energizes, the static switch turns off, and the inverter output is gated through the K3N contacts to the output bus bars. When the inverter goes off, the K3N contactor coil deenergizes, the static switch turns on, and the bypass ac input power is gated to the output bus bars. During transfers between the static switch and the inverter output contactor, there is a make-before-break connection for 2 to 3 cycles. The static switch contains a thermal switch that opens on an overtemperature condition. When the thermal switch opens, the operation of the static switch is inhibited and a "THERM S. S. OVERLOAD" alarm condition is displayed on the LCD.

The output of the static switch follows the main ac input power flow through the output current transformers CT5, CT6, and CT7, and the output isolation switch Q5N, to the output bus bars.

4.3 HA32A UPS LOGIC FLOW

The logic flow for the rectifier/battery charger, the inverter, and the static switch are described in the following sections. Figure B–2 in Appendix B should be used to follow the information signal paths for the rectifier/battery charger and the inverter, and the command signal path for the static switch.

4.3.1 Rectifier/Battery Charger Information Signal Path

The information from the rectifier/battery charger is sent from the FILO board to the AQCx board. The three-phase rectifier/battery charger input voltage and the dc output voltage are sent from connector XM1305 on the FILO board to connector XM5004 on the TACO board. These voltages pass through the TACO board and are sent out on connector XM5005 to connector XM56 on the AQCx board. The rectifier/battery charger phase 1 and phase 3 input currents are sent from connector XM1304 on the FILO board to connector XM54 on the AQCx board.

On the AQCx board, the high voltage ac is stepped down from 208 or 480 Vac to 12-20 Vac. The AQCx board also sends analog signals to the CANU board for analog-to-digital conversion.

The signals for the the rectifier/battery charger input voltage, input current, and output voltage are sent from connector XM52 on the AQCx board to connector XM42 on the CANU board.

The CANU board contains a microprocessor and is the master multiplexer board that communicates with all of the other boards. The CANU board sends the signals required for rectifier/battery charger dc voltage regulation from connector XM41 to connector XM21 on the CHAP board.

The CHAP board generates the drive signals for the six SCRs in the rectifier/battery charger and sends them from connector XM23 to connector XM71 on the rectifier/battery charger module. The dc output voltage of the rectifier/battery charger is regulated to the value set for the float, boost, and equalization voltage through the PERSONALIZATION menu.

4.3.2 Inverter Information Signal Flow

The information from the inverter is sent from the FILO board to the AQOx board. The three phase inverter output voltages are sent from connector XM1303 on the FILO board to connector XM66 on the AQOx board. The phase 1 and phase 3 inverter output currents are sent from connector XM1302 on the FILO board to connector XM63 on the AQOx board.

On the AQOx board, the high voltage ac is stepped down from 208 or 480 Vac to 12-20 Vac. The AQOx board also sends analog signals to the CANU board for analog-to-digital conversion.

The signals for the the inverter output voltage are sent from connector XM62 on the AQOx board to connector XM42 on the CANU board. The CANU board contains a microprocessor and is the master multiplexer board that communicates with all of the other boards. The CANU board sends the signals required for inverter ac voltage regulation from connector XM41 to connector XM31 on the ODUP board.

The signals for the phase 1 and phase 3 inverter output currents are sent from connector XM62 on the AQOx board to connector XM12 on the ALIP board. These signals are then sent out on connector XM11 on the ALIP board to connector XM31 on the ODUP board.

The ODUP board generates the control signals required for regulating the inverter ac output voltage and sends them from connector XM33 to connector XM2101 on the FALP board. The control signals are then sent from connector XM2102 on the FALP board, through the inverter ferrite, to connector XM2001 on the FMUP board. The control signals are distributed through connectors XM2002, XM2003, and XM2004 on the FMUP board to connectors XM83 on the individual inverter modules. The ac output voltage of the inverter is regulated to the value set for the bypass input voltage through the PERSONALIZATION menu.

NOTE

On the 20 kVA units, inverters 1, 2, and 3 are in one plug-in module and only the connecting cable from XM2002 on the FMUP board to XM83 on the plug-in module is used.

4.3.3 Static Switch Command Signal Path

The command signal for turning the static switch off and on is generated on the CANU board. This signal is sent from connector XM43 on the CANP board to connector XM5007 on the TACO board. The signal passes through the TACO board and is sent from connector XM5006 on the TACO board to connector XM101 on the static switch module.

4.4 LOGIC BOARD DESCRIPTIONS

The following sections contain a description of the logic boards contained in the HA32A UPS.

4.4.1 FILO Board

The FILO board is a high-voltage fused interface board. The board has 208 to 480 Vac and up to 436 Vdc passing through it. The rectifier/battery charger input voltage, the bypass ac input voltage, the inverter output voltage, the UPS output voltage, the rectifier/battery charger output voltage, and the battery current are picked off on the FILO board and go through fuses on the FILO board to their respective sensing circuits.

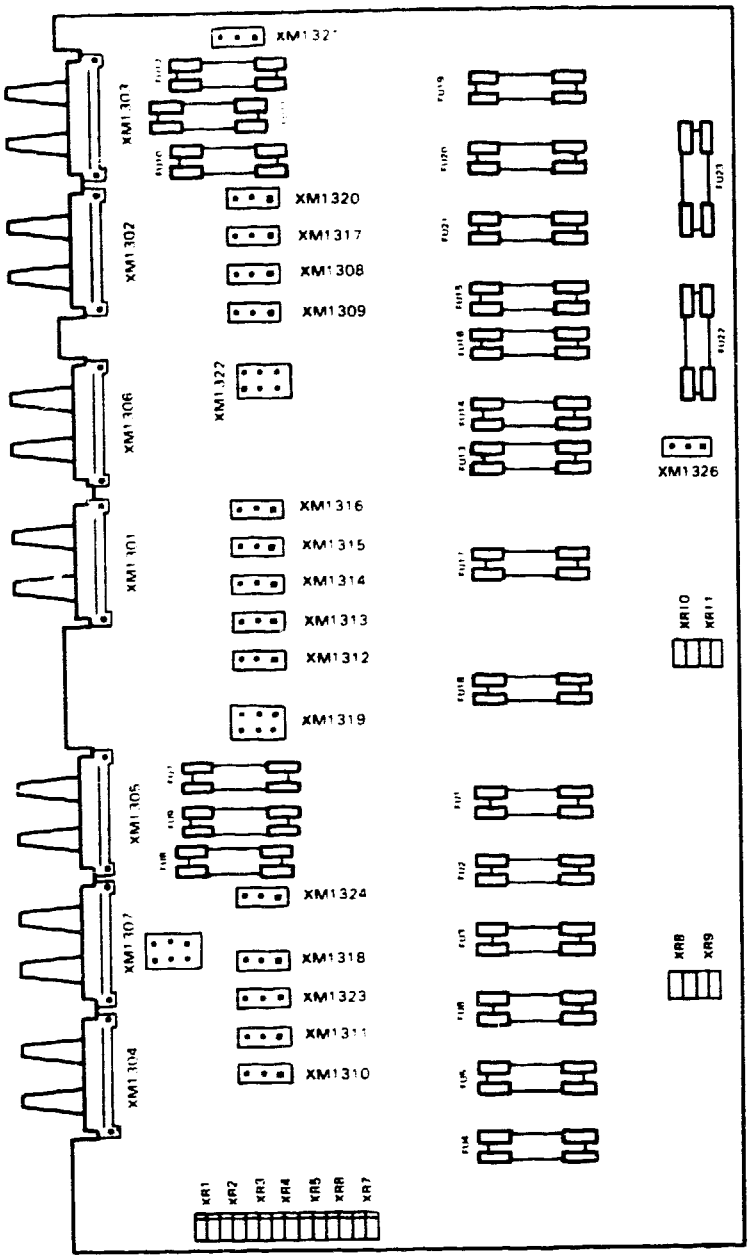
Figure 4–1 is an assembly drawing showing the location of the fuses and connectors on the FILO board.

4.4.2 TACO Board

The TACO board is the auxiliary power supply board. It contains circuits for the HA32B UPS Battery Cabinet interface information and an auxiliary +24 Vdc power supply for the battery cabinet circuit breaker QF1 undervoltage release. The auxiliary +24 Vdc power supply on the TACO board also supplies the +24 Vdc for the shunt trip coils on the main ac input circuit breaker Q1 and the bypass ac input switch Q4S. The TACO board also contains the circuits for the EPO and REPO interface information.

The main ac input (MAINS1) voltage goes to the TACO board through connectors XM5001, XM5002, and XM5003. These three phase voltages go through fuses FU1, FU2, and FU3 on the TACO board to the main ac input voltage sensing circuits to detect over/undervoltage conditions and phase rotation sequence.

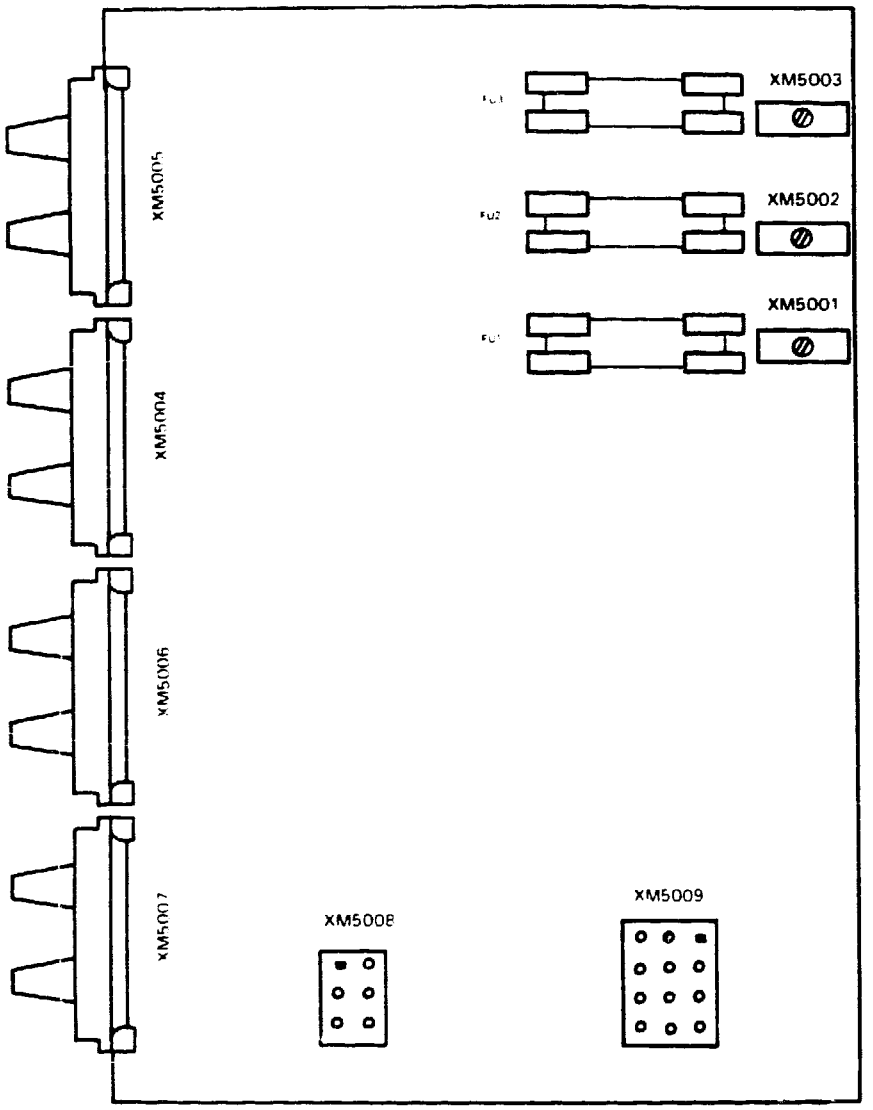
Figure 4–2 is an assembly drawing showing the location of the fuses and connectors on the TACO board.



NOTE:
FUSES FU4 THROUGH FU9 AND FU13 THROUGH FU16 ARE 6 A, 600 V. FUSES FU1 THROUGH FU3, FU10 THROUGH FU12, AND FU17 THROUGH FU23 ARE 2 A, 600 V.

MKV89-0286

Figure 4–1 FILO Board



NOTE:
FUSES FU1, FU2, AND FU3 ARE 2 A, 600 V.

Figure 4–2 TACO Board

4.4.3 AQCx Board

The AQCx board is the rectifier/battery charger acquisition board and contains a microprocessor. It collects the rectifier/battery charger ac input voltage, input current, and dc output voltage information. On the AQCx board, the high voltage ac is stepped down from 208 or 480 Vac to 12-20 Vac. The AQCx board also sends analog signals to the CANU board for analog-to-digital conversion, and passes the rectifier/battery charger information on to the CANU and CHAP boards to provide proper regulation of the rectifier/battery charger.

The AQCx board is a voltage-dependent board. An AQCT board is required for an HA32A UPS with a 208/220 Vac input voltage rating, while an AQCF board is required for an HA32A UPS with a 480 Vac input voltage rating.

Figure 4–3 is an assembly drawing showing the location of the connectors on the AQCx board.

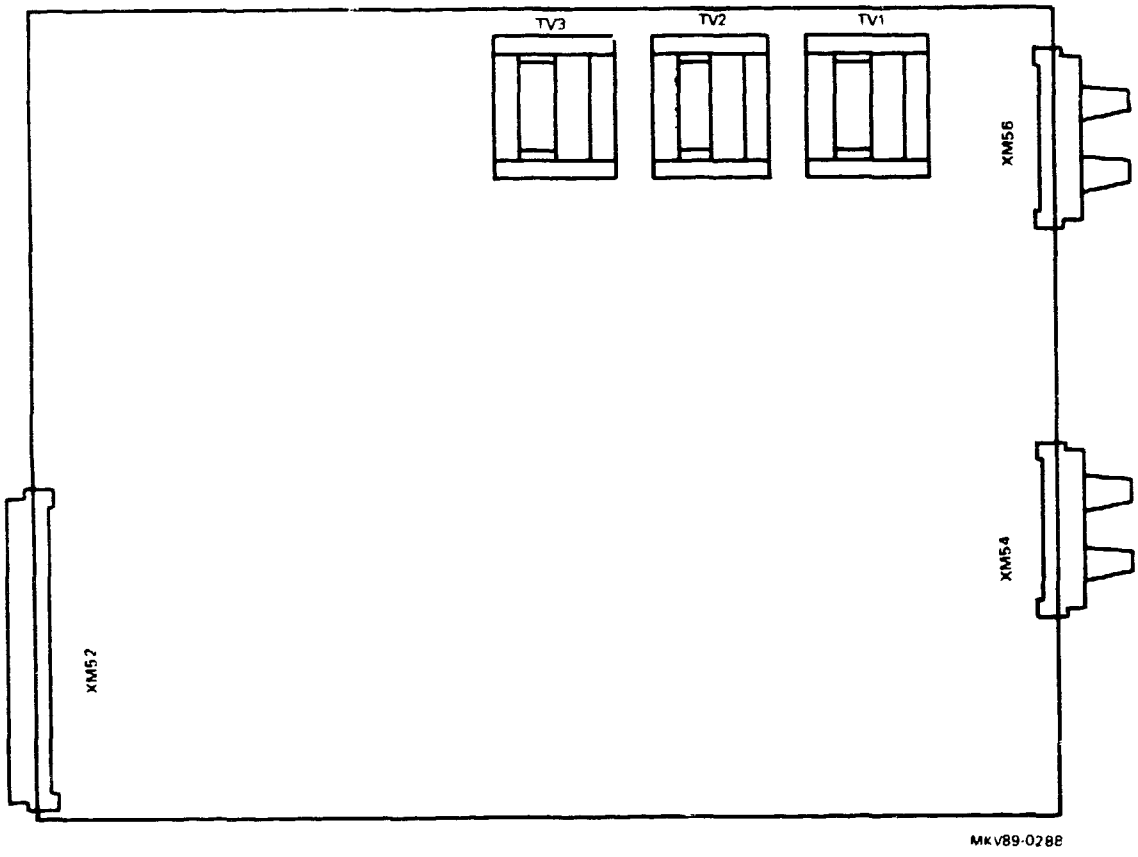


Figure 4–3 AQCx Board

4.4.4 AQOx Board

The AQOx board is the inverter acquisition board and contains a microprocessor. It collects the inverter ac output voltage and phase 1 and phase 3 inverter output current information. On the AQOx board, the high voltage ac is stepped down from 208 or 480 Vac to 12-20 Vac. The AQOx board also sends analog signals to the CANU board for analog-to-digital conversion, and passes the inverter information on to the CANU and ODUP boards to provide proper regulation of the inverter.

The AQOx board is a voltage-dependent board. An AQOT board is required for an HA32A UPS with a 208/220 Vac output voltage rating, while an AQOF board is required for an HA32A UPS with a 480 Vac output voltage rating.

Figure 4–4 is an assembly drawing showing the location of the connectors on the AQOx board.

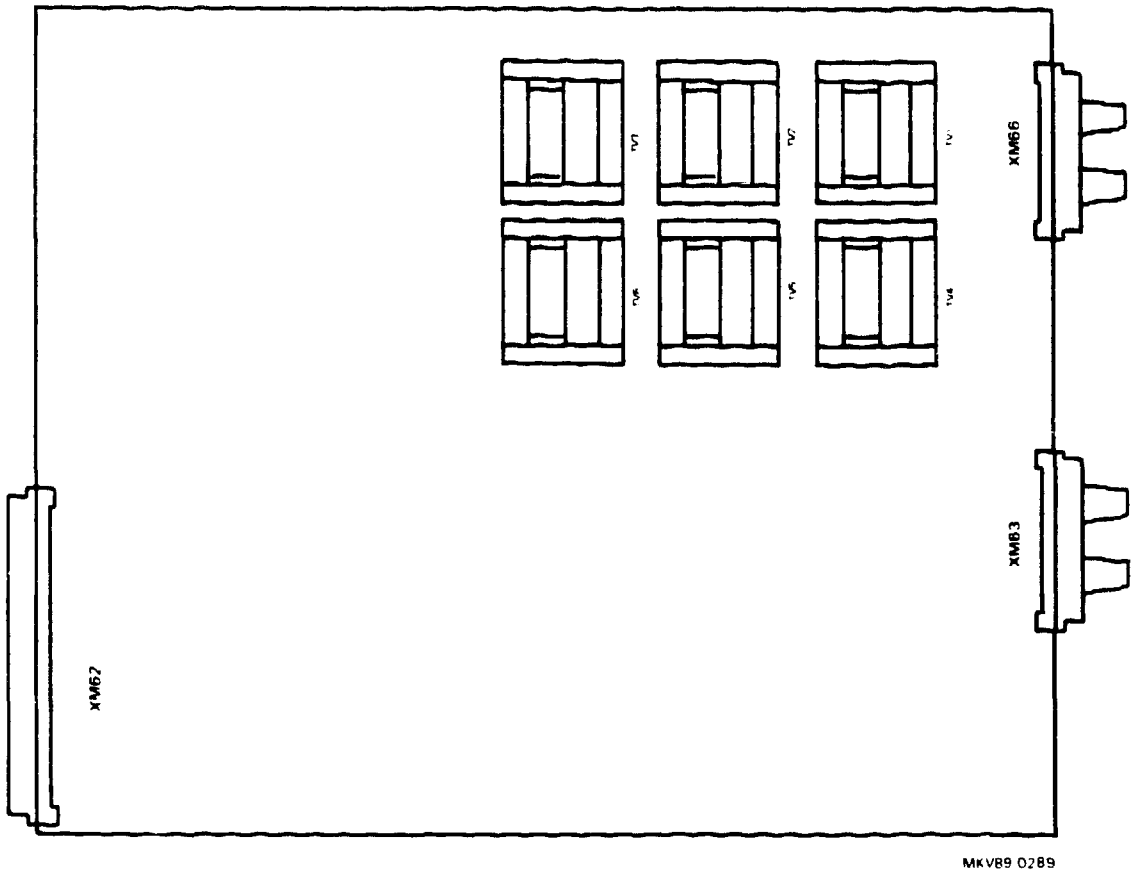


Figure 4–4 AQOx Board

4.4.5 FALP and FMUP Boards

The FALP and FMUP boards are part of the high frequency filter assembly which is located behind the top front cover panel. These boards are for signal routing and distribution and contain ribbon cable ferrites for interference/noise filtering.

Figure 4–5 is an assembly drawing showing the location of the connectors on the FALP and FMUP boards.

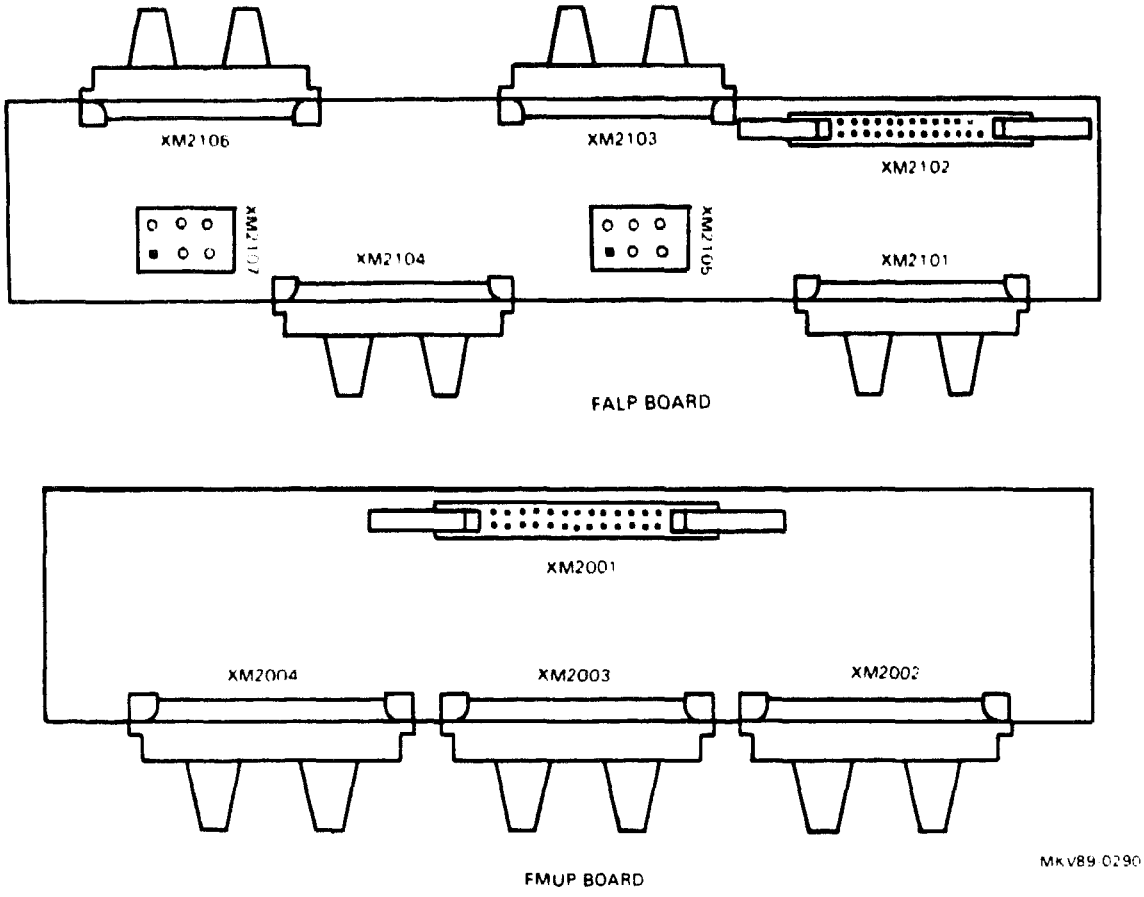


Figure 4–5 FALP and FMUP Boards

4.4.6 DISP and DIFP Boards

The DISP and DIFP boards are the communication boards that are used for RS-232 communication. They are mounted on a hinged assembly above the AQCx, AQOx, and TACO boards to allow easy access to these boards.

There are 10 jumpers on the DIFP board that must be properly installed for RS-232 communication. Refer to Table 4–1 and Figure 4–7 to ensure proper jumper installation.

Figure 4–6 is an assembly drawing showing the location of the connectors on the DISP board. Figure 4–7 is an assembly drawing showing the location of the connectors and jumpers on the DIFP board.

Table 4–1 DIFP Board Jumpers

Jumper	Jumper Pin Connectio
XM102	None
XM103	None
XM104	None
XM105	None
XM106	A to C and B to D
XM107	A to B
XM108	A to B
XM109	A to B
XM110	A to B
XM111	A to B

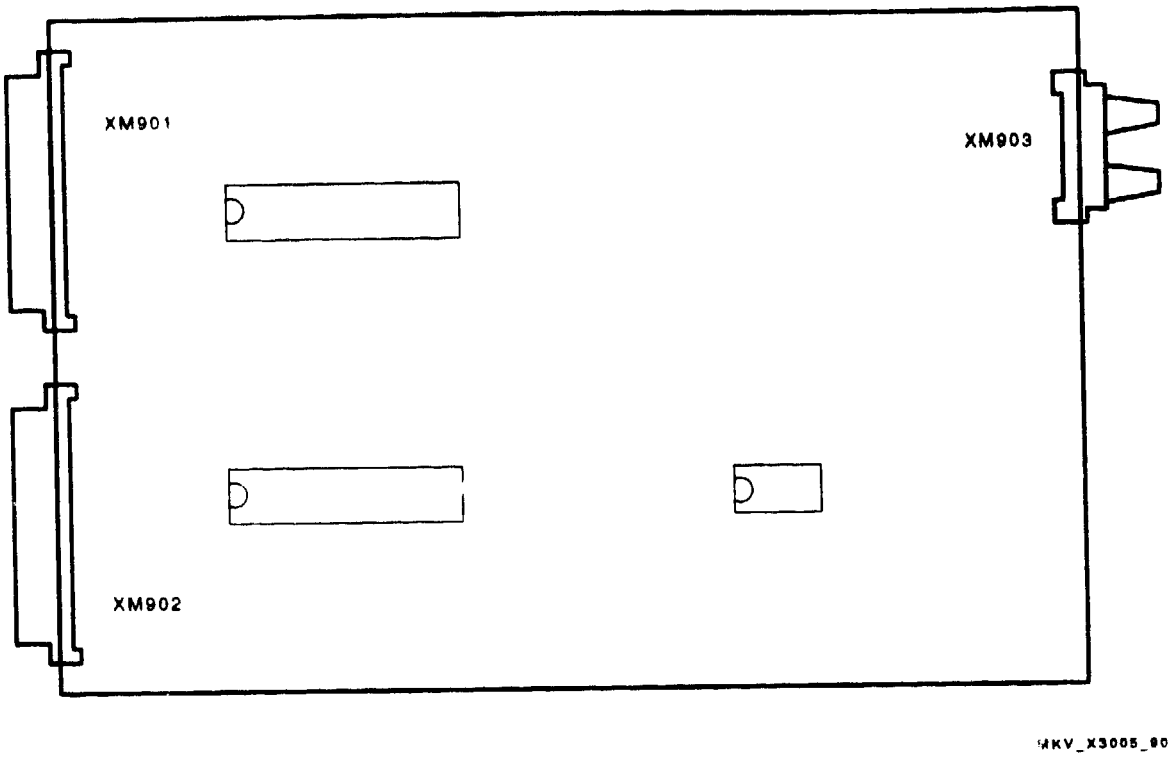


Figure 4–6 DISP Board

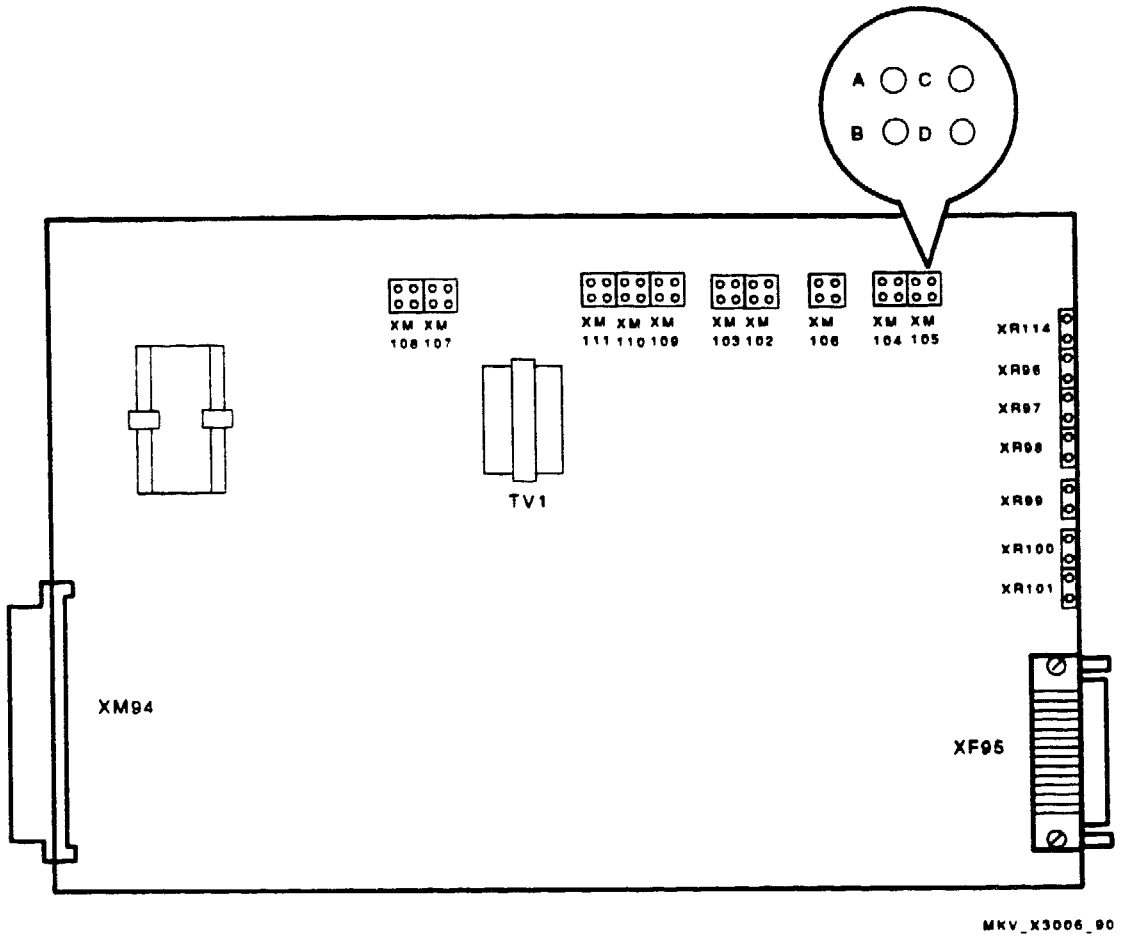


Figure 4–7 DIFP Board

4.4.7 Display Module

The display module contains the display for the HA32A UPS and is part of the the SS&CP. It contains a microprocessor and the firmware EAROM for the personalization and metering information. It also contains the LCD for displaying up to two lines of information at 20 characters per line.

If the display module is replaced, the EAROM on the new module must be repersonalized by accessing the PERSONALIZATION menu and setting all 31 items to the correct value for the specific installation.

4.4.8 Card Module Boards

The card module, located behind the left front door on the HA32A UPS, contains the following four boards:

- The ALIP board
- The CHAP board
- The ODUP board
- The CANU board

The SADP board is an interface board that plugs into the back of the ALIP board. On newer models of the HA32A UPS, the SADP board circuits have been incorporated into the ALIP board and, therefore, the SADP board has been removed. The following sections describe the four boards in the card module and the SADP board.

4.4.8.1 ALIP Board

The ALIP board is the main logic power supply board. The ALIP board normally uses the rectifier/battery charger dc output voltage (409 to 436 Vdc) to produce the +24 Vdc that is distributed to all other boards for logic operation. The ALIP board can use the phase 1 to phase 2 ac input voltage to produce the +24 Vdc logic voltage if the rectifier/battery charger dc output voltage is not available (for example, during initial startup).

4.4.8.2 CHAP Board

The CHAP board is the rectifier/battery charger dc output voltage regulation board. The CHAP board contains a microprocessor and receives rectifier/battery charger ac input voltage, rectifier/battery charger input current, rectifier/battery charger dc output voltage, and dc battery current information. It uses this information and the float, equalization, and boost voltage settings from the PERSONALIZATION menu to regulate the rectifier/battery charger dc output voltage to the value set in the PERSONALIZATION menu.

4.4.8.3 ODUP Board

The ODUP board is the inverter ac output voltage regulation board. The ODUP board contains a microprocessor and receives UPS output current and inverter ac output voltage information. It uses this information and the output voltage setting from the PERSONALIZATION menu to regulate the inverter ac output voltage to the value set in the PERSONALIZATION menu. It also receives bypass ac input voltage information for synchronization.

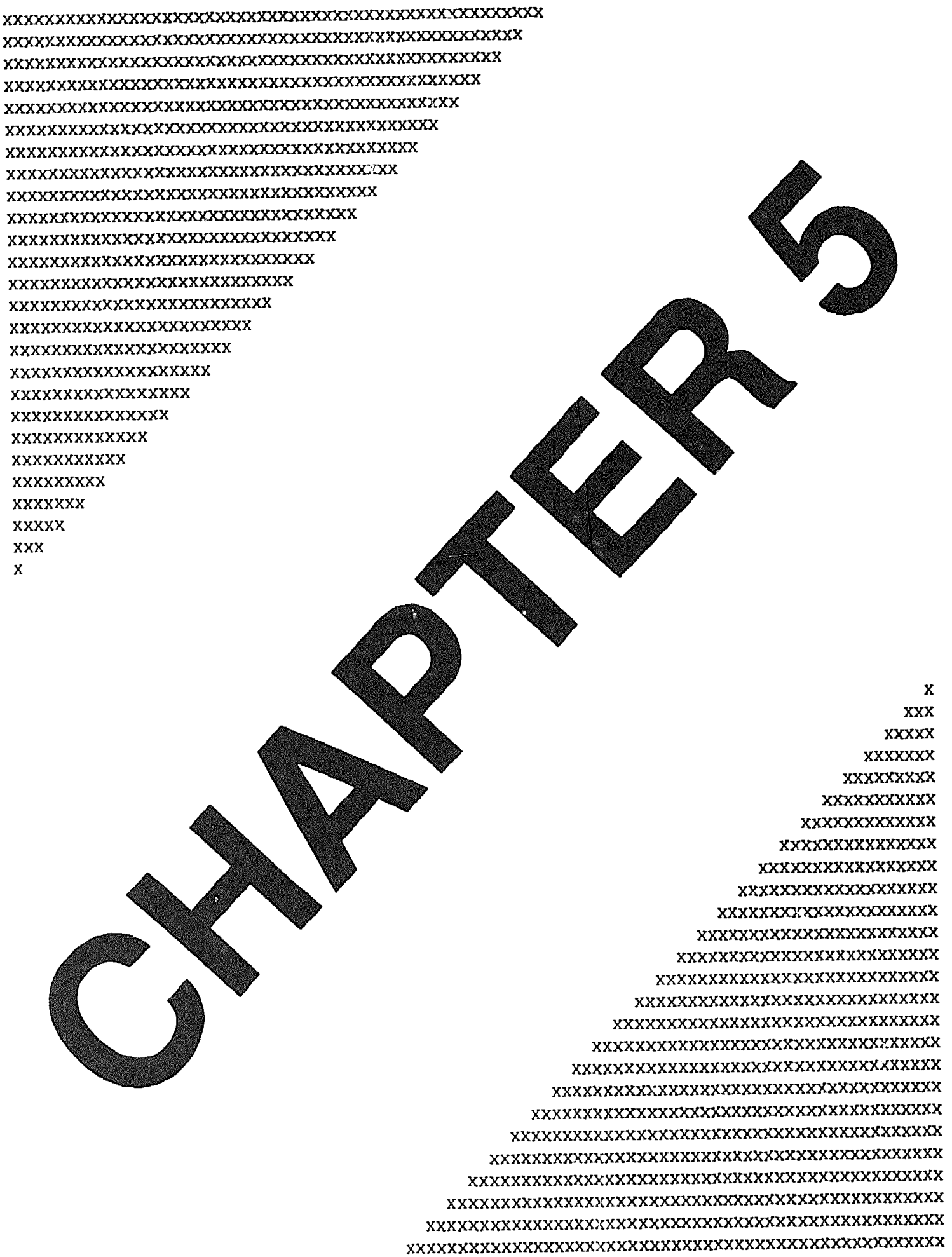
4.4.8.4 CANU Board

The CANU board is the master multiplexer board. The CANU board contains a microprocessor and communicates with all other boards to route voltage and current sampling information, command signals, and status signals. The CANU board performs the analog-to-digital conversion of the ac voltage referance signals from the AQCx and AQOx boards. The CANU board also contains the self-diagnostic firmware.

4.4.8.5 SADP Board

The SADP board is a signal interface and noise filter board. The SADP board plugs into the connectors on the back of the ALIP board and contains ferrite beads for filtering high frequency noise.

On newer models of the HA32A UPS, the SADP board circuits have been incorporated into the ALIP board and, therefore, the SADP board has been removed.


CHAPTER 5

5
TROUBLESHOOTING AND MAINTENANCE

5.1 SAFETY

The HA3000 series Uninterruptible Power System cabinets contain HIGH VOLTAGE. Formal training on the HA3000 series UPS *is required* for all maintenance personnel. All appropriate safety precautions *must be* taken to ensure the safety of personnel troubleshooting and repairing this equipment.

WARNINGS

The HA3000 series UPS cabinets contain HIGH VOLTAGE. Only authorized Digital Customer Services representatives who have received formal, authorized training on the HA3000 series UPS product will be certified to work on this product. There will be no exceptions to this policy.

Troubleshooting, repairing, opening the left front door of the UPS, and removing the covers or panels should NOT be attempted with the HA32A UPS in manual bypass.

There are still high voltages present in the HA32A UPS cabinet with the UPS in manual bypass. DO NOT open the left door or remove any covers or protective panels when in manual bypass. In manual bypass, there is a difference of voltage potential between the modules mounted in the parasitic attenuator plate (static switch, rectifier/battery charger, inverter(s), and card module) and the UPS cabinet frame. Voltage is also present in the rectifier/battery charger circuits, on the cable entry area busbars (MAINS1, MAINS2, BATTERY, and OUTPUT), on the input and output terminals of circuit breaker Q1, on the input terminals of bypass switch Q4S, on the output terminals of output isolation switch Q5N, and on the input and output terminals of manual bypass switch Q3BP.

There is a so high voltage present in the HA32B UPS Battery Cabinet when the UPS is in manual bypass. There is a difference of voltage potential between the battery circuit breaker QF1 terminals and the battery cabinet frame, and between the battery terminals and the UPS cabinet frame. There is also high voltage present on the input and output terminals of the battery circuit breaker QF1.

Before any covers or panels (except the allen key locked door) can be opened for troubleshooting or repairing, the HA32A UPS must be placed in maintenance bypass (see Section 2.3.2.5). This sequence is used to manually transfer the load to the bypass ac input (MAINS2) power source to bypass the UPS circuits when covers need to be removed for troubleshooting or repairing. This sequence should be initiated before the left door of the UPS or UPS Battery Cabinet is opened, and before any covers or protective panels are removed from the HA32A UPS or HA32B UPS Battery Cabinet. This sequence goes farther than manual bypass in removing voltage from the UPS cabinet. It eliminates the difference of voltage potential between the modules mounted in the parasitic attenuator plate (static switch, rectifier/battery charger, inverter(s), and card module) and the UPS cabinet frame, and the voltage in the rectifier/battery charger circuits.

This sequence also eliminates the difference of voltage potential between the battery circuit breaker QF1 terminals and the battery cabinet frame, the difference of voltage potential between the battery terminals and the UPS cabinet frame, and the voltage present on the output terminals of the battery circuit breaker QF1.

WARNINGS

There are still high voltages present in the HA32A UPS cabinet with the UPS in maintenance bypass. In maintenance bypass, there are high voltages on the cable entry area busbars (MAINS1, MAINS2, and OUTPUT), on the input terminals of circuit breaker Q1, on the input terminals of bypass switch Q4S, on the output terminals of output isolation switch Q5N, and on the input and output terminals of manual bypass switch Q3BP.

There is also high voltage present in the HA32B UPS Battery Cabinet on the battery terminals and on the input terminals of battery circuit breaker QF1.

During troubleshooting and repairing, keep all covers and panels in place whenever possible. Remove all rings and jewelry, and wear safety glasses at all times when working in the UPS cabinets. DO NOT wear an ESD wriststrap when working on the UPS equipment.

Use the following procedure if voltage measurements are required during troubleshooting:

1. Place the UPS in maintenance bypass (see Section 2.3.2.5).
2. Remove the cover or panel that is required to access the area where the voltage measurement must be made.
3. Return the UPS to normal operation.
4. With extreme care and observing all appropriate safety precautions, make the voltage measurement.
5. If the voltage measurement isolates the faulty component, place the UPS in maintenance bypass.
6. Remove and replace the faulty component.
7. Replace the cover or panel that was removed.
8. Return the UPS to normal operation and ensure that the problem has been corrected.

5.1.1 Discharging the Parasitic Attenuator Plate (PAP)

The parasitic attenuator plate (PAP), which runs vertically down the middle of the back of the inverter/static switch/card cage module backplane, can have as much as 450 Vdc present, even with all power removed from the HA32A UPS cabinet.

WARNING

The voltage on the PAP must be discharged after removing the top or rear cover on the HA32A UPS cabinet, and before accessing any internal components.

Tools Required

- Power Servicing and Safety Tool Kit (P/N 22-00518-01)
- Anode discharge probe
- Fluke 8026B digital voltmeter† or equivalent

Use the following procedure to discharge the PAP before accessing any internal components in the HA32A UPS cabinet.

1. Place the UPS in maintenance bypass (see Section 2.3.2.5).
2. Remove the top or rear cover on the HA32A UPS cabinet.
3. Locate the PAP running vertically down the middle of the inverter/static switch/card cage module backplane.

NOTE

The PAP is a metal strip, approximately one inch wide, that is mounted perpendicular to the plug-in module backplane. The top end of the PAP has a small rectangular capacitor connected between it and the metal cabinet chassis. The bottom end of the PAP has a large-gauge insulated conductor connected between it and the frame of inverter transformer T2 (the frame of inverter transformer T2 is insulated from the cabinet chassis).

4. Connect the alligator clip on the anode discharge probe to a good ground and connection point on the HA32A cabinet chassis.
5. Touch the tip of the anode discharge probe to the PAP and allow 30 seconds for the PAP to discharge.
6. Verify that the PAP has been discharged by connecting a voltmeter, set to the highest dc voltage range, between the PAP and the cabinet chassis.

   If the PAP is completely discharged, a voltage reading of 0 Vdc will be obtained between the PAP and the cabinet chassis.

   If a voltage reading of other than 0 Vdc is obtained between the PAP and the cabinet chassis, repeat steps 4 through 6 until a voltage reading of 0 Vdc is obtained.

† The Fluke 8026B digital voltmeter is manufactured by the John Fluke Manufacturing Co., Inc.

5.1.2 Power Servicing and Safety Tool Kit

The Power Servicing and Safety Tool Kit (P/N 22-00518-01) has been developed to aid the Customer Services engineer in safely servicing power products such as the HA32A UPS.

All of the tools in the kit except the torque wrench and the socket set are insulated. The screwdriver shafts are insulated to prevent shorting and making connections with the metal shaft. The insulation on all tools except the screwdrivers is rated for 1 kVA. All of the insulated tools except the screwdrivers have a red inner layer that is used to determine if the insulation has been damaged.

WARNINGS

The red inner layer showing through the insulation indicates that the insulation has been damaged and the tool MUST NOT be used. Throw the tool away and order a replacement. DO NOT attempt to repair damaged insulation.

The leather gloves are NOT insulating gloves and must always be used in conjunction with the rubber insulating gloves.

The leather gloves or protectors must ALWAYS be worn over the rubber insulating gloves to protect the insulating gloves from damage.

Personal protective equipment such as the leather gloves/rubber insulating gloves and the insulated floor mat must be used to provide protection against unintentional contact with live circuits. They must always be used when working on the batteries since the batteries are always live.

5.2 GENERAL TROUBLESHOOTING PROCEDURES

When an alarm condition exists in the UPS, an audible alarm sounds and the red alarm LED flashes. Use the following general procedures as a guide in troubleshooting the UPS to the faulty component.

1. Observe the LEDs on the SS&CP and what is displayed on the LCD.
2. Press the Enter key twice to access the alarm menu, then use the Scroll Down key to display all of the alarms.
3. Record all of the alarms in the alarm menu.

NOTE

Some of the alarms may be normal under the given conditions (for example if the inverter is off while others are abnormal. Refer to the tables in Section 5.3 for the alarm messages and indications.

4. The displayed alarms or performing the DIAGNOSIS menu will normally reveal the problem, and the appropriate action can be taken to correct the problem.
5. If an alarm is not displayed, and performing the DIAGNOSIS menu does not reveal the problem, place the UPS in maintenance bypass and perform a mechanical and visual inspection on the components in the inoperable area (inverter or rectifier/battery charger). Ensure that power cables and wiring terminations are securely connected, and that modules and ribbon cable connectors are properly seated.
6. If a mechanical and visual inspection does not reveal the problem, use the power flow and logic flow figures in Appendix B, and descriptions in Chapter 4 to logically replace components or logic boards until the problem is corrected.

5.3 ALARMS

There are two types of alarms in the HA32A UPS; minor and major alarms. The following sections describe the minor and major alarms and contain tables listing the alarms and what they indicate.

5.3.1 Minor Alarms

Minor alarms are those that occur during normal operation but do not interfere with the normal operation of the UPS. These alarms should be corrected as soon as possible. Minor alarms are indicated by the audible alarm sounding, the red Alarm LED flashing, and the following screen being displayed on the LCD:

```
                ALARMS
↓       LOAD ON UPS
```

Table 5–1 contains minor alarm messages that could appear on the LCD after pressing the Scroll Down key and what each message indicates.

Table 5–1 Minor Alarm Messages

Alarm Message	Problem Indication
MAINS2 RC FU BLOWN	A bypass ac input (MAINS2) surge protector network fuse (F4, F5, or F6) has blown.
UPS FAN FAILURE	One of the two internal fans has failed.
OUTPUT OVERLOAD	One or more of the three output phases is providing more than 100% of the full load current rating of the UPS.
CHARGER CT FAULT	The input current sensing circuit (CT1 or CT2) is not operating correctly.
CHARG MODULE FAULT	A fault has occurred in the rectifier/battery charger module.
MAINS2 OV OR UV	The UPS inverter output is not synchronized to the bypass ac input (MAINS2) source because the bypass ac input voltage is not within ±10% of the nominal value. Operation of the static switch is inhibited.
MAINS2 OF OR UF	The UPS inverter output is not synchronized to the bypass ac input (MAINS2) source because the bypass ac input frequency is not within the selected frequency window (normally ±0.5 Hz). Operation of the static switch is inhibited.
MAINS2 UNSYNCHRON	The UPS inverter output is not synchronized to the bypass ac input (MAINS2) source because the phase differential between the two is greater than 3°. Operation of the static switch is inhibited.
ENVIRONMENT PROBLEM	This indicates that one of four problems has occurred in the UPS Auxiliary Cabinet or the UPS Distribution Cabinet: 1. The input circuit breaker CB1 in the UPS Auxiliary Cabinet has tripped. 2. The input isolation transformer in the UPS Auxiliary Cabinet has overheated. 3. One or more of the input harmonic current filter fuses (F1, F2, and F3) in the UPS Auxiliary Cabinet have blown. 4. The isolation/step-down transformer in the UPS Distribution Cabinet has overheated.

5.3.2 Major Alarms

There are two types of major alarms in the HA32A UPS; rectifier/battery charger and inverter alarms. Major alarms are those that prevent normal operation of the UPS by causing the rectifier/battery charger or the inverter to shut down. These alarms should be corrected immediately.

The following sections describe the rectifier/battery charger and inverter major alarms and contain tables listing the alarms and what they indicate.

5.3.2.1 Rectifier/Battery Charger Major Alarms

Rectifier/battery charger major alarms occur when the rectifier/battery charger is not operating and load power is being provided by the batteries. These alarms are indicated by the audible alarm sounding, the red Alarm LED flashing, the UPS being on battery operation, and the following screen being displayed on the LCD:

```
INV ON BATTERY
MINI AUTO. = xxxMN
```

Table 5–2 contains the rectifier/battery charger major alarm messages that could appear on the LCD after pressing the Scroll Down key and what each message indicates.

Table 5–2 Rectifier/Battery Charger Major Alarm Messages

Alarm Message	Problem Indication
END OF AUTOMY	The battery has reached its end point of discharge and the inverter has turned off.
MAINS1 OV OR UV	The rectifier/battery charger has turned off because of an input ac over/undervoltage condition.
MAX BAT VOLTAGE	The rectifier/battery charger has turned off because of a high dc output voltage condition.
MAINS1 PH SEQ NOK	The rectifier/battery charger will not start because of an incorrect phase rotation sequence on the input.
CHARGER OFF	The rectifier/battery charger has been programmed OFF or turned off automatically.

5.3.2.2 Inverter Major Alarms

Inverter major alarms occur when the inverter is not operating and load power is being supplied by the bypass ac input (MAINS2) source after a successful static transfer. These alarms are indicated by the audible alarm sounding, the red Alarm LED flashing, the UPS being on bypass operation, and the following screen being displayed on the LCD:

```
                ALARMS
↓       INVERTER OFF
```

Table 5–3 contains the inverter major alarm messages that could appear on the LCD after pressing the Scroll Down key and what each message indicates.

Table 5–3 Inverter Major Alarm Messages

Alarm Message	Problem Indication
INV FUSE BLOWN	One or more of the inverter output fuses (F1, F2, or F3) has blown.
TRANSFO OVERTEMP	The inverter transformer (T2) has an overtemperature condition
INV LEG1 OVERTEMP	The inverter module for phase 1 has an overtemperature condition.
INV LEG2 OVERTEMP	The inverter module for phase 2 has an overtemperature condition.
INV LEG3 OVERTEMP	The inverter module for phase 3 has an overtemperature condition.
S.S. OVERTEMP	The static switch has an overtemperature condition.
LEG1 POW SUP FAULT	The inverter module for phase 1 has a power supply fault.
LEG2 POW SUP FAULT	The inverter module for phase 2 has a power supply fault.
LEG3 POW SUP FAULT	The inverter module for phase 3 has a power supply fault.
LEG1 DESATURATION	The inverter module for phase 1 is not operating in saturation.
LEG2 DESATURATION	The inverter module for phase 2 is not operating in saturation.
LEG3 DESATURATION	The inverter module for phase 3 is not operating in saturation.
PCB POW SUP FAULT	Logic power supply board (ALIP) fault.
MIN BAT VOLTAGE	The inverter has turned off because of low battery voltage.
INV OV OR UV	The inverter has turned off because of an over/under output voltage condition.
THERM UPS OVERLOAD	The UPS has shut down because of an overtemperature condition.
INV CT FAULT	The inverter output current sensing circuits are not operating correctly.
MAINS2 PH SEQ NOK	The inverter has turned off and prevented a static switch transfer because of an incorrect phase sequence on the bypass ac input (MAINS2) source.
K3N IS OPEN	The inverter output contactor is open.
INV CURRENT LIMIT	The inverter has turned off because of an overload condition on the inverter output.
THERM S.S. OVERLOAD	The static switch has shut down due to an overload condition.

5.4 SPECIFIC TROUBLESHOOTING PROBLEMS

This section contains specific problem indications and the procedure for troubleshooting them. Refer to Figure 5–1 for connector pin locations when taking voltage measurements on the connectors.

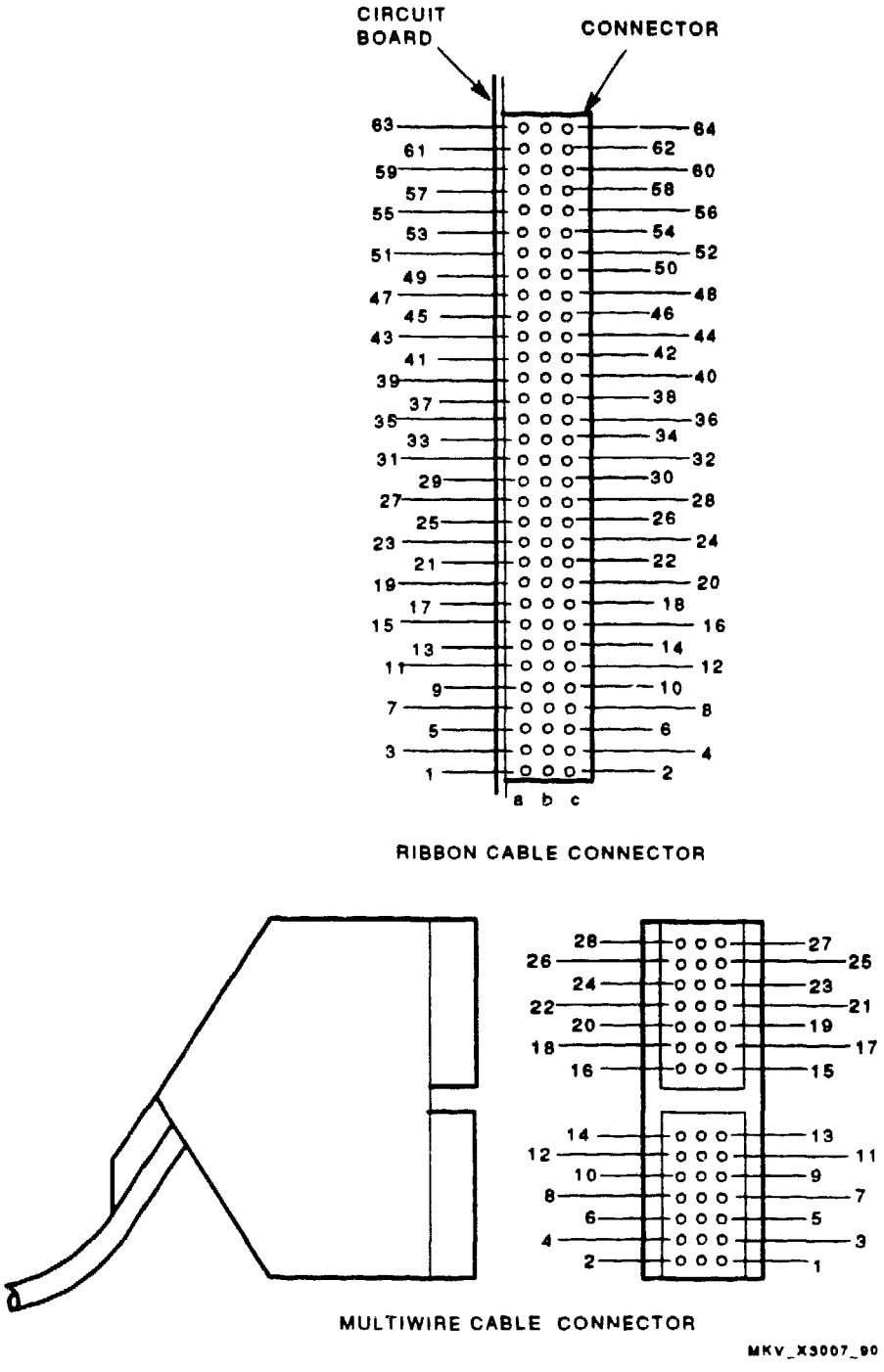


Figure 5–1 Connector Pin Locations

5.4.1 No LCD Display

If the main ac input circuit breaker Q1 is closed and the LCD display is blank, use the following procedure to isolate the problem.

1. Check fuses FU1 through FU9 on the FILO board. If any of these fuses are blown, replace them and see if the problem is corrected.

NOTE

Fuses FU1 through FU3 are 600 V, 2 Amp fuses. Fuses FU4 through FU9 are 600 V, 4 Amp fuses.

2. If none of the fuses are blown, use a voltmeter and measure for +24 Vdc between pin 56 (+24 Vdc) and pin 64 (Gnd) at connector XM62 on the AQOx board.

NOTE

Probes with very fine pointed tips must be used.

3. If +24 Vdc is not present on connector XM62, replace the ALIP board.
4. If +24 Vdc is present on connector XM62 but the LCD display is still blank, use a voltmeter and measure for +12 Vdc between pin 6 (+12 Vdc) and pin 1 (Gnd) at connector XM151 on the AFIP board (inside the display module).
5. If +12 Vdc is present on connector XM151, but the display is still blank, replace the display module.

NOTE

If the display module is replaced, all 31 personalization items must be accessed and set to the correct values for the specific installation.

6. If +12 Vdc is not present on connector XM151, check for a bad ribbon cable or connection between XM62 on the AQOx board and XM52 on the AQCx board, XM54 on the AQCx board and XM1304 on the FILO board, or XM1307 on the FILO board and XM151 on the AFIP board (inside the display module).

5.4.2 Unable to Close Battery Circuit Breaker QF1

If battery circuit breaker QF1 cannot be closed during the startup of the UPS, the +24 Vdc undervoltage release is missing. Use the following procedure to isolate the problem.

1. Check and verify that the rectifier/battery charger is on and that the dc voltage is at the proper value.
2. Use a voltmeter and measure for the +24 Vdc input to the TACO board between pin 10 (+24 Vdc) and pin 12 (Gnd) at connector XM5007 on the TACO board.

3. If the +24 Vdc is not present on connector XM5007, replace the ALIP board.
4. If the +24 Vdc is present on connector XM5007, measure for +24 Vdc between pins 1 and 2 at connector XM5009 on the TACO board.
5. If +24 Vdc is not present on connector XM5009, replace the TACO board.
6. If +24 Vdc is present on connector XM5009, measure for +24 Vdc between TB1-1 and TB1-2 in the UPS cable entry area.
7. If +24 Vdc is not present on TB1 in the cable entry area, check for loose or broken wires between pins 1 and 2 at connector XM5009 on the TACO board and TB1-1 and TB1-2.
8. If +24 Vdc is present on TB1 in the cable entry area, measure for +24 Vdc between TB1-1 and TB1-2 in the UPS Battery Cabinet.
9. If +24 Vdc is not present on TB1 in the UPS Battery Cabinet, check for loose or broken wire between TB1 in the UPS cable entry area and TB1 in the UPS Battery Cabinet.
10. If +24 Vdc is present on TB1 in the UPS Battery Cabinet, check for loose or broken wires between TB1 in the UPS Battery Cabinet and the battery circuit breaker QF1.
11. If the wires are good, replace the battery circuit breaker QF1.

5.4.3 Inverter Output Contactor K3N Does Not Close

If the inverter output contactor K3N does not close when the inverter is started, use the following procedure to isolate the problem.

NOTE

To make the voltage checks in the following procedure, connect the meter probes to the specified points and then try to start the inverter.

1. Use a voltmeter and measure for the +220 Vdc between A1 and A2 on the inverter output contactor K3N coil.
2. If the +220 Vdc is measured across the coil when the inverter is started, but the contactor does not close, replace the K3N contactor coil.
3. If the +220 Vdc is not measured across the coil when the inverter is started, use a voltmeter and measure for +220 Vdc between pin 10 (Command K3N +) and pin 8 (Command K3N -) at connector XM16 on the ALIP board.
4. If the +220 Vdc is not present between pins 10 and 8 at XM16 on the ALIP board, use a voltmeter and measure for +409 to +436 Vdc between pin 6 (DC Bus +) and pin 4 (DC Bus -) at connector XM16 on the ALIP board.
5. If the DC Bus voltage (+409 to +436 Vdc) is present between pins 6 and 4 at connector XM16 on the ALIP board, replace the ALIP board.
6. If the DC Bus voltage (+409 to +436 Vdc) is not present between pins 6 and 4 at connector XM16 on the ALIP board, check fuses FU6 and FU9 on the FILO board.
7. Replace fuses FU6 and/or FU9 if they are blown.

5.4.4 Inverter Current Limit Alarm

If the "INV . URRENT LIMIT" alarm message is displayed on the LCD check for a short circuit between the inverter output and the inverter output contactor K3N. Use the following procedure to isolate the problem.

1. Check the customer's load to ensure that there is not an actual overload condition.
2. Disconnect the hall-effect current transformers CT3 at connector XM1309 and CT4 at connector XM1308 on the FILO board. Measure and compare the resistance of CT3 and CT4.
3. If either current transformer measures open, replace that transformer.
4. If a significant resistance difference is found between CT3 and CT4, replace both current transformers.
5. If there is not a resistance difference, reconnect CT3 to XM1309 and CT4 to XM1308 on the FILO board.
6. Check the C3 output ac filter capacitors for a short.
7. Check phase-to-phase and phase-to-ground on the inverter transformer T2 primary and secondary for a short.
8. Check the inverter output contactor K3N line to load for a short.

NOTE

On the 40, 60, and 80 kVA models, ensure that the XM83 connectors from the FMUP board to the inverter modules are connected to the correct inverter module. The cable from connector XM2002 on the FMUP board goes to connector XM83 on the inverter 1 module. The cable from connector XM2003 on the FMUP board goes to connector XM83 on the inverter 2 module. The cable from connector XM2004 on the FMUP board goes to connector XM83 on the inverter 3 module.

5.4.5 Growling Sounds when Inverter Turns On

If the inverter makes strange growling sounds when it turns on, use the following procedure to isolate the problem.

1. Check for the hall-effect current transformer CT3 and CT4 leads being swapped on the FILO board. CT3 should be connected to connector XM1309 and CT4 should be connected to connector XM1308 on the FILO board
2. Disconnect the hall-effect current transformers CT3 at connector XM1309 and CT4 at connector XM1308 on the FILO board. Measure and compare the resistance of CT3 and CT4.
3. If either current transformer measures open, replace that transformer.
4. If a significant resistance difference is found between CT3 and CT4, replace both current transformers.
5. If there is not a resistance difference, reconnect CT3 to XM1309 and CT4 to XM1308 on the FILO board.
6. Check the C3 output ac filter capacitors for a short.

7. Check phase-to-phase and phase-to-ground on the inverter transformer T2 primary and secondary for a short.
8. Check the inverter output contactor K3N line to load for a short.
9. Remove the inverter module(s) and measure the forward and reverse resistance between the input and output pins on the back of the module. The output pin(s) is/are on the top and the input pins are on the bottom.
10. Replace any inverter module that has a shorted forward or reverse resistance reading between the input and output pins.

5.4.6 Inverter Shuts Down for No Apparent Reason

If the inverter shuts down for no apparent reason, use the following procedure to isolate the problem.

1. Ensure that the power connections in the inverter section are properly secured.
2. Disconnect the hall-effect current transformers CT3 at connector XM1309 and CT4 at connector XM1308 on the FILO board. Measure and compare the resistance of CT3 and CT4.
3. If either current transformer measures open, replace that transformer.
4. If a significant resistance difference is found between CT3 and CT4, replace both current transformers.
5. If there is not a resistance difference, reconnect CT3 to XM1309 and CT4 to XM1308 on the FILO board.
6. Remove the static switch module and check for shorted SCRs by measuring the forward and reverse resistance between the input and output pins for each phase on the back of the module. The output pins are on the top and the input pins are on the bottom.
7. If a shorted SCR is found, replace the static switch module.
8. If the power connections are secure, current transformers CT3 and CT4 check good, and there are no shorted SCRs in the static switch but the problem still exists, replace the CANU board.
9. If the problem still exists, replace the ODUP board.

5.4.7 Blown Inverter Output Fuses (F1, F2, and F3)

If one or more inverter output fuses are blown, use the following procedure to isolate the problem.

1. Remove all power modules (rectifier/battery charger, inverter(s), and static switch).
2. Measure the forward and reverse resistance between all input and output pins on each module to check for a short circuit between power pins.
3. If a short circuit is detected on one of the modules, replace the module.
4. Replace the blown inverter output fuse or fuses.
5. Ensure that the blown fuse indicator switches (SW4, SW5, and SW6) are reset.

5.5 CHANGING CARD MODULE BOARDS

Use the following procedure to remove and replace one of the boards (CANU, ODUP, CHAP, or ALIP) in the card module.

1. Place the UPS in maintenance bypass (see Section 2.3.2.5).
2. Open the left front door on the UPS.
3. Disconnect the four cables connected to the front of the card module.
4. Remove the screw and nut that secures the card module in place on the side edge.
5. Pull the card module out of its slot just enough to access the the ribbon cable connectors on the back of the boards.
6. Disconnect the ribbon cable from the back of the boards.
7. Pull the card module all the way out of its slot.
8. Disconnect the SADP board from the back of the ALIP board (if the SADP board is installed).
9. Remove the two screws that secure the retaining bar across the back of the card module.
10. Pull the board to be replaced out through the rear of the card module.

NOTE

To remove the ALIP board, four special torx screws (two on the top and two on the bottom of the card module) must be removed before the ALIP board can be pulled out through the rear of the card module.

11. Slide the new board into its proper slot through the rear of the card module.

NOTE

If the ALIP board is being installed, ensure that the four special torx screws (two on the top and two on the bottom of the card module) are installed to hold it in place.

12. Reinstall the retaining bar across the back of the card module.
13. Reconnect the SADP board to the back of the ALIP board (if the SADP board is installed).
14. Set the card module on the edge of its slot and reconnect the ribbon cable to the back of the boards.
15. Slide the card module all the way into its slot.
16. Replace the screw and nut that secures the card module in place on the side edge.
17. Reconnect the four cables connected to the front of the card module.

18 Close and secure the left front door on the UPS.

19 Return the UPS to normal operation from maintenance bypass (see Section 2.3.2.6).

NOTE

If the CHAP, ODUP, or CANU board is replaced, the PERSONALIZATION menu must be accessed and the first 20 items must be stepped through and the Enter key pressed to refresh the microprocessor on the new board.

5.6 BATTERY CABINET TROUBLESHOOTING

If it appears that there is a problem with the batteries or the battery cabinet, use the following procedure to isolate the problem.

WARNING

Use extreme care and observe all safety precautions when performing the checks on the UPS Battery Cabinet. High voltage is present on the battery terminals and on the line (battery) side of circuit breaker QF1. Wear insulated gloves and only use insulated tools when working in the UPS Battery Cabinet.

1. Place the UPS in maintenance bypass (see Section 2.3.2.5).
2. Use the allen key to open the right front door of the HA32B UPS Battery Cabinet.
3. Use a Phillips screwdriver to open the left front door on the HA32B UPS Battery Cabinet.
4. Remove the top cover on the HA32B UPS Battery Cabinet.
5. Remove the front cover panel(s) in the HA32B UPS Battery Cabinet.
6. Ensure that the input and output cables on circuit breaker QF1 are properly tightened.
7. Ensure that the positive, negative, and ground cables that go to the HA32A UPS are properly connected to the positive, negative, and ground terminals on the back wall of the UPS Battery Cabinet and tightened.
8. Ensure that the four control wires that go to the HA32A UPS are properly connected to TB1-1, TB1-2, TB1-4, and TB1-5 on the back wall of the UPS Battery Cabinet and tightened.
9. Visually inspect the inside of the UPS Battery Cabinet for debris or damage.
10. Visually inspect each battery for cracks or signs of electrolyte leakage or seepage. Any battery that is cracked or shows signs of leakage or seepage should be replaced before continuing this procedure.
11. With a voltmeter on the dc voltage scale, measure between the UPS Battery Cabinet chassis and the positive terminal on the line (battery) side of circuit breaker QF1. Measure between the UPS Battery Cabinet chassis and the negative terminal on the line (battery) side of circuit breaker QF1. Both measurements should be 0 Vdc. If a dc voltage is present for either measurement, a dc ground fault is indicated and must be corrected before continuing.
12. With a voltmeter on the dc voltage scale, measure between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1. A voltage reading of approximately 360 to 385 Vdc should be obtained.

    A voltage reading of 0 Vdc between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1 indicates an open battery. To locate the open battery, measure the voltage between the positive and negative terminal on each individual battery. A measurement of approximately 12 Vdc indicates a good battery while a measurement of 0 Vdc indicates an open battery.

A voltage reading of less than 350 Vdc between the positive terminal and the negative terminal on the line (battery) side of circuit breaker QF1 indicates shorted or severely discharged batteries. To locate the defective battery, measure the voltage between the positive and negative terminal on each individual battery. A measurement of approximately 12 Vdc indicates a good battery while a measurement of less than 10.5 Vdc indicates a defective battery that should be replaced.

13. Replace the top cover on the HA32B UPS Battery Cabinet.

14. Replace the front cover panel(s) and close the left front door.

15. Return the UPS to normal operation from maintenance bypass (see Section 2.3.2.6).

5.7 PREVENTIVE MAINTENANCE

Preventive maintenance is the process of making repairs or performing other services to a properly functioning unit for the purpose of preventing it from failing.

Preventive maintenance should be performed on the HA32A UPS, the HA32B UPS Battery Cabinet, and any installed UPS options (UPS Auxiliary Cabinet and UPS Distribution Cabinet) anually. This maintenance must be scheduled because the UPS and all attached equipment must be deenergized.

The preventive maintenance consists of a visual and mechanical inspection, cleaning, and electrical checks. The following sections contain the procedures for inspecting, cleaning, and checking the HA32A UPS and associated equipment.

If any problems are discovered during the inspections, they must be corrected or repaired before continuing.

5.7.1 Visual And Mechanical Inspection

Use the following procedure to perform the visual and mechanical inspection on the HA32A UPS, the HA32B UPS Battery Cabinet, and the UPS Auxiliary Cabinet and UPS Distribution Cabinet if they are installed.

1. Turn OFF all equipment attached to the UPS output by using the appropriate sequence.
2. Place the UPS in maintenance bypass (see Section 2.3.2.5).
3. Have the customer's electrician remove all building source power from the UPS system.
4. Open the front doors and remove all covers and panels that are necessary to access the internal components of the UPS cabinets.
5. Check all power connections in the cable entry area with a voltmeter to ensure that all voltage has been removed.

WARNING

Use extreme care and observe all safety precautions when performing the checks on the UPS Battery Cabinet. High voltage is present on the battery terminals and on the line (battery) side of circuit breaker QF1. Wear insulated gloves and only use insulated tools when working in the UPS Battery Cabinet.

6. Ensure that all power cable connections on the bus bars, circuit breakers, switches, and transformers in each cabinet are properly tightened.
7. Visually inspect all transformers for discolored or overheated transformer windings. The transformer windings should be a dark golden brown color. Black windings indicate overheating.
8. Ensure that the interbattery links in the UPS Battery Cabinet are properly tightened.
9. Visually inspect the inside of each cabinet for dirt, debris, and signs of damaged components or cables.
10. Inspect the ac and dc capacitors in the HA32A UPS cabinet for signs of leakage or blown capacitors.

11 Inspect the batteries in the UPS Battery Cabinet for cracks or signs of electrolyte leakage or seepage.

12. Ensure that all ribbon cable connectors and multiwire connectors are properly seated on the printed circuit boards.

13. Ensure that the control wires on all terminal boards are properly tightened.

14. Ensure that all fuses are properly seated on the FILO and TACO boards in the HA32A UPS cabinet.

15. Ensure that the delta-RC fuses (F4, F5, and F6) located on the right side wall of the HA32A UPS cabinet are installed with the button end toward the front of the cabinet, and that the indicator switch (SW1) is closed.

16. Ensure that the wires to the inverter output fuses (F1, F2, and F3) and indicator switches (SW4, SW5, and SW6) located on the right side wall or back wall of the HA32A UPS cabinet are properly connected, and that the indicator switches are all reset.

17. Remove and inspect the inside of each inverter, charger, and static switch module for debris and visible damage before replacing.

18. Perform the cleaning procedures in Section 5.7.2

5.7.2 Cleaning

Cleaning of the UPS cabinets should be performed after making the visual and mechanical inspection. Use the following procedure to perform the cleaning of all the UPS cabinets.

1. Use a clean dry cotton cloth to wipe any dust off the tops of the batteries in the UPS Battery Cabinet.

WARNING

Use extreme care and observe all safety precautions when performing the checks on the UPS Battery Cabinet. High voltage is present on the battery terminals and on the line (battery) side of circuit breaker QF1. Wear insulated gloves and only use insulated tools when working in the UPS Battery Cabinet.

2. Check the interbattery link terminals in the UPS Battery Cabinet for signs of corrosion. Remove the interbattery links and clean the terminals if corrosion is present. When the interbattery links are replaced, ensure that they are torqued to the value specified in Table 5–4.

3. Vacuum the interior of each cabinet to remove any loose dust, dirt, and debris.

4. Vacuum the air inlet and outlet grates in each cabinet to ensure that air can flow freely through the cabinets.

5. Remove the lower front cover panel on the HA32A UPS cabinet. Remove and inspect the draw-out air filter. Replace if necessary.

NOTE

The draw-out air filter, located behind the lower front cover panel on the HA32A UPS cabinet, should be replaced quarterly or as needed. The frequency of replacement depends upon the amount of dust and dirt present at the installation site.

6. Replace all panels and covers that were removed for the visual and mechanical inspection and for cleaning.
7. Clean the exterior covers of each cabinet with a spray cleaner and a clean cotton cloth.
8. Perform the electrical check procedure in Section 5.7.3.

Table 5–4 Interbattery Link Torque Values

Manufacturer	Model No.	Initial Torque Values	Subsequent Torque Values
Yuasa	DM33-12	1.8 N·m (16.3 inch-pounds)	1.2 N·m (10.85 inch-pounds)
Yuasa	DM55-12	1.8 N·m (16.3 inch-pounds)	1.2 N·m (10.85 inch-pounds)
Yuasa	DM80-12	1.8 N·m (16.3 inch-pounds)	1.2 N·m (10.85 inch-pounds)
Johnson Controls	UPS12-95	3.9 N·m (35.0 inch-pounds)	3.4 N·m (30.0 inch-pounds)
Johnson Controls	UPS12-135	3.9 N·m (35.0 inch-pounds)	3.4 N·m (30.0 inch-pounds)
Johnson Controls	UPS12-225	3.9 N·m (35.0 inch-pounds)	3.4 N·m (30.0 inch-pounds)

5.7.3 Electrical Checks

After the visual and mechanical inspection and the cleaning has been performed, the UPS should be returned to normal operation and checked out electrically. Use the following procedure to return the UPS to normal operation and make the electrical checks.

1. Have the customer's electrician return the building source power to the UPS system.
2. Close the main ac input (MAINS1) circuit breaker Q1 on the HA32A UPS.
3. Access the START-UP menu and go through the menu to return the UPS to normal operation.
4. Access the PERSONALIZATION menu and ensure that the first 20 personalization items are set correctly for the specific installation.
5. Access the DIAGNOSIS menu and run self-tests on the UPS.
6. Perform the initial startup tests found in Section 3.4.
7. Turn ON all equipment attached to the UPS output by using the appropriate sequence.


APPENDIX A

A
UPS PARTS

This appendix contains tables listing the parts and part numbers for the different kVA rated UPS units. The figures contained in this appendix show the location of the major parts on the different kVA rated UPS units.

Order parts through normal channels using the supplied part numbers. Parts without Digital part numbers are available on special order.

Table A–1 Parts List for the 20 kVA UPS Units

Part Description	Part Number
Fan Assembly	29-27313-01
Draw-out Air Filter	29-27329-02
Card Module Ribbon Cable	29-27416-01
ALIP Board	29-27299-01
CHAP Board	29-27300-01
ODUP Board	29-27301-01
CANU Board	29-27302-01
TACO Board	29-27303-01
FILO Board	29-27323-01
AQCT Board (208 Vac Input)	29-27304-01
AQCF Board (480 Vac Input)	29-27306-01
AQOT Board (208 Vac Output)	29-27305-01
AQOF Board (480 Vac Output)	29-27307-01
DIFP Board	29-28004-01
DISP Board	29-28005-01
Display Module	29-27308-01
Card Module (Without Boards)	29-27411-01
Inverter Module	29-27309-01
Rectifier/Battery Charger Module	29-27314-01
Static Switch (208 Vac)	29-27319-01
Static Switch (480 Vac)	29-27322-01
Contactor (32 Amp, 600 V)	29-27342-01
Contactor (70 Amp, 600 V)	29-27343-01
Current Transformer (50:1)	29-27330-01
Current Transformer (100:1)	29-27331-01
Hall-effect Current Transformer CT3 and CT4	29-27418-01
AC Output Filter Capacitor Assembly (208 Vac)	29-27324-01
AC Output Filter Capacitor Assembly (480 Vac)	29-27325-01
DC Capacitor Assembly	29-27415-01
Bypass Surge Protector Fuses F4, F5, and F6 (25 Amp, 500 V)	12-31780-01 (Qty 10)
Bypass Surge Protector Capacitor (15 uF, 550 V)	10-31779-01
Bypass Surge Protector Resistor (27 Ohm, 200 W)	13-31781-01
Inverter Output Fuses F1, F2, and F3 (100 Amp, 600 V for 208 Vac Output)	12-31782-02
Inverter Output Fuses F1, F2, and F3 (63 Amp, 600 V for 480 Vac Output)	12-31782-01
FILO and TACO Board Fuses (2 Amp, 600 V)	12-31783-01 (Qty 10)

Table A–1 (Cont.) Parts List for the 20 kVA UPS Units

Part Description	Part Number
FILO Board Fuses (6 Amp, 600 V)	12-31783-02 (Qty 10)
Top Door Hinge	29-27419-01
Bottom Door Hinge	29-27420-01
DM33-12 Battery	12-33052-01
UPS12-95 Battery	12-33053-01

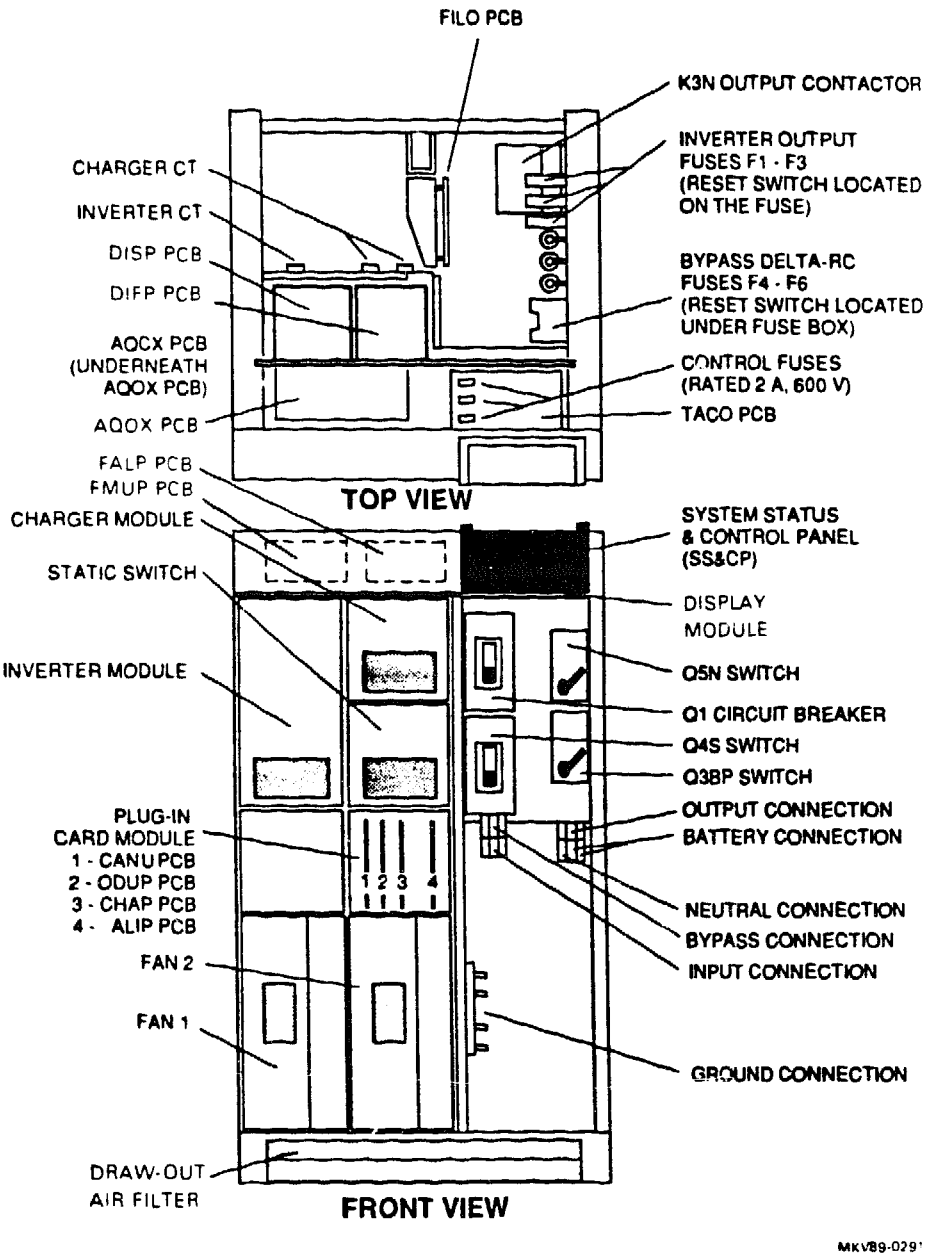


Figure A–1 20 kVA UPS Parts Location

Table A–2 Parts List for the 40 kVA UPS Units

Part Description	Part Number
Fan Assembly	29-27313-01
Draw-out Air Filter	29-27329-02
Card Module Ribbon Cable	29-27416-01
ALIP Board	29-27299-01
CHAP Board	29-27300-01
ODUP Board	29-27301-01
CANU Board	29-27302-01
TACO Board	29-27303-01
FILO Board	29-27323-01
AQCT Board (208 Vac Input)	29-27304-01
AQCF Board (480 Vac Input)	29-27306-01
AQOT Board (208 Vac Output)	29-27305-01
AQOF Board (480 Vac Output)	29-27307-01
DIFP Board	29-28004-01
DISP Board	29-28005-01
Display Module	29-27308-01
Card Module (Without Boards)	29-27411-01
Inverter Module	29-27310-01
Rectifier/Battery Charger Module	29-27315-01
Static Switch (208 Vac)	29-27319-01
Static Switch (480 Vac)	29-27322-01
Contactor (70 Amp, 600 V)	29-27343-01
Contactor (125 Amp, 600 V)	29-27344-01
Current Transformer (100:1)	29-27331-01
Current Transformer (200:1)	29-27333-01
Hall-effect Current Transformer CT3 and CT4	29-27418-01
AC Output Filter Capacitor Assembly (208 Vac)	29-27326-01
AC Output Filter Capacitor Assembly (480 Vac)	29-27327-01
DC Capacitor Assembly	29-27415-01
Bypass Surge Protector Fuses F4, F5, and F6 (25 Amp, 500 V)	12-31780-01 (Qty 10)
Bypass Surge Protector Capacitor (15 uF, 550 V)	10-31779-01
Bypass Surge Protector Resistor (27 Ohm, 200 W)	13-31781-01
Inverter Output Fuses F1, F2, and F3 (160 Amp, 600 V for 208 Vac Output)	12-31782-03
Inverter Output Fuses F1, F2, and F3 (100 Amp, 600 V for 480 Vac Output)	12-31782-02
FILO and TACO Board Fuses (2 Amp, 600 V)	12-31783-01 (Qty 10)

Table A–2 (Cont.) Parts List for the 40 kVA UPS Units

Part Description	Part Number
FILO Board Fuses (6 Amp, 600 V)	12-31783-02 (Qty 10)
Top Door Hinge	29-27419-01
Bottom Door Hinge	29-27420-01
DM55-12 Battery	12-33052-02
UPS12-135 Battery	12-33053-02

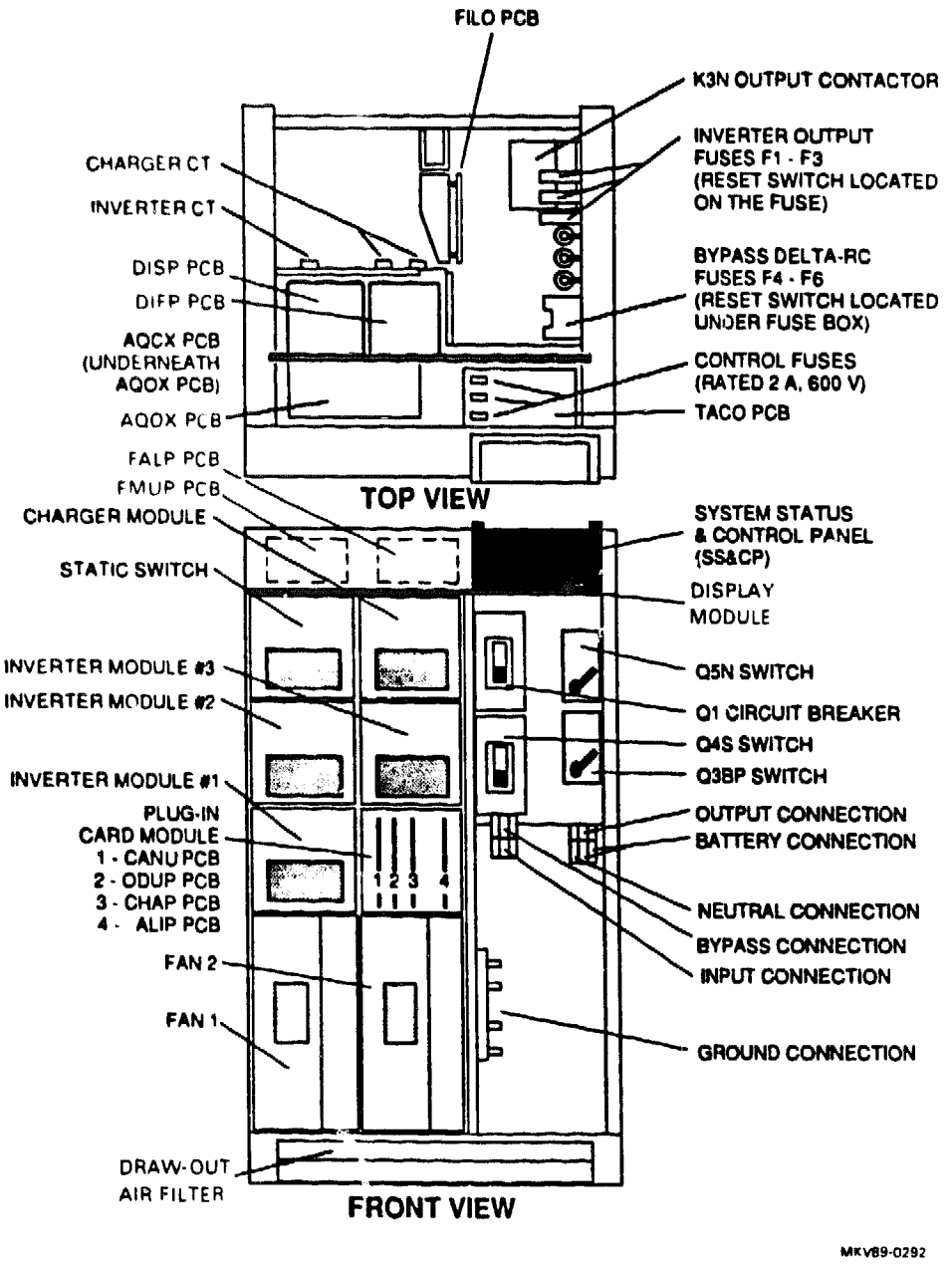


Figure A–2 40 kVA UPS Parts Location

Table A–3 Parts List for the 60 kVA UPS Units

Part Description	Part Number
Fan Assembly	29-27318-01
Draw-out Air Filter	29-27329-01
Card Module Ribbon Cable	29-27416-01
ALIP Board	29-27299-01
CHAP Board	29-27300-01
ODUP Board	29-27301-01
CANU Board	29-27302-01
TACO Board	29-27303-01
FILO Board	29-27323-01
AQCT Board (208 Vac Input)	29-27304-01
AQCF Board (480 Vac Input)	29-27306-01
AQOT Board (208 Vac Output)	29-27305-01
AQOF Board (480 Vac Output)	29-27307-01
DIFP Board	29-28004-01
DISP Board	29-28005-01
Display Module	29-27308-01
Card Module (Without Boards)	29-27411-01
Inverter Module	29-27311-01
Rectifier/Battery Charger Module	29-27316-01
Static Switch (208 Vac)	29-27320-01
Static Switch (480 Vac)	29-27322-01
Contactor (125 Amp, 600 V)	29-27344-01
Contactor (200 Amp, 600 V)	29-27345-01
Current Transformer (150:1)	29-27332-01
Current Transformer (300:1)	29-27334-01
Hall-effect Current Transformer CT3 and CT4	29-27418-01
AC Output Filter Capacitor Assembly (208 Vac)	29-27328-01
AC Output Filter Capacitor Assembly (480 Vac)	29-27412-01
DC Capacitor Assembly	29-27415-01
Bypass Surge Protector Fuses F4, F5, and F6 (25 Amp, 500 V)	12-31780-01 (Qty 10)
Bypass Surge Protector Capacitor (15 uF, 550 V)	10-31779-01
Bypass Surge Protector Resistor (27 Ohm, 200 W)	13-31781-01
Inverter Output Fuses F1, F2, and F3 (250 Amp, 600 V for 208 Vac Output)	12-31782-05
Inverter Output Fuses F1, F2, and F3 (160 Amp, 600 V for 480 Vac Output)	12-31782-03
FILO and TACO Board Fuses (2 Amp, 600 V)	12-31783-01 (Qty 10)

Table A–3 (Cont.) Parts List for the 60 kVA UPS Units

Part Description	Part Number
FILO Board Fuses (6 Amp, 600 V)	12-31783-02 (Qty 10)
Top Door Hinge	29-27419-01
Bottom Door Hinge	29-27420-01
DM80-12 Battery	12-33052-03
UPS12-225 Battery	12-33053-03

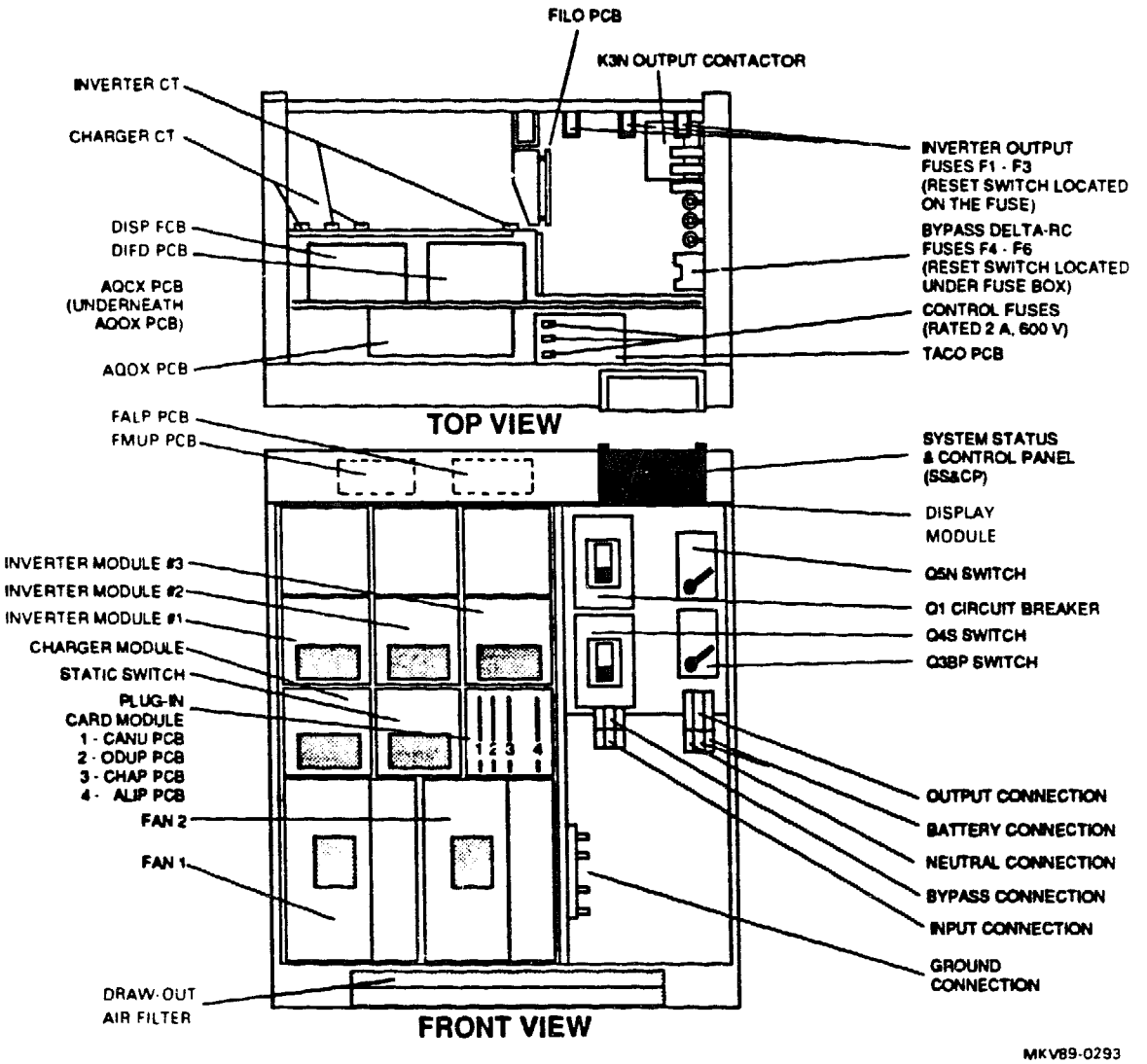


Figure A–3 60 kVA UPS Parts Location

Table A–4 Parts List for the 80 kVA UPS Units

Part Description	Part Number
Fan Assembly	29-27318-01
Draw-out Air Filter	29-27329-01
Card Module Ribbon Cable	29-27416-01
ALIP Board	29-27299-01
CHAP Board	29-27300-01
ODUP Board	29-27301-01
CANU Board	29-27302-01
TACO Board	29-27303-01
FILO Board	29-27323-01
AQCT Board (208 Vac Input)	29-27304-01
AQCF Board (480 Vac Input)	29-27306-01
AQOT Board (208 Vac Output)	29-27305-01
AQOF Board (480 Vac Output)	29-27307-01
DIFP Board	29-28004-01
DISP Board	29-28005-01
Display Module	29-27308-01
Card Module (Without Boards)	29-27411-01
Inverter Module	29-27312-01
Rectifier/Battery Charger Module	29-27317-01
Static Switch (208 Vac)	29-27321-01
Static Switch (480 Vac)	29-27322-01
Contactor (125 Amp, 600 V)	29-27344-01
Contactor (300 Amp, 600 V)	29-27346-01
Current Transformer (200:1)	29-27333-01
Current Transformer (400:1)	29-27417-01
Hall-effect Current Transformer CT3 and CT4	29-27418-01
AC Output Filter Capacitor Assembly (208 Vac)	29-27413-01
AC Output Filter Capacitor Assembly (480 Vac)	29-27414-01
DC Capacitor Assembly	29-27415-01
Bypass Surge Protector Fuses F4, F5, and F6 (25 Amp, 500 V)	12-31780-01 (Qty 10)
Bypass Surge Protector Capacitor (15 uF, 550 V)	10-31779-01
Bypass Surge Protector Resistor (27 Ohm, 200 W)	13-31781-01
Inverter Output Fuses F1, F2, and F3 (315 Amp, 600 V for 208 Vac Output)	12-31782-06
Inverter Output Fuses F1, F2, and F3 (200 Amp, 600 V for 480 Vac Output)	12-31782-04
FILO and TACO Board Fuses (2 Amp, 600 V)	12-31783-01 (Qty 10)

Table A–4 (Cont.) Parts List for the 80 kVA UPS Units

Part Description	Part Number
FILO Board Fuses (6 Amp, 600 V)	12-31783-02 (Qty 10)
Top Door Hinge	29-27419-01
Bottom Door Hinge	29-27420-01
DM55-12 Battery	12-33052-02
UPS12-135 Battery	12-33053-02

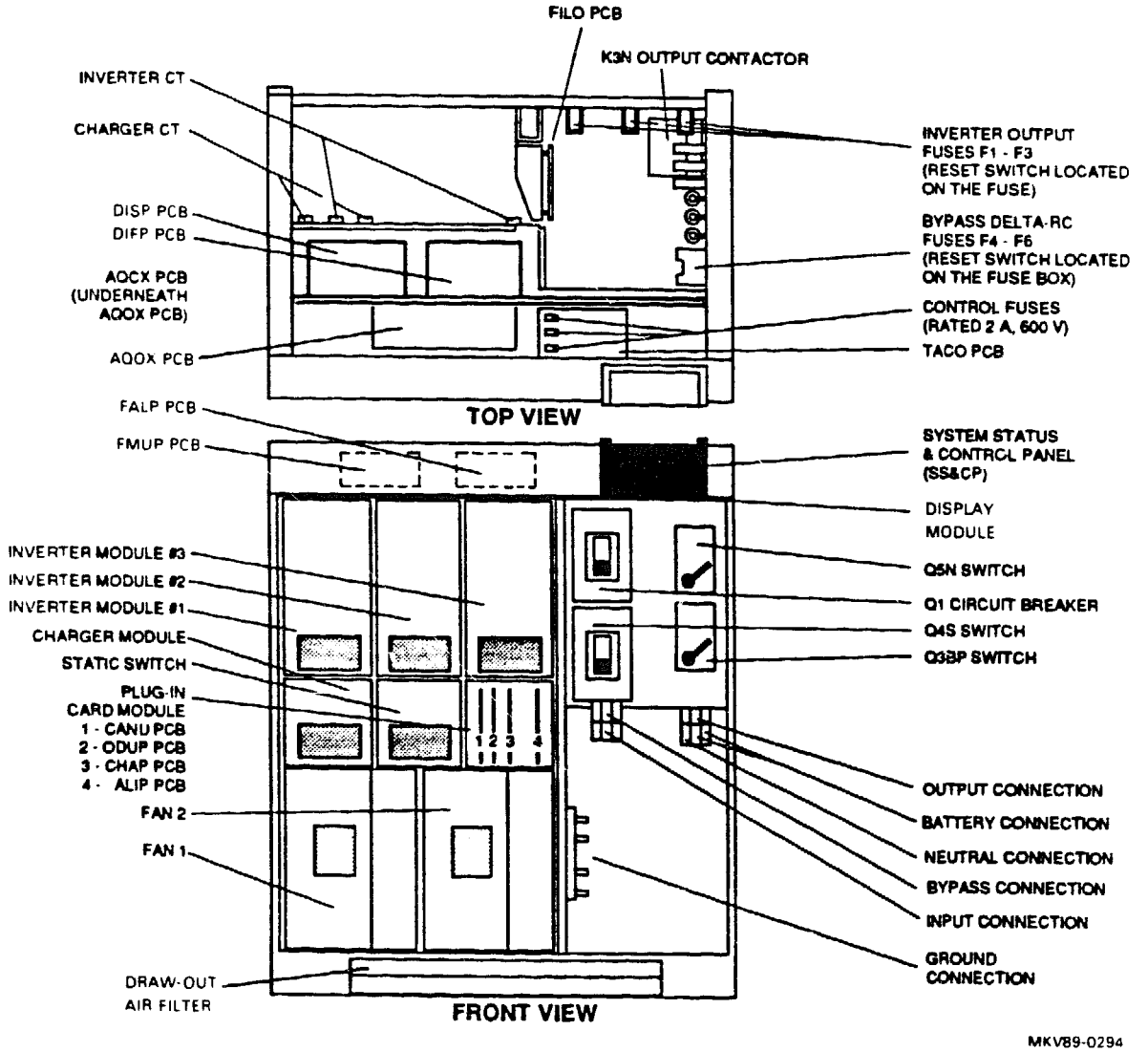


Figure A–4 80 kVA UPS Parts Location

Table A–5 Parts List for the UPS Auxiliary Cabinet with Harmonic Current Filter

kVA Rating	Part Description	Part Number
20 kVA	AC Capacitor Assembly	29-28247-01
40 kVA	AC Capacitor Assembly	29-28247-02
60 kVA	AC Capacitor Assembly	29-28247-03
80 kVA	AC Capacitor Assembly	29-28247-04

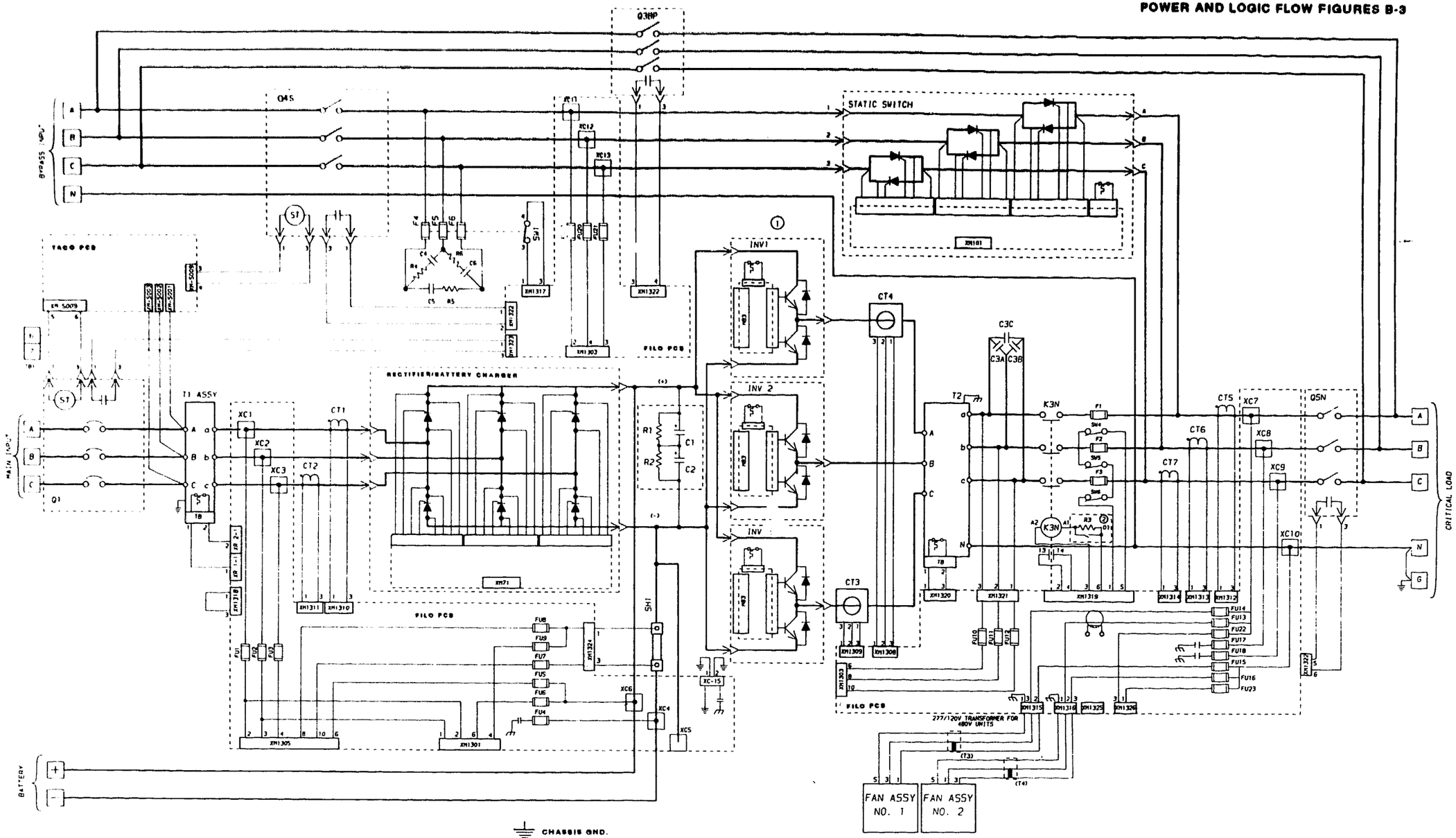

APPENDIX B

B

POWER AND LOGIC FLOW FIGURES

This appendix contains the power flow and logic flow figures for the HA3000 UPS. These figures should be used along with the technical descriptions in Chapter 4 to help in troubleshooting the HA3000 UPS.

NOTES



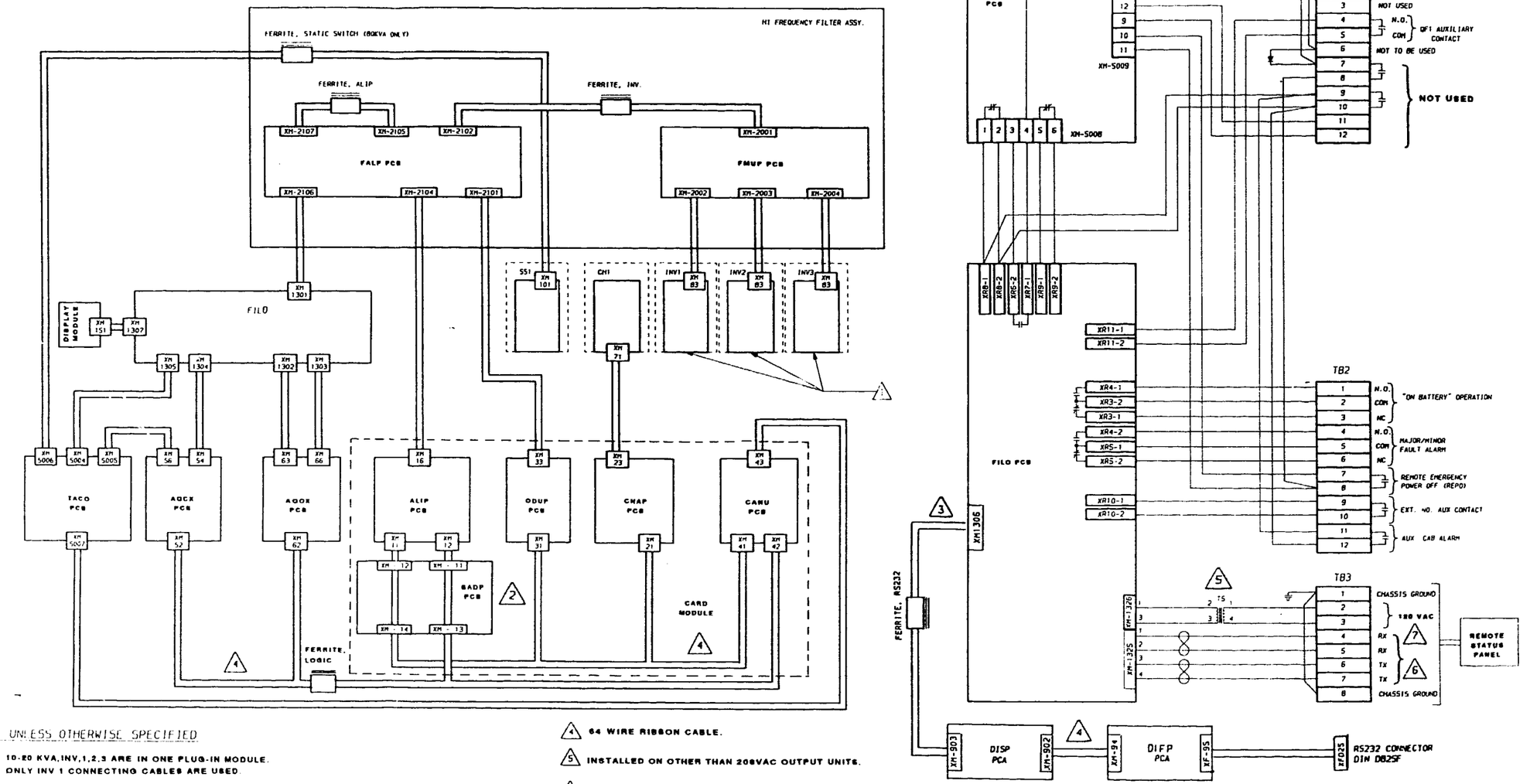
NOTES:

① FOR 10-20 KVA INV 1,2,3 ARE IN ONE MODULE.

② FOR 80 KVA 208V UNITS ONLY.

FIGURE B-1 HA3000 POWER FLOW

MKV89-0295



NOTES: UNLESS OTHERWISE SPECIFIED

1. 10-20 KVA,INV,1,2,3 ARE IN ONE PLUG-IN MODULE. ONLY INV 1 CONNECTING CABLES ARE USED.
2. THE SADP PCB IS NOT USED ON NEWER MODELS
3. CONNECTOR USED FOR CONNECTING SPECIAL KEY BOX TO ACCESS PERSONALIZATION MENU ITEMS 21 THRU 31.
4. 64 WIRE RIBBON CABLE.
5. INSTALLED ON OTHER THAN 208VAC OUTPUT UNITS.
6. CONTROL WIRES: 24VAC,20MA MAX,RUN IN A SEPERATE STEEL CONDUIT.
7. POWER WIRES: 120VAC,2A MAX,RUN IN A SEPERATE STEEL CONDUIT.

Figure B–2 HA3000 Logic Flow

MKV89-0296


INDEX

Index

G

H

I

L

M