UNITY/I™

SERVICE MANUAL

This Workshop Guide is for Training purposes Only by Best Power.

LTS-0511

UNITY/I SERVICE MANUAL
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WARNING!

These procedures must be performed by a qualified service technician ONLY!

UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage and injury. A short circuit can cause a battery to explode. Always wear protective clothing and eye protection and use insulated tools when working near batteries.

BEST recommends the following for qualified service technicians servicing the UPS:

1. Remove rings, watches and other jewelry before servicing the UPS.
2. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
3. Whenever you are servicing an energized unit with the cover removed, electric shock is possible follow all local safety codes.

To avoid possible personal injury or equipment damage, assume that there may be AC voltage at the UPS's output terminals any time AC input power or DC battery voltage is applied. The UPS can provide output voltage from the batteries even when there is no AC input line voltage. When AC voltage is present, the UPS can provide output voltage even when the batteries are disconnected. Be sure to **TEST BEFORE TOUCHING!**

Some units have been programmed at the factory for autostart. This parameter will automatically switch the unit on any time mains (AC line) is applied. For more information, or how to change this feature, see Subsection 306.

Full voltage and current are always present at the battery terminals. The batteries used in this system can produce dangerous voltages, extremely high currents and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). You must be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals during battery installation. Do not touch uninsulated battery terminals.

A qualified electrician who is familiar with battery systems and required precautions must install and service the batteries. Any battery used with this UPS shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924.

The installation must conform to national and local codes as well. Keep unauthorized personnel away from batteries.

The electrician must take these precautions:

1. Wear protective clothing (rubber gloves and boots) and protective eye wear. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Don't carry metal objects in your pockets where the objects can fall into the battery cabinet.

2. Tools must have insulated handles and must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay them where they could fall onto the batteries or into the cabinet.

3. Install the batteries as shown on the drawing provided with the batteries. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.

4. Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.

5. Install the battery cables so they cannot be pinched by the battery cabinet or UPS doors.

6. Battery cabinet chassis (ground or earth) must be connected to the UPS chassis (ground or earth). If you use conduit, this ground conductor must be routed in the same conduit as the battery conductors.

7. Where conductors may be exposed to physical damage, protect the conductors in accordance with ANSI/NFPA 70-1993.

8. If you are replacing batteries or repairing battery connections, follow the correct procedures to shut off your UPS and remove both AC and DC power.

SECTION 100: INTRODUCTION

This Service Manual supplements the Planning and Installation Manual and the User Manual that was sent with the UPS. You should be familiar with both manuals before you use this Service Manual. If the Planning and Installation Manual or User Manual have been lost or misplaced, please contact our Technical Support Center for a replacement.

This manual does not cover changes that were made in the UT310, UT315, UT320, and UT330 after this manual was published, available options, or Customer Purchase Options (CPOs).

100-1 Technical Support

Best Power Technology, Inc. has an outstanding Technical Support Center. Please write or call if you have a problem or a question about your UNITY/I Series 300. When you do contact technical support, please have the unit's serial number and model number available. These numbers can be found on the specification label located inside the front door(s) of the unit. All service records and system modifications are filed by serial number.

The Technical Support Center is open every business day from 7:00 a.m. to 11:00 p.m. Central Time. Customers outside the United States may wish to use the TELEX number. If you need to send drawings or diagrams, you can use our fax number. If you have a sales inquiry, you may call the Sales department toll-free in the U.S. and Canada. (See the telephone numbers below; for other countries, see the back cover of this manual.)

Technical Support	1-800-356-5737 (U.S. and Canada)
Technical Support	1-608-565-2100
Technical Support Fax	1-608-565-2509
General Fax	1-608-565-2221
TELEX	701934
Sales	1-800-356-5794 (U.S. and Canada)
General Office	1-608-565-7200
BBS	1-608-565-7424
CompuServ:	Type "Go BEST" at any ! prompt
E-Mail:	Service@bestpower.gensig.com

Mailing Address: Best Power Technology, Inc.
Technical Support Center
P.O. Box 11
Necedah, WI 54646

A variety of technical services are available from BEST's Technical Support Center.

Telephone Support

If you have a question about a UNITY/I Series 300 system, such as how to install or repair it, call the Technical Support hotline at 1-800-356-5737. BEST's staff of Field Service Technicians is available 24 hours a day to help customers with any type of problem relating to a UNITY/I system.

Field Support

In the unlikely event that your UNITY/I Series 300 system should fail, you can make arrangements to have your system repaired by a BEST factory-trained technician. Call the technical support hotline for price and scheduling information.

Service Training

If you would like to arrange factory training for your in-house service technicians, call 1-800-356-5794 (in the U.S.A. or Canada) or call 1-608-565-7200 for pricing and workshop information.

100-2 Warranty Information

As stated in the Warranty section of the user manual, the warranty period is two years from the date of purchase. If within the two year period you return a UNITY/I system, component (fuses, transformer, etc.), or circuit board to BEST's Technical Support Center, BEST will repair or replace it free of charge. Make sure that you call for a Return Material Authorization (RMA) number before returning anything to BEST. The customer is responsible for all freight charges to and from BEST. See Section 103 for more information.

Customers who purchase the Customer Protection Plan (CPP) receive on-site service and extended warranty coverage. Contact the Technical Support Center for detailed information about the CPP and other warranty enhancement plans.

100-3 Ordering Exchange Parts

BEST products are warranted for two years. If a product fails while under warranty, you may order replacement parts for exchange.

After the warranty has expired, you may order exchange parts. However, the failed part must be repairable to qualify for the Non-Warranty Parts pricing.

To send in a failed part for exchange, contact the Technical Support Center, give the serial number of your system, and ask for a Return Material Authorization (RMA) number. Once you have been issued an RMA, ship the failed part back to BEST. **Do not ship returned parts COD**; BEST will refuse such shipments. Please be sure to mark the RMA number clearly on the outside of the shipping carton. When the Technical Support Center receives the failed parts, the Center will send repaired and reconditioned replacement parts out within two days, and you will be invoiced for shipping charges. If BEST judges the failed parts to be out of warranty, the replacement parts will be sent COD for the value of the parts plus shipping charges.

SECTION 200: SYSTEM DESCRIPTION AND THEORY OF OPERATION

This section will provide an overview of how the unit operates and the major components involved in that process.

200-1 System Description

The three-phase UNITY/I protects sensitive equipment from blackouts, brownouts, lightning, spikes, sags, surges, and noise while it provides harmonics isolation and uninterruptible power. The UNITY/I also provides ±1% static voltage regulation for symmetrical loads and features a true on-line, single-conversion technology.

As an on-line UPS, the UNITY/I provides regulated output voltage in normal and battery operation. When mains (AC input) fail, there is no transfer switching and no interruptions in the output voltage when switching from normal to battery operation and vice versa.

The UNITY/I patented, single-conversion technology, converts the incoming power only once. The UPS transfers the mains directly through a choke and then to the output. The inverter is on, regulating the output and charging the batteries. This allows for a sinusoidal input current, regardless of the output load.

In addition, the UNITY/I has the following features:

Full KVA/KW rating

The unit has full KVA/KW rating, regardless of crest factor.

Overload capability

During normal operation, the unit can handle a 250% overload for one minute and 150% for ten minutes. The unit is capable of handling an instantaneous (step-load) spike up to 150%, without going out of the "normal" mode.
During battery operation, the unit can handle a 150% overload for one minute and 125% for ten minutes.

Accepts 100% asymmetrical load

A single phase (leg) can be fully loaded, provided the output current rating per phase is not exceeded. However, the output voltage tolerance must not exceed ±3%.

Temperature compensated charger function

The temperature compensated charger function optimizes battery life by monitoring the temperature and adjusting the charge voltage automatically. The charge profile (voltage and current) can be tailored to the recommendations of a specific battery manufacturer or to a customer's preferred method. This feature comes standard on models with internal batteries and is available on all models.

Microprocessor controlled

Each UNITY/I has multiple microcomputers that let you control, monitor, meter, and diagnose conditions. Because of these microcomputers, you can easily change and calibrate set points and functions from the unit's front panel.

Parallel option

Up to nine units of various size, with the same DC bus voltage, can be paralleled to increase power and to obtain redundancy. A redundant system is set up to allow sufficient reserve power in case of a single unit break down. When set up for redundancy, the remaining units are able to carry the load. This is not the case if the units are paralleled to increase power and the system is fully loaded.

Economy Mode

Economy mode provides the highest efficiency available – up to 98%. During economy mode, the mains run directly to the load. However, the UPS continues to monitor the mains and the output voltage, and in case of a mains failure, the unit will switch into battery operation without interruption.

Modular components

Because of the modular components, servicing and maintenance are easy.

Generator Compatibility

In case of a mains failure, the UNITY/I switches to battery operation. At this time, the diesel generator is started and is stabilized. As soon as the supply is reestablished by the generator, the unit switches back to normal operation.

Because the inverter is constantly interacting with the input, the output remains constant. A pure sinusoidal mains current is seen with minimal harmonics created. This allows the generator to be sized with a rating close to same rating as the UPS.

Furthermore, for very sensitive diesel installations, the UNITY/I may be programmed for soft walk-in. When the unit switches back to normal operation, the soft start feature will transfer the load slowly to the generator from the battery.

200-2 Theory of Operation

The three-phase UNITY/I operates in five different modes: "Normal Operation," "Battery Operation," "Bypass Operation," "Economy Mode," and "Standby Mode."

During **normal operation**, mains (AC input) pass through the static switch, through the input choke, into the main transformer and out to the loads. (See Figure 1.) During normal operation, the output is regulated via the inverter and the battery is being charged. This is the only mode that the batteries can be charged during.

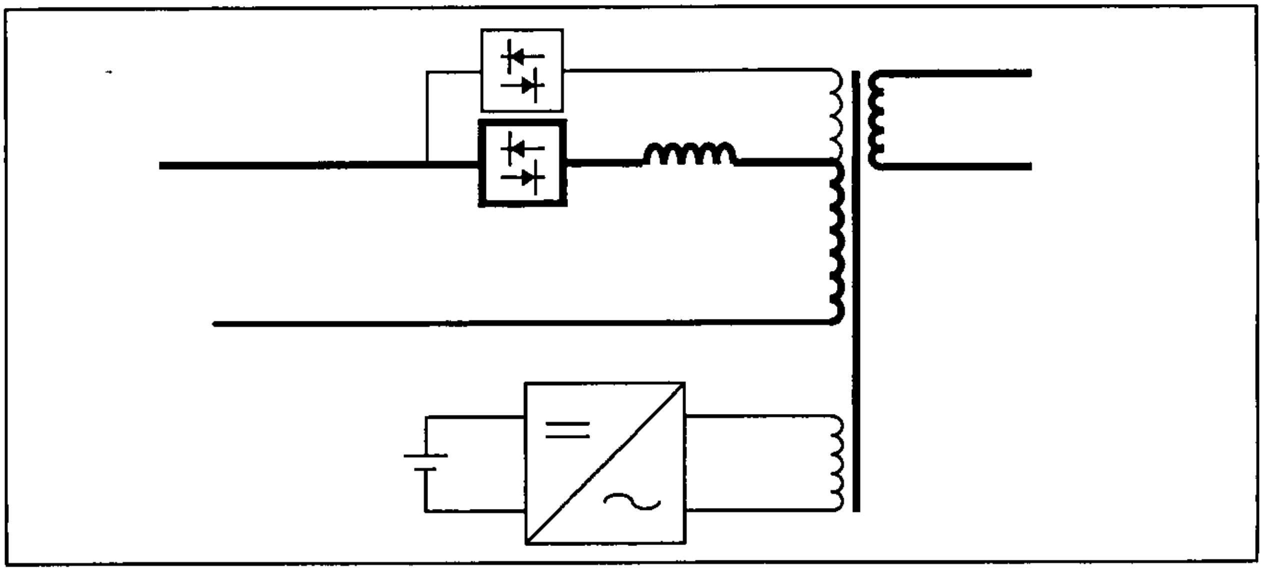


Figure 1 - Normal Operation

When mains is out of tolerance, the unit switches into **battery operation**. The main static switch opens, and the inverter draws power from the batteries. The power is then sent through the main transformer and out to the loads. (See Figure 2.) If battery capacity is exceeded, the unit will go into standby and wait for the return of mains. If autostart is programmed "On," the unit will automatically start after mains returns. If autostart is programmed "Off," the unit must be started manually.

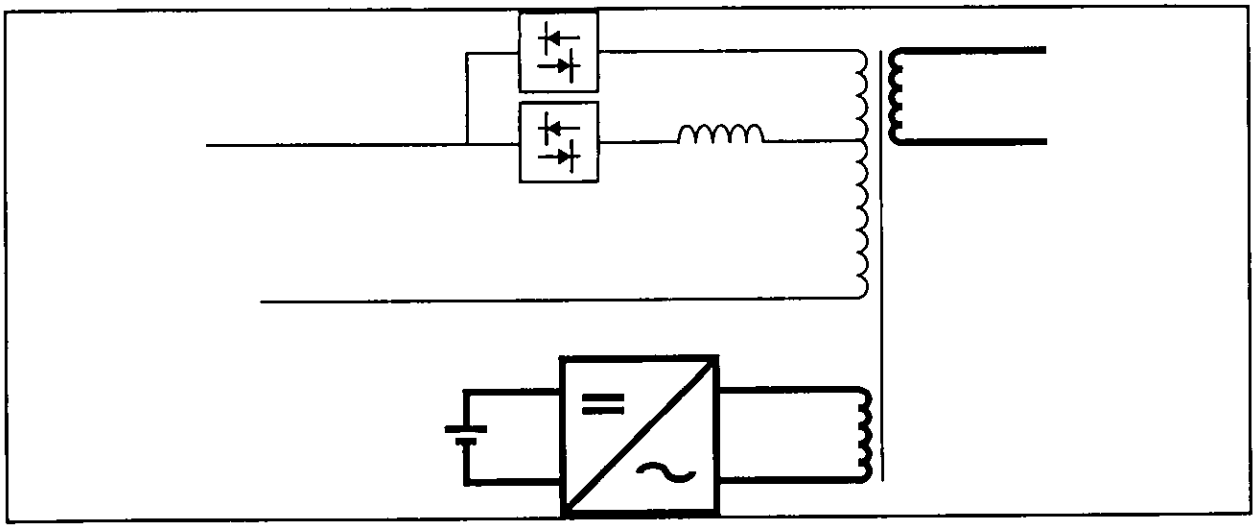
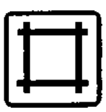
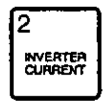
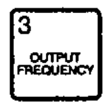
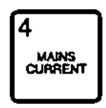
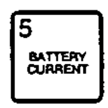
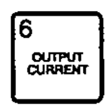
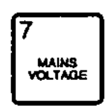
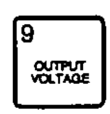


Figure 2 - Battery Operation

300-5-1 Keypad

KEY	DESCRIPTION
	Scroll up through a list
	Scroll down through a list
	Enter or Exit a mode
	Switch a parameter from "ON"to "OFF", or when used alone to view the alarm log
	Access to user parameters
	Silences audible alarm
	Not used

KEY	DESCRIPTION
	when used alone to view the time and date.
	Displays inverter current
	Displays output frequency
	Displays mains current
	Displays battery current
	Displays output current
	Displays mains voltage
	Displays battery voltage
	Displays output voltage

THE DISPLAY UNIT

The standard display unit is located on the front panel of the UNITY/I. It consists of a display, an alarm LED and a keypad.

(See Figure 5).

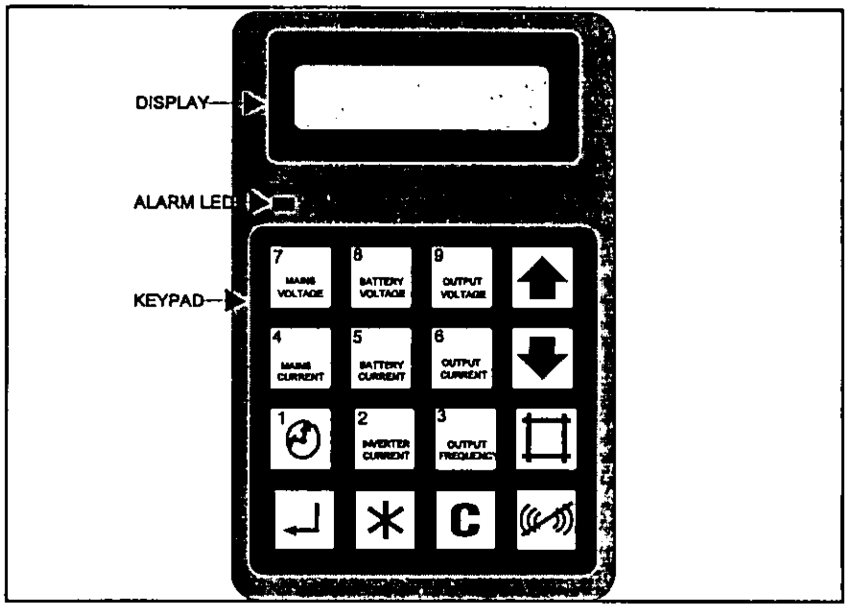
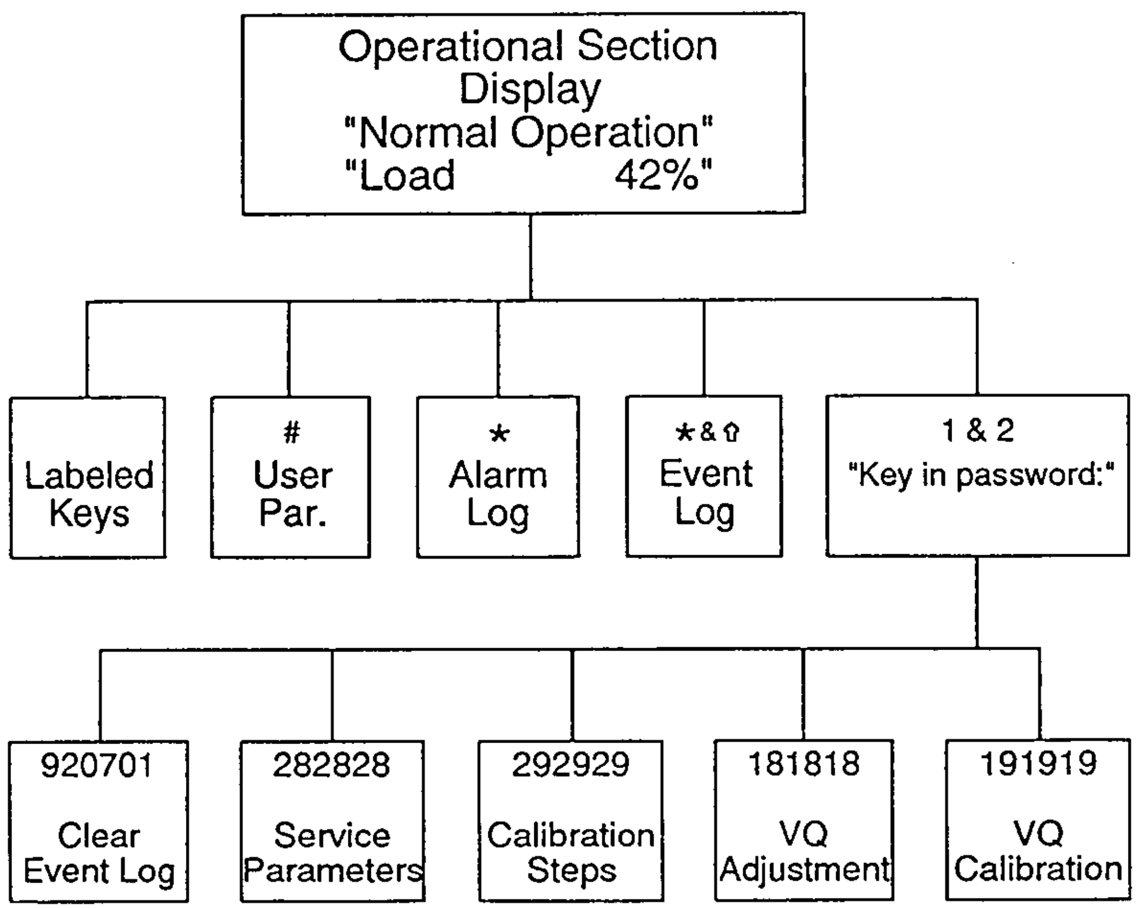


Figure 5 - Display Unit

UNITY/I Three-Phase
Keypad Flowchart



D219-TRN0038a

9. **If you have <u>External Batteries</u>**, with one or more separate battery cabinet(s) with DC switch(es), pre-charge, then turn the switch(es) on. Push the green "ON" button, and observer the display "Normal operation load power xx%". (Skip to Step #14)

10. **If you have <u>Internal Batteries</u>**, When the audible alarm stops, push the green "ON" button located inside the front door. The display will show "Normal operation load power xx%."

    This may take several attempts, as the DC capacitors need to charge. If the unit still doesn't start, and you have <u>Internal Batteries</u>, check that the displayed Battery Voltage is at least 100 V before engaging the DC. (See below)

11. Open the fuse holder (F001, F002, F003), by pulling the handle towards you. Place the fuses in the holder with the red tab facing the top of the fuse holder. The fuse locking tabs must be aligned in the slots on the fuse holder. (See Figure 9.)

12. Lock the fuses into the holder by applying a light downward force on the fuse. When the fuse is locked in correctly, there will be a "click."

13. **Using an open palm**, close the fuse holder. Push the green "ON" button to start the UPS.
    or you'll hurt your hand.

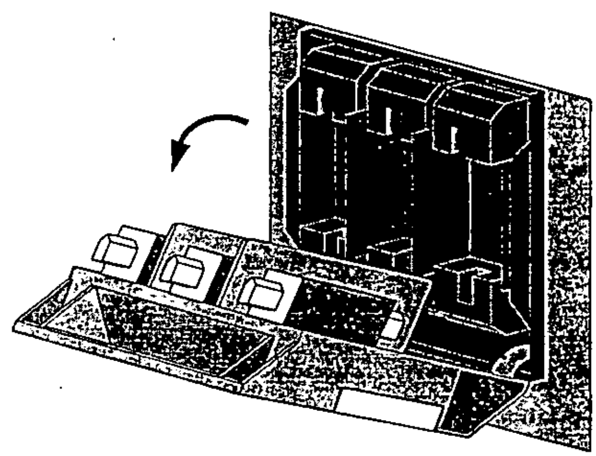


FIGURE 9 - Fuse Holder

14. **If an alarm sounds, access the alarm log. Check to see if the battery monitor alarm was activated.**
    (See Section 300-6 for instructions on how to access the alarm log and how to access the user parameters and activate the parameter "battery monitor reset."

15. Close the front door(s).

NOTE: If the UPS is connected to a generator, verify that the unit runs properly on the generator before continuing. If the unit operates correctly, continue. However, if the UPS is not functioning properly on the generator, phone BEST's Technical Support Center for assistance.

SECTION 300: SYSTEM OPERATION AND COMMUNICATION

This section will describe the basic startup and shutdown procedures and how to communicate with the unit via the display unit.

300-1 ON/OFF BUTTONS

When the front doors are open, the green "ON" button and the red "OFF" button will be visible. When the green "ON" button is pressed, the UPS will begin to provide backup power when it is needed, depending on system modes, and providing that AC and DC power are properly applied. The red "OFF" button, when activated, means that the unit is in standby and **will not provide output voltage.**

300-2 INITIAL STARTUP

FOLLOW THIS ENTIRE PROCEDURE EXACTLY!

1. With all AC and DC power **off**, place the UPS external bypass switch on the MBC to "UPS."

2. Make sure either the main circuit breaker in the load service panel is off or the loads cannot receive power from the UPS.

3. Open the UPS's front door(s).

4. If you have Internal Batteries, remove the retaining brackets for the fuse holder containing fuses F001, F002, and F003.
   The DC fuses should have been shipped along with the UPS in a separate bubble wrap.
   Wait until after Step 9 to engage the DC fuses.

5. At the UPS's mains AC input service panel, switch "ON"the input power to the UPS and the bypass switch. (There should be a noticeable sound (click) as the backfeed relay energizes.)
   * smaller units also have several small clicks' while charging capacitors.

6. Turn the UPS AC input disconnect switch on. The display will show "System type xxkVA xxxV" and an audible alarm will sound.

7. After ten seconds, the display will show "**Stand-by**."

8. Check the phase rotation at the service panel and the unit, **it must be A, B, C and clockwise.** The unit will not start if the rotation is incorrect. Synchronization error alarm

SHUTDOWN

If the loads are to remain powered, program the unit into static bypass operation before shutting down. If the loads are not connected, go to Step 3.

1. Program the unit into static bypass operation.

   a. Press  to access the user parameters.

   b. Use the arrow keys until the display shows "Bypass operation "OFF."

   c. Press  to activate "ON." The display shows "Bypass operation."

2. Turn the UPS bypass switch on the MBC to "BYPASS."

3. Shut the unit off by pressing the red "OFF" button located inside the front door.

4. Turn the UPS AC disconnect switch to "OFF."

5. Open the DC fuse holder and remove the fuses (F001, F002, F003), and store them in a safe place.

6. If you have one or more separate battery cabinet(s) with DC switch(es), turn the switch(es) off. Then discharge the DC capacitors via the discharge button in the cabinet.

7. If the loads are not to be powered, switch off all AC power sources to the UPS and MBC.

8. After all AC & DC power has been removed, press the green start button to bleed off any remaining voltage on the DC caps. Wait an additional 5 minutes before preceding.

To reset the alarm of Battery monitor alarm
It then ↑ to Battery monitor reset.

Any external batteries, bring up in D.C., as per 4a.

300-3 START-UP FROM BYPASS OPERATION

For initial startup procedures see Section 300-2.

1. Make sure the UPS AC disconnect switch is OFF, the UPS bypass switch is on LINE and the DC disconnect is OFF.

2. Switch the UPS AC input disconnect switch to "ON." The display will show "System type xxkVA xxV" and an audible alarm will sound.

3. After ten seconds, the display will show "**Stand-by**."

4a. If you have <u>external</u> batteries, turn the precharge/discharge switch to the precharge position and hold it until the LED is off. Then, switch the DCD to the "ON" position.
4b. If you have <u>internal</u> batteries, and the DC fuses have been removed, wait until after Step 5 before engaging DC.

5. Push the green "On" button located inside the front door. The display will show "Normal operation load power xx%."

*→ Push the fuses in Now.

6. Using the keypad, program the unit into static bypass operation.

   a. Press to access the User parameters.

   b. Use the or keys until the display shows "Bypass operation: OFF."

   c. Press to activate ON. The display shows "Bypass operation."

7. Place the UPS bypass switch on the MBC to "UPS."

8. Using the keypad, program the unit into normal operation by turning the bypass mode "OFF".

   a. Access the User parameters by pressing

   b. Use the arrow keys until the display shows "Bypass operation: ON."

   c. Press to switch the bypass mode to "OFF."

   d. The display should now show "Normal operation load power xx%"

200-3-5 Transistor Switch Module-TSM (Inverter)

The TSM consists of 6 Darlington transistors connected in three, half-bridge modules and three ISO drivers. The transistors are controlled by a pulse-width modulation (PWM) technique. The ISO driver secures galvanic isolation between the controller and the inverter module. It also provides internal protection for the power components, which is indicated by an LED on the ISO driver. The LED will flash only when the circuit is active.

The unit is temperature protected by two thermal switches. One switch is a warning, the other is a shutdown. At 90°C, the unit will alert the user of a high temperature warning condition and at 100°C, the unit will alarm a shutdown, and transfer into bypass operation. There is no interruption in output voltage during the transfer. These temperature switches are connected to the controller board via the inverter ISO driver.

200-3-6 Static Switches

The unit consists of two, three-phase thyristor switches that are physically one module. One switch is for the mains (SSW1), the other for the bypass (SSW2). The two switches share one ISO driver board which controls the switches and provides galvanic isolation.

200-3-7 RFI/Fuse Boards (Mains and Output)

The RFI/Fuse boards provide part of the FCC Class A requirements for the unit. It also contains the fuses that protect the interface, PSU transformer sub assembly, fans, backfeed protection relay, external connection board, and the optional fan monitor.

200-3-8 DC Fuse Board

The DC fuse board contains the fuses that provide protection for the PSU and the interface board.

200-3-9 Mains Choke

The Inverter varies the phase displacement across the choke; therefore, controlling the energy flow from the mains. It also protects the loads from spikes, etc. and absorbs voltage differences between mains and output.

200-3-10 Inverter Choke
The inverter choke, together with the AC capacitor, filters the PWM signal into a sinewave.

200-3-11 AC Capacitors
The AC capacitors work with the inverter choke in filtering the PWM signal into a sinewave.

200-3-12 DC Capacitors
Suppresses the ripple current generated by the inverter.

200-3-2 Power Supply Unit (PSU)

The power supply unit (PSU) together with the PSU transformer, provides safe output voltage to the interface board which distributes the voltages to the rest of the system.

- +5VDC
- +12VDC
- -12VDC
- +20VDC

The PSU is supplied from either the batteries or the mains. The mains is supplied through the fuseboard, to the PSU transformer sub-assembly, and to the PSU. The PSU transformer contains a full wave rectifier. From the battery, the PSU receives its power through the DC Fuse Board. Either source is enough to supply the PSU and secure full operation of the system.

200-3-3 Interface Board (I/F)

The interface board provides isolation, and steps down high AC and DC voltages to logic voltage levels for use on the controller board. It also converts single wire to ribbon cables.

200-3-4 External Connection Board

The external connection board provides the connection for outgoing and incoming signals. These signals are used in controlling and monitoring the system.

Output

- Common alarm relay NO/NC
- Battery operation relay NO/NC
- External bypass contactor
- Maintenance bypass cabinet switch inhibit

Input

- Emergency Power OFF (EPO)
- Temperature sensor compensation charge voltage
- Position indication of external battery DC disconnect (optional)
- Position indication of external Manual Service Bypass switch
- Remote ON/OFF

There are three different ways the MPU controls sections of the controller. They are:

- parallel outputs
- serial data transmission
- setting of voltage reference by means of A/D-converter

The MPU must also adapt and/or control miscellaneous options, such as AS/400, Novell, RS232 communication, external service switch, etc. Because of these options, the MPU is equipped with external parallel input and outputs, as well as one serial 20mA current loop port and one RS232 port.

200-3-1-7 Master logic

The purpose of the master logic is to rapidly switch between the different operational modes that the unit can function in.

- Normal operation
- Battery operation
- Bypass operation
- Economy mode
- Standby

200-3-1-8 Analog reference setting

The analog reference setting circuit receives reference signals for the inverter control, battery charge regulator, DC voltage detector and the VQs. The input to analog reference setting comes from the MPU.

200-3-1-9 Battery charge regulator

The battery charge regulator circuit detects charging voltage and charging current to the battery, and either the voltage or the current (depending on the charging state of the battery) is kept constant.

200-3-1-10 +5V Reference

The +5V Reference circuit generates an internal +5V reference for the analog reference setting.

200-3-1-4 Serial communication

The serial communication section of the controller board communicates with the:

- Display Unit
- Communication Interface Board (Option)
- MPU

200-3-1-5 Inverter Control

The inverter control guarantees that:

- the system generates the correct sinusoidal output voltage
- the system is protected against overload
- the batteries receive the correct amount of charge

Output

- control signal for TSM1, TSM2, TSM3

Input

- feedback from the inverter output voltage and current
- masterlogic
- MPU
- analog reference setting

200-3-1-6 Main Processor Unit (MPU)

The main purpose of the MPU is to enable the user to operate the UPS system.

The MPU consists of many sub-units. These sub-units collect information from the user and from other units on the controllers: such as the three VQ-units, DMU, inverter, master logic, and the DC voltage detector.

The MPU can generally control which mode the system operates in. However, it is the master logic which is responsible for putting the system in the requested mode. Information is collected from the controller, three different ways:

- parallel inputs
- serial data transmission
- measuring by means of A/D-converter

200-3-1-1 Voltage Quality (VQ) Detectors

There are three, nearly identical VQs on the controller board: VQ-Mains, VQ-Bypass, and VQ-Output.

Note: The following description is valid for all three VQs, unless otherwise noted.

The VQ-units take care of the following:

- Fast detector of 3 phases
- Average detector of 3 phases
- Missing phase detector of 3 phases
- Zero cross detector of 3 phases
- Frequency detector
- Phase sequence detector (Only for the VQ-Mains and VQ-Bypass)
- Serial communication with the Main Processor Unit (MPU)
- Unit-data programming

200-3-1-2 Display Measuring Unit (DMU)

The DMU takes the following measurements:

- "I MAINS", "I OUT" and "I INVERTER" for all three phase
- Battery current
- Battery voltage
- Battery temperature
- Serial communication with the MPU

200-3-1-3 DC Voltage Detector

The DC voltage detector takes care of the following:

- High DC warning
- High DC shut down
- Low DC warning
- Low DC shut down
- Forward the information to the MPU
- Receive the settings for the alarm from the analog reference setting
- "High DC shut down" and "Low DC shut down" are indicated with a red LED (H001) on the controller board, as well as in the alarm log and events log.

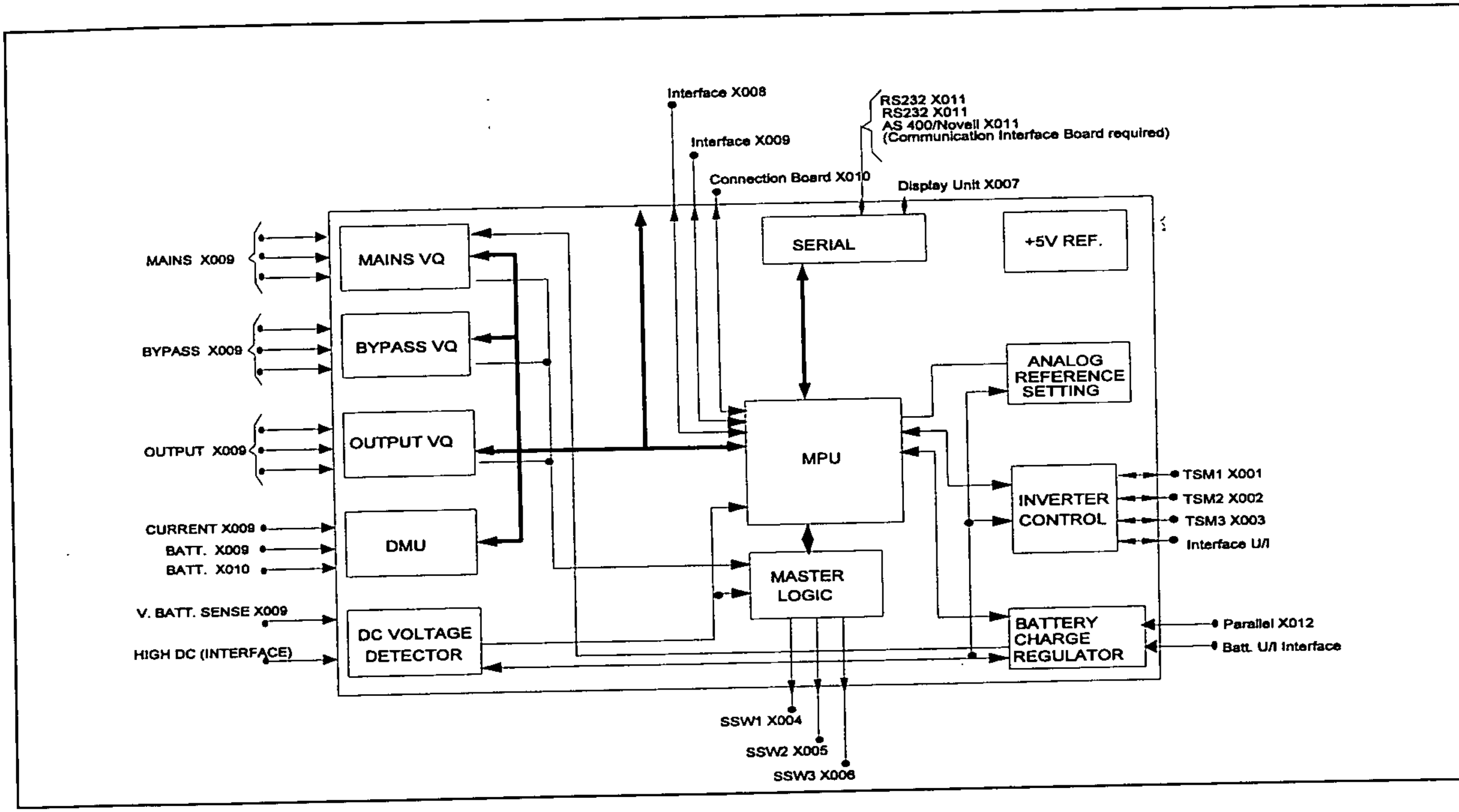


Figure 4 - Controller Board

LTS-0511

200-3 Major System Components

The subsections below describe the major components and their sub-assemblies or circuits. BEST recommends that you treat each component as electrostatic discharge (ESD) sensitive.

200-3-1 Controller Board

The controller board is a multi-layered PC-board containing several microprocessor units. To a great extent, the controller board is software-supported. Because the controller board is software-supported, parameters can be modified by using the display unit.

The controller board is divided into 10 major sections (see Figure 4 for reference):

- Three Voltage Quality (VQ) detectors one for Mains, Bypass and Output
- Display Measuring Unit (DMU)
- DC voltage detector
- Serial communication
- Inverter Control
- Main Processor Unit (MPU)
- Master logic
- Analog reference setting
- Battery charge regulator
- +5V Reference

In **bypass operation**, the mains pass unregulated through the bypass static switch, through the main transformer and out to the loads (see Figure 3.) The inverter is in a standby mode and is synchronized to the mains, it is ready to handle the loads if mains go out of tolerance.

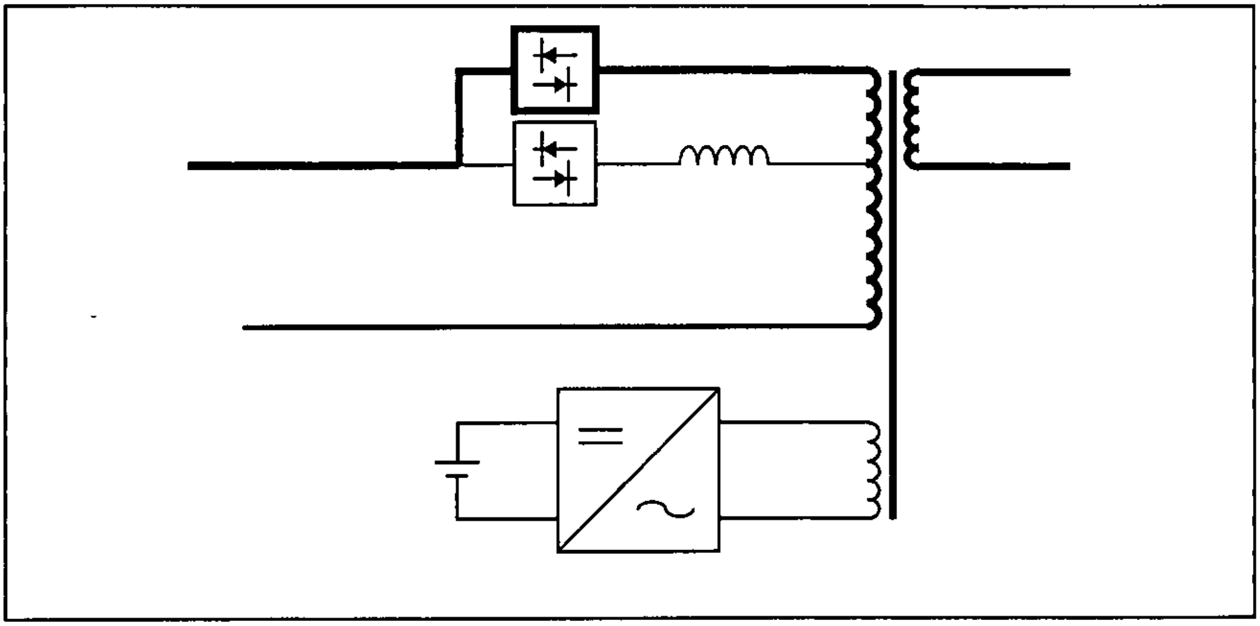


Figure 3 - Bypass Operation

Economy mode allows the mains to pass through the bypass static switch, to the main transformer and out to the loads. The flow is the same as in bypass operation, except that the unit will periodically transfer into normal operation to charge the batteries (default is 7 days). The inverter is in standby and is synchronized to the mains, ready to handle the loads if mains go out of tolerance. The output voltage is not regulated in this mode, but efficiency increases to 93 - 97% (depending upon model). When desired, the user must program the unit to operate in economy mode.

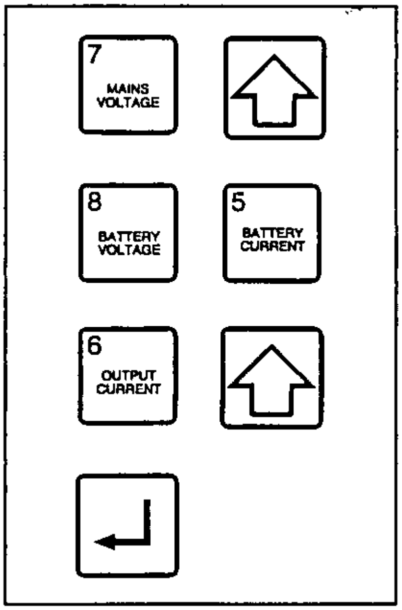
When the unit is in **standby mode**, both static switches are open. The display is active and the unit is ready to be switched "on," but the unit does not have an output voltage.

300-5-2 Viewing Measurements

This section explains how to read the measurements from the front keypad. If two keys are shown, press them simultaneously. Sample display values are shown below. Actual values may vary.

KEY	SAMPLE DISPLAY	DESCRIPTION
7 MAINS VOLTAGE	Mains 1. voltage 210 210 210 Vac	Mains (AC line) voltage is 3 x 210 Vac (L_{1-2}, L_{2-3}, L_{3-1})
4 MAINS CURRENT	Mains 1. current 21 21 21 Aac	Mains current is 3 x 21 Aac (I_1, I_2, I_3)
8 BATTERY VOLTAGE	Battery voltage 216 Vdc	Battery voltage is 216 Vdc
5 BATTERY CURRENT	Battery current 2 Adc (-30 Adc)	Charging current is (+) 2 Adc Discharging current (–) 30 Adc
2 INVERTER CURRENT	Inverter current 12 12 12 Aac	Inverter current is 3 x 12 Aac
9 OUTPUT VOLTAGE	Output voltage 208 208 208 Vac	Output voltage is 3 x 208 Vac (L_{1-2}, L_{2-3}, L_{3-1})
6 OUTPUT CURRENT	Output current 15 15 15 Aac	Output current is 3 x 15 Aac (I_1, I_2, I_3)
3 OUTPUT FREQUENCY	Output frequency 60 Hz	Output frequency is 60 Hz

☞ **When two keys are shown, press them simultaneously.**



KEY(S)	SAMPLE DISPLAY	DESCRIPTION
	Mains 2. voltage 210 210 210 Vac	Does not apply to this unit
	Battery temp. 25 C°	Battery temperature is 25° C (units with internal batteries)
	Output peak curr 19 19 19 Aac	Output peak current is 3 x 19 Aac
	Normal operation load power xx%	Returns to "Normal operation" display and indicates the % load of the most fully loaded phase (leg)

300-6 Parameters

The next few pages indicate the user and service parameters for the unit, along with the factory setting and ranges for each parameter (if available).

<u>Be sure that you fully understand a parameter before you attempt to change it. Some of the parameters listed SHOULD NEVER BE CHANGED!</u>

<u>300-7 How to Access the User Parameters</u>

1. Press  to access the user parameters.
2. Next, press  or  to scroll through the list.
3. Press  to activate "ON"
4. Press  to activate "OFF"

See Table X (User Parameters) on following page.

TABLE X - User Parameters

PARAMETER	**PASSWORD to CHANGE**	**FACTORY SETTING/ RANGE**	**EXPLANATION**
Second Language	None	OFF	ON will display the 2nd language of text on the display, which for 60Hz systems is Spanish. The other languages available must be ordered from the factory, they are: Polish, Portuguese, Danish, French, Italian, Dutch, German, and Finnish.
Adaptive slewrate	None	ON	ON allows the UPS to automatically adjust the slewrate. OFF is used in case of very unstable mains frequency. **Phone BEST before changing.**
Battery monitor reset	None	(Option)	ON will reset the battery monitor alarm and flush the corresponding messages in the alarm log. (Applies only to units with a battery monitor.)
Battery monitor test	None	(Option)	Calculates the condition of the batteries. (Applies only to units with a battery monitor.)
Battery capacity test	None		Determines backup time available. (See Section 500-3)
M3 startup	None	—	N/A
Autoboost charger use only on wet cells	None	OFF (not normally used)	Autoboost charge for 8 hours after battery operation
Boost charge	None	OFF	ON results in 8 hours (programmable) of continuous boost (equalize) charge

PARAMETER	PASSWORD to CHANGE	FACTORY SETTING/ RANGE	EXPLANATION
Bypass operation	None	OFF	ON will switch the system into bypass operation, if it is within tolerance. The unit must be switched into static bypass operation before an external bypass switch is used. Otherwise, power to the loads may be disturbed. **Note:** When the system is operated in bypass, the batteries will not be charged.
Autostart	None	OFF	ON will switch the unit on **automatically** 60 seconds after mains (AC line) is applied.

300-8 How to Access the Service Parameters

1. Simultaneously press [1] and [2 INVERTER CURRENT] . The display shows "Key in password."
2. Enter password "282828."
3. Next, press [▲] or [▼] until the display indicates the desired parameter.
4. Press [1] to switch a parameter on, or press [0 ✱] to switch a parameter off.
5. Use the digits on the keypad to enter the desired value.

   Press [□] , Then [↵] to save any changes.

TABLE Y - Service Parameters

PARAMETER	PASSWORD to CHANGE	FACTORY SETTING/ RANGE	EXPLANATION See Appendix A for details per Model
Normal charge voltage	282828	UT310-360=216-270V U380-3100=410-450V 3120-3220=467-480V	UT310-360=246V UT380-3100=410V U3120-3220=467V
Boost charge voltage	282828	UT310-360=216-270V U380-3100=410-450V 3120-3220=467-480V	UT310-360=246V UT380-3100=410V U3120-3220=467V
Charge current max.	282828	10k = 6 Amps 15k = 8 Amps 20k = 10 Amps 30k = 15 Amps 40k = 20 Amps 60k - 30 Amps	80k = 24 Amps 100k = 30 Amps 120k = 30 Amps 160k = 46 Amps 220k = 55 Amps
Low battery warning	282828	UT310-330=170-270V UT340-360=187-270V UT380-3100=306-450V UT3120-3220=348-480V	UT310-330=190V UT340-360=191V UT380-3100=318V U3120-3220=369V

PARAMETER	PASSWORD to CHANGE	FACTORY SETTING/ RANGE	EXPLANATION See Appendix A for details per Model
Low battery shutdown	282828	UT310-330=170-270V UT340-360=187-270V UT380-3100=306-450V UT3120-3220=348-480V	UT310-330=170V UT340-360=181V UT380-3100=306V U3120-3220=348V
Boost charge time	282828	0-255	Default is 8 hours.
Slewrate 0-4	282828	0 = 0.25 Hz/sec 1 = 0.5 Hz/sec **2 = 1 Hz/sec** 3 = 2 Hz/sec 4 = 4 Hz/sec	Default is a slew rate of 2 = 1.
Battery back-up time	282828	0-999 min.	Default is 0 min.
High battery temp.	282828	0-128°C	Default is 35°C
Auto. battery monitor	282828	ON/OFF (Optional)	The default is "OFF." However, when "ON" will perform a battery monitor test every 90 days.
Remote shut down	282828	ON/OFF	Used with CheckUPS software.
Remote shut down polarity	282828	ON/OFF	Used with CheckUPS software.
Remote shut down time	282828	10 min.	Used with CheckUPS software.

300-9 LOGS

The UNITY/I allows user access to two different sets of logs, an alarm log and an events log. These logs are used mainly in troubleshooting. The alarm log contains all present alarm conditions. The events log stores the 250 most recent events of the unit, including alarms.

300-9-1 Alarm Log

The alarm log stores all **active** alarm conditions, with the most recent first. *This log is not time-stamped.* (See Section 500-3 for a list of the unit's possible alarms)

<u>To access the alarm log, do the following</u>:

1. Press 

2. Press  or  to scroll through the log.

3. When the end of the list has been reached, the display shows "No further alarms."

4. To exit, press 

300-9-2 Events Log

The events log is a list of the last 250 alarms and operational modes. *This log is time-stamped.* If more than 250 events occur, the list will begin to drop off the oldest event in order to maintain 250 entries.

<u>To access the events log:</u>

1. Simultaneously press  and  .

2. Use  or  to scroll through the log.

3. When the last event has been reached, the display shows "No further event."

4. To exit, press 

300-9-3 How to Reset the Events Log

After servicing the unit, or after initial startup, the service technician should reset the events log.

<u>To reset the events log:</u>

1. Simultaneously press  and 

   The display shows "Key in password."

2. Enter "920701." The display shows "Logging stack is reset."

3. The events log is now cleared.

300-10 Performing a Battery Capacity Test

The battery capacity test discharges the batteries to the "Low DC warning" to determine an estimated runtime.

The runtime that is estimated during the test is for the unit conditions at the time of the test. If the load changes and you would like to establish a new estimated runtime, perform the test again.

IMPORTANT! If you are using the UPS contacts for remote monitoring, take any necessary precautions to prevent an automatic shutdown of the load equipment during this test. Consult your remote monitoring software documentation.

IMPORTANT! The batteries will be discharged during the test, and it will take at least eight hours to recharge the batteries to full capacity.

To perform a battery capacity test, follow the steps below:

1. Press to access the user parameters.
2. Press or until the display shows `Battery capacity test: xxx`.

   NOTE: `xxx` is the estimated minutes of runtime from the previous test; `A display showing ???` indicates that the test has never been completed.

3. To exit without testing: Press .

   To start the test: Press . The unit will transfer to battery operation and the display will show `Batt. operation > time xxx min`.

   To abort the test after it has started:

   a. Press to access the user parameters.

   b. Press or until the display shows `Battery capacity test: xxx`.

   c. Press to switch the test off.

4. When the test is completed, a short alarm will activate, the unit will automatically transfer to normal operation, and the display will show `Normal operation load power xx%`.

300-10 (Cont.)

5. To display the estimated runtime, press to access the user parameters. The display should show `Battery capacity test: xxx`, where xxx is the estimated runtime in minutes.

6. Press to exit the user parameters.

7: Press the & Keys simultaneously.

8: The display should read "Key in Password".

9: Enter "282828"

10: Use the key until you reach "Battery Back Up Time".

11: Enter the value received in "Battery Capacity Test" using three digits.

12: Press the key. Press the key twice.
The display should now be back in "Normal Operation".

13: After 8 hours the unit will now show back up time when in Battery operation.

300-11 Performing a Battery Monitor Test

The battery monitor test calculates the condition of the batteries and compares it to data programmed into the unit at the factory.

This test discharges the batteries to about 75% of their capacity. The unit accounts for load and temperature conditions and compares the results of the test to the programmed data. If the test determines that the battery condition is unacceptable, it activates a "Battery monitor warning" or "Battery monitor alarm" (see Section 500-3 for more information about alarms).

NOTE: The battery data programmed into the unit is based on the size and type of batteries at the time of original sale. If the battery configuration changes, this test will not be accurate for the new configuration.

NOTE: If you would like the unit to perform an automatic battery monitor test every 90 days, see service parameter "Auto. batt monitor" in Section 300-8.

300-11 (Cont.)

IMPORTANT! If you are using the UPS contacts for remote monitoring, take any necessary precautions to prevent an automatic shutdown of the load equipment during this test. Consult your remote monitoring software documentation.

To perform a battery monitor test, follow the steps below:

1. Press [key] to access the user parameters.
2. Press [↑] or [↓] until the display shows `Battery monitor test.`
3. Press [key] to start the test. The unit will transfer to battery operation and the display will show `Batt. operation time > xxx min.`
4. When the test is completed, the unit will automatically transfer back to normal operation. If the battery condition is unacceptable the unit will activate an alarm (see Section 500-3).

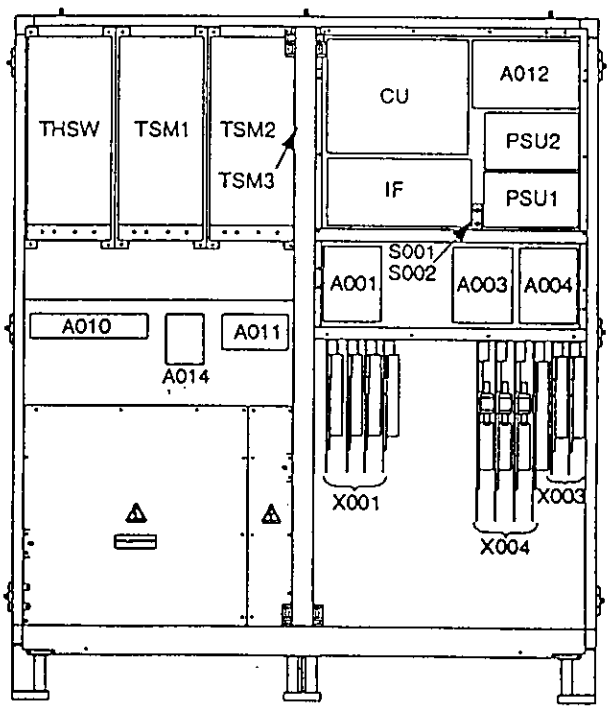
See Appendix D for "Calibration Parameters"

UNITY/I Three-Phase Major System Components

▲ UT3120 - UT3220 Layout

Communication Interface	- A011*
Controller	- CU
DC Fuse Board	- A004
External Connection Board	- A010
External DC Terminals	- X003
Mains Input Terminals	- X001
Off Button	- S002
On Button	- S001
Output Terminals	- X004
Parallel Board	- A012 *
Power Supply Unit 1	- PSU1
Power Supply Unit 2	- PSU2 *
Relay Board	- A014 *
RFI/Fuse Board (Mains)	- A001
RFI/Fuse Board (Output)	- A003
Static Switch Module	- THSW
Transistor Switch Module	- TSM

* Denotes Option

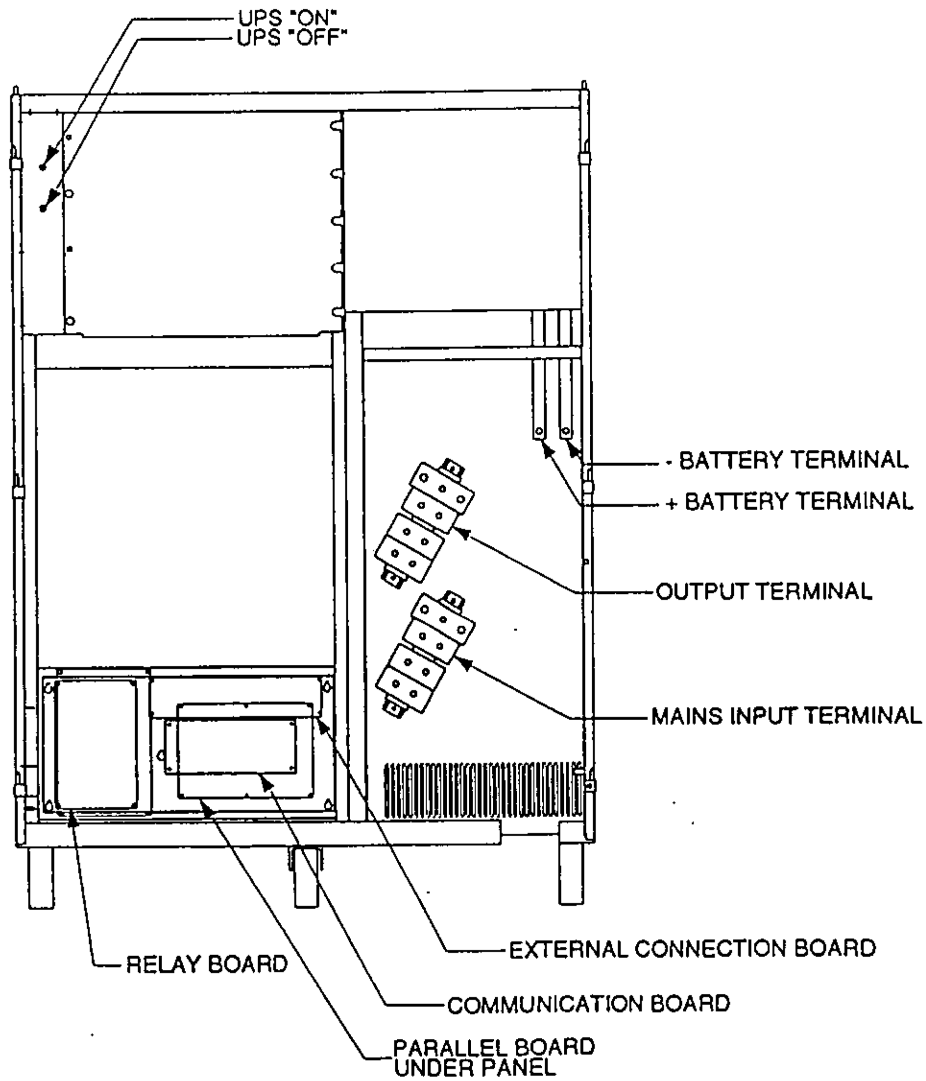


Front view with doors and covers removed.

D219-TRN0022b

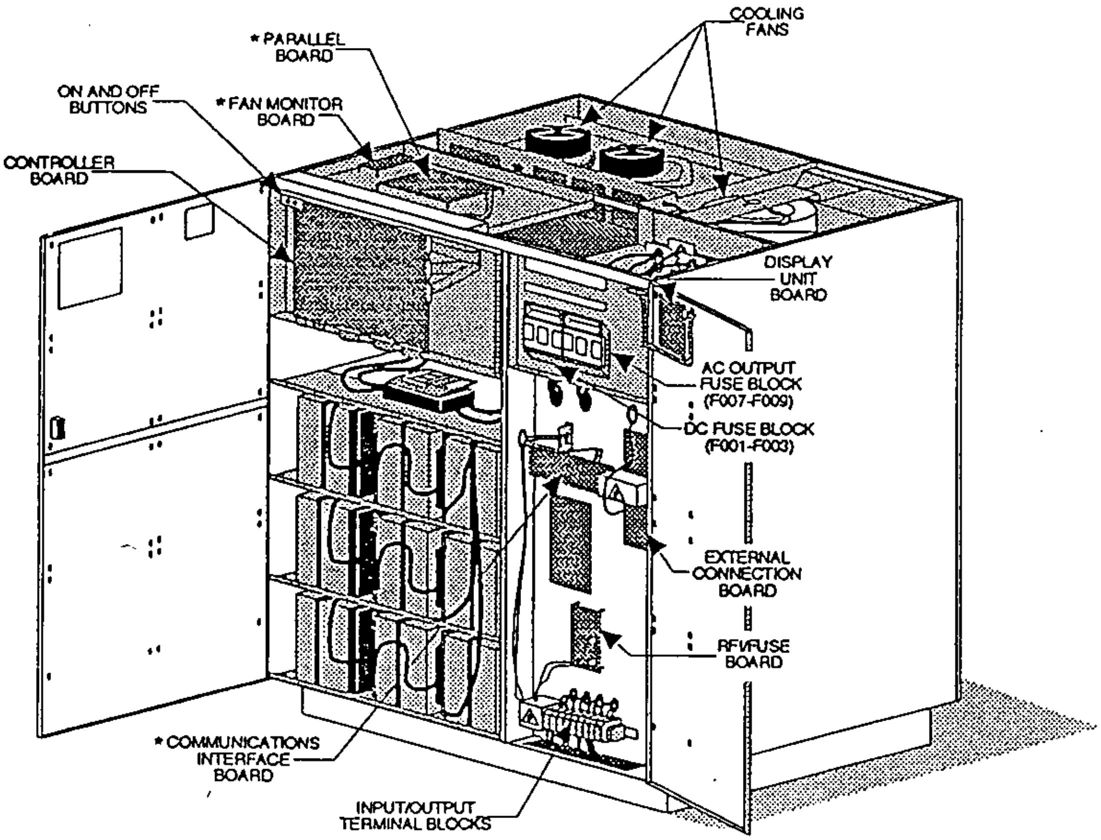
UNITY/I Three-Phase
Major System Components

▲ UT360 Layout



UNITY/I Three-Phase Major System Components

▲ UT320 - UT330 Layout



* OPTIONAL EQUIPMENT

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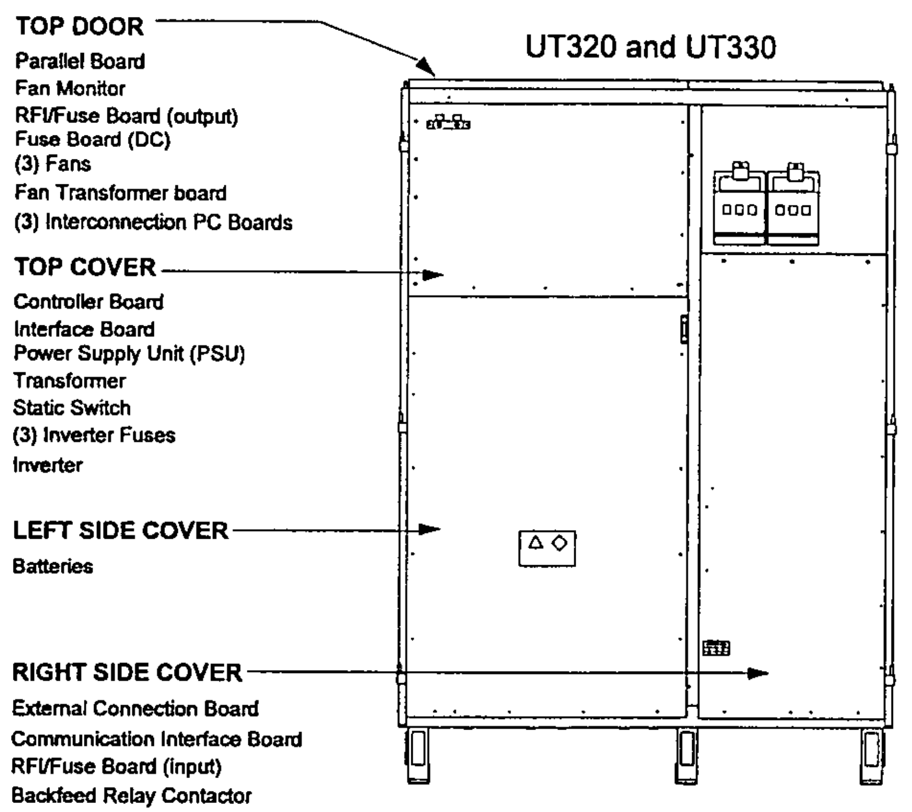


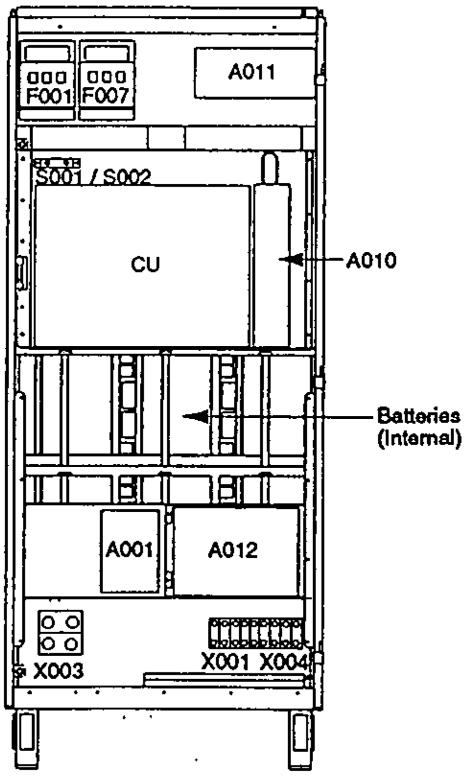
Figure 41 - UT320 and UT330

UNITY/I Three-Phase Major System Components

▲ UT310 - UT315 Layout

AC Output Fuse Block	- F007
Batteries (Internal)	
Communication Interface	- A011*
Controller	- CU
DC Fuse Block	- F001
External Connection Board	- A010
External DC Terminals	- X003
Mains Input Terminals	- X001
Off Button	- S002
On Button	- S001
Output Terminals	- X004
Parallel Board	- A012 *
RFI/Fuse Board (Mains)	- A001
On Button	- S001
Off Button	- S002

* Denotes Option



Front view with door and covers removed.

D219-TRN0017b

Which Covers to Remove

There are several covers located in the unit. To determine which cover needs to be removed, refer to Figures 39 and 40.

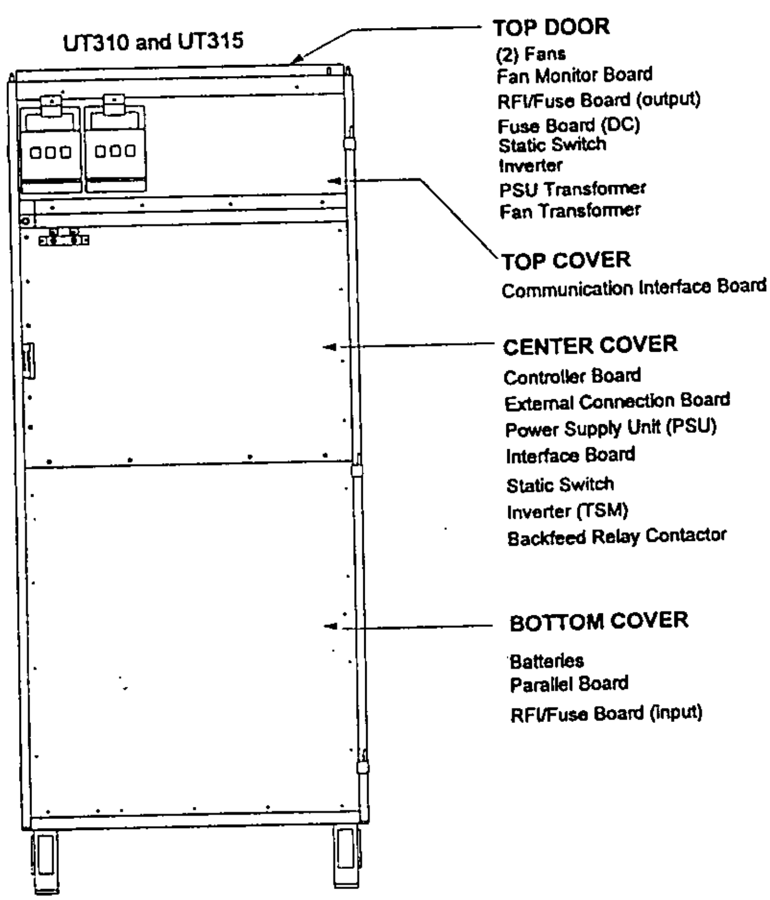


Figure 40 - UT310 and UT315

SECTION 400: MAINTENANCE

Before beginning this section, read the warnings listed at the front of the manual.

Proper maintenance procedures, including a scheduled six month maintenance check, guarantees the reliability of the unit.

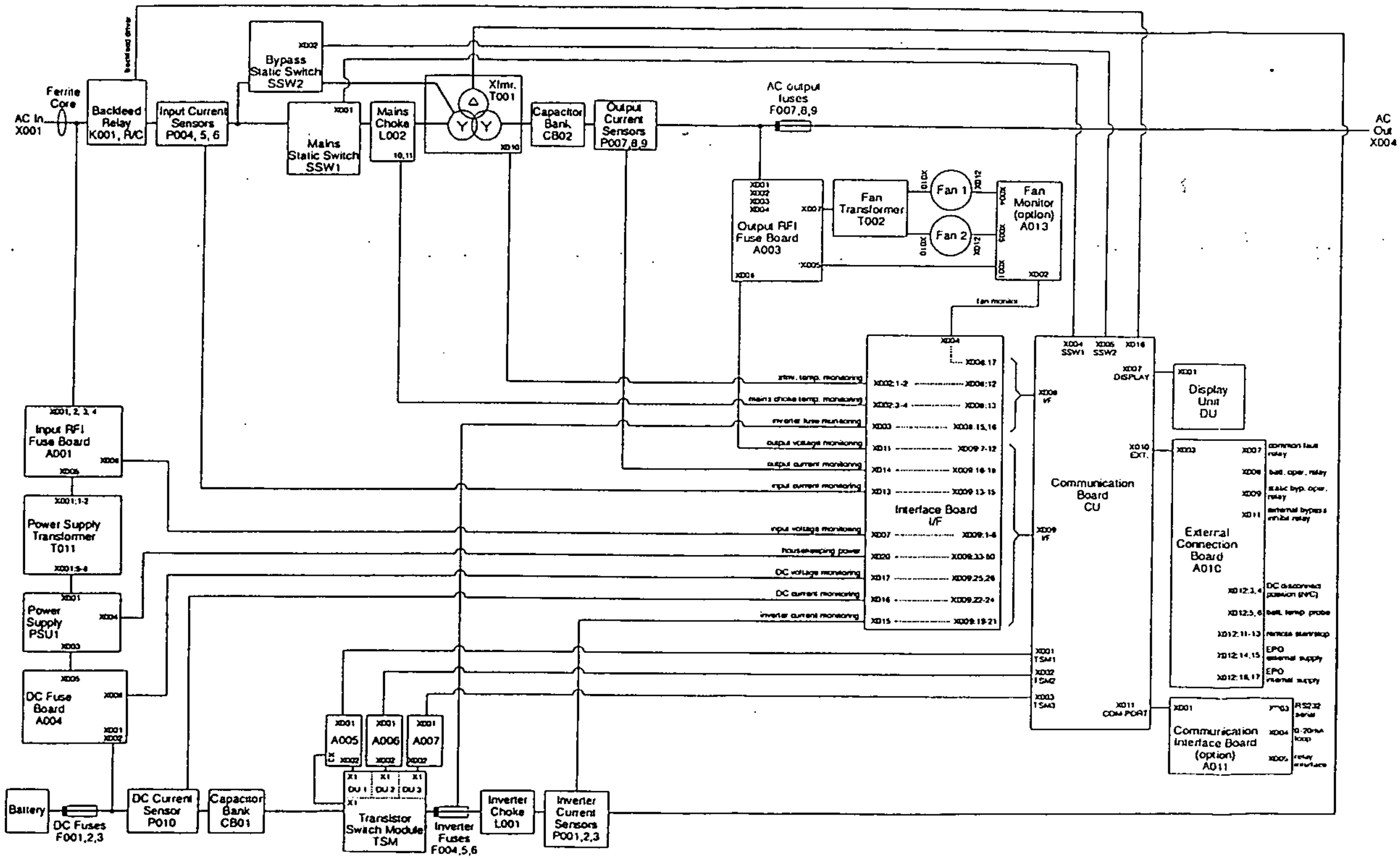
A qualified service technician should perform a scheduled maintenance every six months to make sure the unit is operating properly. You can find the scheduled maintenance procedures in Appendix B. It provides written step-by-step instructions for scheduled maintenance.

The scheduled maintenance procedures include an outage and load test to make sure the UNITY/I can provide power to the loads during a power outage. This test also helps the technician identify any batteries that may need replacing.

400 Parts/Components Replacement Procedures

Refer to Section 300 for Startup and Shutdown Procedures and the beginning of this manual for all warnings. HANDLE ALL COMPONENTS AS ESD SENSITIVE.

If you have any questions or problems while performing this procedure, call BEST's Technical Support Center at 1-800-356-5737.



AC In
X001
Ferrite Core
Backfeed Relay K001, R/C
backfeed driver
Input Current Sensors P004, 5, 6
Bypass Static Switch SSW2
Mains Static Switch SSW1
Mains Choke L002
Xfmr. T001
Capacitor Bank CB02
Output Current Sensors P007,8,9
AC output fuses F007,8,9
AC Out X004
Output RFI Fuse Board A003
Fan Transformer T002
Fan 1
Fan 2
Fan Monitor (option) A013
fan monitor
Interface Board I/F
xfmr. temp. monitoring
mains choke temp. monitoring
inverter fuse monitoring
output voltage monitoring
output current monitoring
input current monitoring
input voltage monitoring
housekeeping power
DC voltage monitoring
DC current monitoring
inverter current monitoring
Communication Board CU
Display Unit DU
External Connection Board A010
common fault relay
batt. oper. relay
static byp. oper. relay
external bypass inhibit relay
DC disconnect position (N/C)
batt. temp. probe
remote start/stop
EPO external supply
EPO internal supply
Communication Interface Board (option) A011
RS232 serial
0-20mA loop
relay interface
Input RFI Fuse Board A001
Power Supply Transformer T011
Power Supply PSU1
DC Fuse Board A004
Battery
DC Fuses F001,2,3
DC Current Sensor P010
Capacitor Bank CB01
A005
A006
A007
Transistor Switch Module TSM
Inverter Fuses F004,5,6
Inverter Choke L001
Inverter Current Sensors P001,2,3

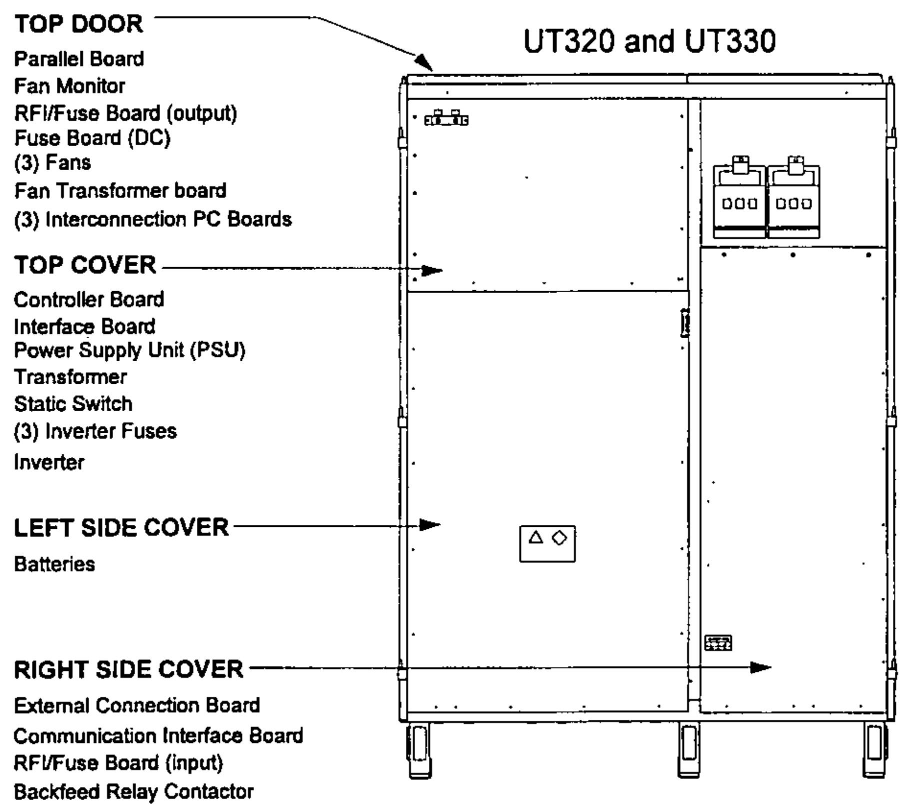


Figure 41 - UT320 and UT330

400-2 Removal and Replacement of the Communication Interface Board

This procedure describes how to remove and replace the communication interface board.

If you are installing a new communication interface board on a unit, and not replacing one, follow all of the sections except Section 400-2-3 which discusses how to remove the old board.

Before you begin:
- inform the customer that the loads will not be protected
- inform the customer that communication with the unit via computer or terminal will be disrupted

400-2-1 Remove All AC and DC Power (See Sec. 300-4)

400-2-2 Cover Removal (See Figure in Sec. 400-1)

400-2-3 Board Removal

Note: Make sure that the cables you are removing are marked as to their placement on the board. If they are not marked, mark them before you continue with the procedure.

(Refer to Figure 1 for cable locations)

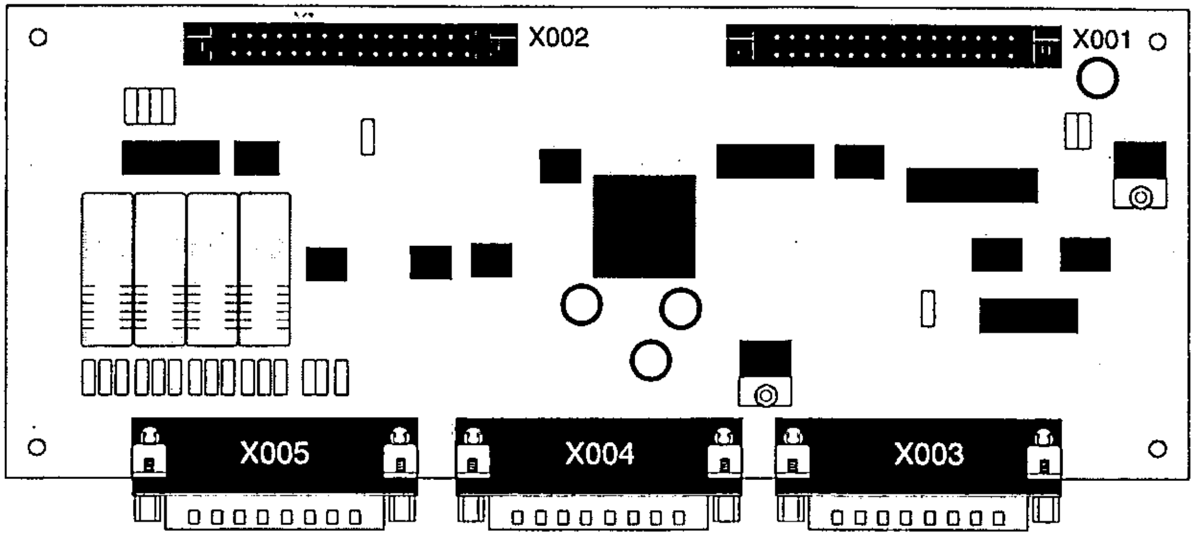


Figure 1 - Communication Interface Board

A. Remove the ribbon cable from X001. The other end of this cable is connected to the controller board.

B. Remove all communication cables from the board. Depending on the unit and the communication system setup, there could be anywhere from 0 - 3 cables connected to the board (X003, X004, X005).

C. Remove the four screws located on the outer corners of the board and remove the board.

D. Replace Board

Note: If you are installing a communication interface board on a UT310 or UT315, attach the ribbon cable to X001 and route the cable behind the board before starting step E.

E. Align the board with the screw holes and insert the screws and tighten..

F. Reconnect the cables you removed in Step 400-2-3 according to their markings. Support the backside of the board with your hand, while replacing the ribbon cables. Make sure that you connect the ribbon cable from X001 on the communication interface board to X011 on the controller board.

G. If this is first time the board is being installed, depending upon the use, connect the appropriate cable to the correct port. Connect the ribbon cable from X001 on the communication interface board to X011 on the controller board.

400-2-4 Replace Cover

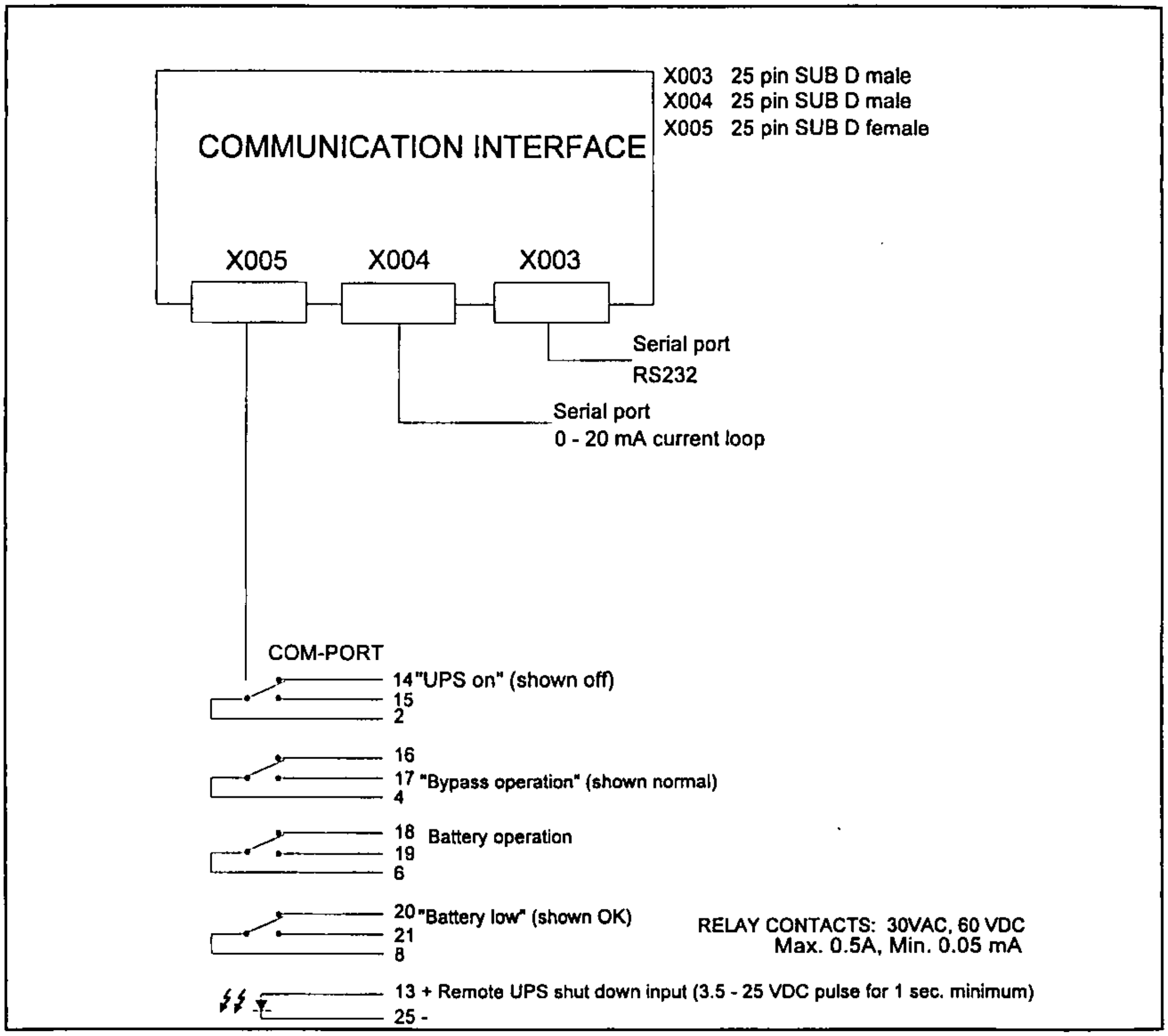


Figure 3 - Communication Interface Board Ports

400-3 Removal and Replacement of the Controller Board

This procedure describes how to remove and replace the controller board.

400-3-1 Remove All AC and DC Power

400-3-2 Remove Covers

400-3-3 Remove the Controller Board

400-3-4 Remove the ribbon cables from the following (if applicable):

- X007
- X010
- X009
- X012
- X008
- X003
- X002
- X001
- X011
- X004
- X005
- X016

400-3-5 Remove the RAM1 from the defect controller.

400-3-6 Remove the screws securing the board and remove the board from the unit.

400-3-7 Replace the Controller Board

400-3-8 **Secure the board to the unit**

Replace the following connections. (See Figure 1 for reference.)

TO	FROM
X005	SSW2
X004	SSW1
X011	Communication Interface Board
X001	TSM1
X002	TSM2
X003	TSM3
X008	Interface Board
X012	Parallel Board
X009	Interface Board
X010	External Connection Board
X007	Display Unit
X016	BF Relay Driver Board

400-3-9 Check to see that the revision number for the new board and the RAM 1 are O.K. (Phone BEST to verify.)

400-3-10 Move the RAM1 from the defected controller board on to the new controller.

400-3-11 Secure the new board to the unit.

400-3-12 **Replace Covers**

400-3-13 **Restore All AC and DC Power**

400-3-14 **Required Testing Procedures**

- Check output voltage, adjust if necessary.
- Check charge voltage, adjust if necessary.
- Check the charge current, adjust if necessary.
- Check to zero phase, and adjust if necessary.
- After all of the adjustments have been made, perform the VQ Calibration procedure located in this section.

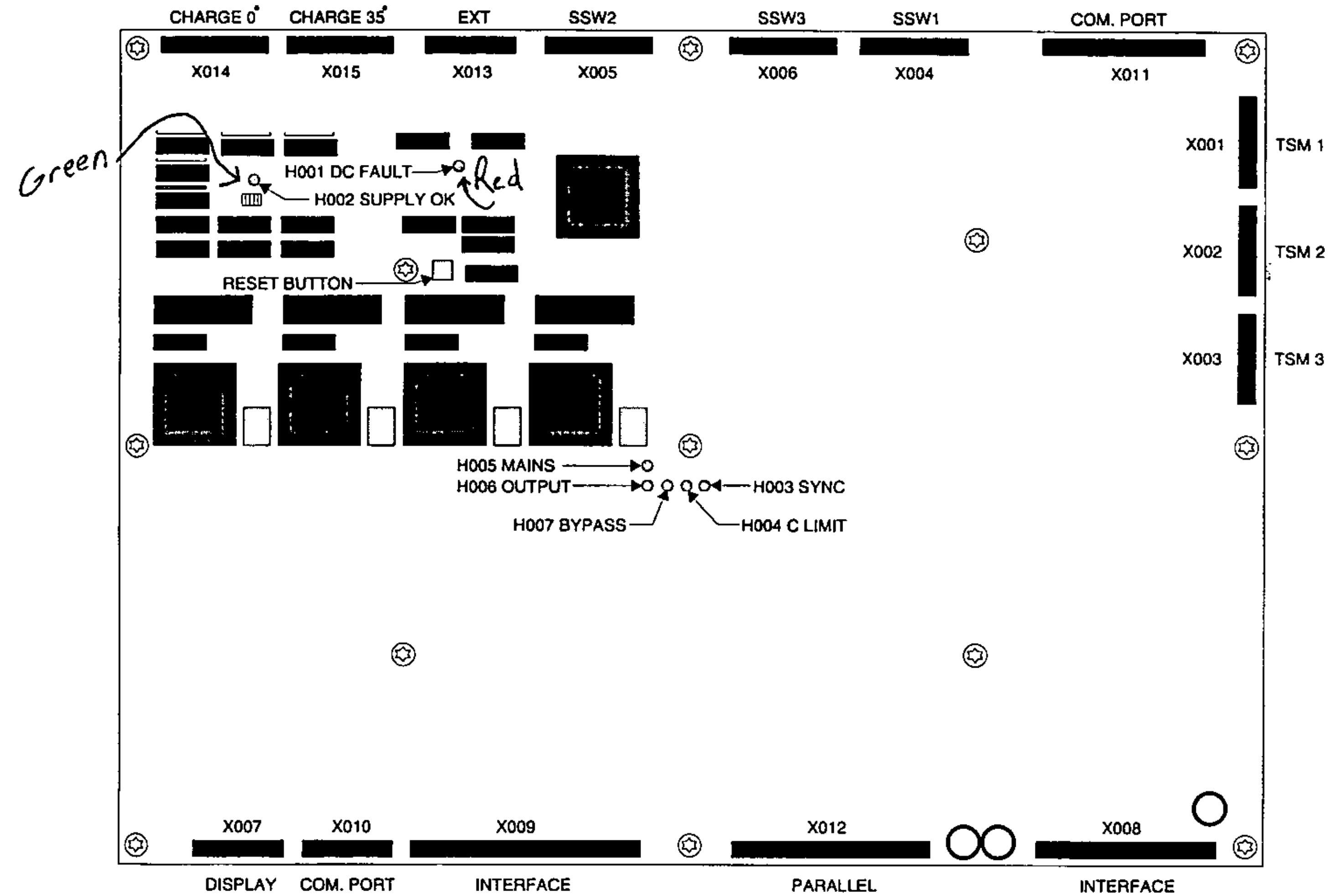
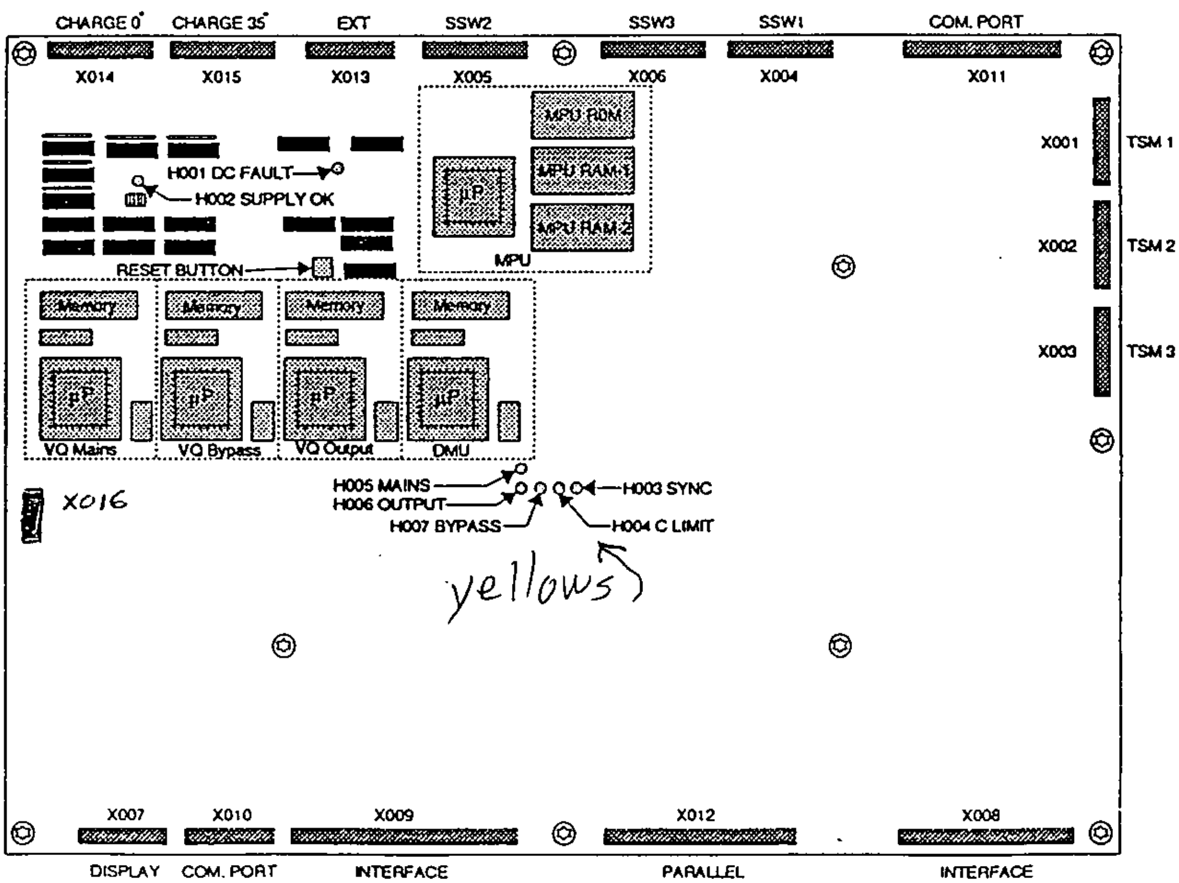


Figure 63- Controller Board

LTS-0511

UNITY/I Three-Phase Major System Components

▲ Controller (CU)



D219-TRN0004c

400-4 Calibrating the Voltage Quality Detectors on the Controller Board

A new calibration of the VQ units is necessary whenever updating software for the VQ unit. This procedure will describe how to calibrate the VQ units.

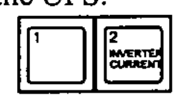
The first part of this document describes how to calibrate when the unit is receiving nominal input voltage ±1% and a fairly sinusoidal waveform from the mains. The second half describes how to calibrate any time the mains voltage is outside the ±1%.

Caution: **While performing this procedure, it is necessary to have nominal input and output voltages on the terminals of the UPS.**

400-4-1 How to Calibrate When Mains Voltage is Within ±1%

Before starting this procedure, double check that the input /output voltage is within ±1% with a calibrated meter.

400-4-1-1 Without any loads, start the UPS.

400-4-1-2 Simultaneously press 

The display shows "Key in password."

400-4-1-3 Using the keypad, enter "191919."

400-4-1-4 The display reads "VQ calibration - wait 25 sec."

400-4-1-5 The alarm sounds and the display shows "Batt. operation time > x min." to indicate that the unit is in battery operation. The unit will remain in battery operation for approximately 25 seconds.

400-4-1-6 When the display shows "Normal operation," check the input and output voltages on the keypad to determine if the correct values are shown.

400-4-1-7 Check the basic UPS functions with output load:

- normal operation
- battery operation
- bypass operation
- fans are operating

The calibration is now complete.

400-4-2 **How to Calibrate When Mains Voltage is Not Within ±1%**

400-4-2-1 While the UPS is in the standby mode, simultaneously press  the display shows "Key in password."

400-4-2-2 Using the keypad, enter "292929."

400-4-2-3 Use the  or  keys until you reach "Step 54."

400-4-2-4 Key in "000" followed by 

400-4-2-5 Press  to return to the "***Stand by***" display.

400-4-2-6 Disconnect the mains supply.

400-4-2-7 Start the UPS and verify that it operates in battery operation.

400-4-2-8 Check that the output voltage is Nominal ±1%. If the output voltage is not within ±1%, Adjust "Calibration Steps" 48,49,& 50. Then continue with step 400-9-2-9. If the output voltage is within ±1%, continue with step 400-9-2-9.

400-4-2-9 Press the red button to shut off the UPS.

400-4-2-10 Connect jumpers from output terminals (L1, L2, L3) to the corresponding mains input terminals (L1, L2, L3). Neutral will not be connected.

400-4-2-11 Start the UPS, using the green button, and key in password "191919." The display shows "VQ calibration - wait 25 sec."

400-4-2-12 The unit will alarm and the display shows "Batt. operation time > x min."

400-4-2-13 When the display shows "Batt. operation," wait at least 25 seconds then, shut off the UPS and remove the jumper wires. (Return it to it's factory wiring config.)

400-4-2-14 Apply mains voltage to the input and start the UPS.

400-4-2-15 Enter password "292929" and go to "Step 54."

400-4-2-16 Key in "100" followed by the  key. The UPS should now switch into normal operation.

400-4-2-17 Verify that the readings for the input and output voltages on the display are correct, and check that the UPS can be switched into bypass operation via the keypad.

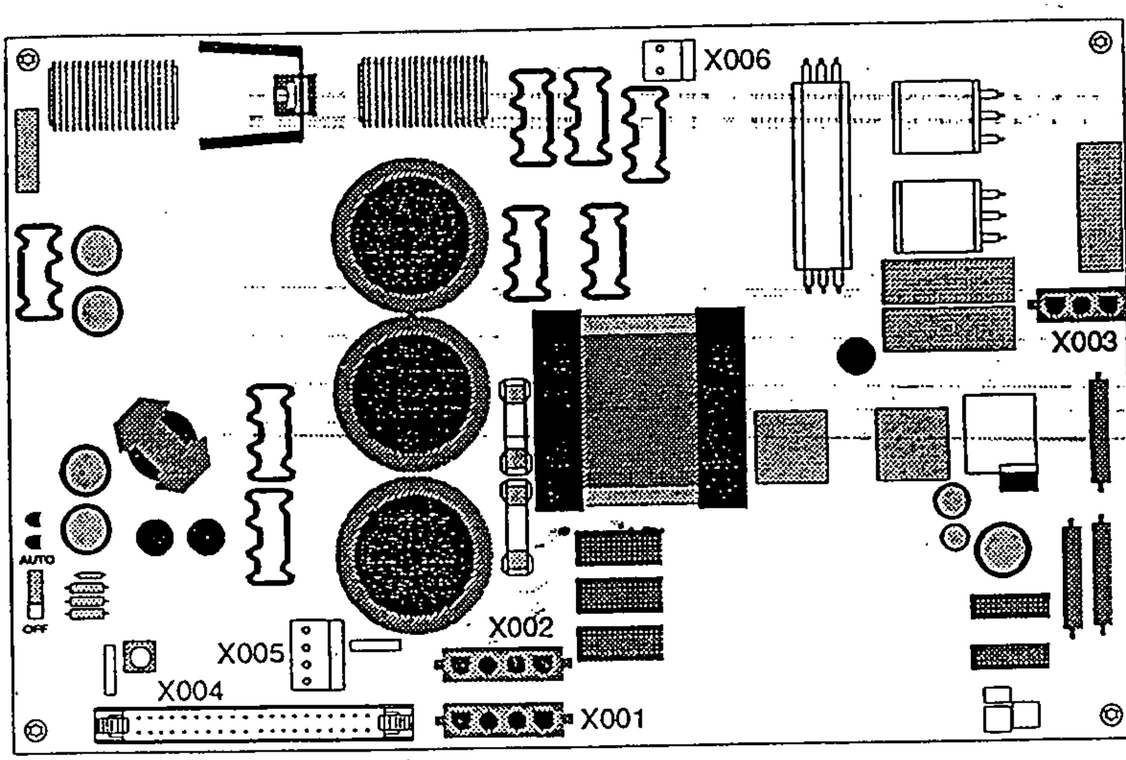
400-4-2-18 Check the basic UPS functions with output load:

- normal operation
- battery operation
- bypass operation
- fans are operating

The calibration is now complete.

UNITY/I Three-Phase
Major System Components

▲ Power Supply Unit (PSU)



400-5 Removal and Replacement of the RFI/FuseBoard

This procedure explains how to remove and replace the RFI/Fuse board.

400-5-1 Remove All AC and DC Power

400-5-2 Cover Removal

400-5-3 Board Removal

Before you remove any wires, verify that the wires are either numbered or marked. If the wires are not numbered or marked, mark them before they are removed.

Position	**AC Input RFI/Fuse Board**	**AC Output RFI/Fuse Board**	**DC Fuse Board**
X001	#364	#372:A003:X1	#367:A004:X1 #378:A004:X1
X002	#365	#373:A003:X2	#377:A004:X2 #379:A004:X2
X003	#366	#374:A003:X3	—
X004	#367	#375:A003:X4	—
X005	3 - Pin	—	3 - Pin
X007	5 - Pin	5 - Pin	—
X008	9 - Pin	9 - Pin	9 - Pin

400-5-3-1 Remove the four screws securing the board to the unit and remove the board.

400-5-4 Replace Board

(See Figure 1 for reference.)

400-5-4-1 Secure the board to the unit.

400-5-4-2 Replace the appropriate connections as listed below.

Position	AC Input RFI/Fuse Board	AC Output RFI/Fuse Board	DC Fuse Board
X001	#364	#372:A003:X1	#367:A004:X1 #378:A004:X1
X002	#365	#373:A003:X2	#377:A004:X2 #379:A004:X2
X003	#366	#374:A003:X3	—
X004	#367	#375:A003:X4	—
X005	3 - Pin	—	3 - Pin
X007	5 - Pin	5 - Pin	—
X008	9 - Pin	9 - Pin	9 - Pin

400-5-5 **Replace Cover**

400-5-6 **Restore AC and DC Power**

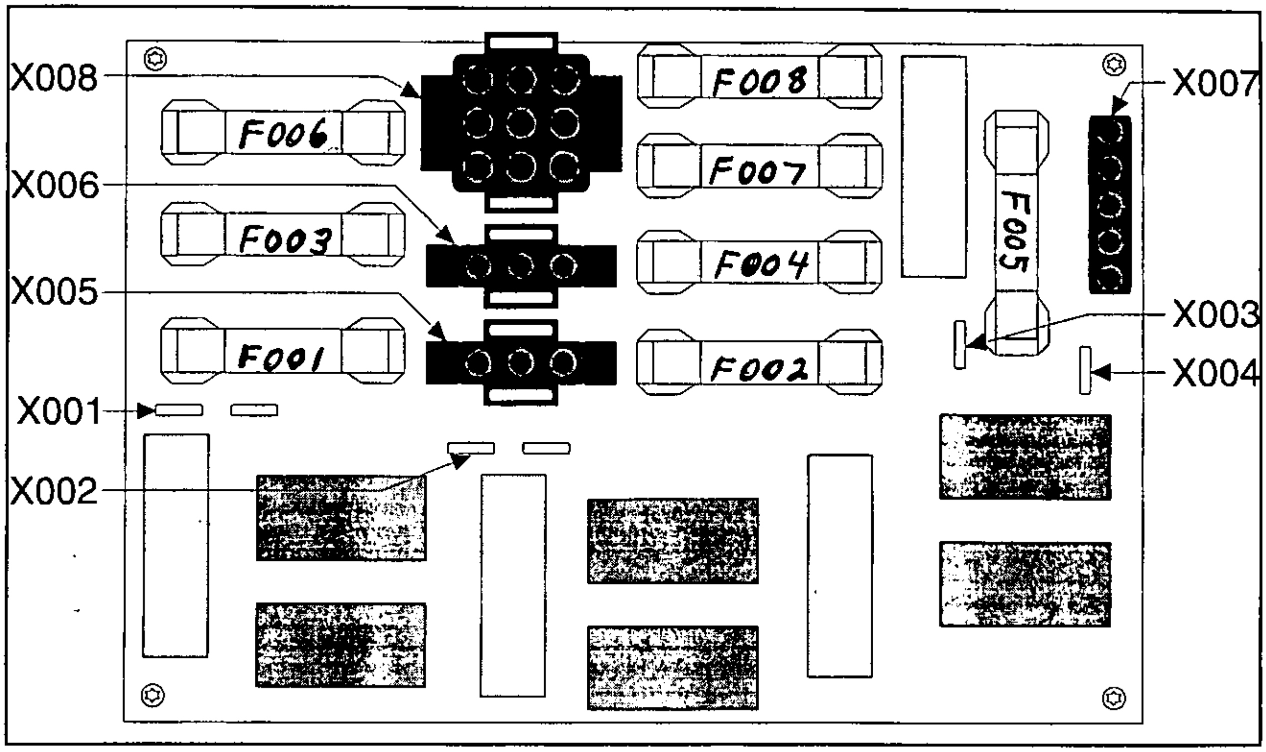


Figure 74 - RFI/Fuse Board

400-6 Removal and Replacement of the Interface Board

This procedure describes how to remove and replace the interface board.

400-6-1 **Remove All AC and DC Power**

400-6-2 **Remove Covers**

400-6-3 **Remove the Interface Board**

400-6-3-1 Remove the connections from:

- X008
- X009
- X007
- X011
- X017
- X020
- X006
- X002
- X013
- X014
- X015
- X016
- X003

400-6-3-2 Remove the nine screws securing the board and remove the board.

400-6-4 Replace Board
(See Figure 1 for reference.)

400-6-4-1 Secure the board to the unit

400-6-4-2 Replace the white molex connectors to:
- X003
- X016
- X014
- X015
- X014
- X013
- X002
- X006

400-6-4-3 Replace the ribbon cable on X020 from X004 on the PSU

400-6-4-4 Replace the 4-pin connector on X017.

400-6-4-5 Replace X011.

400-6-4-6 Replace the 9-pin connector to X007.

400-6-4-7 Replace the ribbon cable to X009 from X009 on the controller.

400-6-4-8 Replace the ribbon cable to X008 from X008 on the controller.

400-6-5 Replace Cover

400-6-6 Restore All AC and DC Power

400-6-7 Required Testing Procedures

400-6-7-1 Check the output voltage, adjust if necessary.

400-6-7-2 Check charge voltage, adjust if necessary.

400-6-7-3 Calibrate voltage quality detectors according to the procedure "How to Calibrate the Voltage Quality Detectors."

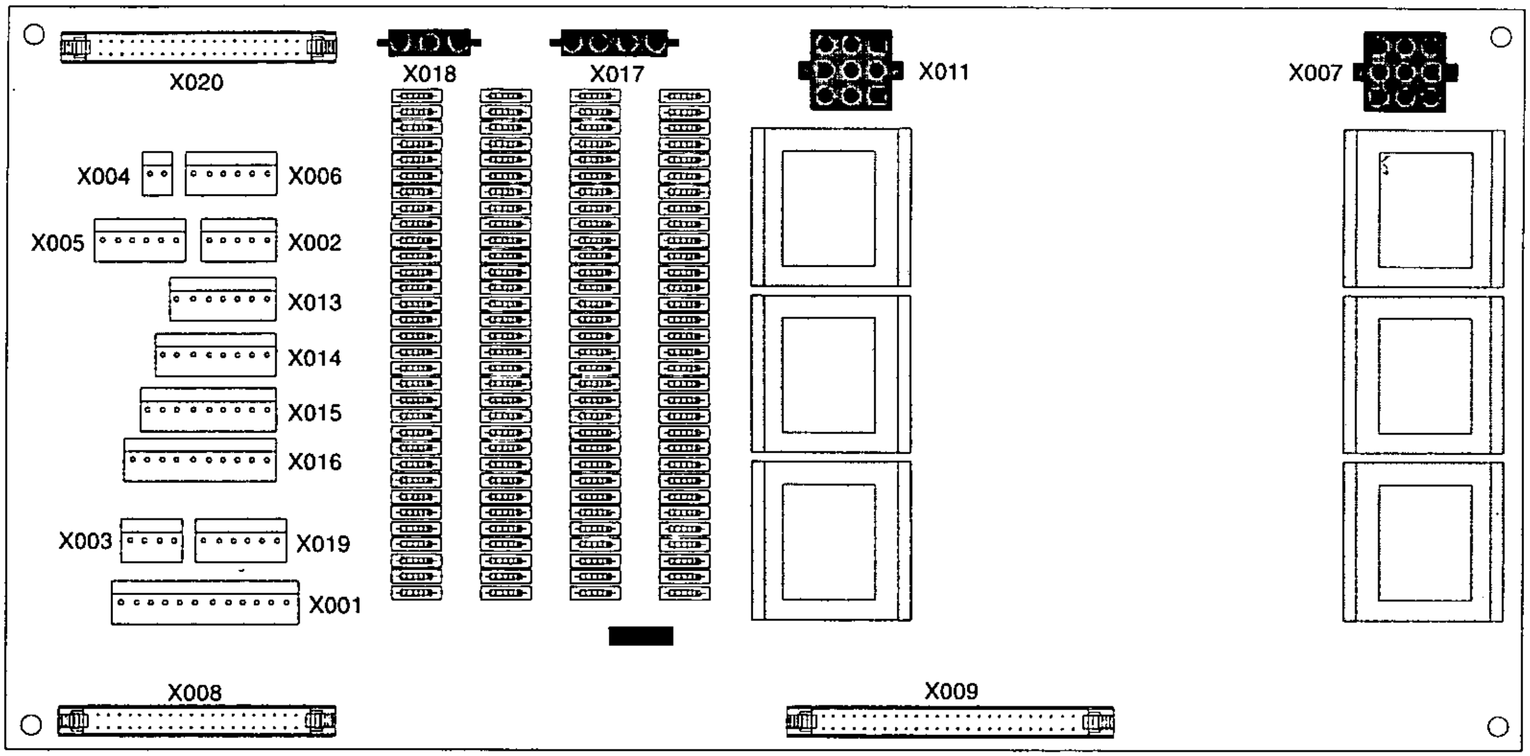


Figure 75- Interface Board

400-7 Removal and Replacement of the External Connection Board

This procedure describes how to remove and replace the external connection board.

400-7-1 Remove All AC and DC Power

400-7-2 Remove Covers

400-7-3 Remove the External Connection Board

400-7-3-1 Remove the temperature probe that is connected to X012 on the external connection board pins 5 and 6.

400-7-3-2 Remove the plastic danger shield.

400-7-3-3 Remove the jumpers on X012 pin 3 and 4, X012 pins 16 and 17.

400-7-3-4 Remove the ribbon cable from X003.

400-7-3-5 Remove any additional optional wires.

400-7-3-6 Remove the four torx screws with lock washers and flat washers that are securing the board.

400-7-3-7 Remove the board from the unit.

400-7-4 Replace the External Connection Board

400-7-4-1 Before securing the board to the unit, route the ribbon cable from the display unit to the controller behind the board.

400-7-4-2 Secure the board to the unit.

400-7-4-3 Reconnect the ribbon cable to X003 from the controller board.

400-7-4-4 Make sure jumpers on X012 are reinstalled between 3 & 4, and 16 & 17.

400-7-4-5 Replace the temperature probe to X012. The blue wire goes to pin 6, the brown wire to pin 5.

400-7-4-6 Replace any additional optional wires removed

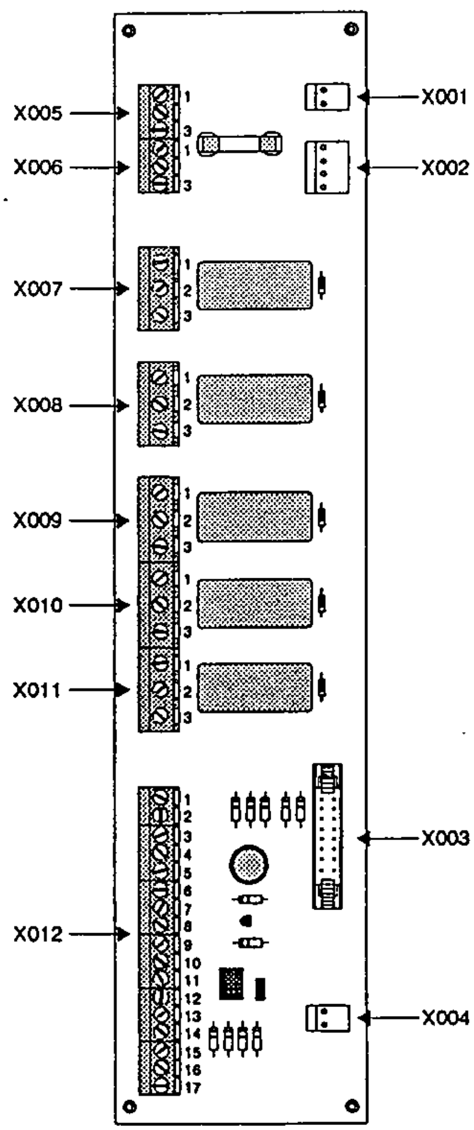
400-7-4-7 Replace the plastic danger shield.

400-7-5 Replace Cover

400-7-6 Restore All AC and DC Power

UNITY/I Three-Phase
Major System Components

▲ External Connection Board (A010)

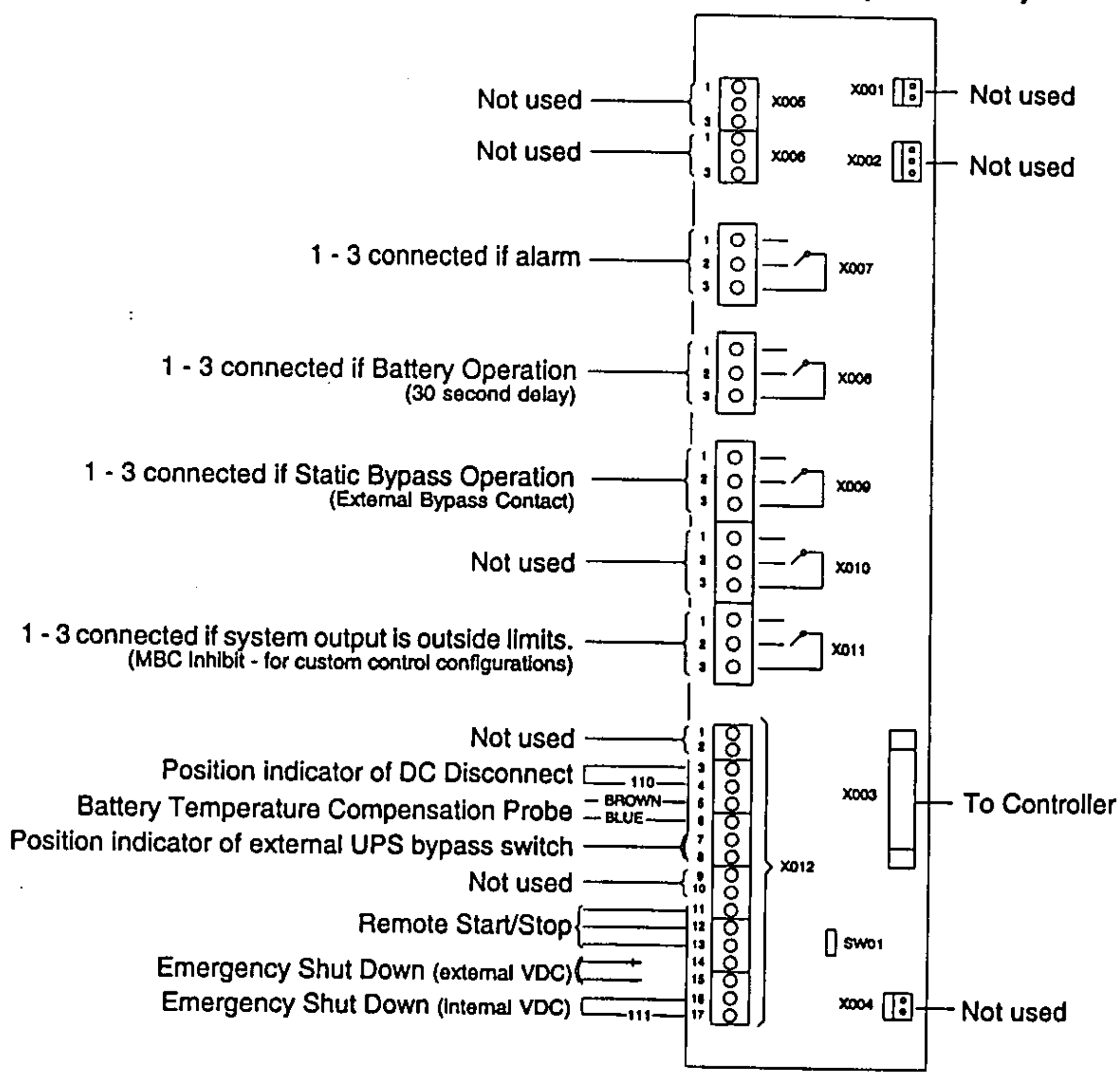


D219-TRN0013b

Figure 45

UNITY/I™ Three-Phase Major System Components

▲ External Connection Board (A010)



X007-X011 are change over relay contacts (not to exceed NEC Art. 725 Class 2 Limits)

BEST

D219-TRN0040a

400-8 Removal and Replacement of the Display Unit

This procedure describes how to remove and replace the display unit

If you have any questions or problems while performing this procedure, call BEST's Technical Support Center at 1-800-356-5737.

400-8-1 Remove All AC and DC Power

400-8-2 Remove Covers

400-8-3 Remove the Display Unit Board

400-8-3-1 Push in on the locking tabs of the plastic cover that surrounds the display unit and remove the plastic cover.

400-8-3-2 From the inside of the door, remove the phillips head screws that are securing the board to the metal plate. Do not pull the board away from the unit until the ribbon cables are removed.

400-8-3-3 Remove the ribbon cable from the keypad attached to X002 on the display unit board.

400-8-3-4 Remove the ribbon cable from X001 on the display unit board.

400-8-3-5 Remove the board from the unit.

400-8-4 Replace the Display Unit Board

400-8-4-1 Replace the keypad's ribbon cable to X002 on the display unit board.

400-8-4-2 Replace the ribbon cable from the controller board to X001 on the display unit board.

400-8-4-3 Attach the board to the metal plate.

400-8-4-4 Snap on the front plastic cover.

400-8-5 Replace Cover

400-8-6 Restore All AC and DC Power

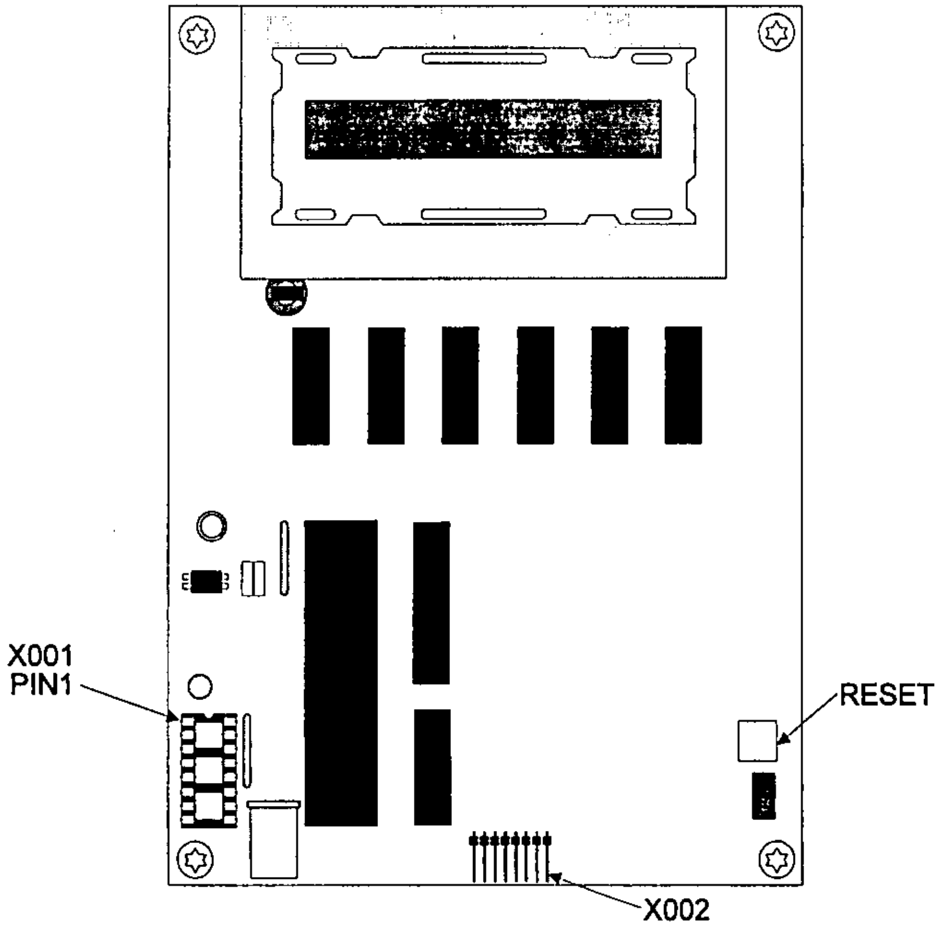
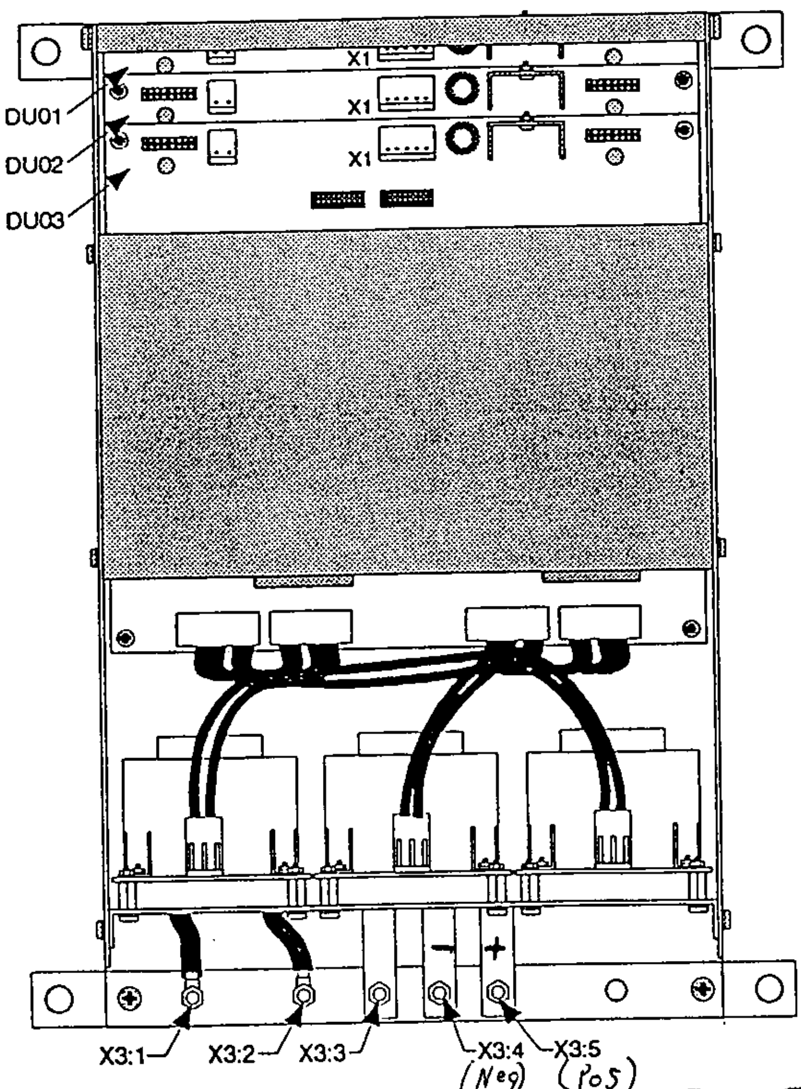


Figure 65- Display Unit Board

UNITY/I Three-Phase
Major System Components

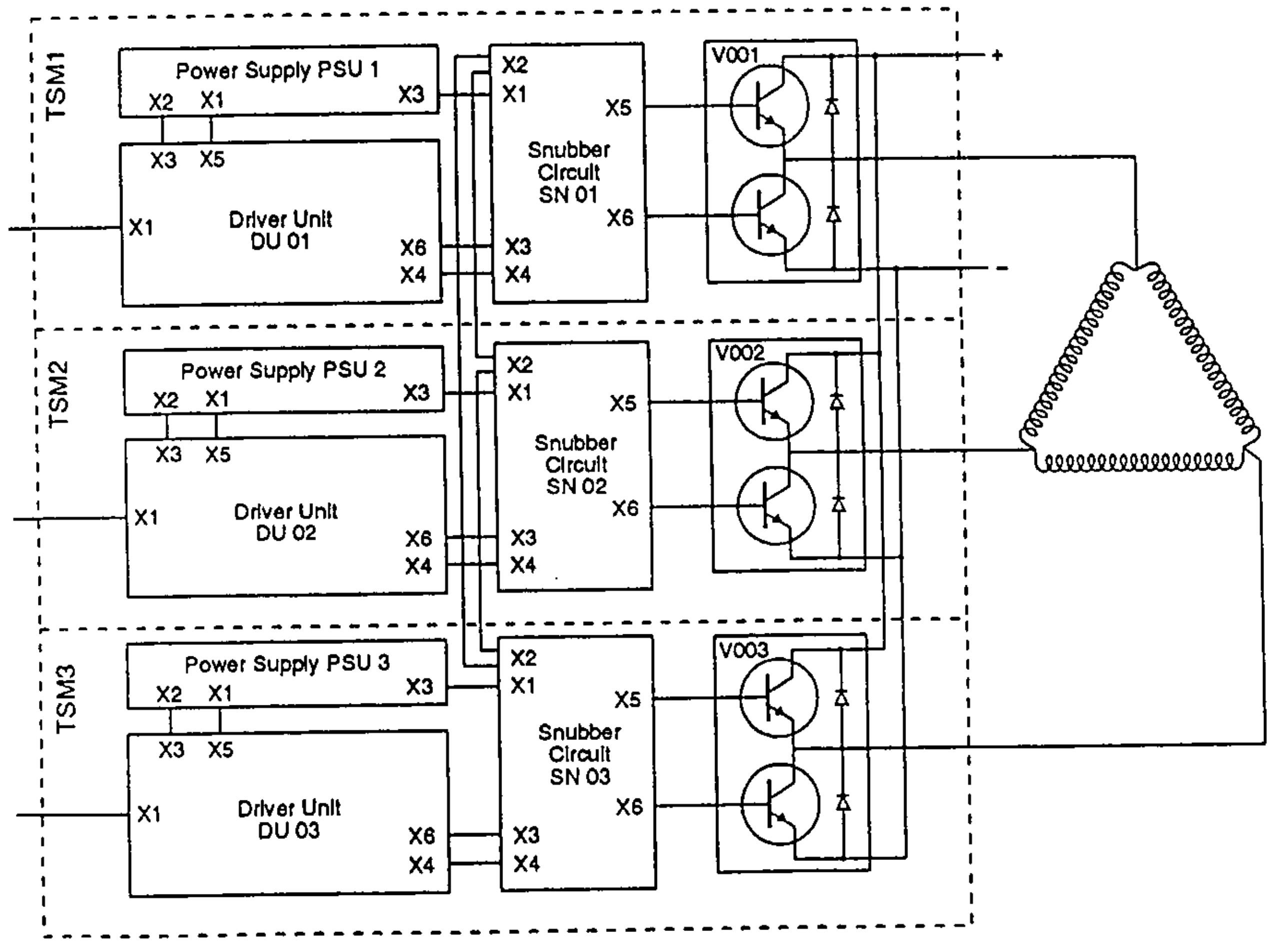
▲ Transistor Switch Module (TSM)



D219-TRN0020b

UNITY/I Three-Phase

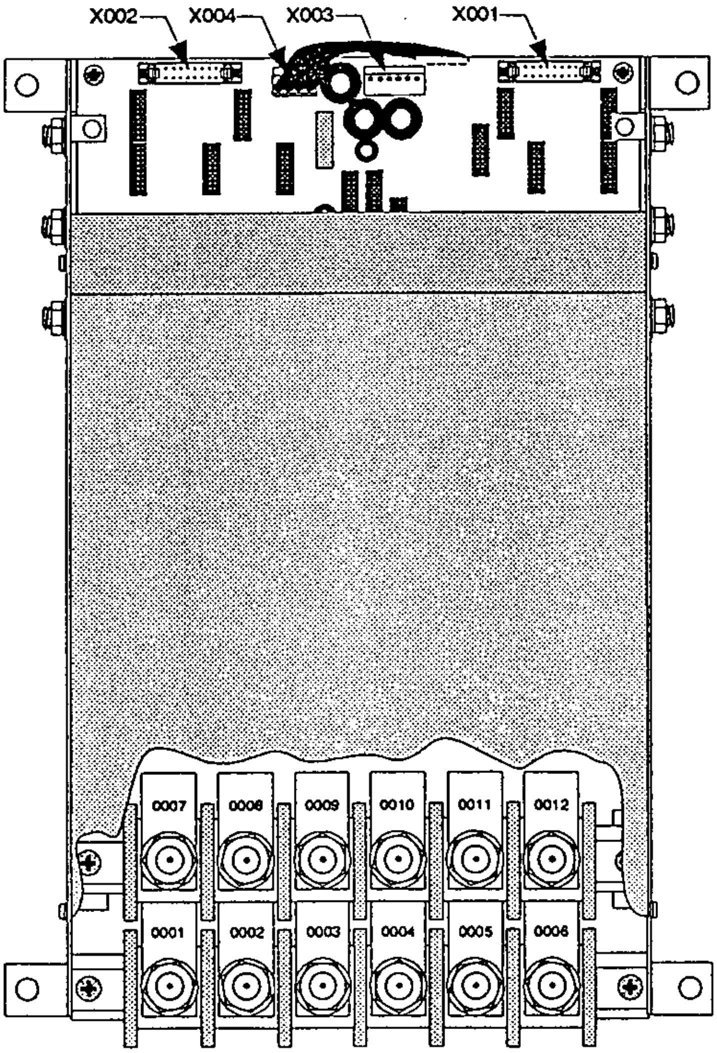
Typical TSM Configuration UT340 - UT3220



D219-TRN0027a

UNITY/I Three-Phase
Major System Components

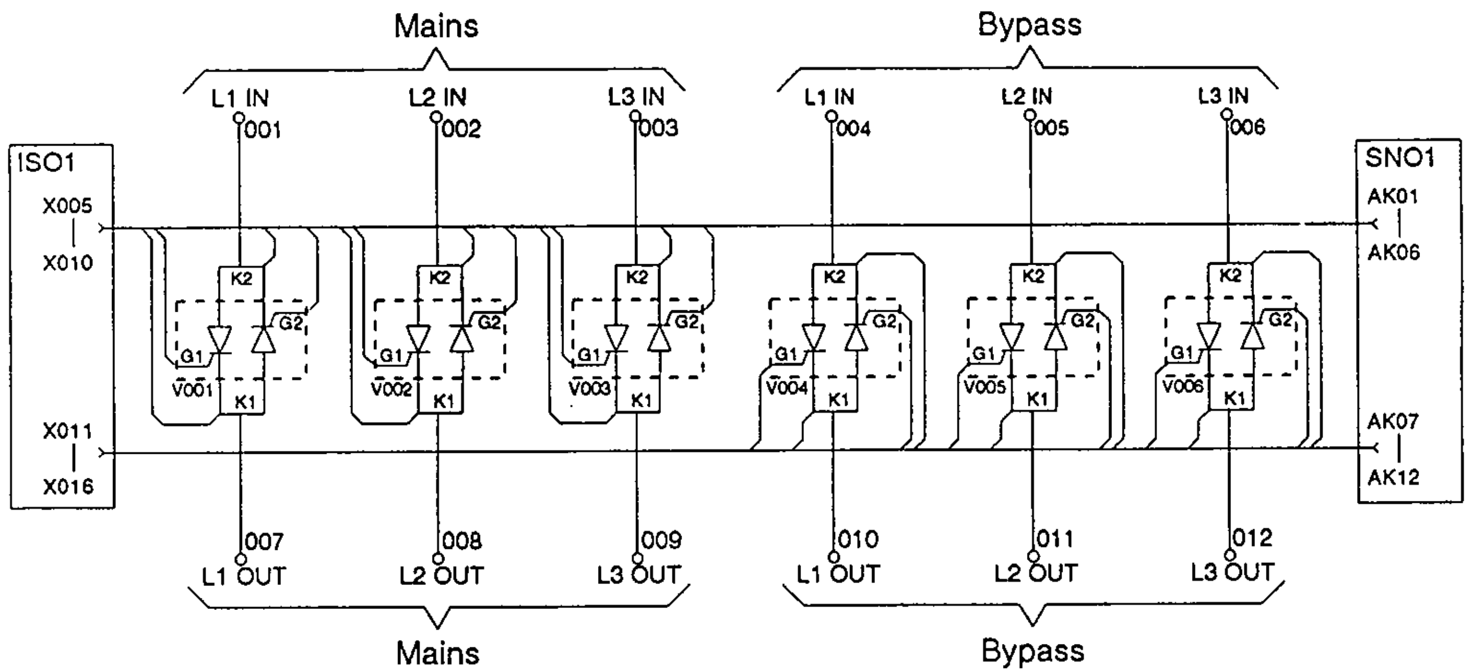
▲ Static Switch (SSW or THSW)



D219-TRN0025c

UNITY/I Three-Phase
Major System Components

- ▲ Static Switch (SSW or THSW)



D219-TRN0024c

UNITY/I Three-Phase Major System Components

▲ Parallel Board (A012)

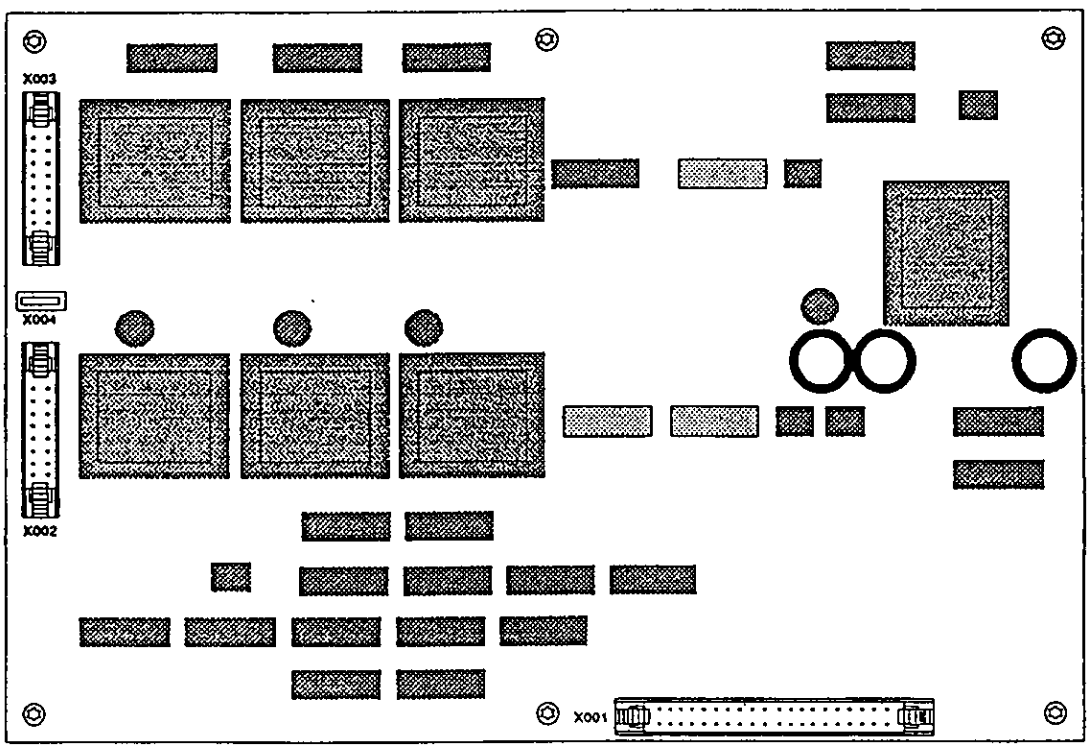
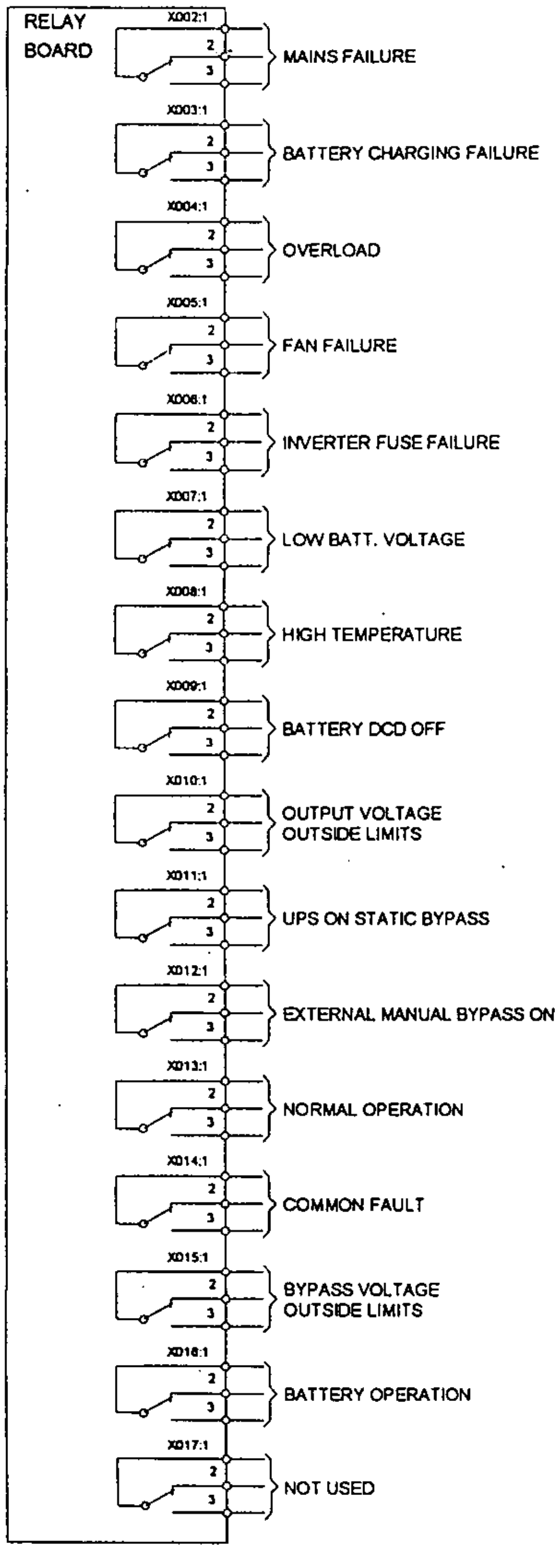


Figure 12: Relay Board (Option)

Not available on the UT310 and UT315.

The relays are shown in the alarm position and correspond to non-energized coils.



Description	Minimum	Maximum
Contact voltage - AC	6 V	250 V
Contact current - AC *	50 mA	8 A
Contact voltage and current - DC *	6 V / 50 mA	250 V / 0.3 A 6 V / 8 A

* Resistive load

SECTION 500: TROUBLESHOOTING

Finding and resolving problems inside the UPS is easy. However, the problem may not be "inside" the UPS cabinet, but outside the cabinet. Improper sizing, reactive loads, poor installation wiring, neglected maintenance, and load failure due to age are common external problems. These problems may start well after the UPS has been operating and protecting vital equipment.

Caution: Only a qualified service technician should service this equipment!

Based on BEST's field experience, 80% of service calls are caused by problems outside the UPS cabinet. If, after following the troubleshooting tables you cannot still run your UPS, feel free to contact BEST's Technical Support Center at 1-800-356-5737. **Please have your model and serial number available before calling.**

500-1 Troubleshooting External Problems

External problems can begin at any time, and you may find them at the mains (AC input) or at the loads.

Some external problems begin at the AC service panel. Ideally, the UPS's AC input circuit should only provide power to the UPS. Even if the service panel was dedicated to the UPS when you installed it, you may discover later that other equipment, such as a copier or a laser printer, was installed on the same circuit. Copiers and laser printers can cause sags in the input power, and this can make the UPS run in battery operation more often.

Other external problems are caused by the loads connected to UPS-protected outlets. For example, electrical heaters can overload the UPS. If you suspect that a load is causing the problem, try disconnecting or switching off the loads one at a time; as you do this, check to see if the UPS runs properly. If the UPS runs properly when one or more loads are off, the problem is with the load (overload), not the UPS.

Caution: Only a qualified service technician should disconnect any cables or connections that may contain voltage or current.

(If these solutions do not help you find an external problem, an electrician can use the section on the following page to check the installation.)

500-1-1 Installation Wiring and Grounding

BEST's statistics show that about 80% of all service calls about UPS units are installation-related. Most of these problems result from simply NOT using the correct wiring diagram provided by BEST. The National Electrical Code (NEC) and NFPA-70 require that listed equipment be installed according to the instructions furnished by the manufacturer. Failure to comply with this is a violation of NEC Article 110-3(b).

If you suspect that the unit is experiencing external problems, begin troubleshooting by reviewing the entire installation. Use the installation wiring diagram that was included in the planning and installation manual, and note any differences. Then, review the following:

- service entrance panel
- UNITY/I connection panel
- bypass switch
- receptacle outlets that the loads are plugged into

500-1-2 Troubleshooting Internal Problems

This section will lead to possible defective modules. To use this guide, you will need to know how to view to alarm log and the events log. If you need instructions on how to view these logs, refer to Section 310 for assistance.

Determine the behavior of the unit; then, turn to the section specified.

BEHAVIOR	ACTION (all in Sec 5)
System is running only in battery operation	Go to Section 500-2-1.
System is running only in bypass operation	Go to Section 500-2-2.
System cannot operate in any mode (no output voltage)	Go to Section 500-2-3.
System alternates between normal operation and bypass mode	Go to Section 500-2-4.
System alternates between battery operation and bypass mode	Go to Section 500-2-5.
System alternates between normal operation and battery operation	Go to Section 500-2-6.
An alarm is present and system is in normal operation	Go to Section 500-2-7.

***NOTE** - When "Fault In" lists the **Controller,** remember that incorrect programming may be the problem. (Check all Parameters)

500-2-1 System is only operating in battery operation.

Check the alarm log. (See Section 300-9 for instructions on how to view the alarm log.) If one of the alarms listed below are in the alarm log, follow the recommendations or suggestions in the fault column. If none of the alarms are found, follow the text at the bottom of the table.

ALARM	FAULT IN:
Choke high temp.	main choke, fans, interface board or controller
Static switch 1, temp. shutdown	static switch 1 (SSW1), fans, or controller
Mains moment. out of tolerance	If mains voltage is O.K.; then, fault in fuse board, interface board, or controller
Mains out of tolerance	If mains voltage is O.K.; then, fault in fuse board, interface board, or controller
Mains frequency out of tolerance	If mains frequency is O.K.; then, fault in fuse board, interface board, or controller.
Synchronization error	If mains voltage and frequency are O.K., then the system slewrate is too slow or there is a fault in the controller
Current limiter active	TSM1
If none of the alarms listed above were found, reset the pendle lock (See Parameter 65.) If the unit starts alternating between normal operation and battery operation, go to Section 500-2-6. If the unit does not start to alternate, there is a fault in the controller.	

500-2-2 System is only operating in bypass operation.

Check the alarm log. (See Section 300-9 for assistance.) If one of the alarms listed below are in the alarm log, follow the recommendations or suggestions in the fault column. If none of the alarms are found, follow the text in the last row.

ALARM	FAULT IN:
TSM1, temp. shutdown	inverter (transistor switch module 1 or TSM1), fans, or controller
Inverter fuse blown	If fuses F004, F005, or F006 are blown, then there is a fault in the TSM. If the fuses are O.K., then the fault is in the fuse monitor, interface board, or controller.
Transformer, high temp.	output transformer, fans, interface board or controller
High output voltage	If output voltage is O.K., then fault in the interface board or controller.
Battery MCB open	Battery DCD, external connection board, or controller.
Low DC shutdown	If battery voltage is O.K., then fault in the fuse board, interface board, or controller.
High DC shutdown	If battery voltage is O.K., then fault in power supply unit (PSU), interface board, or controller.
Output moment. out of tolerance	If output voltage is O.K., then fault in fuse board, interface board, or controller. If the output and frequency are not O.K. and the bypass is out of tolerance, there may be an overload.
Output out of tolerance	If output voltage is O.K., then fault in fuse board, interface board, or controller. If the output is not O.K. and the bypass is out of tolerance, there may be an overload.
Inverter voltage error	If output voltage is O.K., then fault in the interface board, fuse board, or controller.
If none of the alarms listed above were found, reset the pendle lock (step 65 in calibration stack). If the unit starts alternating between normal operation and bypass operation, go to Section 500-2-4. If the unit does not start to alternate, there is a fault in the controller.	

500-2-3 System cannot operate in any mode (no output voltage)

If there is no display, and mains is available and within tolerance and the battery voltage is adequate, check the PSU or the PSU transformer fuses. If mains is out of tolerance, restore mains within tolerance. If proper DC voltage is present the system should start up.

Check the alarm log. (See Subsection 300-9 for assistance.) If one of the alarms listed below are in the alarm log, follow the recommendations or suggestions in the fault column. If none of the alarms are found, follow the text in the last row.

ALARM	FAULT IN:
TSM1, temp. shutdown, Bypass out of Tolerance	TSM1, fans, or controller
Inverter fuse blown	If F004, F005, or F006 are blown, then fault in TSM. If the fuses are O.K., then the fault is in the interface board or controller.
Transformer, high temp.	output transformer, fans, interface board or controller
Battery MCB open	battery DCD, external connection board, or controller
Low DC shutdown	mains supply
High DC shutdown	If battery voltage is O.K., then fault in the PSU, interface board, or controller.
Off button pushed	Normally found in the events log. Verify if an emergency shutdown was activated or if the unit was switched off.
If none of the alarms listed above were found and an emergency shutdown was activated, then there is a fault in the external connection board, or controller. If a shutdown was not activated, then the fault is in the controller.	

500-2-4 System alternates between normal operation and bypass operation

If the system alternates and locks in bypass operation within two minutes, the fault is in the battery, DC-current sense, or controller if the DC-voltage is too low during normal operation. If the DC-voltage is too high during normal operation, the fault is in the PSU, interface board, or controller.

If the system isn't locking in bypass operation within two minutes, place the unit into bypass operation using the keypad. Check the alarms listed and follow the table in Section 500-2-2.

500-2-5 System alternates between battery operation and bypass operation

Using the keypad, place the unit into bypass operation. (See Section 300-6). Check the alarms listed in the events log and follow the table in Section 500-2-2, (except low DC shutdown and high DC shutdown).

500-2-6 System alternates between normal operation and battery operation

If the system alternates and locks in battery operation within two minutes, the fault is in the controller, mains choke, or the zero phase adjustment if the DC-voltage is too high during normal operation. Check the events log. If "charge reg. error" alarm is present, the fault might be with SSW1, backfeed protection relay, or the controller.

If the system isn't locking in battery operation within two minutes, check the input voltage. If the voltage is within tolerance, place the unit into battery operation using the keypad. Check the events log for alarms and follow the table in Section 500-2-1.

500-2-7 System is in normal operation, but there is an alarm

Check the alarm log. (See Subsection 300-9 for instructions.) If one of the alarms listed below are in the alarm log, follow the recommendations or suggestions in the fault column. If none of the alarms are found, follow the text in the last row.

ALARM	FAULT IN:
Fatal error RAM 1	controller or RAM 1
TSM1, temp. warning	TSM1, fans, or controller
Choke high temp.	main choke, fans, interface board, or controller
Transformer, high temp.	output transformer, fans, interface board, or controller
Static switch 2, temp. warning	SSW2, fans, or controller
Static switch 1, temp. warning	SSW1, fans, or controller
Fault in int. power supply	PSU, interface board, or controller
Low DC warning	If battery voltage is O.K., then fault in the fuse board, interface board, or controller.
High DC warning	If battery voltage is O.K., then fault in the interface board, or controller.

ALARM	**FAULT IN:**
Bypass moment. out of tolerance	If bypass mains voltage and frequency are O.K., then fault in controller, interface board, or fuse board.
Bypass out of tolerance	If bypass mains voltage and frequency are O.K., then fault in fuse board, interface board, or controller.
Bypass frequency is out of tolerance	If bypass mains voltage and frequency are O.K., then fault in the controller, interface board, or fuse board.
Overload	If the load is below 100%, then fault in the interface board, controller, or current sensors/torroids.
If none of the alarms listed above were found, then the fault is in the controller or display unit.	

If you need to troubleshoot the unit using a specific alarm, use the following tables. The tables include all possible alarms, their description, and possible action to be taken.

POSSIBLE ALARM	DESCRIPTION	TO DO
Fatal Error RAM1 data error	The RAM1 has exceeded its allowed programmings.	Restart the unit to see if the alarm will disappear. If not, change RAM 1 with a new backup.
OFF Button Pushed	The red "OFF " button has been pushed or an emergency shutdown was activated. This alarm will only be listed in the events log. The unit has been switched off and there will be **no output voltage.**	Try to switch the unit on by pressing the green "On" button. Was an emergency shutdown activated?
High Battery Temperature	The ambient battery temperature is higher than the set alarm level.	If the unit has internal batteries, check that the fans are operating in the unit. If the unit has external batteries, check that the temperature in the external battery cabinet or rack is at the correct level.
Battery Monitor Warning	The battery monitor test has determined that the battery capacity is reduced (typically below 80%).	If this alarm occurs during startup, reset the alarm according to SECTION 300-6. If it is not in the user parameters, phone BEST for assistance. If this alarm occurs during operation, reset the alarm. Perform a battery capacity test, and two days later perform it again. This might "wake-up" the batteries. If the alarm is still activated, your battery capacity may be reduced, phone BEST for assistance.
Battery Monitor Alarm	The battery monitor test has determined that the battery pack is near low runtime capacity or may have a problem.	Check the batteries and if needed, replace them.

POSSIBLE ALARM	DESCRIPTION	TO DO
Static switch 1 temp. warning	The temperature on the heatsink for the mains static switch is higher than normal. The unit will alarm at 194°F (90°C). If the temperature continues to rise to 212°F (100°C), the unit will switch into battery operation.	Check the fans, the air inlet, ambient temperature, and the load. If the temperature of the heatsink is normal, there could be a fault in either the thermal switch or wire.
Static switch 1 temp. shutdown	Because the temperature on the heatsink is higher than permitted 212°F (100°C), the mains static switch has opened and the unit went into battery operation	Check the fans, the air inlet, the ambient temperature and the load.If the temperature of the heatsink is normal, there could be a fault in either the thermal switch or wire.
Static switch 2 temp. warning	The temperature on the heatsink is higher than permitted 194°F (90°C). If the temperature continues to rise to 212°F (100°C), the unit will switch into battery operation.	Check the fans, the air inlet, ambient temperature, and the load. If the temperature of the heatsink is normal, there could be a fault in either the thermal switch or wiring.
Static switch 2 temp. shutdown	The temperature on the heatsink is higher than permitted 212°F (100°C) and the bypass static switch opened and the unit went into battery operation.	Check the fans, the air inlet, ambient temperature, and the load. If the temperature of the heatsink is normal, there could be a fault in either the thermal switch or wiring.
TSM 1 temp. warning	The temperature on the heatsink is higher than permitted 194°F (90°C). If the temperature continues to rise to 212°F (100°C), the inverter will shutdown and the unit will go into bypass operation if within tolerance.	Check the fans, the air inlet, ambient temperature, and the load. If the temperature of the heatsink is normal, there could be a fault in either the thermal switch or wiring.
TSM1 temp. shutdown	The inverter has shutdown because the temperature on the heatsink was higher than permitted 212°F (100°C). The unit will go into bypass operation if mains are within tolerance.	Check the fans, the air inlet, ambient temperature, and the load. If the temperature of the heatsink is normal, there could be a fault in either the thermal switch or wiring.
Inverter fuse blown	One or more of the fuses in the output of the inverter are blown (F004, F005, F006).	Check to see if there is short circuit in one or more of the inverter modules (TSM).

POSSIBLE ALARM	DESCRIPTION	TO DO
High temp. choke	The temperature in the mains choke is too high 248° F (120° C). If the problem will not correct itself shortly, the unit will switch into battery operation after five minutes.	Check the temperature on the choke, if the temperature is too high, check the fan, and air inlet. If the temperature is fine, check the temperature sensor. To do this, short circuit the terminal on the choke for the temperature sensor. If the failure disappears, phone BEST. If the failure remains, check the wiring to the interface board, change the interface board, or change the controller.
High temp. transformer	The temperature in the main transformer is too high 248° F (120° C). If the failure is not corrected shortly, the unit will go into standby and there will be **no output voltage**.	Check the temperature on the main transformer. If the temperature is high, check the fan and the air inlet. If the transformer's temperature is fine, check the temperature sensor. To do this, short circuit the terminal on the transformer for the temperature sensor. If the failure disappears, phone BEST. If the failure remains, check the wire to the interface board, change the interface board, or change the controller.
High output voltage	The output voltage is higher than specification. This alarm will normally only be seen in the events log.	Check if there is a fuse failure on the RFI/Fuse board on the output or there could be a failure in the inverter regulation on the controller.
Synchronization error	The inverter output is not synchronized to the mains. The unit will stay in battery operation.	Check to see if mains is available and within tolerance. If mains is acceptable, check the fuseboard, the interface, or the controller.
Fault in int. power supply	There is a fault in the internal PSU. If the PSUs are paralleled, there is fault in one or more internal PSU.	Change PSU.

POSSIBLE ALARM	DESCRIPTION	TO DO
Fan fault	If the fan monitoring option is installed, this alarm will activate if one or more of the fans are slowing in speed.	Check the fans and the fan supply.
Battery MCB is off	The external battery DC disconnect (MCB) is open.	If there are no external batteries, check to see if 3 and 4 of X012 on the external connection board is connected. These two have to be connected when the external battery DCD is closed or not present.
Low DC warning	The battery voltage drops to 190V, the unit will alarm. If the battery voltage continues to drop, the unit will alarm Low DC shutdown.	Check the events log to determine why the unit went into battery operation.
Low DC shutdown	The unit will shutdown when the battery voltage drops down to 170V and switch into bypass operation if it is in tolerance. If bypass is not within tolerance, **you will lose output voltage.**	Check the events log to determine why the unit went into battery operation.
Mains is moment. out of tolerance	The mains have been out of tolerance (glitch, etc.). This alarm will normally only be found in the events log.	If this alarm occurs at the time of initial start up, check the phase rotation. Otherwise, there was possibly a glitch.
Mains is out of tolerance	The mains voltage is out of tolerance.	Check the mains voltage and the external mains fuses. If mains voltage is within tolerance, check the fuseboard and the interface board. If this alarm occurs at the time of initial start up, check the phase rotation.

POSSIBLE ALARM	**DESCRIPTION**	**TO DO**
Mains freq. is out of tolerance	The mains frequency is out of tolerance.	Check the mains voltage and the external mains fuses. If the unit is running on a diesel generator, check the frequency regulation.
Bypass is moment. out of tolerance	The bypass mains was momentarily out of tolerance (glitch, etc.). This alarm will normally only be found in the events log.	If this alarm occurs at the time of inital start up, check the phase rotation. Otherwise, there was possibly a glitch.
Bypass is out of tolerance	The bypass mains voltage is out of tolerance.	Check the mains voltage frequency and the external mains fuses. If this alarm occurs at the time of initial start up, check the phase rotation.
Bypass freq. is out of tolerance	The bypass mains freq. is out of tolerance.	Check the mains voltage and the external mains fuses. If the unit is running on a diesel generator, the frequency regulation could be bad.
Output is moment. out of tolerance	The output was momentarily out of tolerance. This alarm will normally only be found in the events log.	Check the load. If you have a cyclical load, this alarm may occur regularly.
Output is out of tolerance	The output voltage is out of tolerance.	Check the load and Phone BEST.
Output freq. is out of tolerance	The output frequency is out of tolerance.	Phone BEST.
Overload load is over 100%	The unit is loaded with more than nominal load on one or more phases.	Check the load current per phase. If the unit is overloaded, reduce the load or distribute the load on more phases if they are not fully loaded.
DC current limit	Charging with full power.	For information only. This alarm will usually be seen in the events log.

POSSIBLE ALARM	DESCRIPTION	TO DO
Charge reg. error	For some reason, the unit is unable to recharge the batteries.	Check the battery voltage, the SSW, and the charge current.
Current limiter active	Possibly a short circuit on the output, or an overload.	Check LED on TSM, also possible short on ribbon cable.
Inverter voltage error	The inverter is not operating correctly.	Can be a fault in the inverter. Otherwise seen when the unit is shut off and back on.

UT310 208VAC 60Hz SALES PARTS KIT		
Part#	**Description**	**Qty**
LEVEL F, FUSE KIT, PART # SK31-NA6F		
0015970	Fuse 80A/240V - Inverter	3
0015082	Fuse 35A/500V - AC Output	3
0015110	Fuse 50A/500V - Internal DC Fuses	3
0015111	Fuse 63A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 208V MAINS PART # SK31-AR6B		
0400540	Interface Board	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC WO/RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 208V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NA6M		
0204010	Static Switch Assembly	1
0204275	TSM 10KVA 220VDC	1
LEVEL C, CURRENT CONTACTOR KIT 208V MAINS, PART # SK31-AA6C		
0014122	Contactor, 120v	1
0400389	Current Monitor Board, Inverter	1
0400538	Current Monitor Board, I/O, 208V	1
0400505	Current Monitor Board, DC	1
0020411	Fan	1
0800945	Ribbon Cable Kit	1
0900942	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030924	Fan Transformer	1
SK31-AA6T	Full Parts Kit, 10K, 208VAC	

UT310 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-NA6F		
0015970	Fuse 80A/240V - Inverter	3
0015082	Fuse 35A/500V - AC Output	3
0015110	Fuse 50A/500V - Internal DC Fuses	3
0015111	Fuse 63A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BR6B		
0400628	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC WO/RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 480V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NA6M		
0204010	Static Switch Assembly	1
0204275	TSM 10KVA 220VDC	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BB6C		
0014171	Contactor, 277V	1
0400389	Current Monitor Board, Inverter	1
0400660	Current Monitor Board, I/O, 208V	1
0400505	Current Monitor Board, DC	1
0020044	Fan, 480VAC	1
0800945	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1
SK31-BB6T	Full Parts Kit, 15K, 480VAC	

UT315 208VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-NB6F		
0015971	Fuse 100A/240V - Inverter	3
0015081	Fuse 50A/500V - AC Output	3
0015111	Fuse 63A/500V - Internal DC Fuses	3
0015112	Fuse 100A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 208V MAINS PART # SK31-AR6B		
0400540	Interface Board	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 208V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NB6M		
0204010	Static Switch Assembly	1
0204280	TSM 15KVA 220VDC	1
LEVEL C, CURRENT CONTACTOR KIT 208V MAINS, PART # SK31-AB6C		
0014122	Contactor, 120v	1
0400390	Current Monitor Board, Inverter	1
0400539	Current Monitor Board, I/O, 208V	1
0400506	Current Monitor Board, DC	1
0020411	Fan	1
0800945	Ribbon Cable Kit	1
0900942	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030924	Fan Transformer	1
SK31-AB6T	Full Parts Kit, 15K, 208VAC	

UT315 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-NB6F		
0015971	Fuse 100A/240V - Inverter	3
0015081	Fuse 50A/500V - AC Output	3
0015111	Fuse 63A/500V - Internal DC Fuses	3
0015112	Fuse 100A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BR6B		
0400628	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 480V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NB6M		
0204010	Static Switch Assembly	1
0204280	TSM 15KVA 220VDC	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BB6C		
0014171	Contactor, 277V	1
0400390	Current Monitor Board, Inverter	1
0400661	Current Monitor Board, I/O, 208V	1
0400506	Current Monitor Board, DC	1
0020044	Fan, 480VAC	1
0800945	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1
SK31-BB6T	Full Parts Kit, 15K, 480VAC	

UT320 208VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-NC6F		
0015972	Fuse 160A/240V - Inverter	3
0015111	Fuse 63A/500V - AC Output	3
0015112	Fuse 100A/500V - Internal DC Fuses	3
0015113	Fuse 125A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017024	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
SK31-NC6F	Fuse Kit, 20K, 208-480VAC	
LEVEL B BOARD KIT 208V MAINS PART # SK31-AR6B		
0400540	Interface Board	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 208V Mains	1
SK31-AR6B	Board Kit, 208VAC, 10-60K	
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NC6M		
0204023	Static Switch Assembly	1
0204285	TSM 20KVA 220VDC	1
SK31-NC6M	Module Kit, 20k, 208-480VAC	
LEVEL C, CURRENT CONTACTOR KIT 208V MAINS, PART # SK31-AC6C		
0014143	Contactor, 120v	1
0400391	Current Monitor Board, Inverter	1
0400622	Current Monitor Board, I/O, 208V	1
0400507	Current Monitor Board, DC	1
0020411	Fan	1
0020410	Fan	1
0600996	Ribbon Cable Kit	1
0900942	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030924	Fan Transformer	1
Sk31-AC6C	Cur/Cont Kit, 20K, 208VAC	
SK31-AC6T	**Full Parts Kit, 20K, 208VAC**	

UT320 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-NC6F		
0015972	Fuse 160A/240V - Inverter	3
0015111	Fuse 63A/500V - AC Output	3
0015112	Fuse 100A/500V - Internal DC Fuses	3
0015113	Fuse 125A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017024	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BR6B		
0400628	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 480V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NC6M		
0204023	Static Switch Assembly	1
0204285	TSM 20KVA 220VDC	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK31-BC6C		
0014172	Contactor, 277V	1
0400391	Current Monitor Board, Inverter	1
0400662	Current Monitor Board, I/O, 408V	1
0400507	Current Monitor Board, DC	1
0020044	Fan, 480VAC	1
0020404	Fan, 480VAC	1
0800996	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1
SK31-BC6T	**Full Parts Kit, 20K, 480VAC**	

UT330 208VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-ND6F		
0015973	Fuse 250A/240V - Inverter	3
0015091	Fuse 100A/500V - AC Output	3
0015113	Fuse 125A/500V - Internal DC Fuses	3
FUS-0286	Fuse 160A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017024	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 208V MAINS PART # SK31-AR6B		
0400540	Interface Board	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC withoutR AM1	1
SSICT-0008	RAM1 for UT310-UT360: 208V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-ND6M		
0204023	Static Switch Assembly	1
0204290	TSM 30KVA 220VDC	1
LEVEL C, CURRENT CONTACTOR KIT 208V MAINS, PART # SK31-AD6C		
0014143	Contactor, 120v	1
0400392	Current Monitor Board, Inverter	1
0400621	Current Monitor Board, I/O, 208V	1
0400508	Current Monitor Board, DC	1
0020411	Fan	1
0020410	Fan	1
0800996	Ribbon Cable Kit	1
0900942	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030924	Fan Transformer	1
SK31-AD6T	Full Parts Kit, 30K, 208VAC	

UT330 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-ND6F		
0015973	Fuse 250A/240V - Inverter	3
0015091	Fuse 100A/500V - AC Output	3
0015113	Fuse 125A/500V - Internal DC Fuses	3
FUS-0286	Fuse 160A/500V - External DC Fuses	2
0017080	Fuse 5A/500V - Fuse Boards	10
0017024	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BR6B		
0400628	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 480V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-ND6M		
0204023	Static Switch Assembly	1
0204290	TSM 30KVA 220VDC	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BD6C		
0014172	Contactor, 277V	1
0400392	Current Monitor Board, Inverter	1
0400663	Current Monitor Board, I/O, 480V	1
0400508	Current Monitor Board, DC	1
0020044	Fan, 480VAC	1
0020404	Fan, 480VAC	1
0800996	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1
SK31-BD6T	Full Parts Kit, 30K, 480VAC	

UT340 208VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-NE6F		
0015982	Fuse 315A/660VAC LMT Inv.-AC Out.	3
0015864	Fuse 250A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 208V MAINS PART # SK31-AR6B		
0400540	Interface Board	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 208V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NE6M		
0204026	Static Switch Assembly	1
0204305	TSM 40KVA 220VDC	1
LEVEL C, CURRENT CONTACTOR KIT 208V MAINS, PART # SK31-AE6C		
0014157	Contactor, 120v	1
0400566	Current Monitor Board, Inverter	1
0400637	Current Monitor Board, I/O, 208V	1
0400633	Current Monitor Board, DC	1
0020411	Fan	2
0801070	Ribbon Cable Kit	1
0900942	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030924	Fan Transformer	1
SK31-AE6T	Full Parts Kit, 40K, 208VAC	

UT340 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-NE6F		
0015982	Fuse 315A LMT - Inverter	3
0015864	Fuse 250A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BR6B		
0400628	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 480V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NE6M		
0204026	Static Switch Assembly	1
0204305	TSM 40KVA 220VDC	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BE6C		
0014158	Contactor, 277V	1
0400566	Current Monitor Board, Inverter	1
0400635	Current Monitor Board, I/O, 480V	1
0400633	Current Monitor Board, DC	1
0020044	Fan, 480VAC	2
0801070	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1
SK31-BE6T	Full Parts Kit, 40K, 480VAC	

UT360 208VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-NF6F		
0015977	Fuse 450A LMT - Inverter	3
0015864	Fuse 250A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 208V MAINS PART # SK31-AR6B		
0400540	Interface Board	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC WO/RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 208V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NF6M		
0204026	Static Switch Assembly	1
0204318	TSM 60KVA 220VDC	1
LEVEL C, CURRENT CONTACTOR KIT 208V MAINS, PART # SK31-AF6C		
0014159	Contactor, 277V	1
0400569	Current Monitor Board, Inverter	1
0400639	Current Monitor Board, I/O, 480V	1
0400634	Current Monitor Board, DC	1
0020411	Fan, 480VAC	2
0801070	Ribbon Cable Kit	1
0900942	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030924	Fan Transformer	1
SK31-AF6T	Full Parts Kit, 60K, 208VAC	

UT360 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART #SK31-NF6F		
0015977	Fuse 450A LMT - Inverter	3
0015864	Fuse 250A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BR6B		
0400628	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500145	Power Supply, 220VDC	1
0400801	Controller W/RTC WO/RAM1	1
SSICT-0008	RAM1 for UT310-UT360: 480V Mains	1
LEVEL M, MODULE KIT, 208/480V MAINS, PART # SK31-NF6M		
0204026	Static Switch Assembly	1
0204318	TSM 60KVA 220VDC	1
	Module Kit, 60k, 208-480VAC	
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BF6C		
0014158	Contactor, 277V	1
0400569	Current Monitor Board, Inverter	1
0400636	Current Monitor Board, I/O, 480V	1
0400634	Current Monitor Board, DC	1
0020044	Fan, 480VAC	2
0801070	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1
SK31-BF6T	Full Parts Kit, 60K, 480VAC	

UT380 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-BG6F		
0015978	Fuse 355A/660V - Inverter	3
0015864	Fuse 250A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BO6B		
0400668	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500149	Power Supply, 360VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT380-UT3100: 480V Mains	1
LEVEL M, MODULE KIT, 480V MAINS, PART # SK31-BO6M		
0204025	Static Switch Assembly	1
0204339	TSM 80/100KVA	1
0400476	Crowbar 500VDC	1
0009125	Thyrister	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BG6C		
0014173	Contactor, 277V	1
0400672	Current Monitor Board, Inverter	1
0400664	Current Monitor Board, I/O, 480V	1
0400666	Current Monitor Board, DC	1
0020044	Fan, 480VAC	2
0801070	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1

UT3100 480VAC 60 Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-BH6F		
0015979	Fuse 450A/660V - Inverter	3
0015864	Fuse 250A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BO6B		
0400668	Interface Board 480V	1
0400654	External Connection Board	1
0400657	RFI Fuse Board	1
0400658	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500149	Power Supply, 360VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT380-UT3100: 480V Mains	1
LEVEL M, MODULE KIT, 480V MAINS, PART # SK31-BO6M		
0204025	Static Switch Assembly	1
0204339	TSM 80/100KVA	1
0400476	Crowbar 500VDC	1
0009125	Thyrister	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BH6C		
0014173	Contactor, 277V	1
0400673	Current Monitor Board, Inverter	1
0400665	Current Monitor Board, I/O, 480V	1
0400667	Current Monitor Board, DC	1
0020044	Fan, 480VAC	2
0801070	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0400469	Connection Board for TSM	1
0030923	Fan Transformer	1

UT3120 480VAC 60 Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-BI6F		
0015979	Fuse 450A/660V - Inverter	3
0015982	Fuse 315A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BP6B		
0400645	Interface Board 480V	1
0400654	External Connection Board	1
0400670	RFI Fuse Board	1
0400656	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500144	Power Supply, 408VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT3120-UT3220: 480V Mains	1
LEVEL M, MODULE KIT, 480V MAINS, PART # SK31-BP6M		
0204002	Static Switch Assembly	1
0204365	TSM 120/160/220KVA	1
0400476	Crowbar 500VDC	1
0009130	Thyrister	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BI6C		
0014169	Contactor, 277V	1
0400569	Current Monitor Board, Inverter	1
0400638	Current Monitor Board, I/O, 480V	1
0400494	Current Monitor Board, DC	1
0020404	Fan, 480VAC	2
SSRIB-3000	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0005007	Capacitor for Fan Connection Board	1
0400646	Connection Board for TSM	1
0030704	Fan Transformer	1
SK31-BI6T	Full Parts Kit, 120K, 480VAC	

UT3160 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT, PART # SK31-BJ6F		
0015983	Fuse 450A/660V - Inverter	3
0015865	Fuse 315A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BP6B		
0400645	Interface Board 480V	1
0400654	External Connection Board	1
0400670	RFI Fuse Board	1
0400656	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500144	Power Supply, 408VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT3120-UT3220: 480V Mains	1
LEVEL M, MODULE KIT, 480V MAINS, PART # SK31-BP6M		
0204002	Static Switch Assembly	1
0204365	TSM 120/160/220KVA	1
0400476	Crowbar 500VDC	1
0009130	Thyrister	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BJ6C		
0014170	Contactor, 277V	1
0400643	Current Monitor Board, Inverter	1
0400551	Current Monitor Board, I/O, 480V	1
0400495	Current Monitor Board, DC	1
0020404	Fan, 480VAC	2
SSRIB-3000	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0005007	Capacitor for Fan Connection Board	1
0400646	Connection Board for TSM	1
0030704	Fan Transformer	1
SK31-BJ6T	Full Parts Kit, 160K, 480VAC	

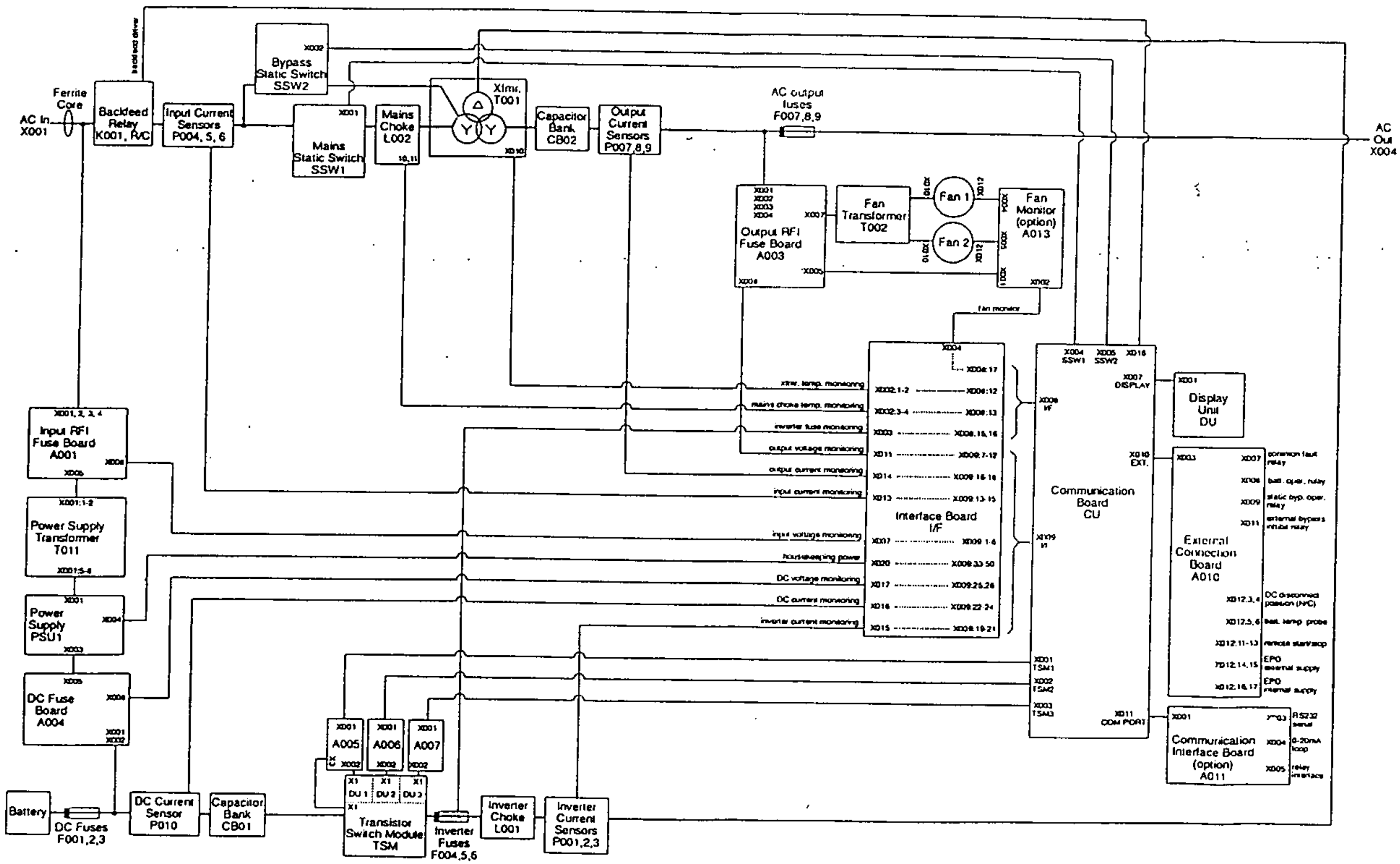
UT3220 480VAC 60Hz SPARE PARTS KIT

Part#	Description	Qty
LEVEL F, FUSE KIT PART #SK31-BK6F		
0015979	Fuse 450A/660V - Inverter	3
0015980	Fuse 400A/660V - AC Output	3
0017080	Fuse 5A/500V	10
0017053	Fuse 10A/250V - PSU DC	2
0017059	Fuse 6.3A/250V - PSU AC	2
0017047	Fuse 15A/250V - PSU X-former	2
ATM-8	Fuse 8 Amp 500 VDC	2
LEVEL B BOARD KIT 480V MAINS PART # SK31-BP6B		
0400645	Interface Board 480V	1
0400654	External Connection Board	1
0400670	RFI Fuse Board	1
0400656	DC Fuse Board	1
0400707	Display Unit	1
0400650	Backfeed Relay Driver Board	1
0500144	Power Supply, 408VDC	1
0400801	Controller W/RTC without RAM1	1
SSICT-0008	RAM1 for UT3120-UT3220: 480V Mains	1
LEVEL M, MODULE KIT, 480V MAINS, PART # SK31-BP6M		
0204002	Static Switch Assembly	1
0204365	TSM 120/160/220KVA	1
0400476	Crowbar 500VDC	1
0009130	Thyrister	1
LEVEL C CURRENT CONTACTOR KIT 480V MAINS PART # SK1-BK6C		
0014170	Contactor, 277V	1
0400644	Current Monitor Board, Inverter	1
0400640	Current Monitor Board, I/O, 480V	1
0400463	Current Monitor Board, DC	1
0020404	Fan, 480VAC	2
SSRIB-3000	Ribbon Cable Kit	1
0900968	PSU Transformer Assembly	1
0005007	Capacitor for Fan Connection Board	1
0400646	Connection Board for TSM	1
0030704	Fan Transformer	1
SK31-BK6T	Full Parts Kit, 220K, 480VAC	

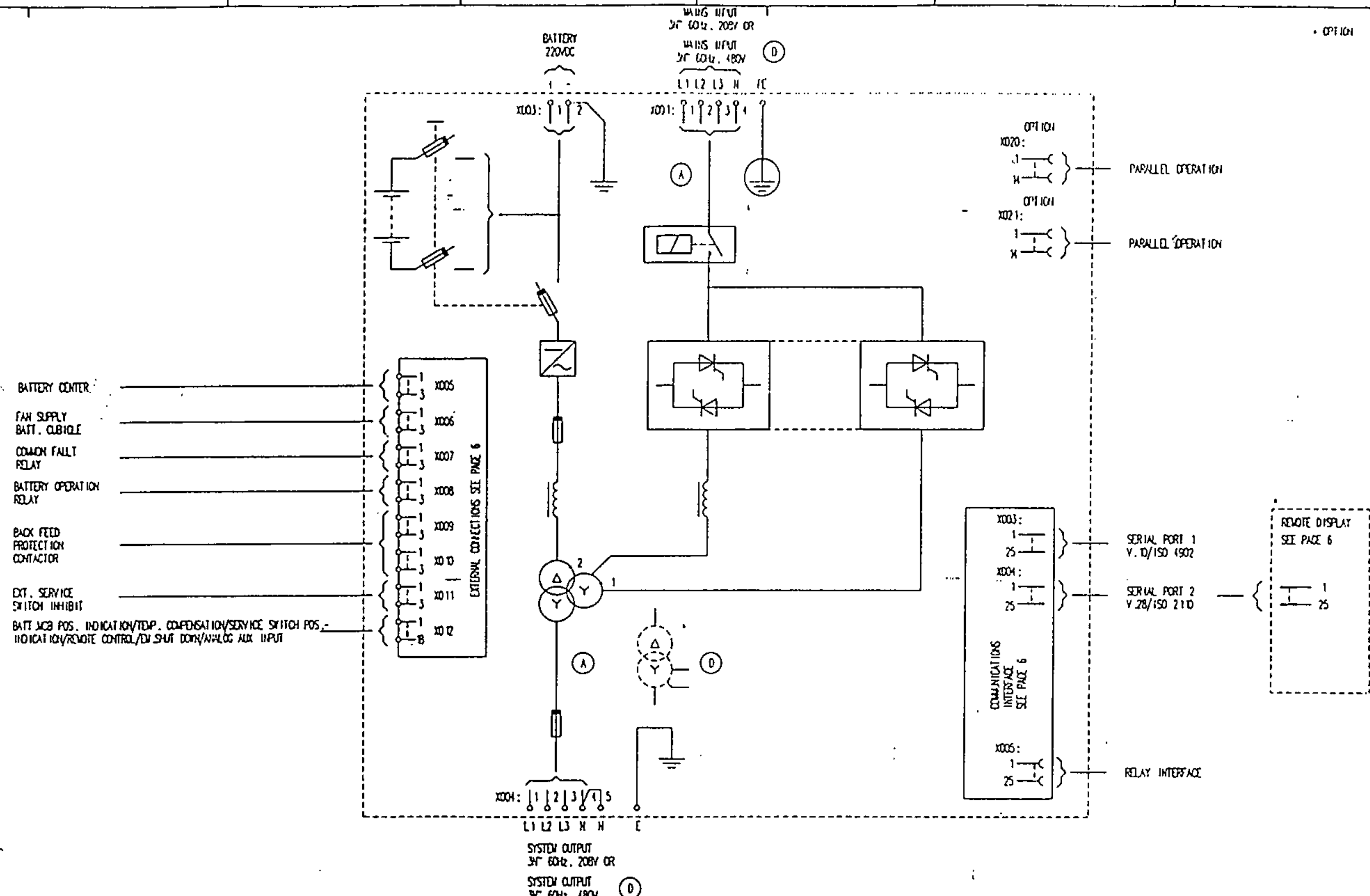
INDEX - WIRING DIAGRAMS

- System Wiring Block Diagram

8.000.527	UT310 - 315	Old Controller
8.000.595	UT310 - 315	Controller w/ RTC
8.000.528	UT320 - 330	Old Controller
8.000.596	UT320 - 330	Controller w/ RTC
8.000.572	UT340 - 360	Old Controller
8.000.597	UT340 - 360	Controller w/ RTC
8.000.583	UT380 - 3100	Controller w/ RTC
8.000.573	UT3120 - 3220	Old Controller
8.000.598	UT3120 - 3220	Controller w/ RTC



AC In X001
Ferrite Core
Backfeed Relay K001, R/C
backfeed driver
Input Current Sensors P004, 5, 6
Bypass Static Switch SSW2
Mains Static Switch SSW1
Mains Choke L002
Xfmr. T001
Capacitor Bank CB02
Output Current Sensors P007,8,9
AC output fuses F007,8,9
AC Out X004
Output RFI Fuse Board A003
Fan Transformer T002
Fan 1
Fan 2
Fan Monitor (option) A013
fan monitor
Interface Board I/F
xfmr. temp. monitoring
mains choke temp. monitoring
inverter fuse monitoring
output voltage monitoring
output current monitoring
input current monitoring
input voltage monitoring
housekeeping power
DC voltage monitoring
DC current monitoring
inverter current monitoring
Communication Board CU
X004 SSW1
X005 SSW2
X007 DISPLAY
X010 EXT.
X011 COM PORT
X001 TSM1
X002 TSM2
X003 TSM3
Display Unit DU
External Connection Board A010
common fault relay
batt. oper. relay
static byp. oper. relay
external bypass inhibit relay
DC disconnect position (N/C)
batt. temp. probe
remote start/stop
EPO external supply
EPO internal supply
Communication Interface Board (option) A011
RS232 serial
0-20mA loop
relay interface
Input RFI Fuse Board A001
Power Supply Transformer T011
Power Supply PSU1
DC Fuse Board A004
Battery
DC Fuses F001,2,3
DC Current Sensor P010
Capacitor Bank CB01
A005
A006
A007
Transistor Switch Module TSM
Inverter Fuses F004,5,6
Inverter Choke L001
Inverter Current Sensors P001,2,3



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
A	RFI-FILTERS DELETED.	20.06.94	CF	DRAWN	06.06.94	CF
D	AUTO-TRANSFORMER ADDED AS OPTION.			CHECKED	13.02.95	
	3Ph 60Hz 480V ADDED AT IN- AND OUTPUT.	8.11.94	CF	ISSUE NO.	08	

SCALE	DS/ISO ES	TITLE
		Main Circuit Diagram DP 310-316 B.C. BEST
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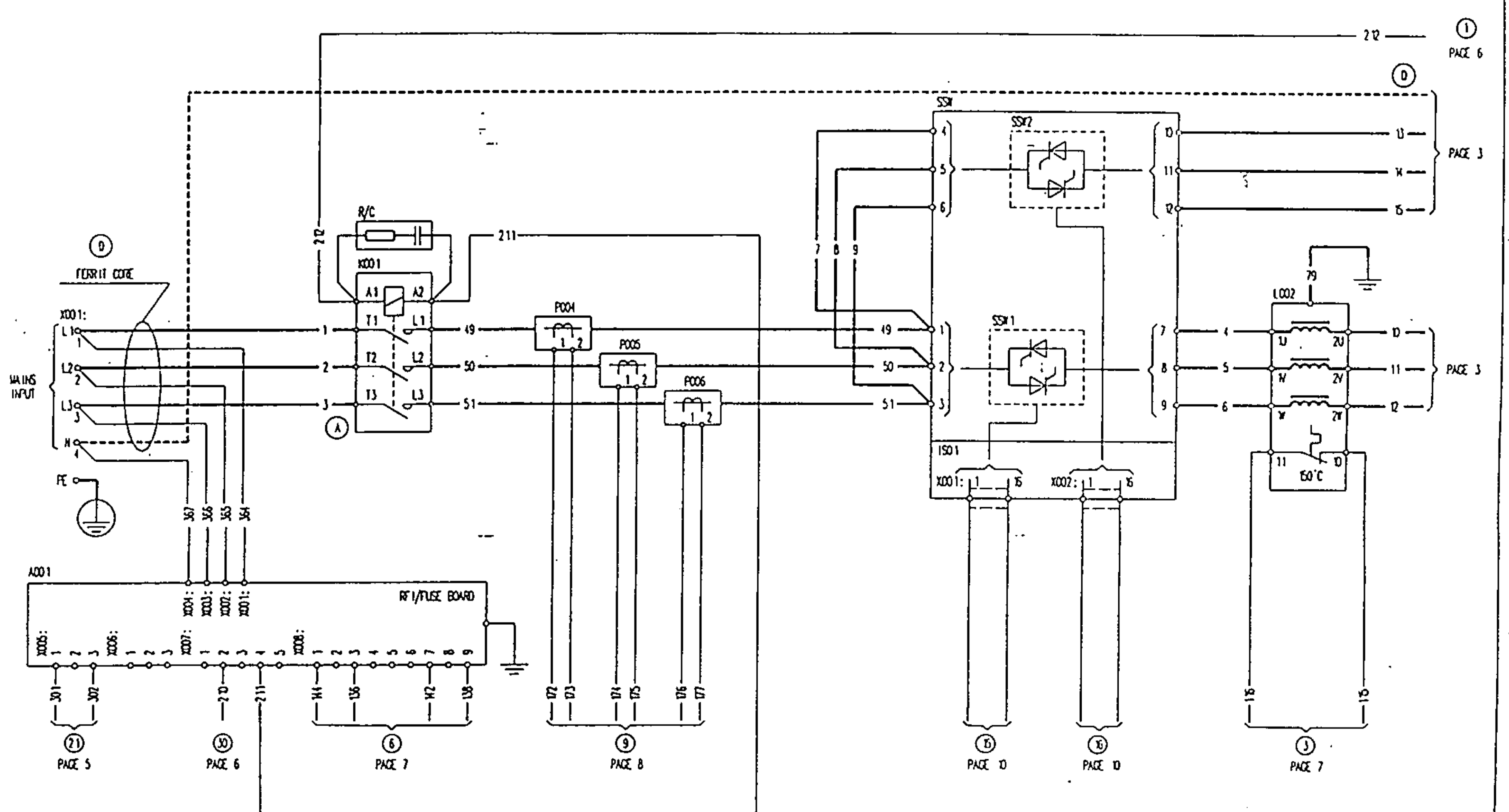

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A	RF11 AND WIRE FROM N/INPUT TO RF11							DRAWN	06.06.94	CF
	DELETED.	20.06.94	CF					CHECKED	13.02.95	
D	FERRIT CORE AT MAINS INPUT AND							ISSUE NO.	08	
	CORRECTION FROM N/IN TO E/OUT ADDED.	18.11.94	CF							

SCALE

TITLE Main circuit diagram DP 310-315 B.C. BEST

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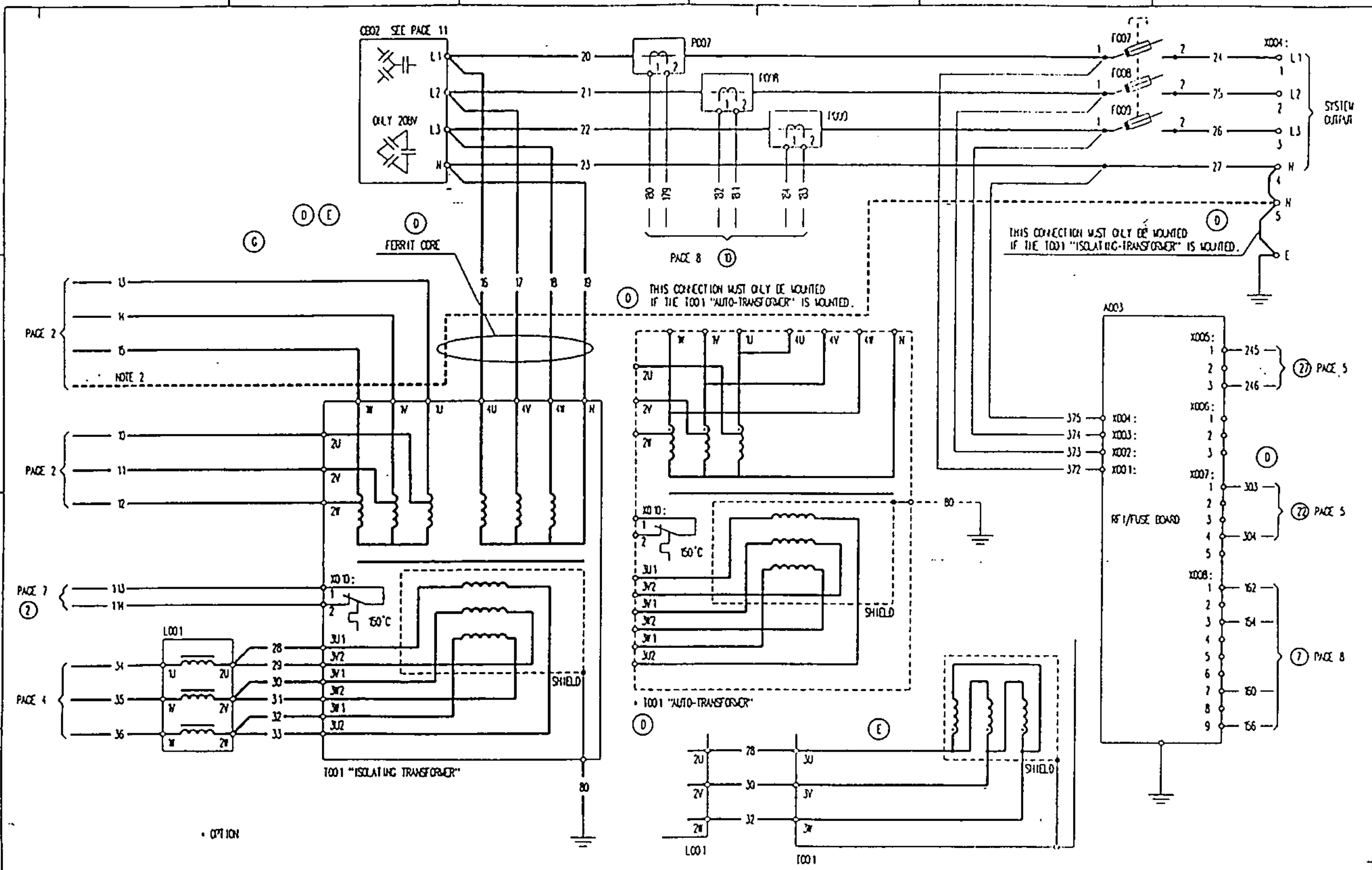

MARK.	CORRECTION	DATE	SIGN.	MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
D	AUTO-TRANSF. + NOTE, FERRIT CORE AT			E	CB03: C023, C025, C027 + WIRES ADD.			DRAWN	06.06.94	
	WIRE NO. 15 -> 19 AND CONNEC. N/IN ->				SW. WINDING FOR ISOLATING- AND AUTO			CHECKED	13.02.95	
	E/OUT + NOTE ADD. WIRE NO. 312 AND 313				TRANSFORMER 480V ADDED.	09.12.94		ISSUE NO.	08	
	DEL. CB03 ADD. ELSE ALL IS REARRANGED.	18.11.94		G	CB03-NOO. AND WIRE NO. 92, 93, 94 DEL.	13.02.95				

SCALE

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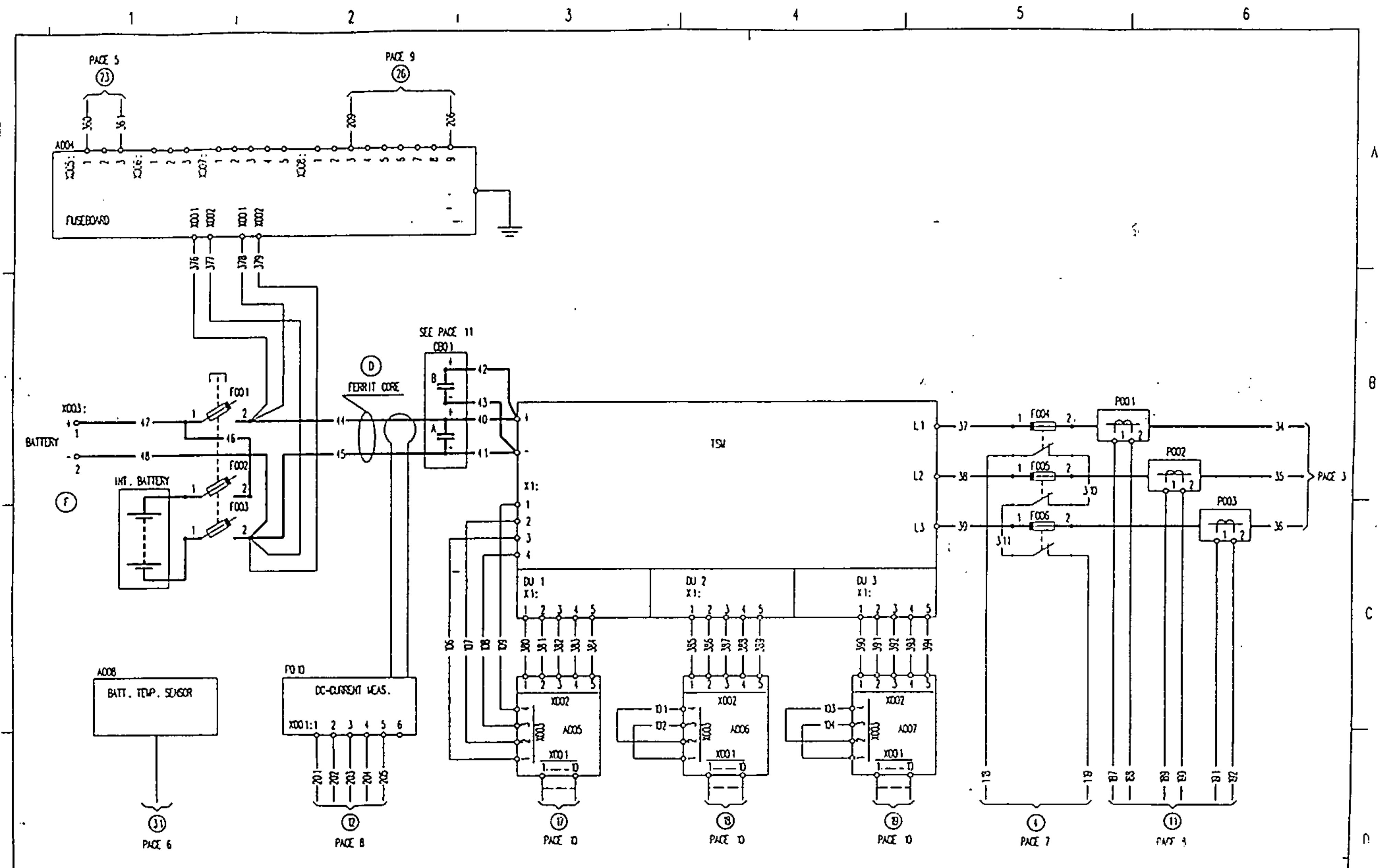

MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
D	FERRIT CORE AT WIRE NO. 44 AND 45 ADD.	18.11.94	CT	DRAWN	06.06.94	CT
F	EARTH WIRE NO. 81 AT BATT. OUTPUT DEL.	26.01.95	CT	CHECKED	13.02.95	
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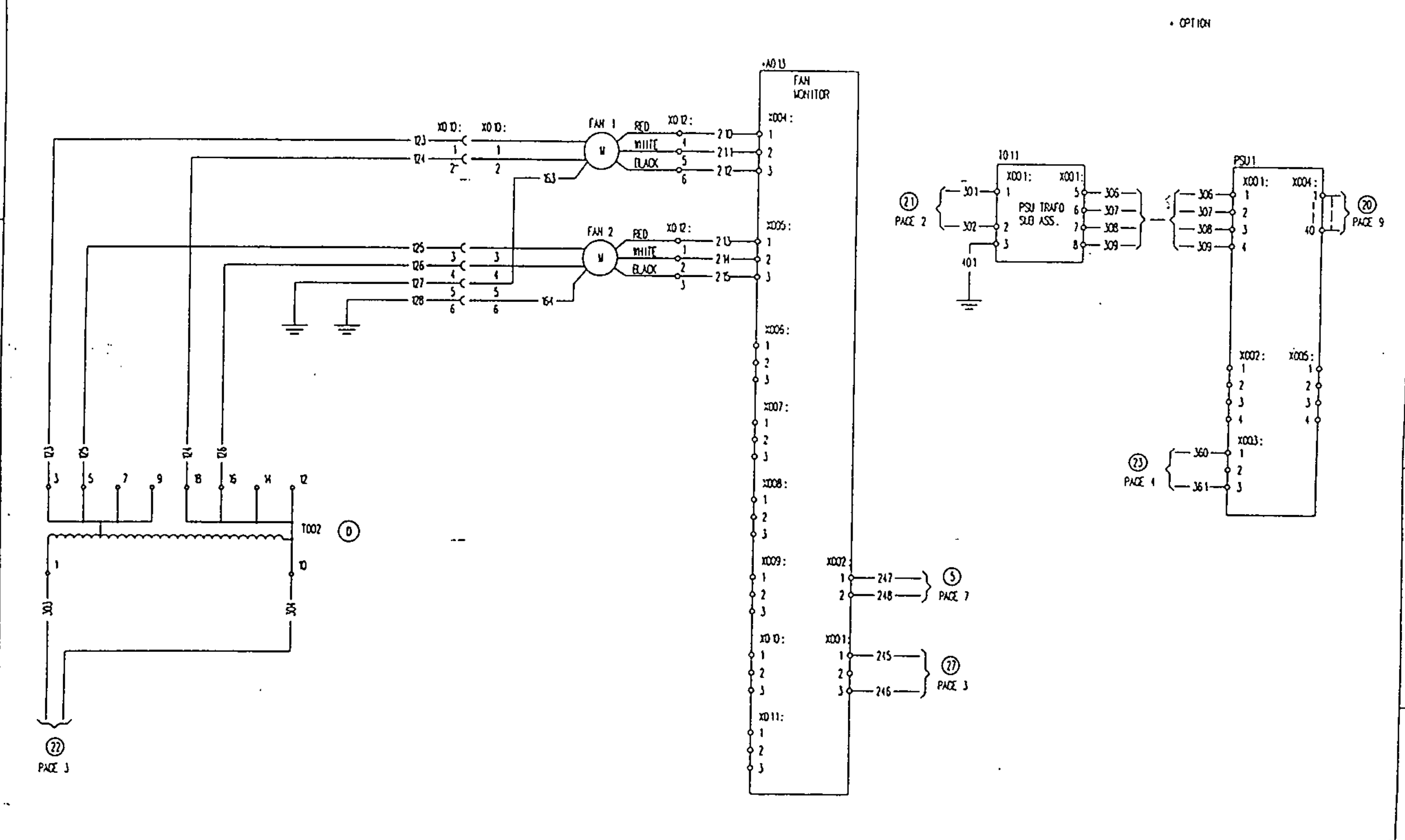

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B	VOLTAGES CHANGED. NOTE CHANGED.	22.08.94	CF	DRAWN	06.06.94	CF
D	A009 DELETED. T002 ADDED.	18.11.94	CF	CHECKED	13.02.95	
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TITLE MAIN CIRCUIT DIAGRAM DP 310-315 B.C. BEST

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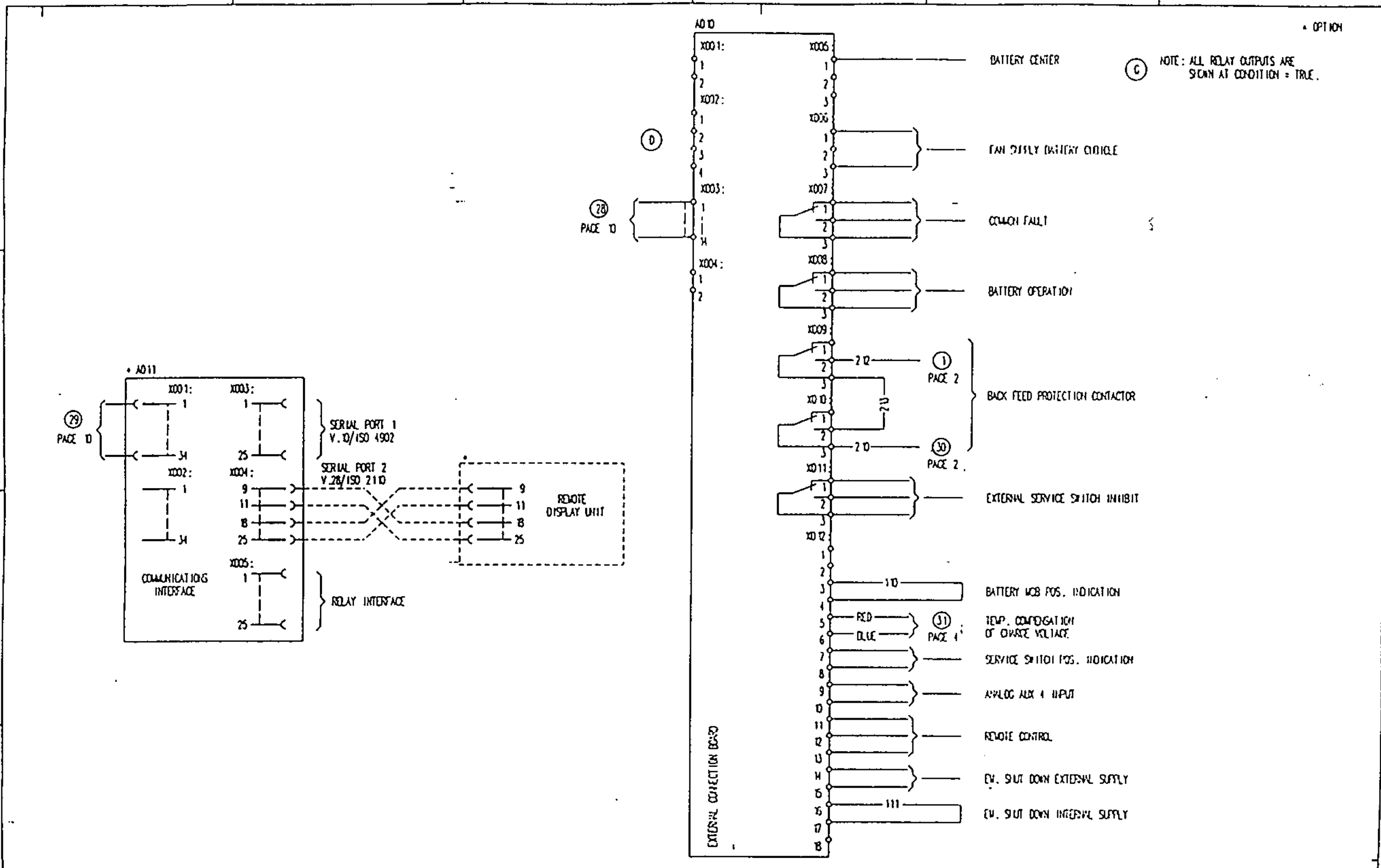

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0	WIRE NO. 312 AND 313 DELETED.	18.11.94	CF	DRAWN	06.06.94	CF
C	NOTE ADDED.	13.02.95	CF	CHECKED	13.02.95	
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TITLE
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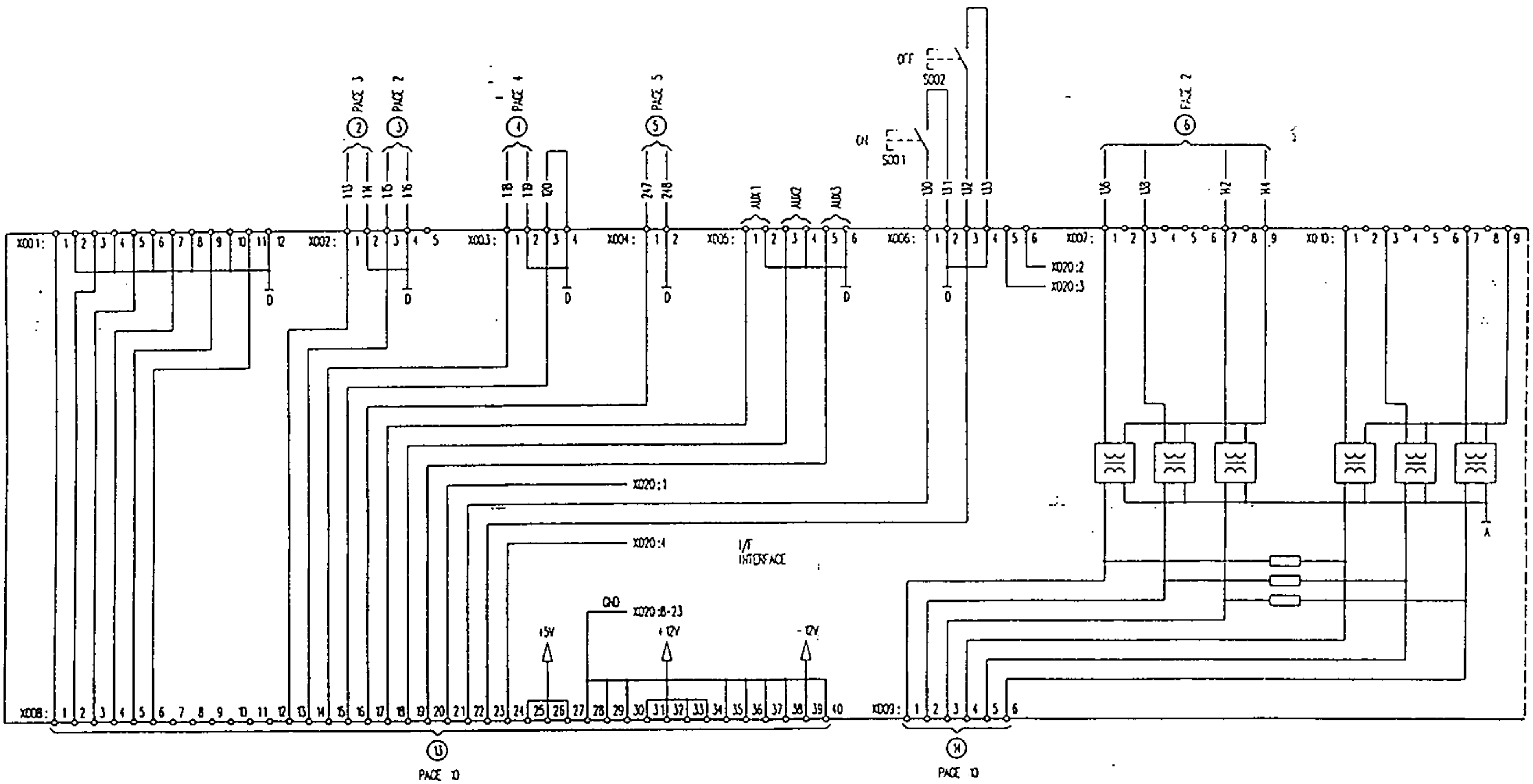

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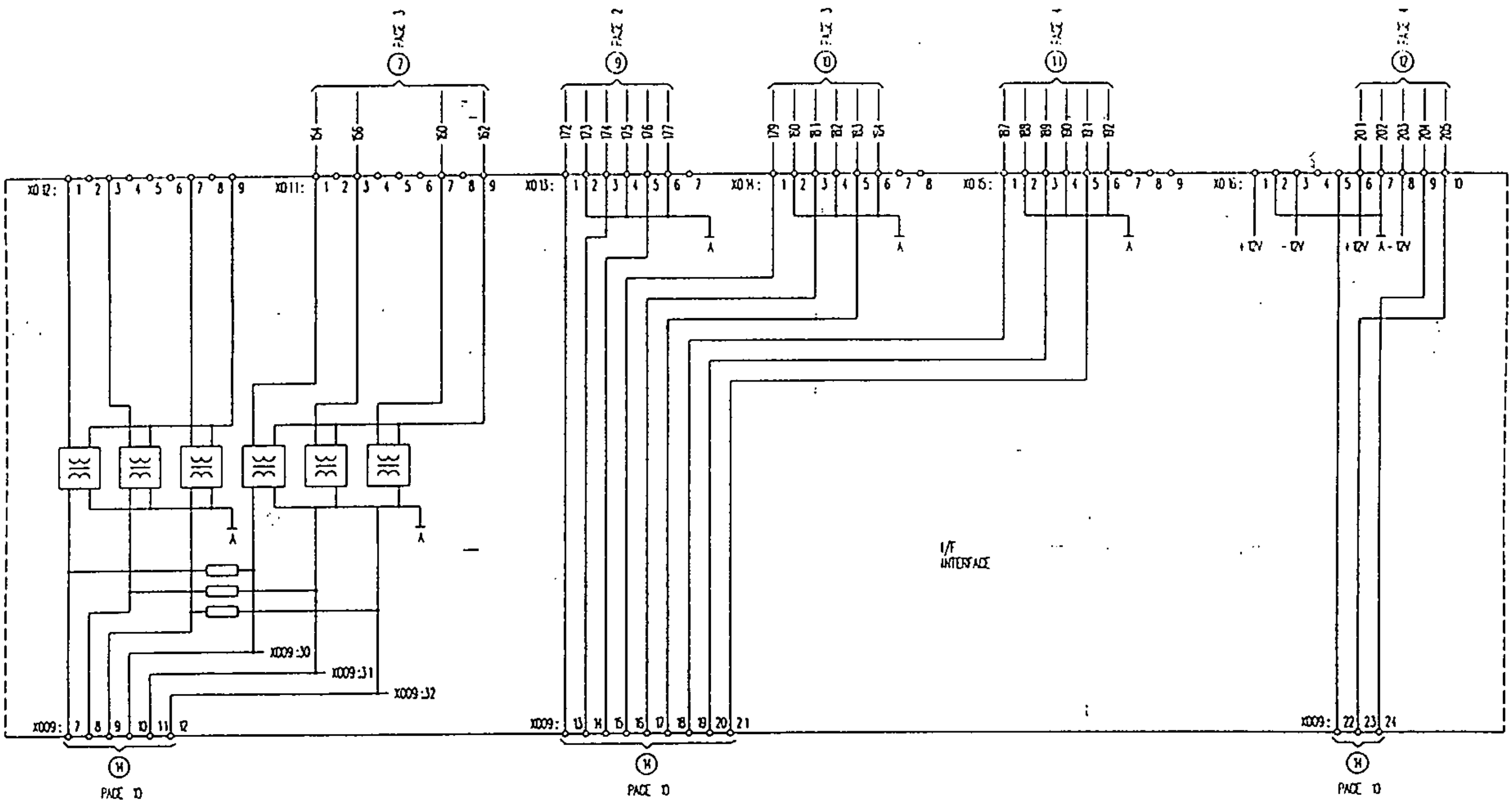

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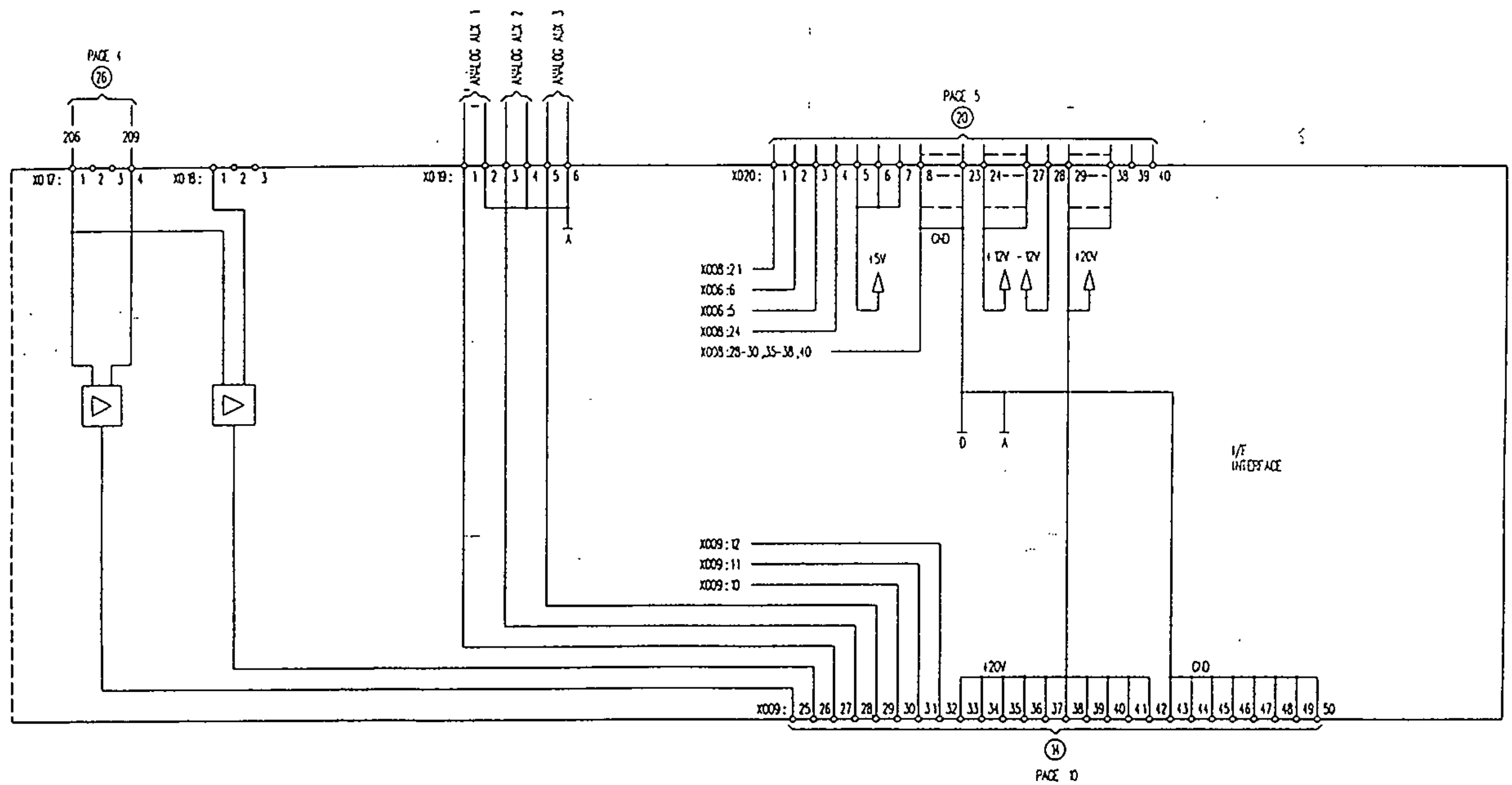

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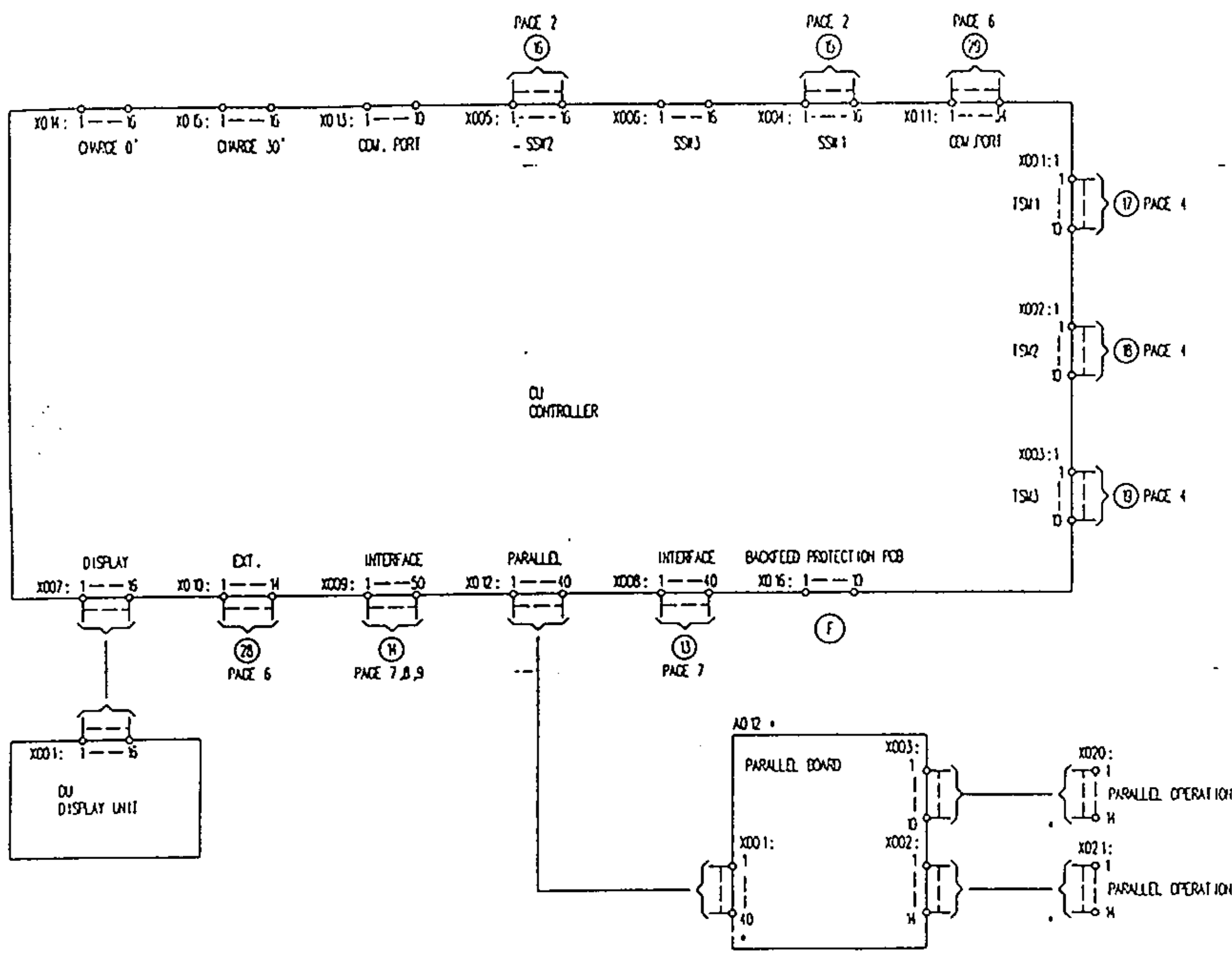

• OPTION

MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
F	X016 ADDED AT CONTROLLER (CU).	26.01.95	CF	DRAWN	06.06.94	CF
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SCALE		TITLE Main Circuit Diagram DP 310-315 B.C. BEST
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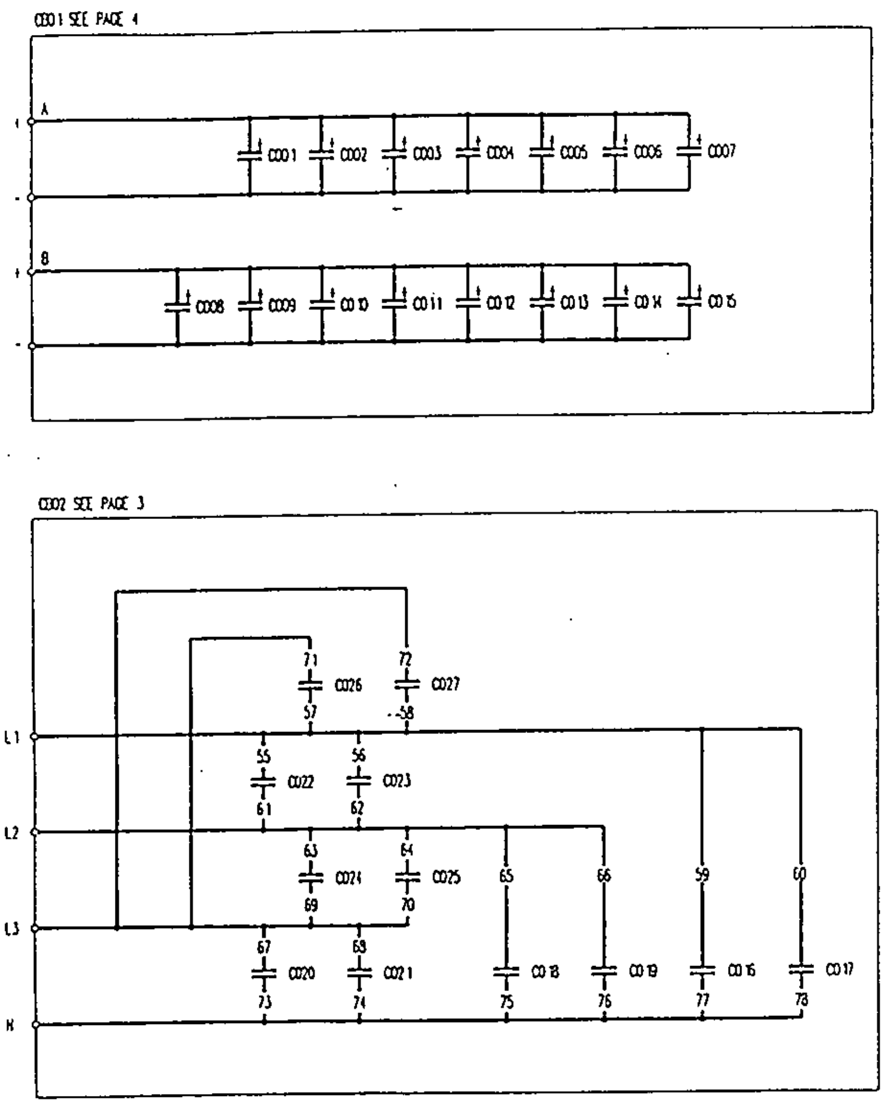

MRK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	DOT FROM WIRE NO. 71 MOVED FROM L2 TO			DRAWN	06.06.94	CF
	L3. WIRE NO. 72 MOVED FROM L2 TO L3.	01.09.94	CF	CHECKED	13.02.95	[illegible]
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SCALE		TITLE
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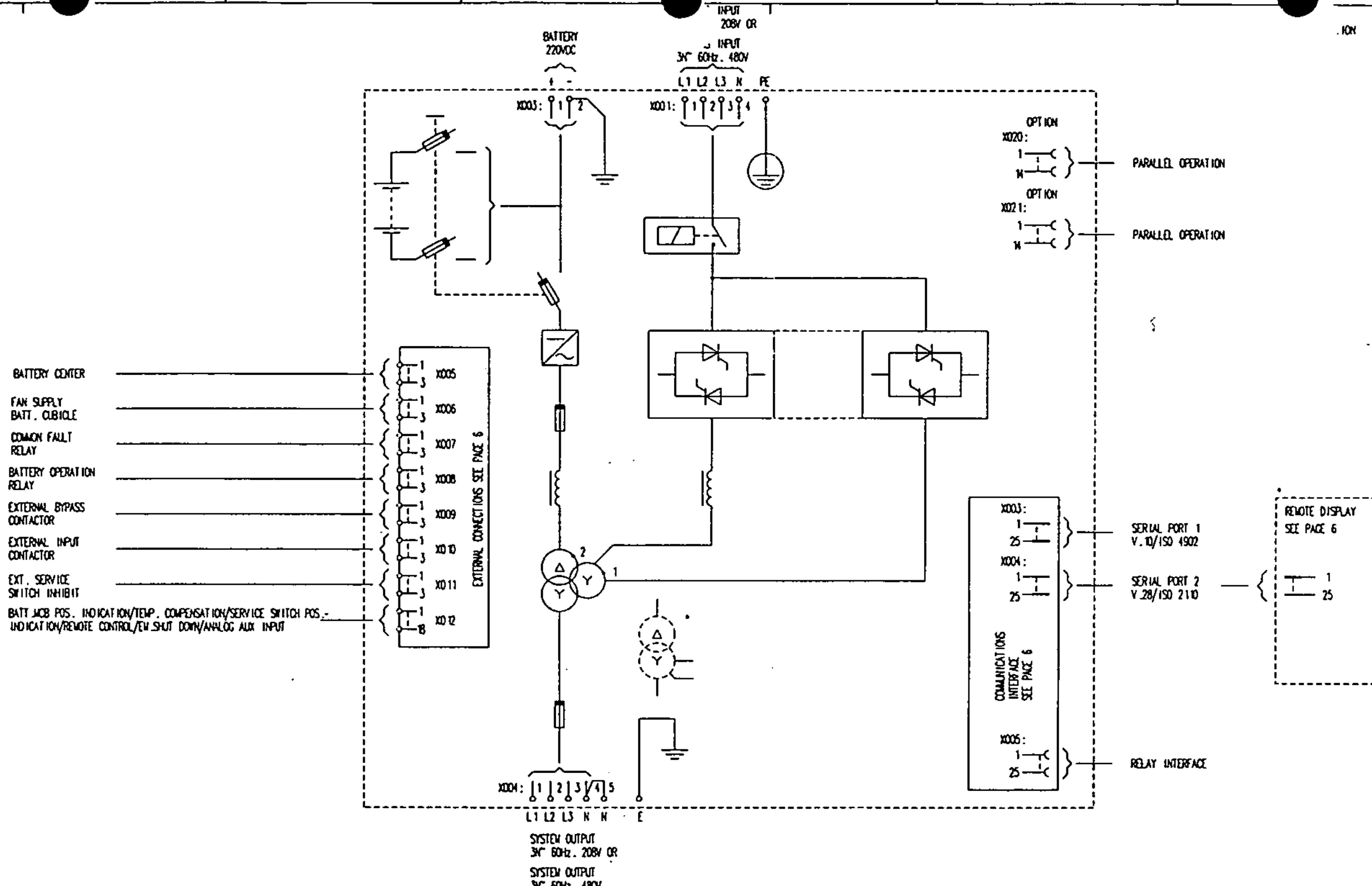
Page 11 of 11		DRAWING NO. 8.000.527



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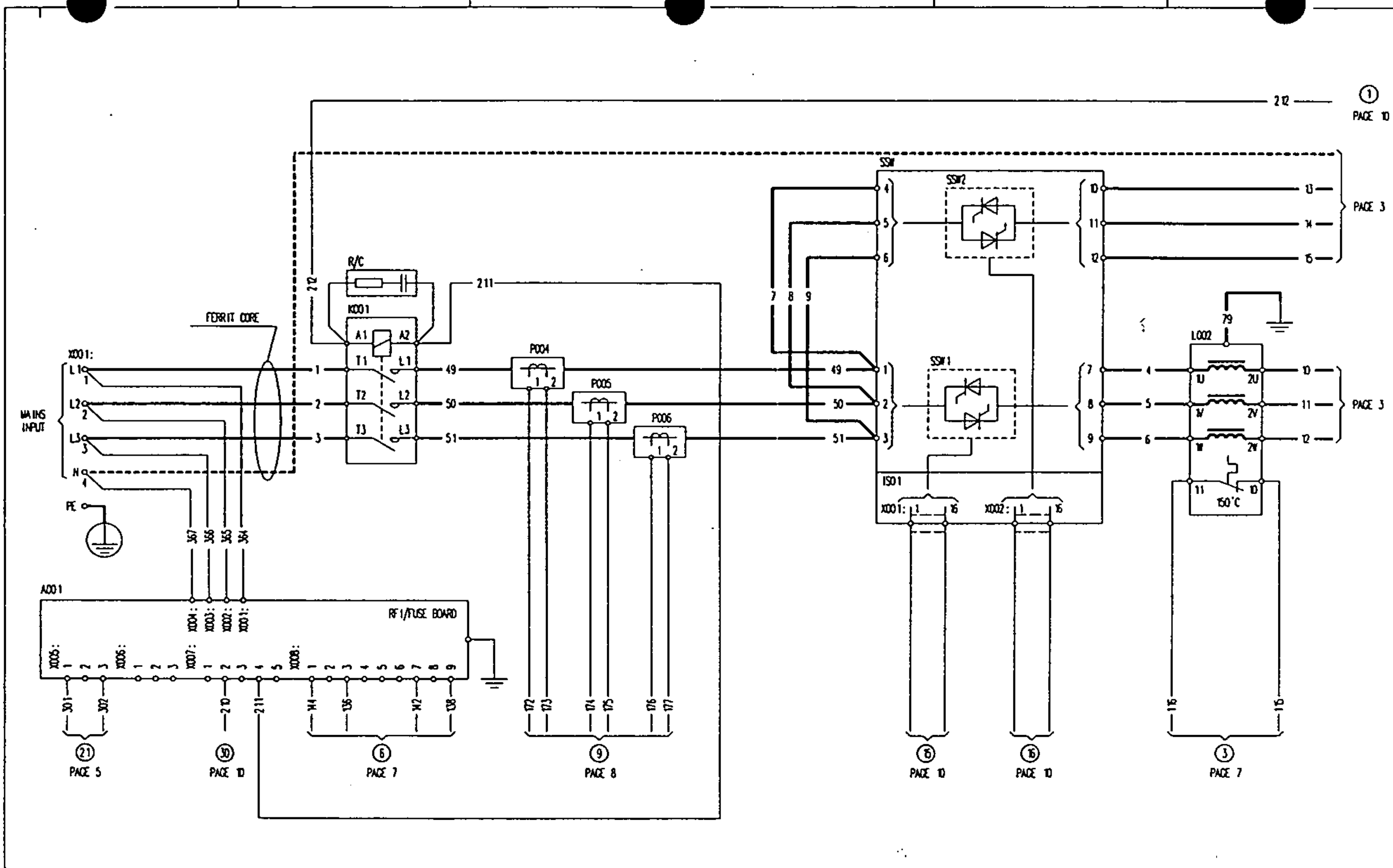

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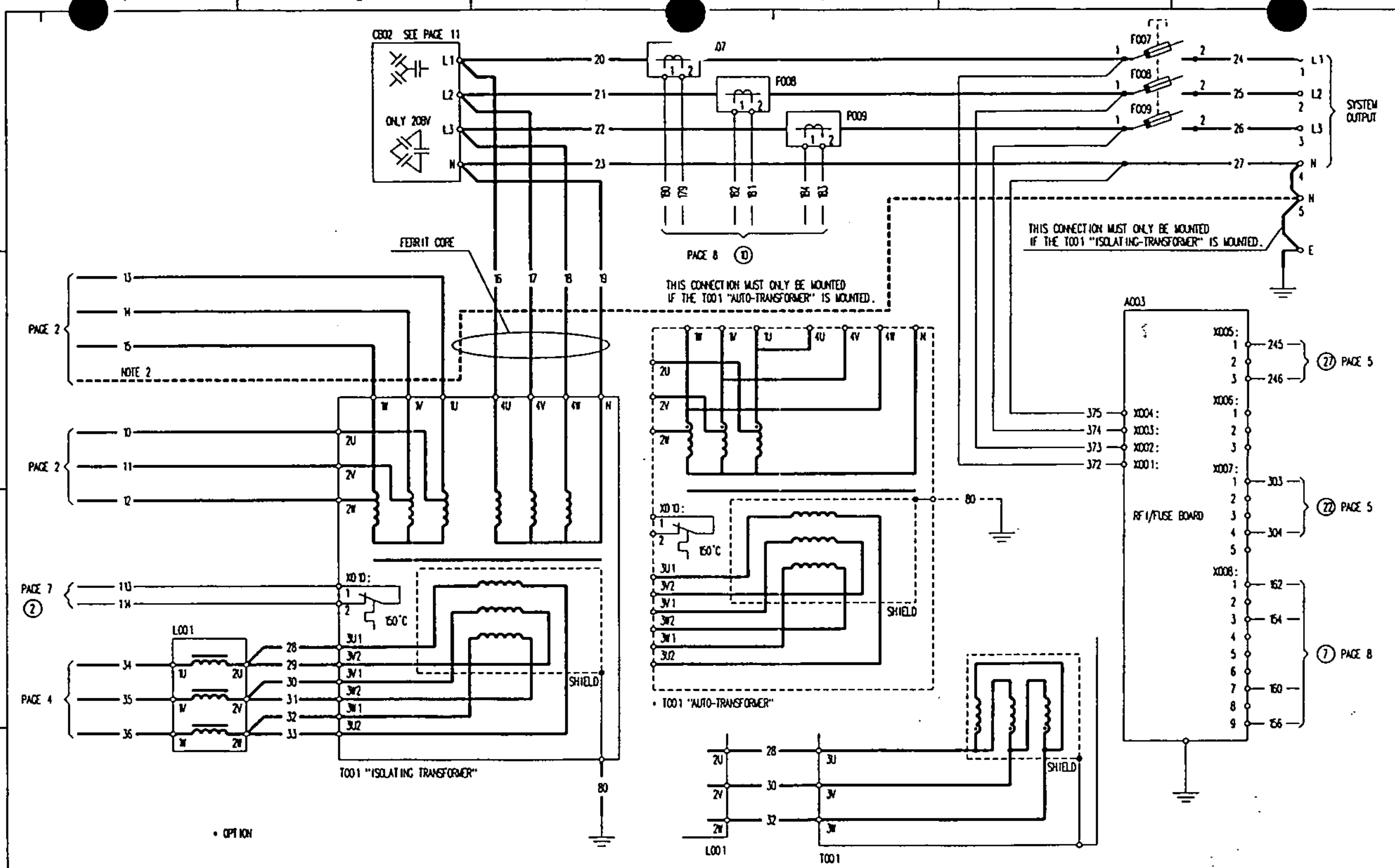

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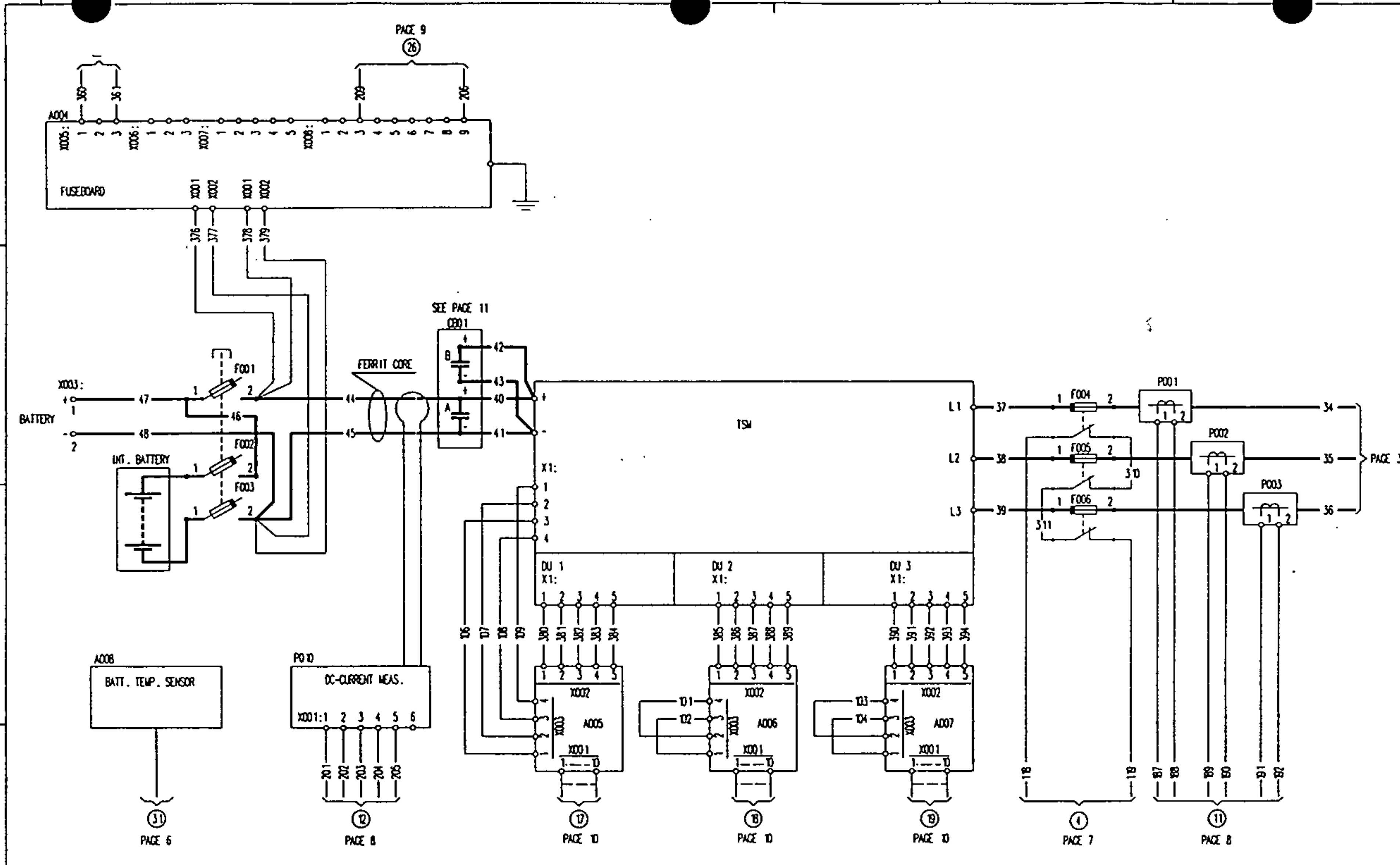
S139



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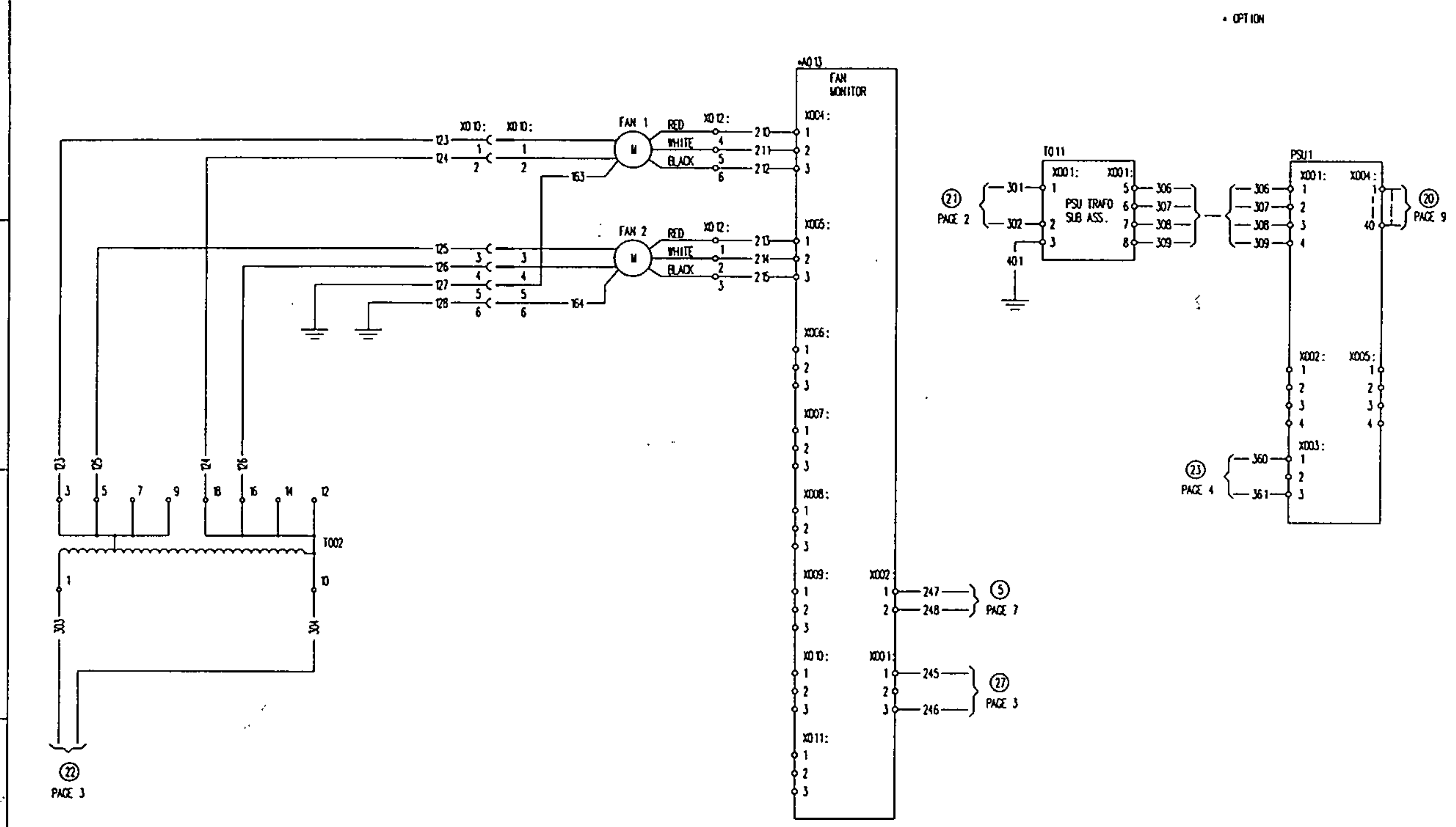

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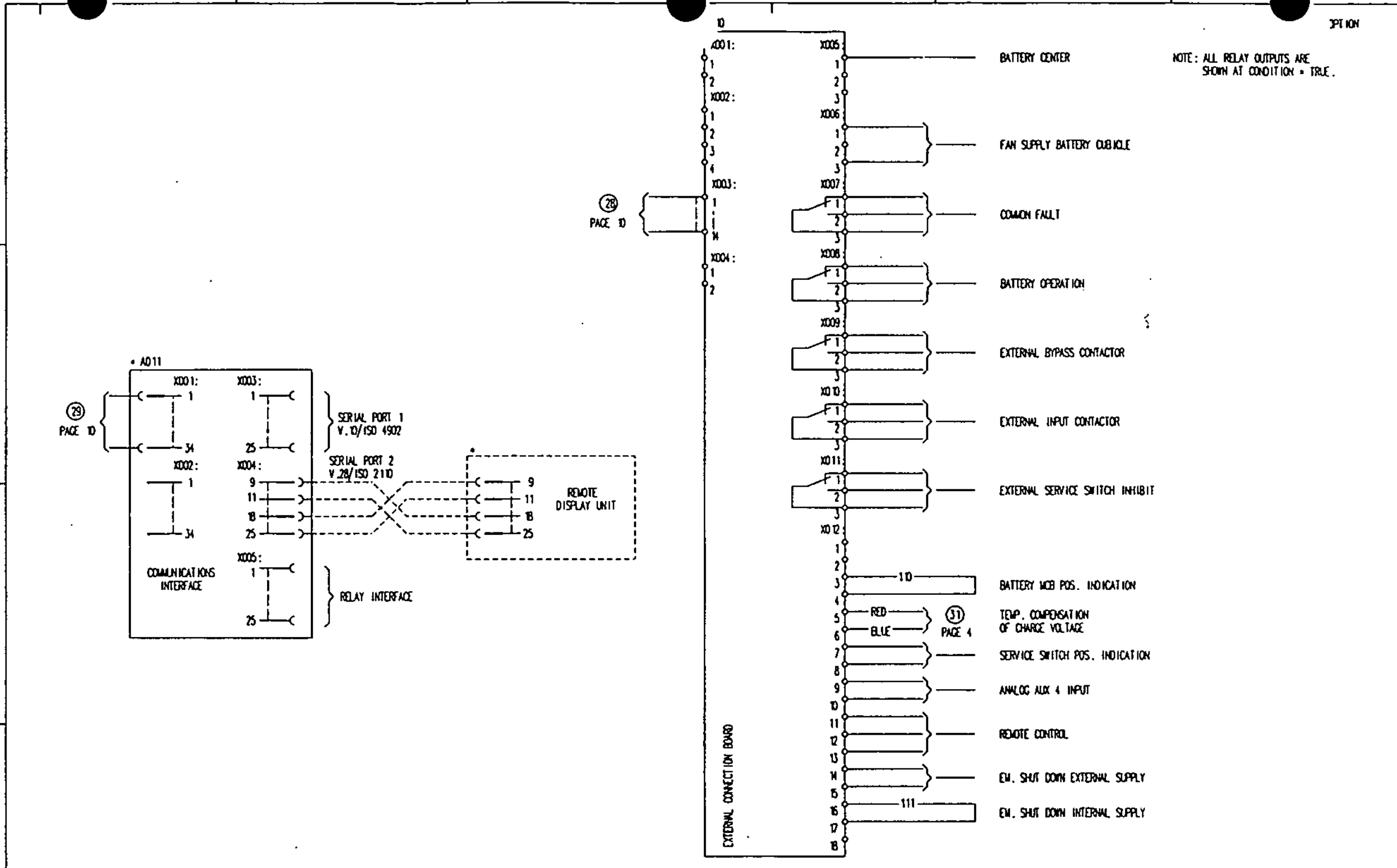
S139



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TITLE Main Circuit Diagram DP310-315 BC, UL

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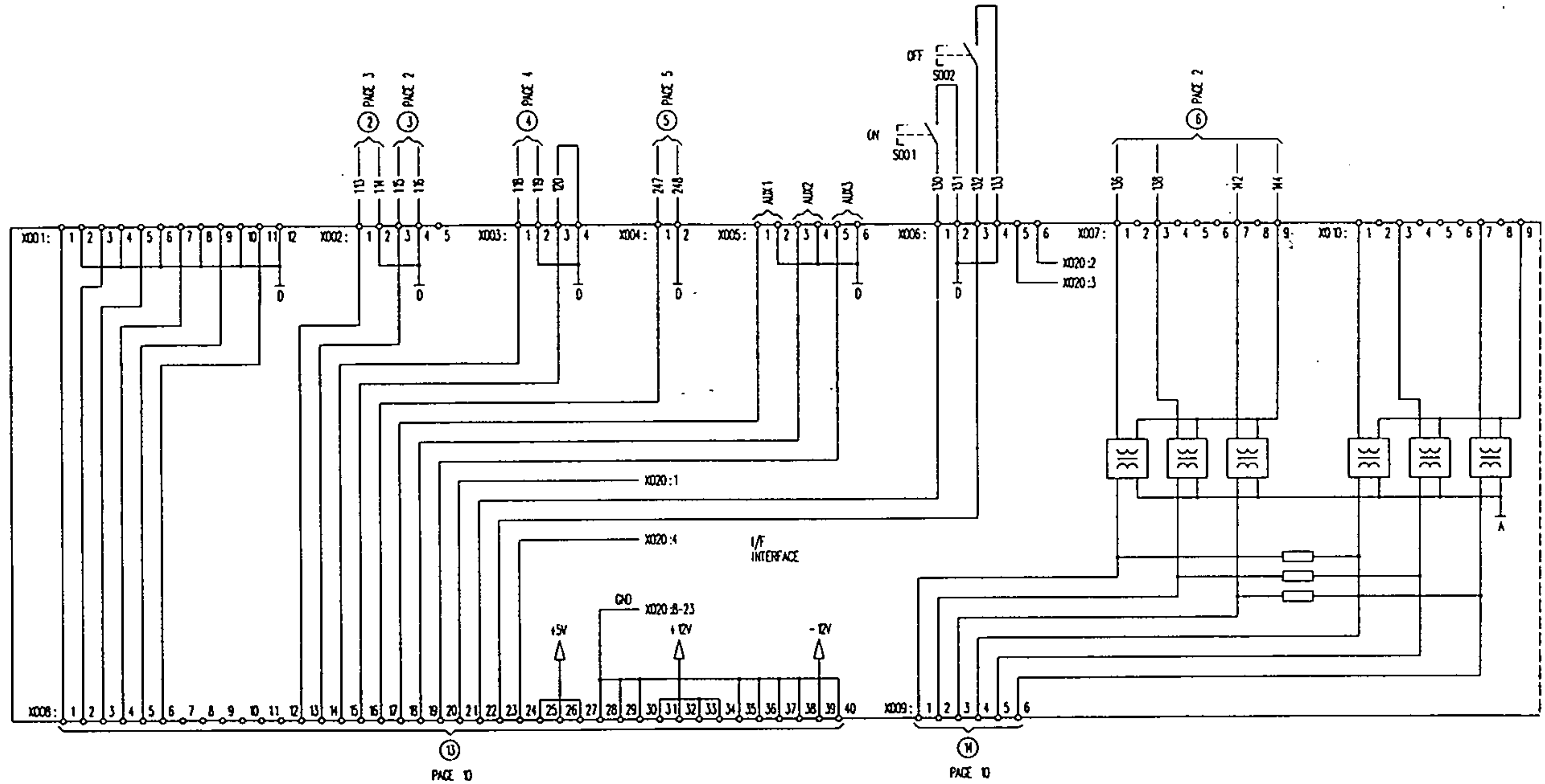
DRAWING NO. 8.000.595

S109



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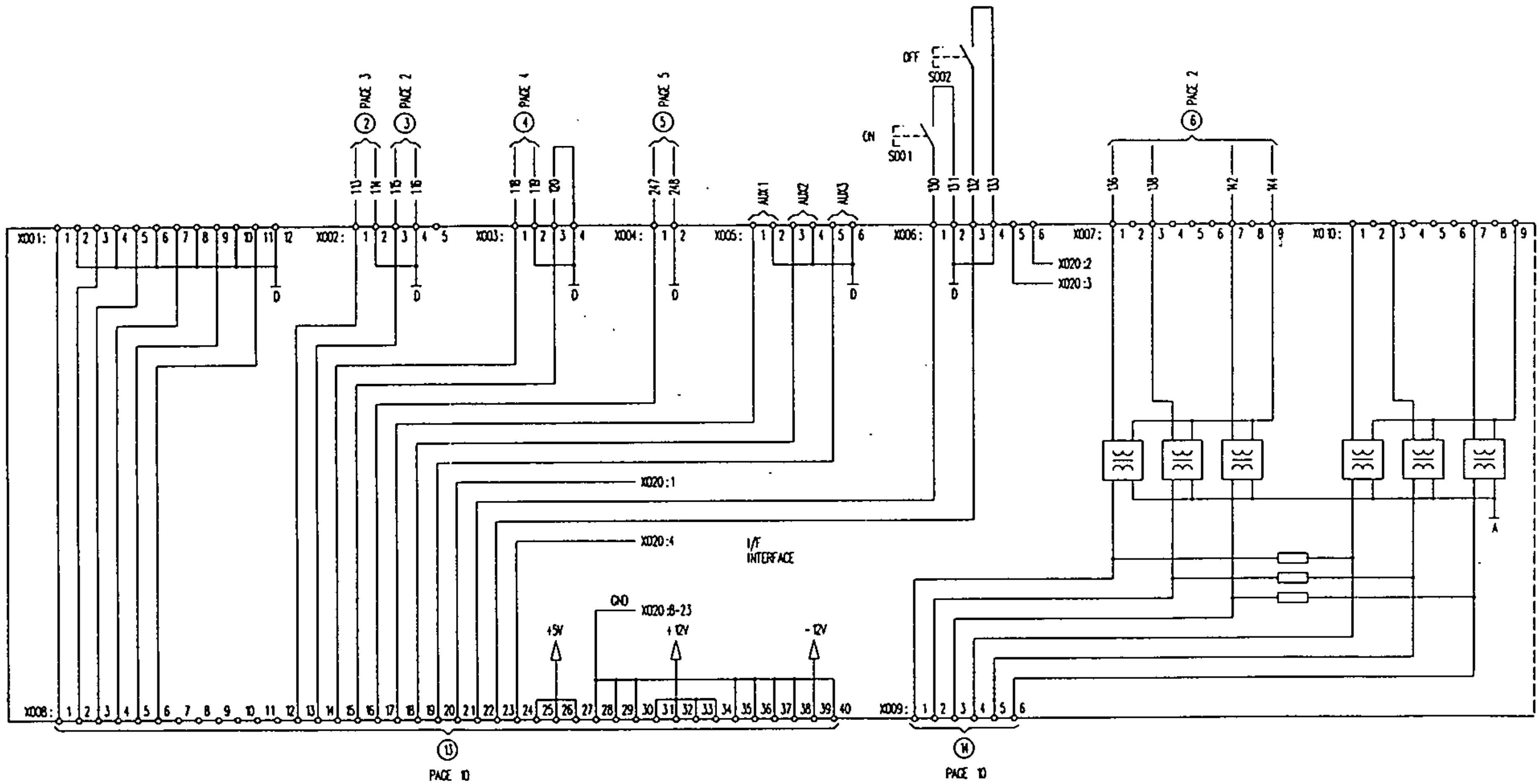
SCALE		TITLE
		Main Circuit Diagram DP310-315 BC, UL
Page 7 of 11		DRAWING NO. 8.000.595

S133



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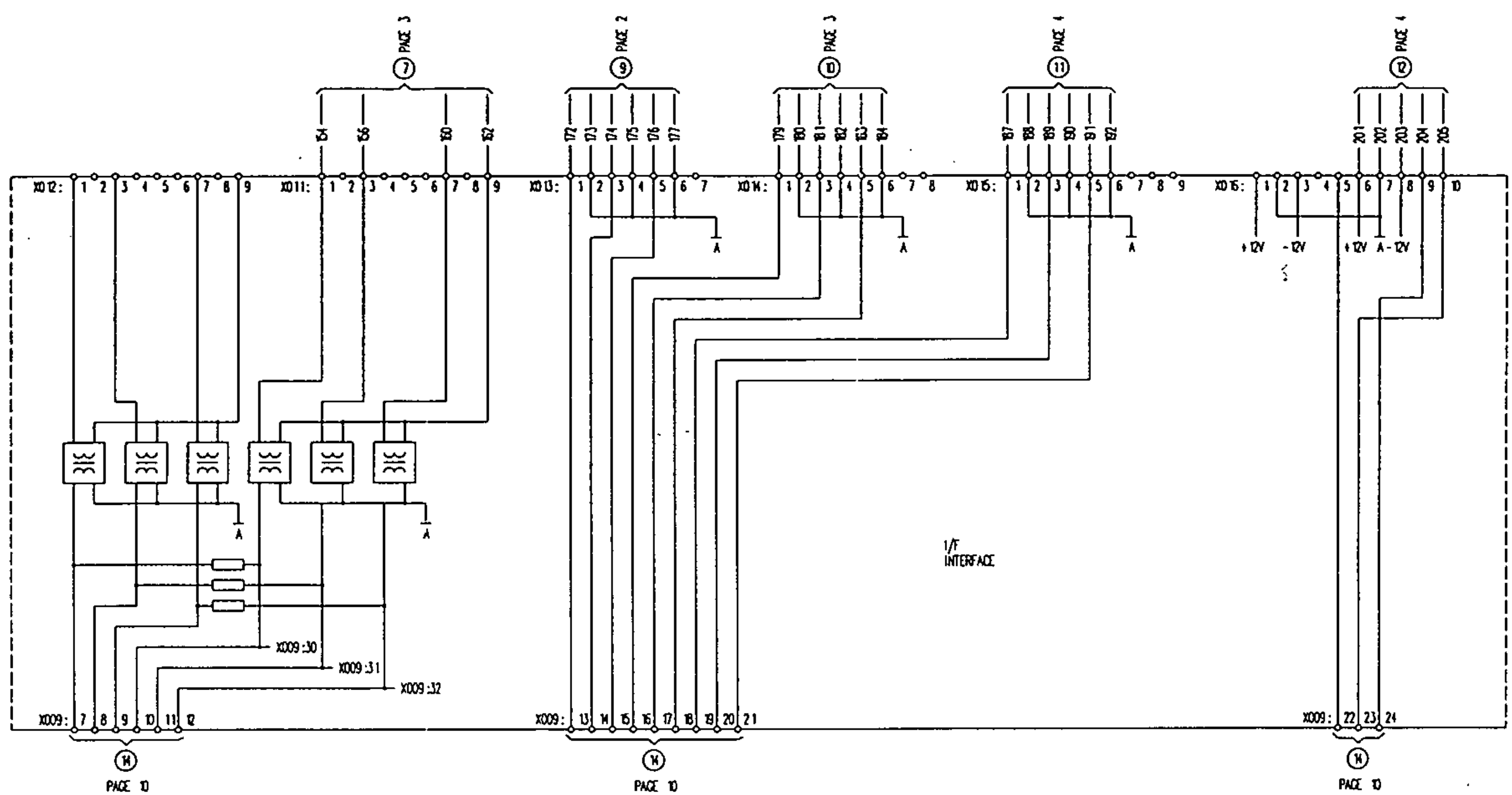
SCALE

TITLE Main Circuit Diagram
DP310-315 BC, UL

Page 7 of 11

DRAWING NO. 8.000.595

S139



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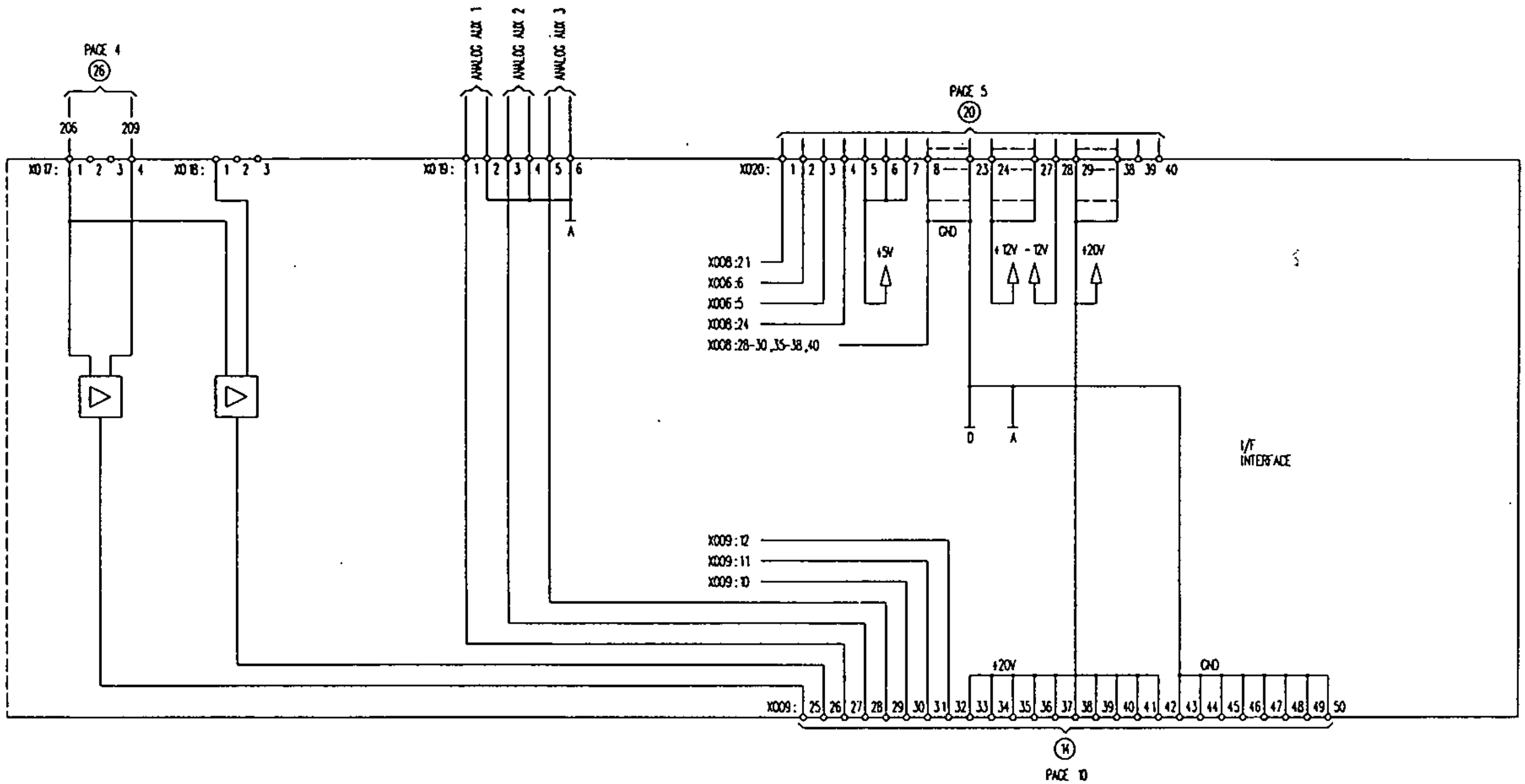
SCALE		TITLE Main Circuit Diagram DP310-315 BC, UL
Page 8 of 11		DRAWING NO. 8.000.595

S109



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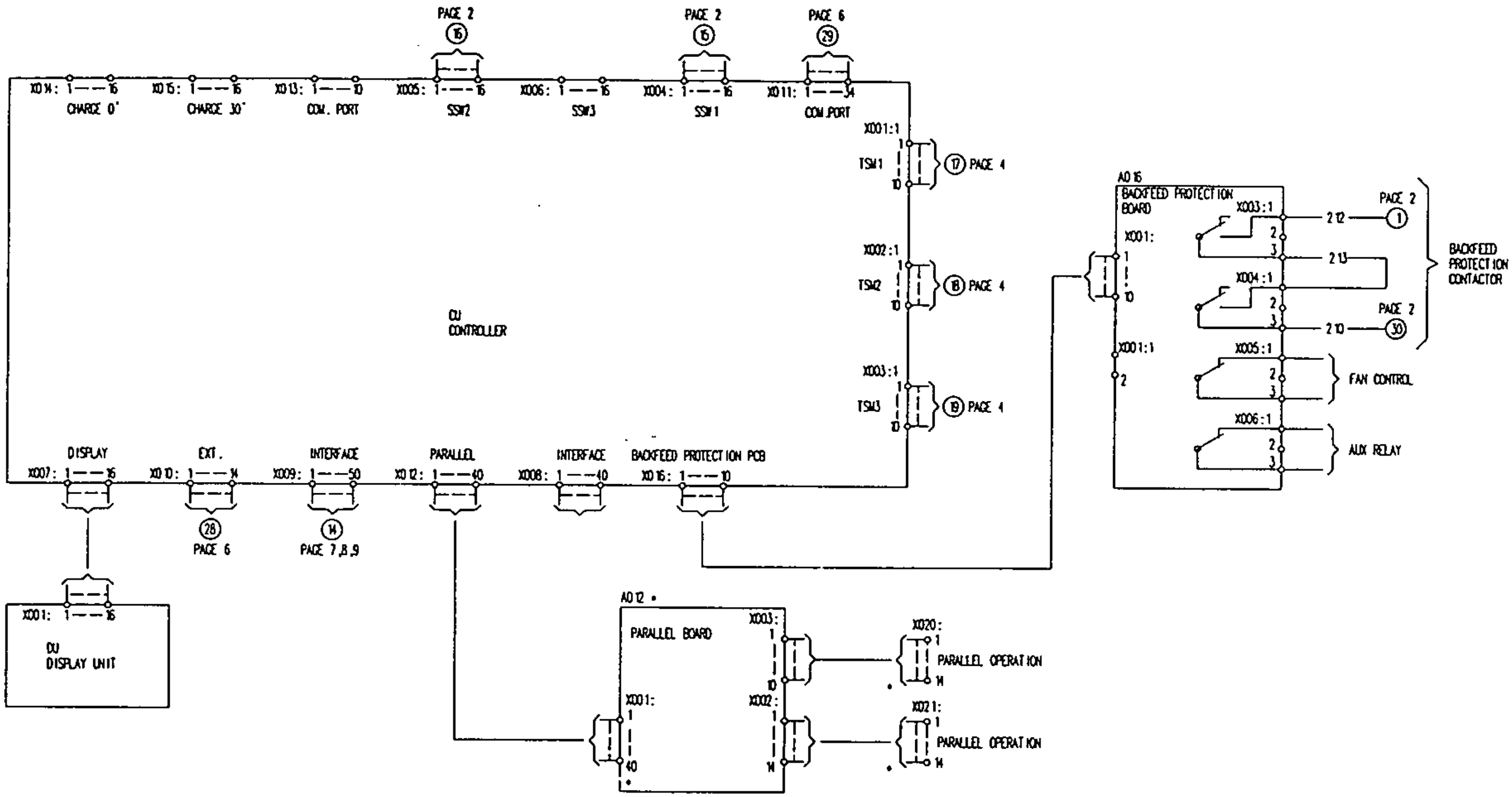
SCALE

TITLE Main Circuit Diagram DP310-315 BC, UL

Page 9 of 11

DRAWING NO. 8.000.595

S139



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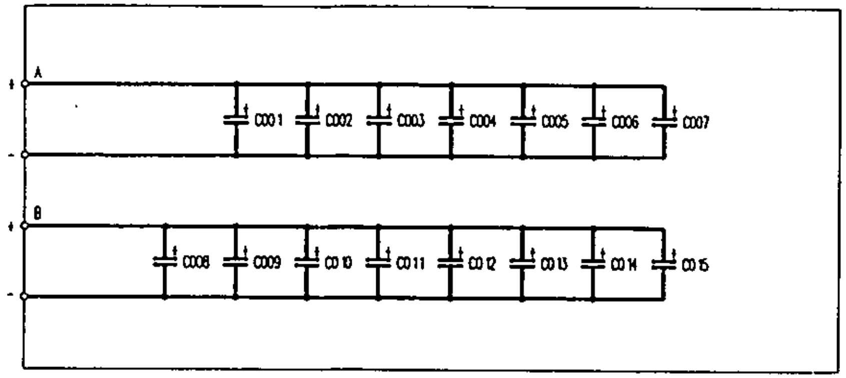
SCALE

TITLE Main Circuit Diagram DP310-315 BC, UL

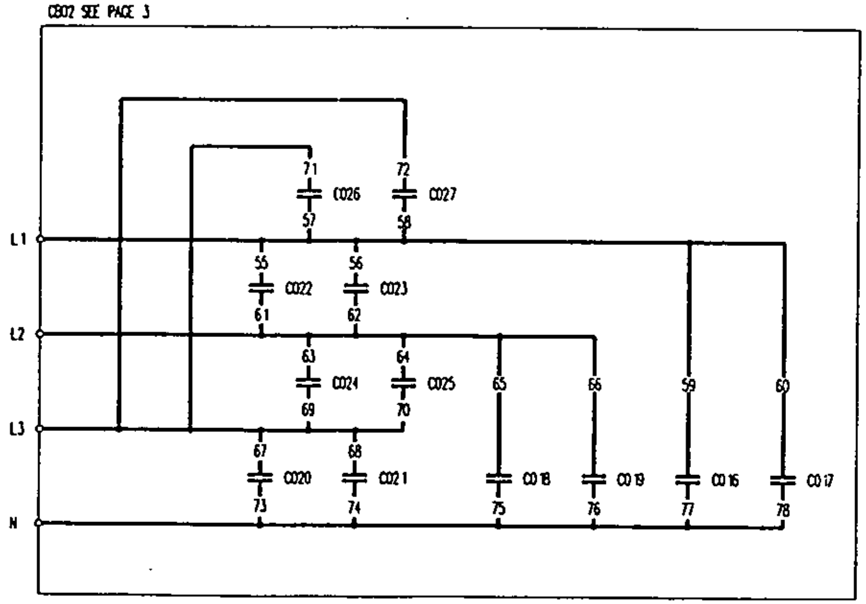
Page 10 of 11

DRAWING NO. 8.000.595

CB01 SEE PAGE 4



CB02 SEE PAGE 3



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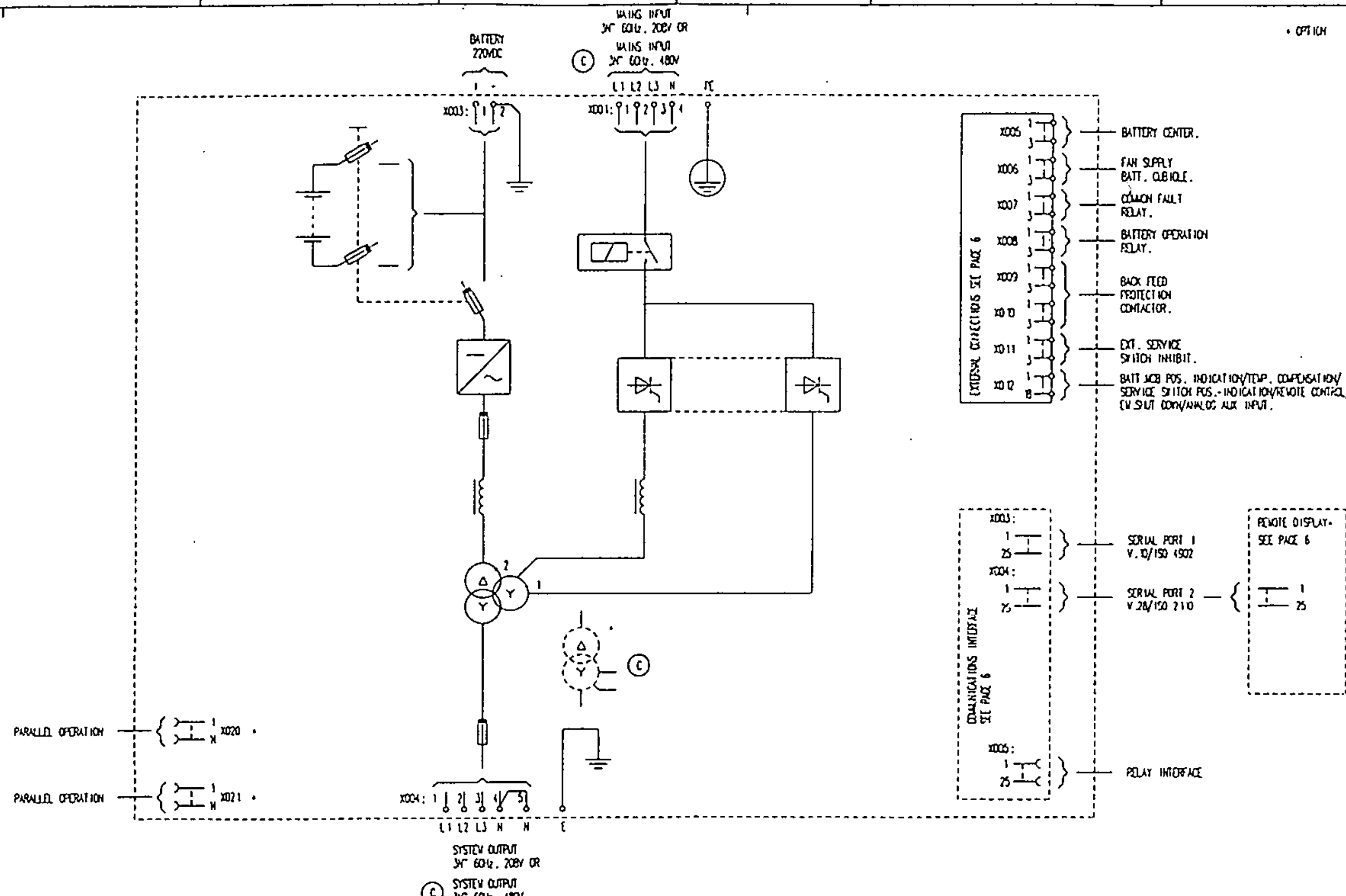
				ISSUE NO.	01	

SCALE

TITLE Main Circuit Diagram DP310-315 BC, UL

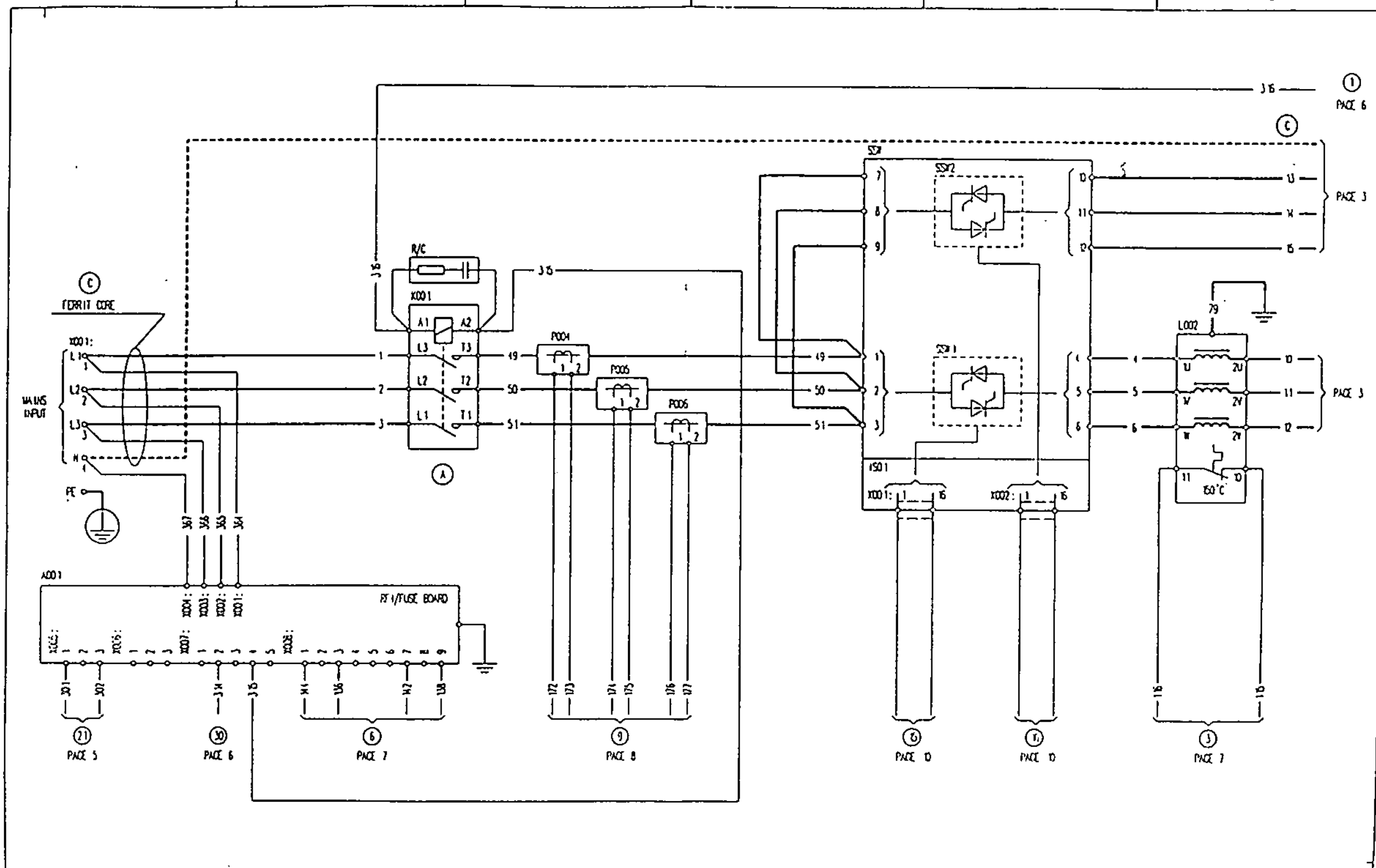
Page 11 of 11

DRAWING NO. 8.000.595



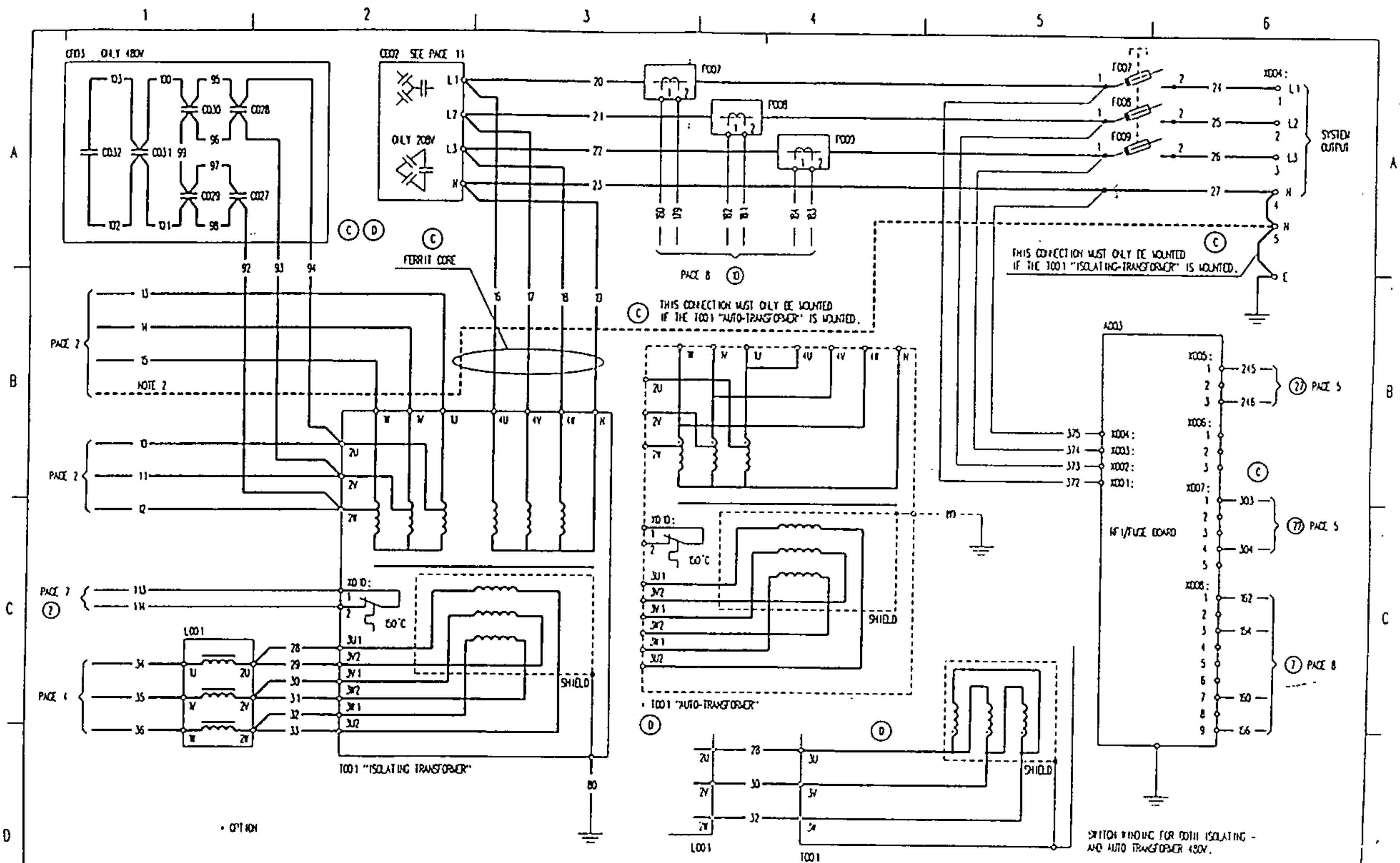
MRK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	AUTO-TRANSFORMER ADDED AS OPTION.			DRAWN	10.06.94	CF
	3~ 60Hz 480V ADDED AT IN- AND OUTPUT.	8.11.94	CF	CHECKED	09.12.94	JS
				ISSUE NO.	04	

SCALE	DS/ISO E1	TITLE
		MAIN CIRCUIT DIAGRAM DP 320-330 B.C. BEST
PAGE 1 OF 11		DRAWING NO. 8.000.528



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
A	AT X001 TERM. L1, L2, L3 AND T1, T2,			DRAWN	13.06.94	CF
	T3 ARE CHANGED.	27.08.94	CF	CHECKED	09.12.94	
C	FERRIT CORE AT MAINS INPUT AND			ISSUE NO.	04	
	CONNECTION FROM N/IN TO E/OUT ADDED.	15.11.94	CF			

SCALE		TITLE	MAIN CIRCUIT DIAGRAM DP 320-330 B.C. BEST
PAGE 2 OF 11		DRAWING NO.	8.000.528



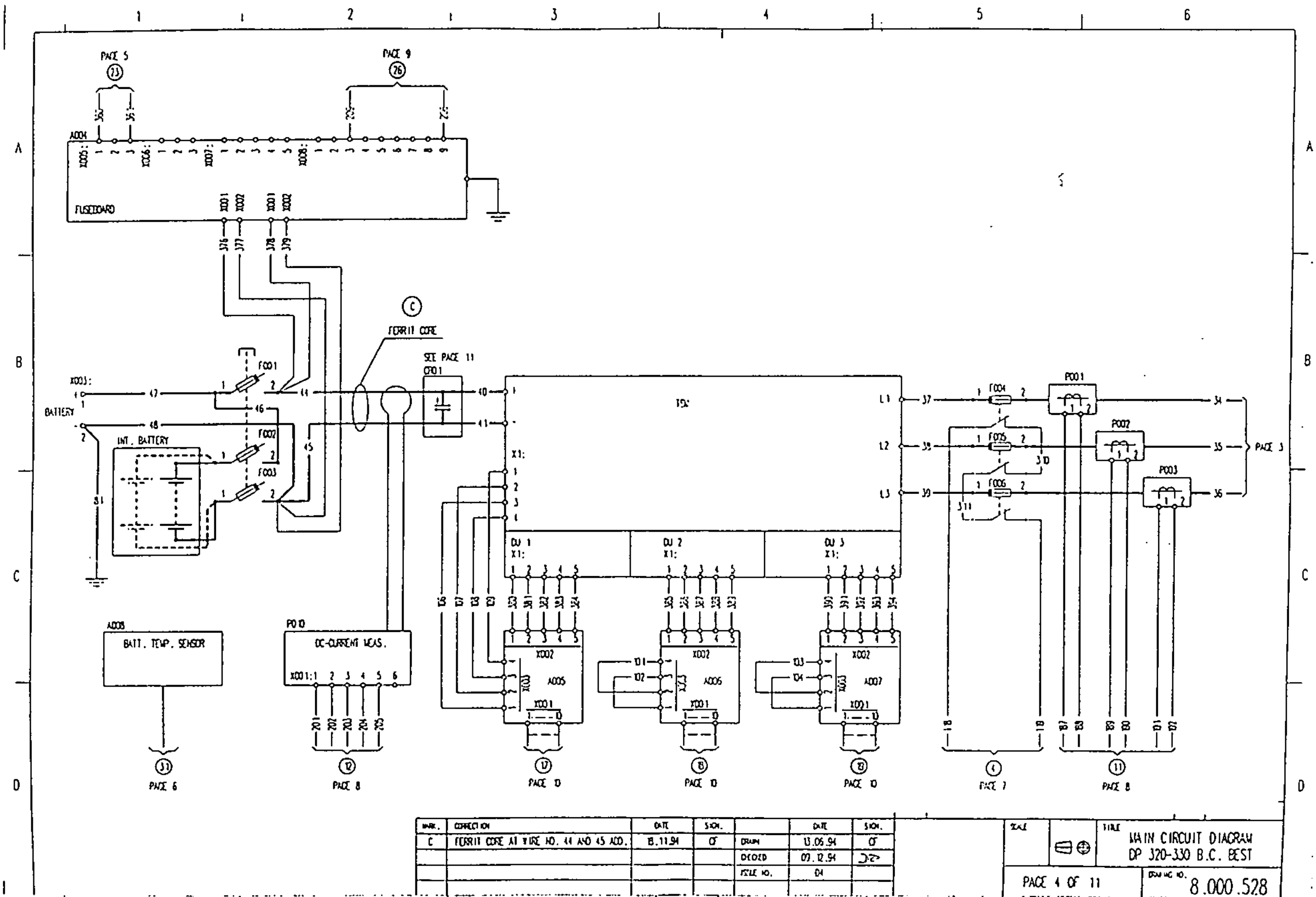
MARK	CORRECTION	DATE	SIGN.	MARK	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	AUTO-TRANSF. + NOTE, FERRIT CORE AT			D	C003: C0028, C030, C032 + WIRES ADDED.			DRAWN	13.05.94	CF
	WIRE NO. 16 -> 19 AND CONNEC. N/IN ->				SW. WINDING FOR ISOLATING - AND AUTO			CHECKED	09.12.94	
	E/OUT + NOTE ADD. WIRE NO. 312 AND 313				TRANSFORMER 480V ADDED.	09.12.94	CF	ISSUE NO.	04	
	DEL. C003 ADD. ELSE ALL IS REARRANGED.	18.11.94	CF							

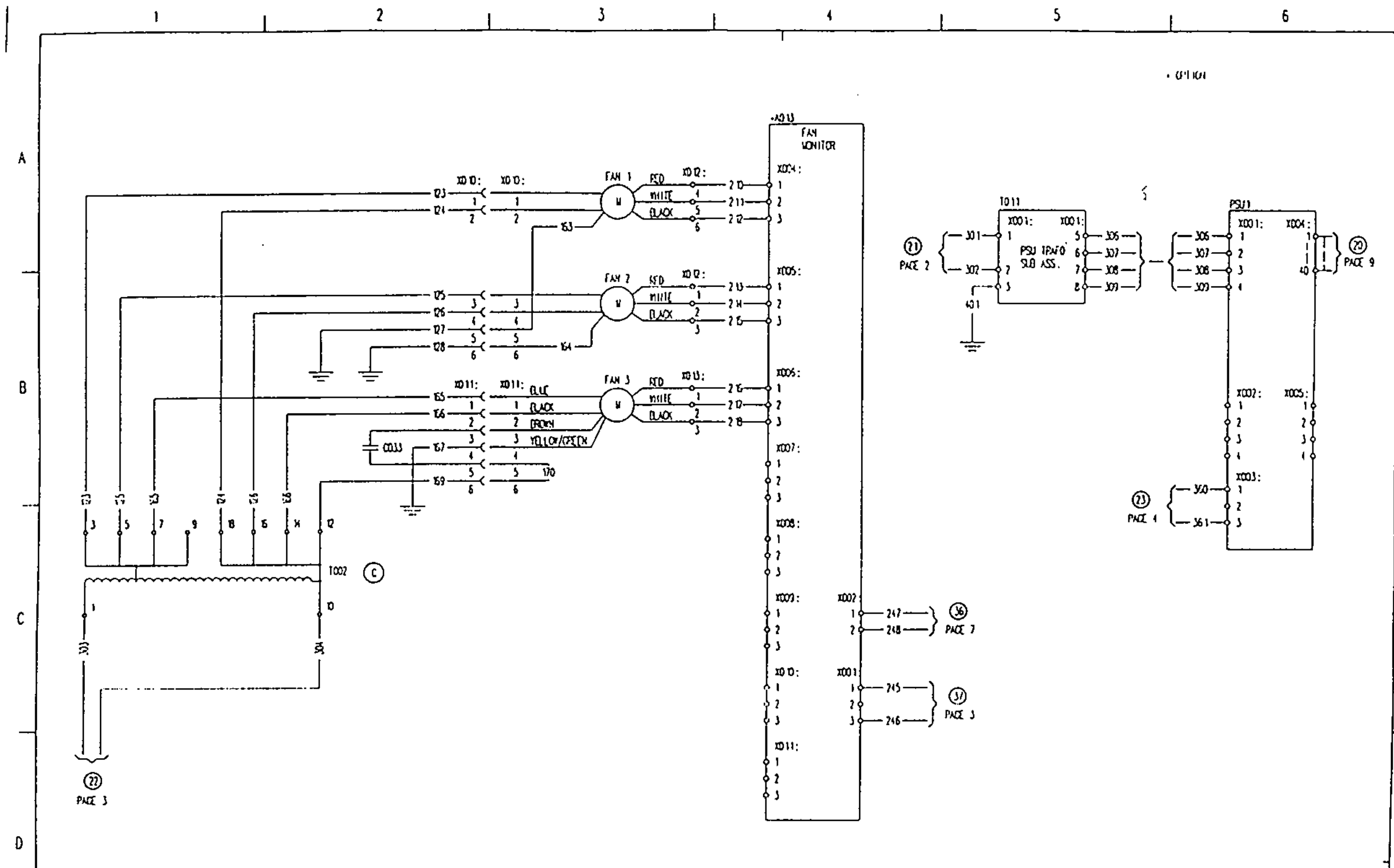
SCALE

TITLE: Main Circuit Diagram DP 320-330 B.C. BEST

PAGE 3 OF 11

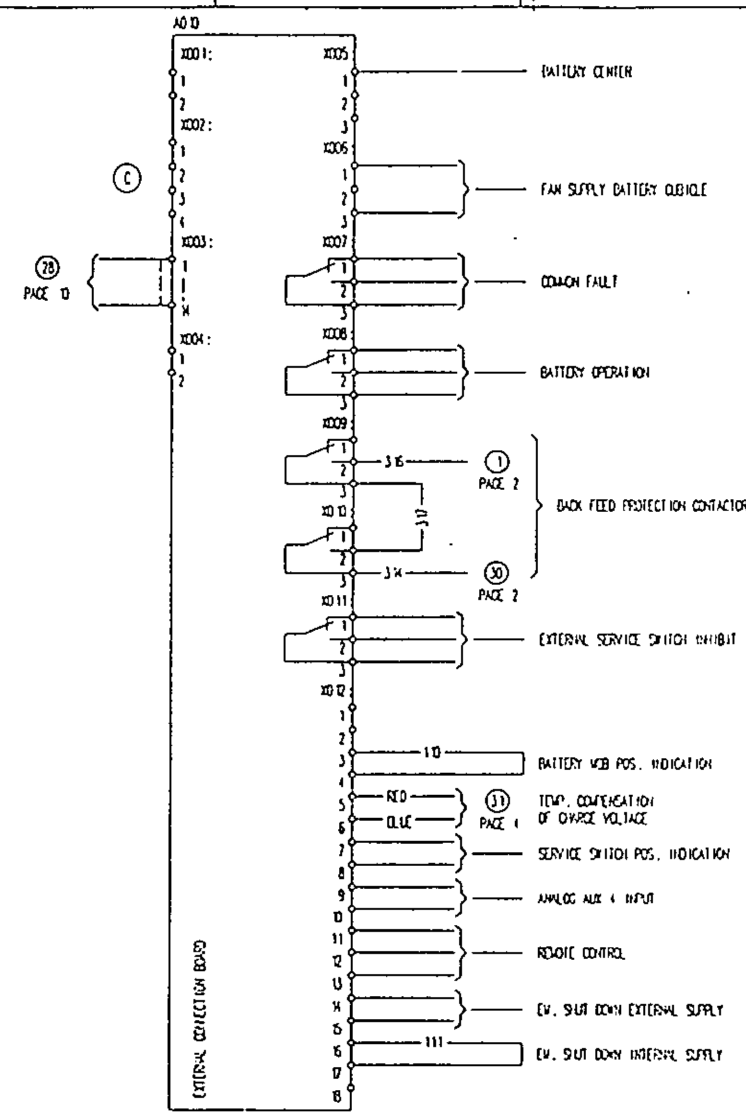
DRAWING NO. 8.000.528


PAGE 5
PAGE 9
A004
FUSEBOARD
X005:
X006:
X007:
X008:
X001
X002
FERRIT CORE
SEE PAGE 11
C001
F001
F002
F003
X003:
BATTERY
INT. BATTERY
T51
X1:
DU 1
DU 2
DU 3
L1
L2
L3
F004
F005
F006
P001
P002
P003
PAGE 3
A008
BATT. TEMP. SENSOR
P010
DC-CURRENT MEAS.
A005
A006
A007
PAGE 6
PAGE 8
PAGE 10
PAGE 7
MARK.
CORRECTION
DATE
SIGN.
C
FERRIT CORE AT WIRE NO. 44 AND 45 ADD.
15.11.94
DRAWN
13.06.94
CHECKED
07.12.94
ISSUE NO.
04
SCALE
TITLE
MAIN CIRCUIT DIAGRAM
DP 320-330 B.C. BEST
PAGE 4 OF 11
DRAWING NO.
8.000.528



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
B	VOLTAGES CHANGED. NOTE CHANGED.	22.08.94	GT	DRAWN	13.06.94	GT
C	A009 DELETED. T002 ADDED.	15.11.94	GT	CHECKED	09.12.94	
				ISSUE NO.	04	

SCALE		TITLE
		MAIN CIRCUIT DIAGRAM DP 320-330 B.C. BEST
PAGE 5 OF 11		DRAWING NO. 8.000.528



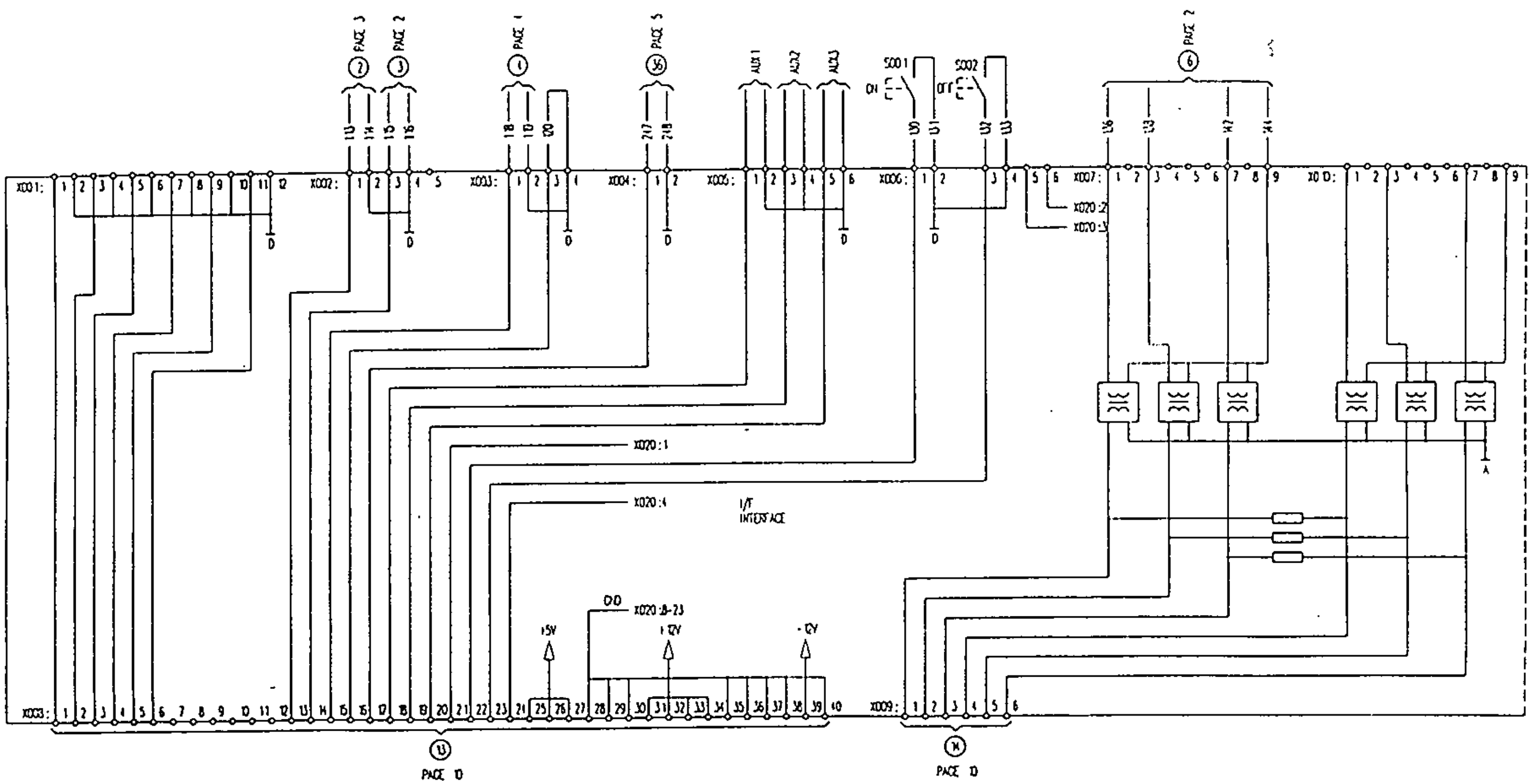
MARK	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	WIRE NO. 312 AND 313 DELETED.	8.11.94	CF	DRAWN	13.05.94	CF
				CHECKED	09.12.94	
				ISSUE NO.	04	

SCALE

TITLE
MAIN CIRCUIT DIAGRAM
DP 320-330 B.C. BEST

PAGE 6 OF 11

DRAWING NO. 8.000.528



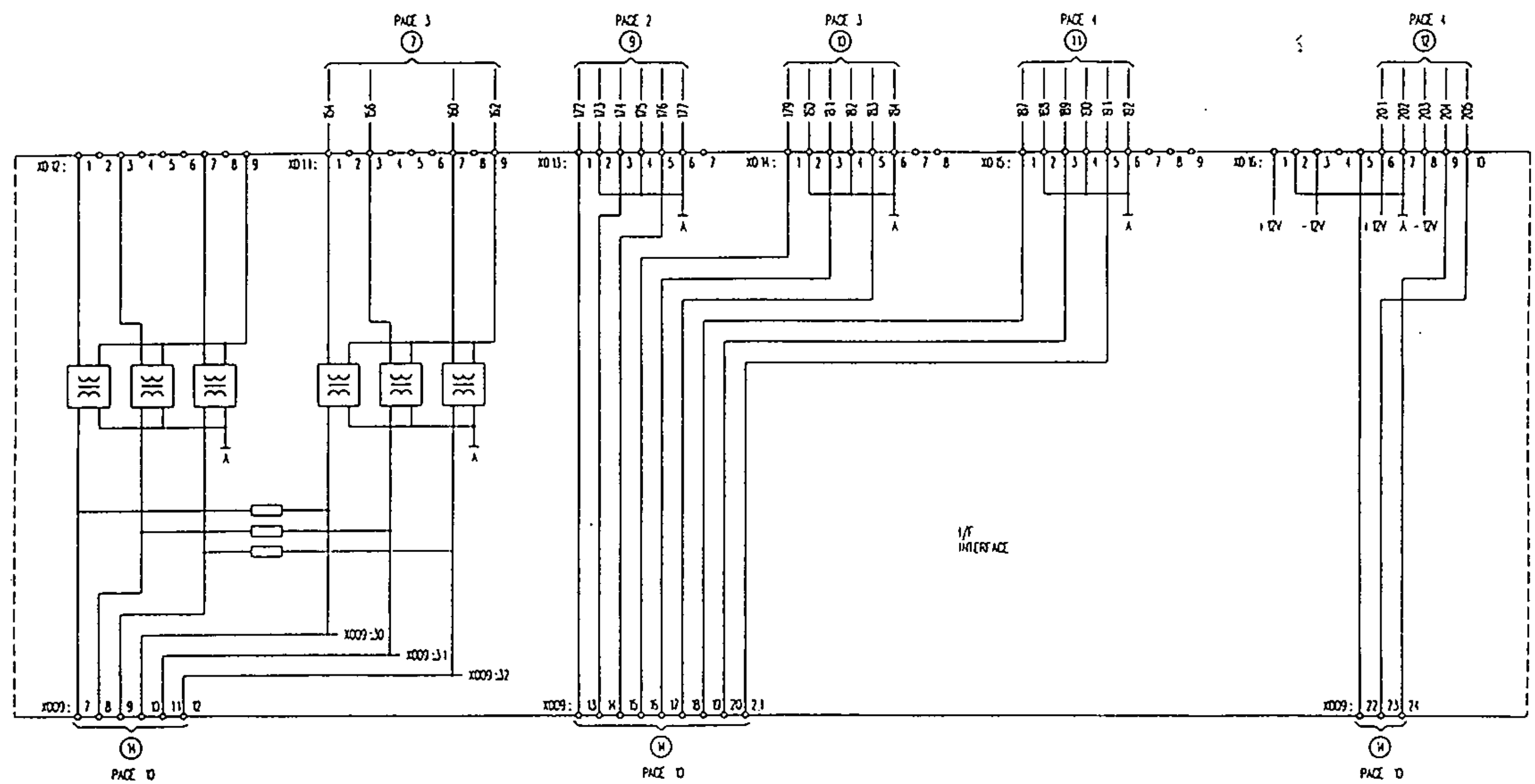
MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
				DRAWN	13.06.94	GT
				CHECKED	09.12.94	
				ISSUE NO.	04	

SCALE

TITLE MAIN CIRCUIT DIAGRAM
DP 320-330 B.C. BEST

PAGE 7 OF 11

DRAWING NO. 8.000.528



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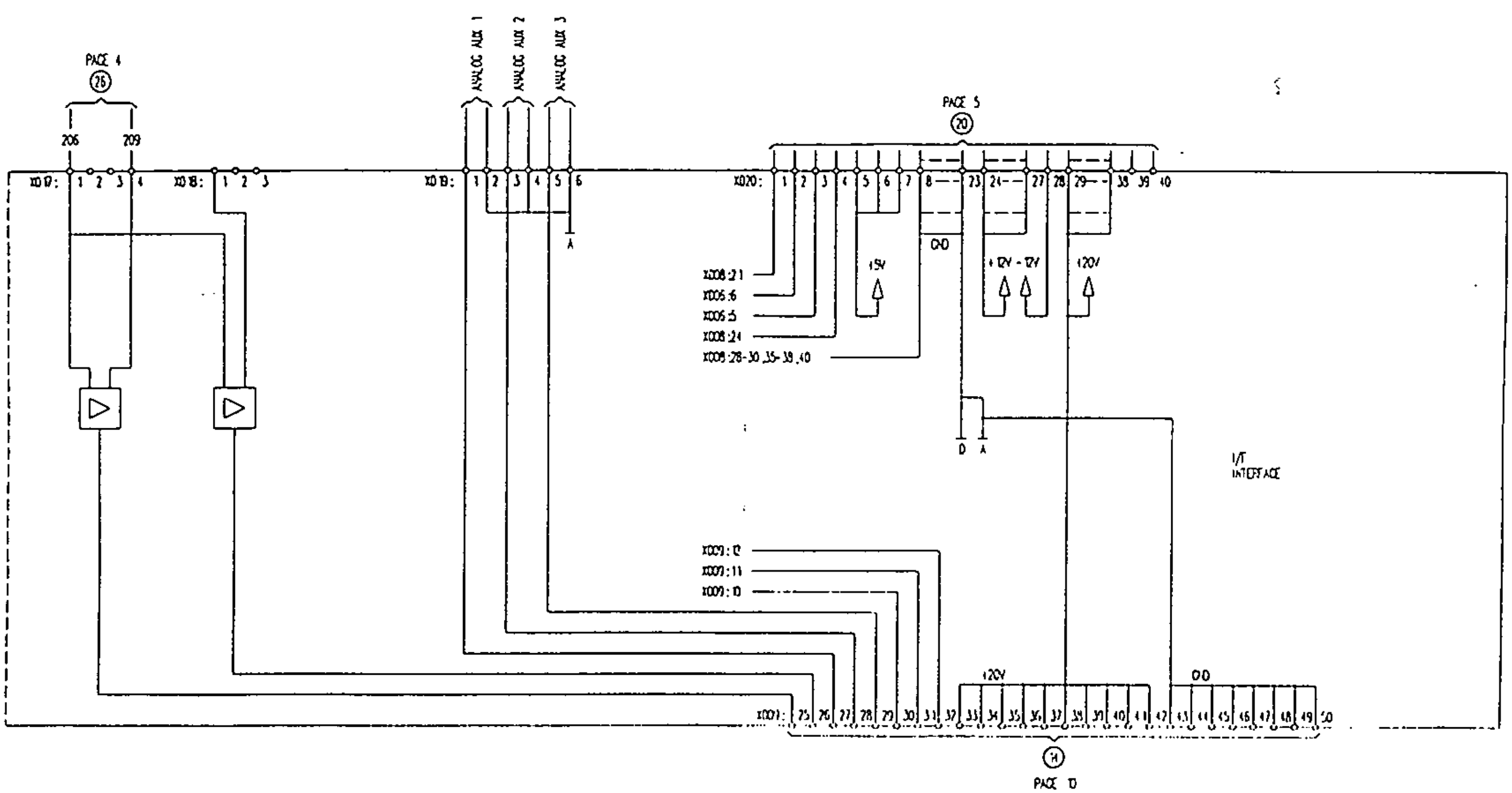
				CHECKED	09.12.94	
				ISSUE NO.	04	

SCALE		TITLE
		MAIN CIRCUIT DIAGRAM DP 320-330 B.C. EEST
PAGE 8 OF 11		DRAWING NO. 8.000.528



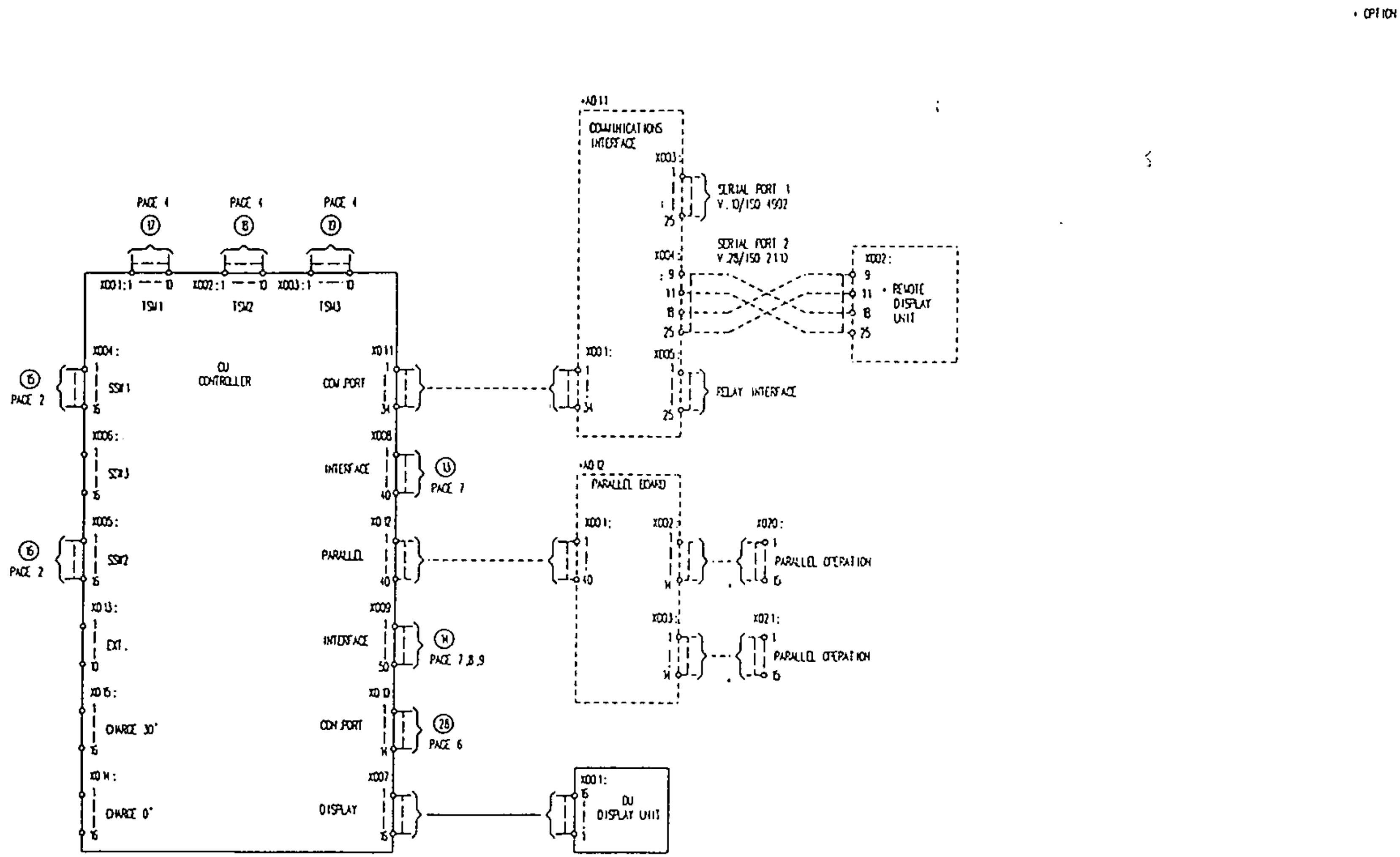
MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
				DRAWN	13.06.94	CF
				CHECKED	09.12.94	
				ISSUE NO.	04	

SCALE

TITLE
MAIN CIRCUIT DIAGRAM
DP 320-330 B.C. BEST

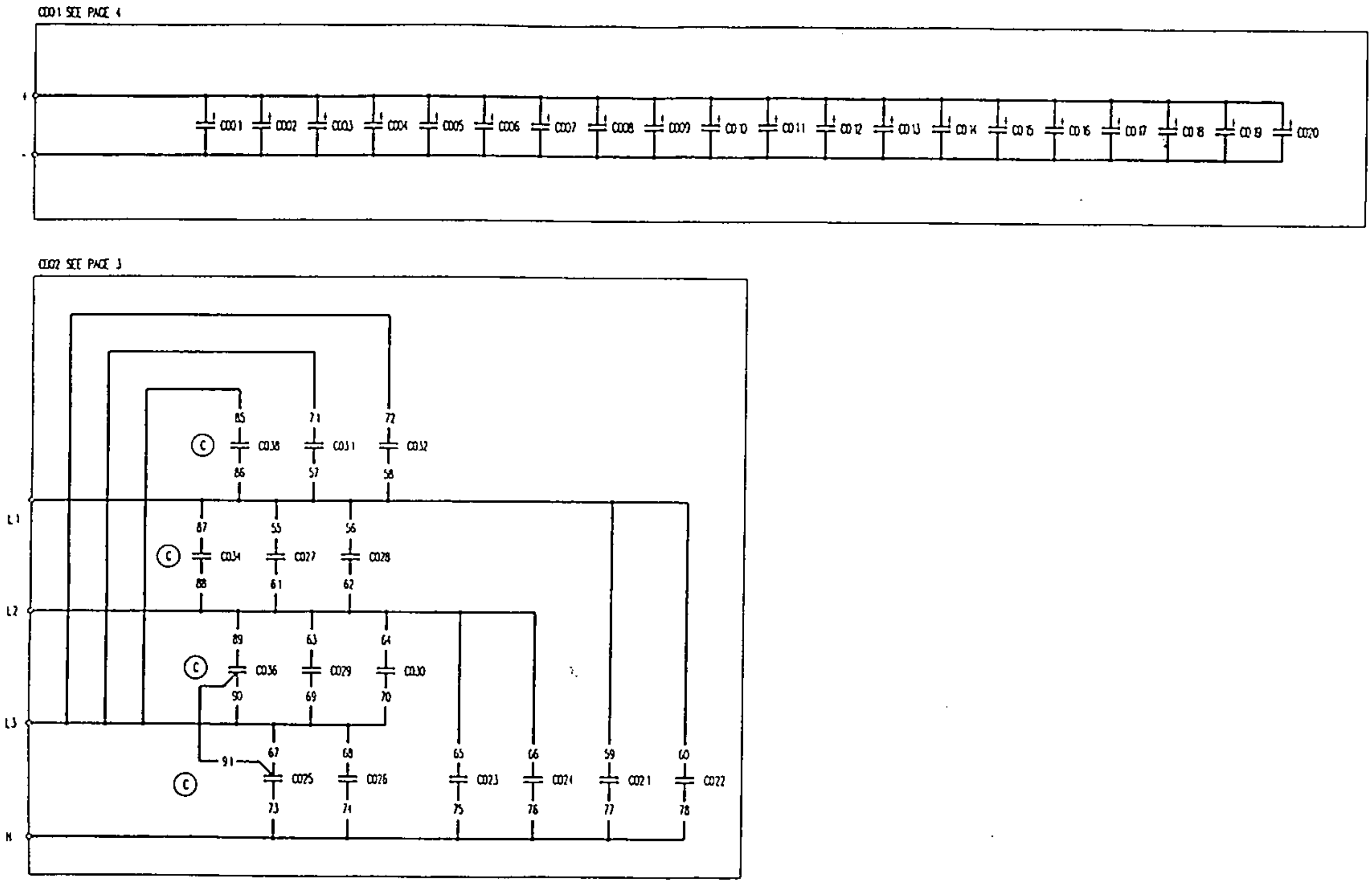
PAGE 9 OF 11

DRAWING NO. 8.000.528



MARK	CORRECTION	DATE	SIGN.		DATE	SIGN.
				DRAWN	13.05.94	OF
				CHECKED	03.12.94	
				ISSUE NO.	04	

SCALE		TITLE MAIN CIRCUIT DIAGRAM OP 320-330 B.C. BEST
PAGE 10 OF 11		DRAWING NO. 8.000.528



MAR.	CORRECTION	DATE	SIGN.
C	WIRE NO. 79 - 84 DEL. NO. 85 - 91 ADD.	18.11.94	CT

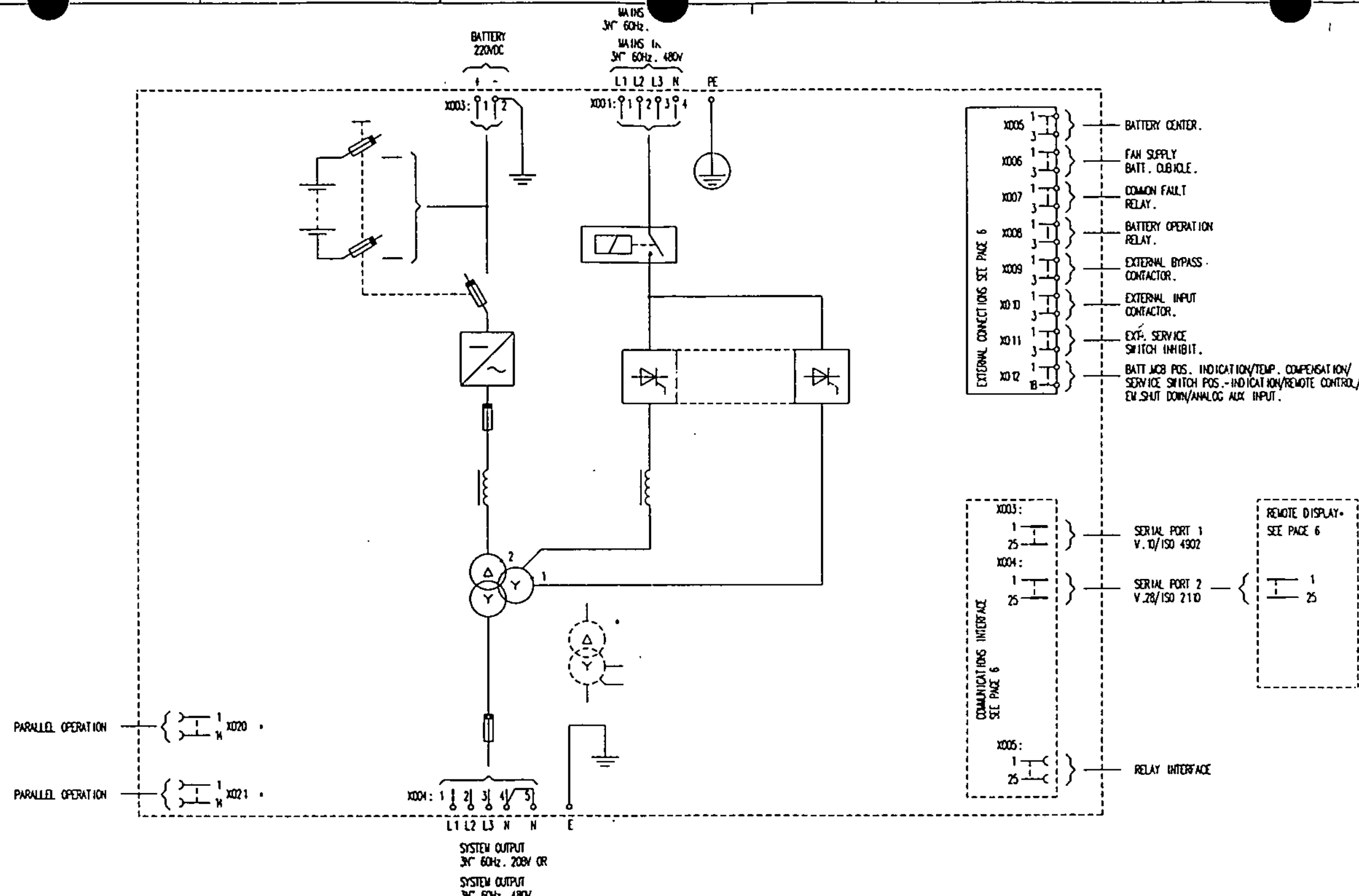
	DATE	SIGN.
DRAWN	13.06.94	CT
CHECKED	09.12.94	
ISSUE NO.	04	

SCALE

TITLE MAIN CIRCUIT DIAGRAM DP 320-330 B.C. BEST

PAGE 11 OF 11

DRAWING NO. 8.000.528



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
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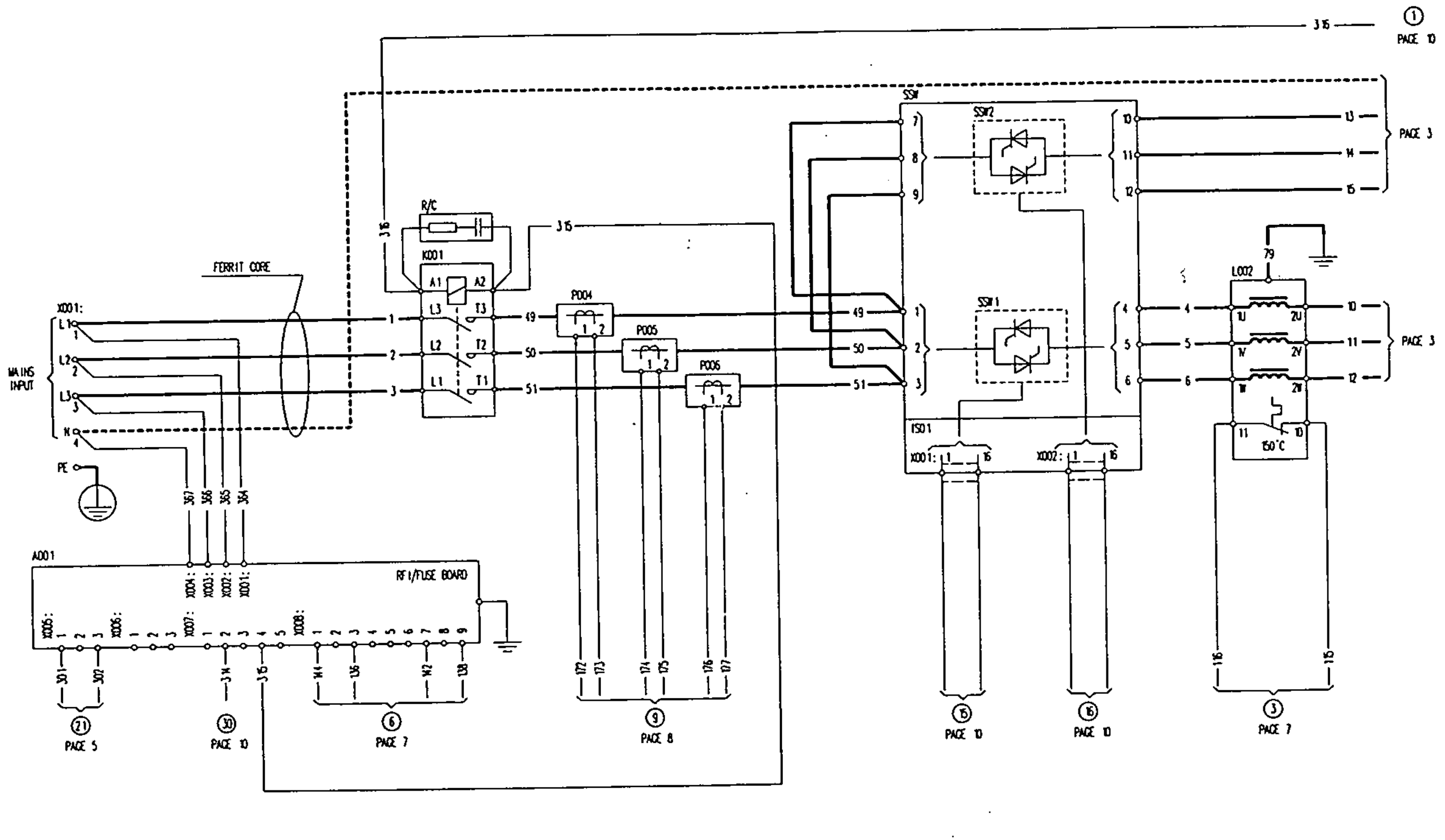
				ISSUE NO.	02	

SCALE	DS/ISO 128	TITLE
		MAIN CIRCUIT DIAGRAM DP320-330 BC, UL
PAGE 1 OF 11		DRAWING NO. 8.000.596

S139



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
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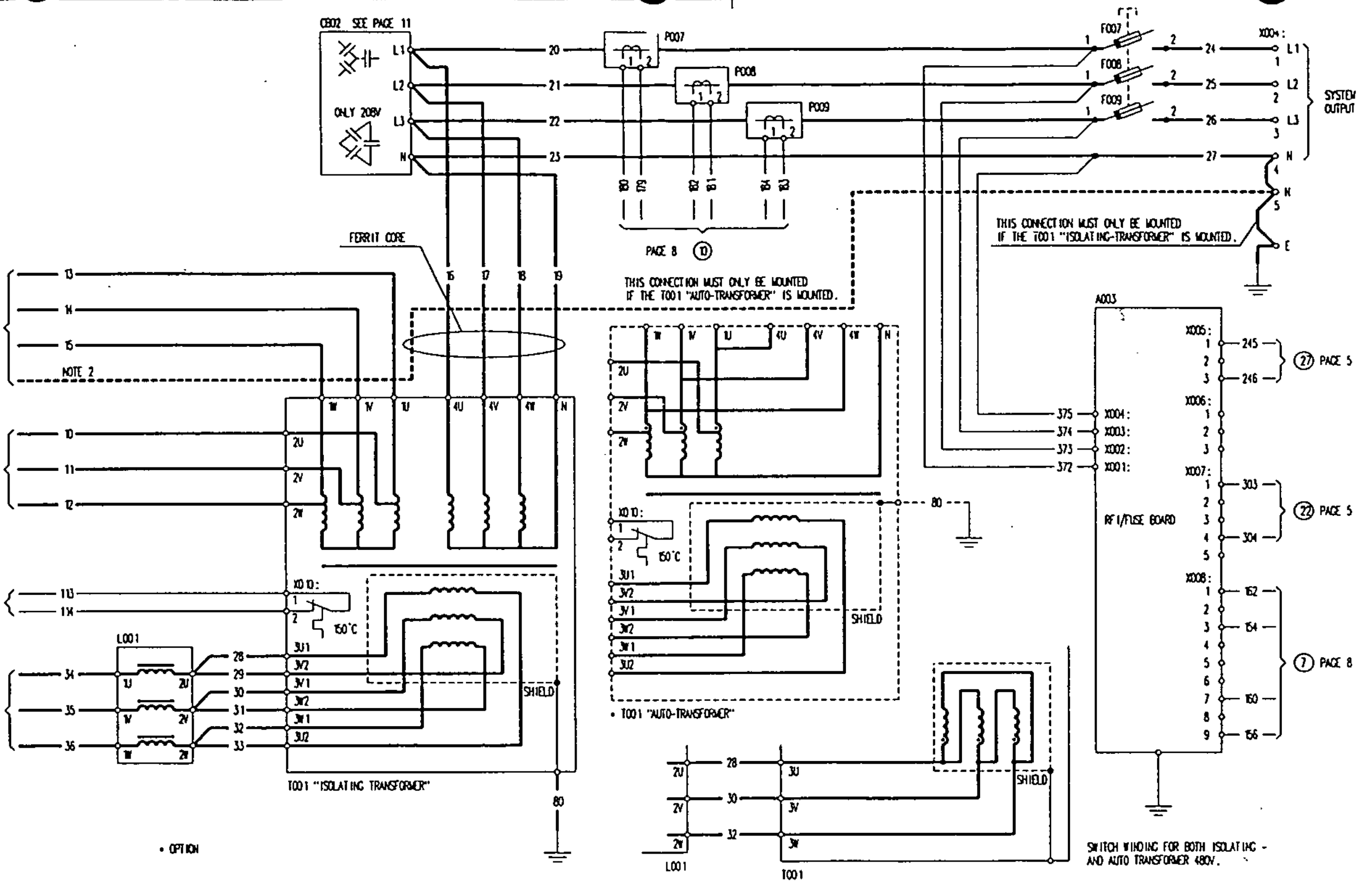
				CHECKED	15.06.95	
				ISSUE NO.	02	

SCALE	DS/ISO 128	TITLE
		MAIN CIRCUIT DIAGRAM DP320-330 BC, UL
PAGE 2 OF 11		DRAWING NO. 8.000.596

S09



MARK.	CORRECTION	DATE	SIGN.	MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
								DRAWN	23.03.95	CF
								CHECKED	15.06.95	DE
								ISSUE NO.	02	

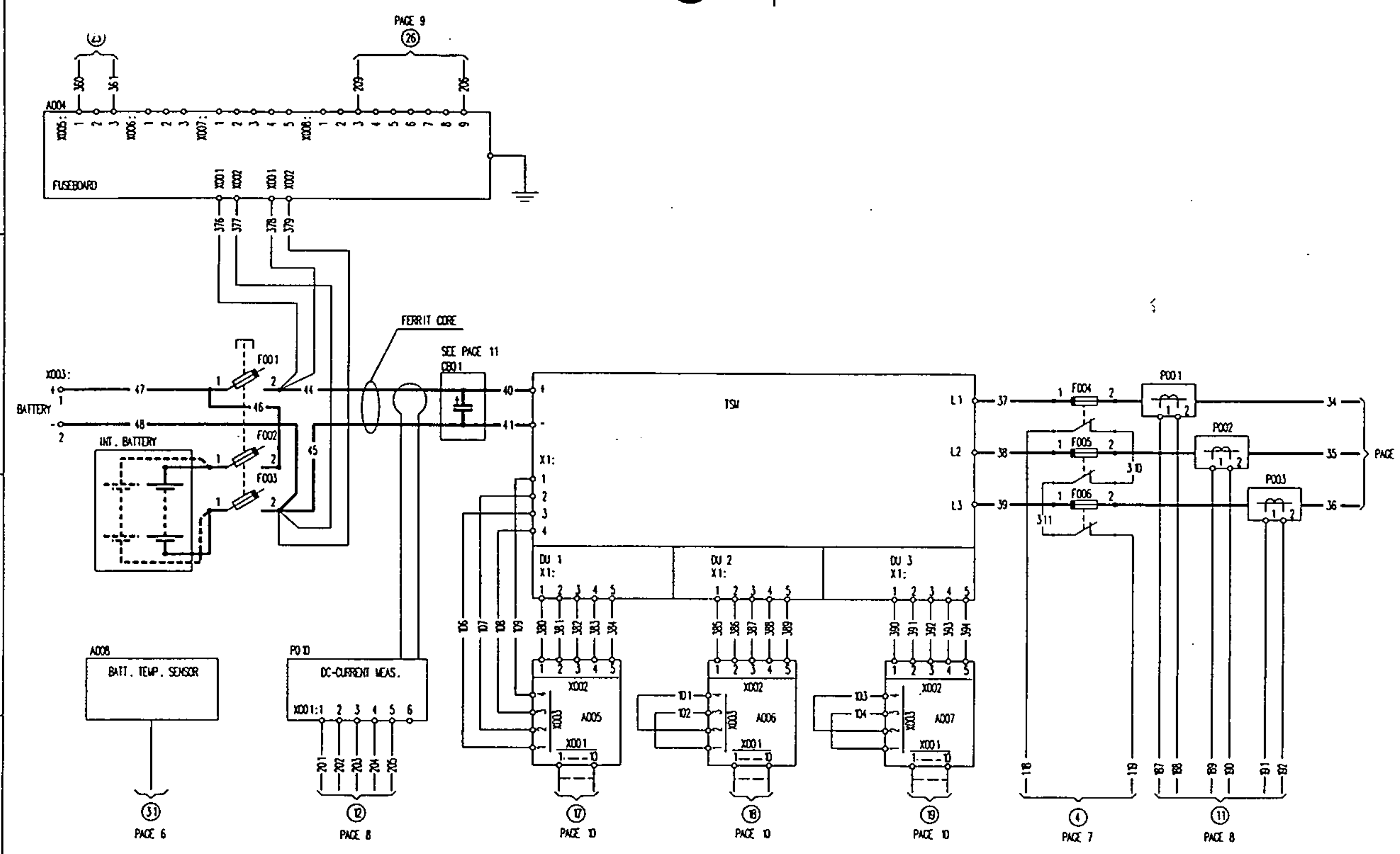
SCALE

TITLE Main Circuit Diagram DP320-330 BC, UL

PAGE 3 OF 11

DRAWING NO. 8.000.596

5139



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.	SCALE		TITLE
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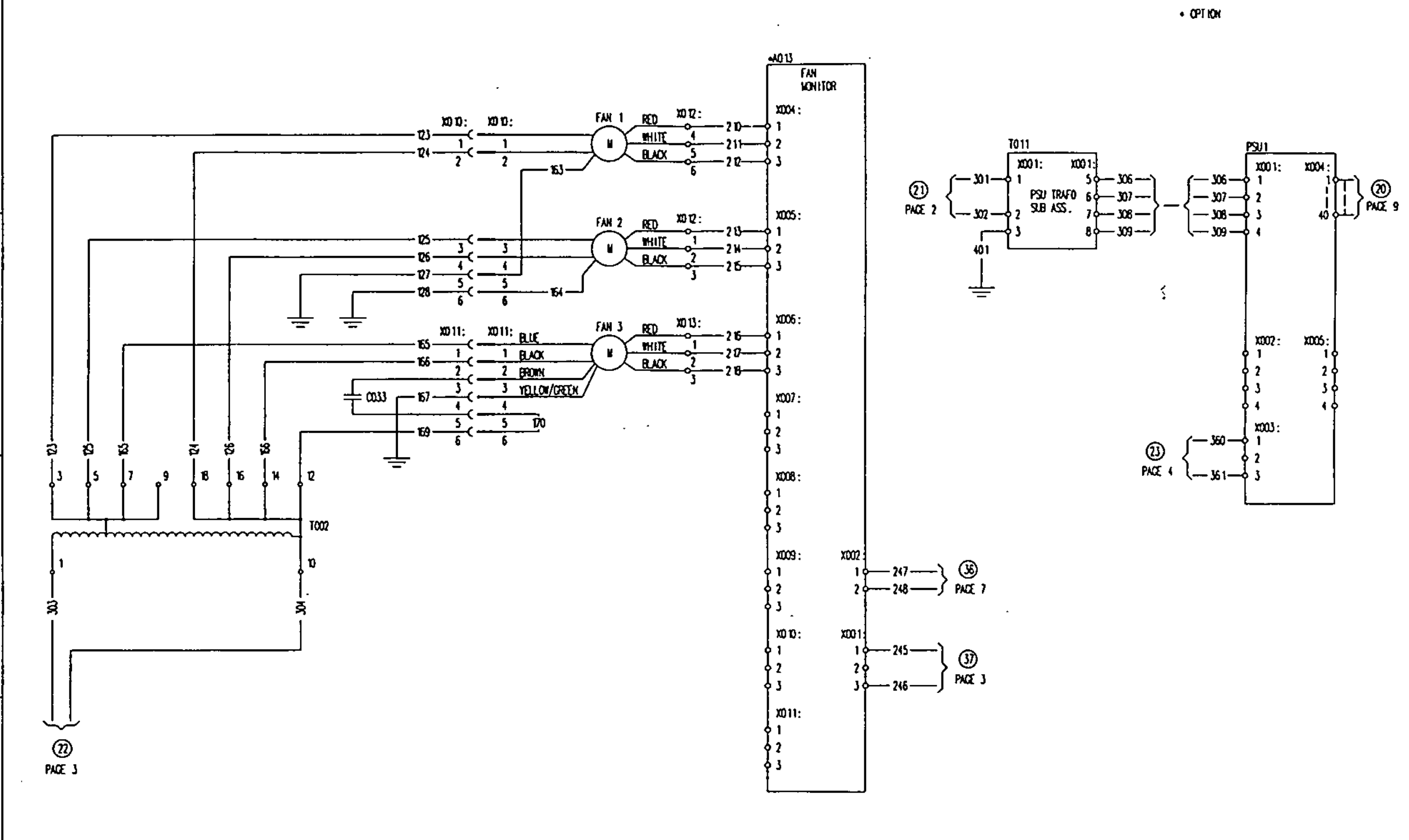
				CHECKED	15.06.95				
				ISSUE NO.	02		PAGE 4 OF 11		DRAWING NO. 8.000.596

5139



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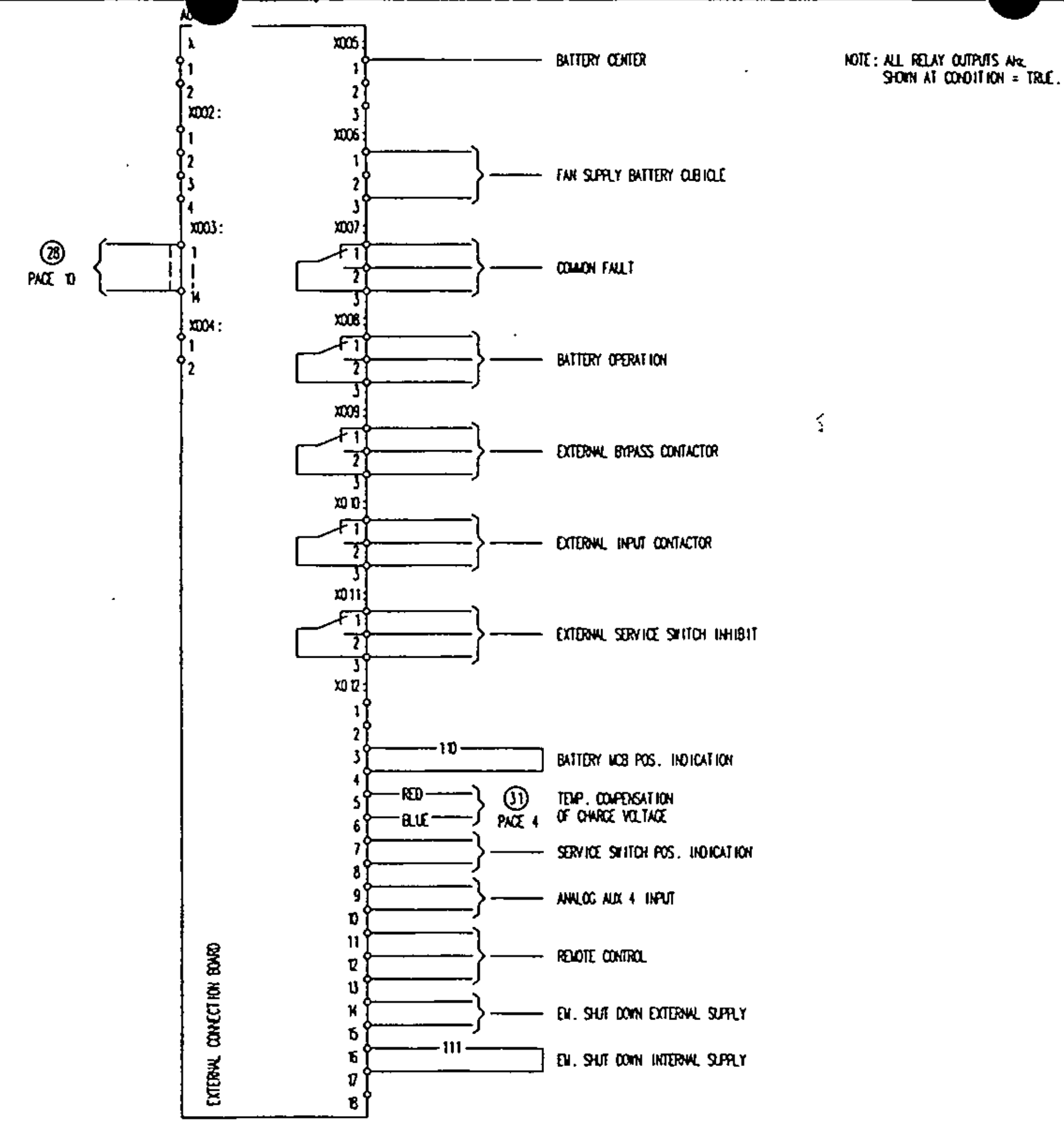
				CHECKED	15.06.95	[illegible]
				ISSUE NO.	02	

SCALE		TITLE
		MAIN CIRCUIT DIAGRAM DP320-330 BC, UL
PAGE 5 OF 11		DRAWING NO. 8.000.596

S139



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				CHECKED	15.06.95	[illegible]
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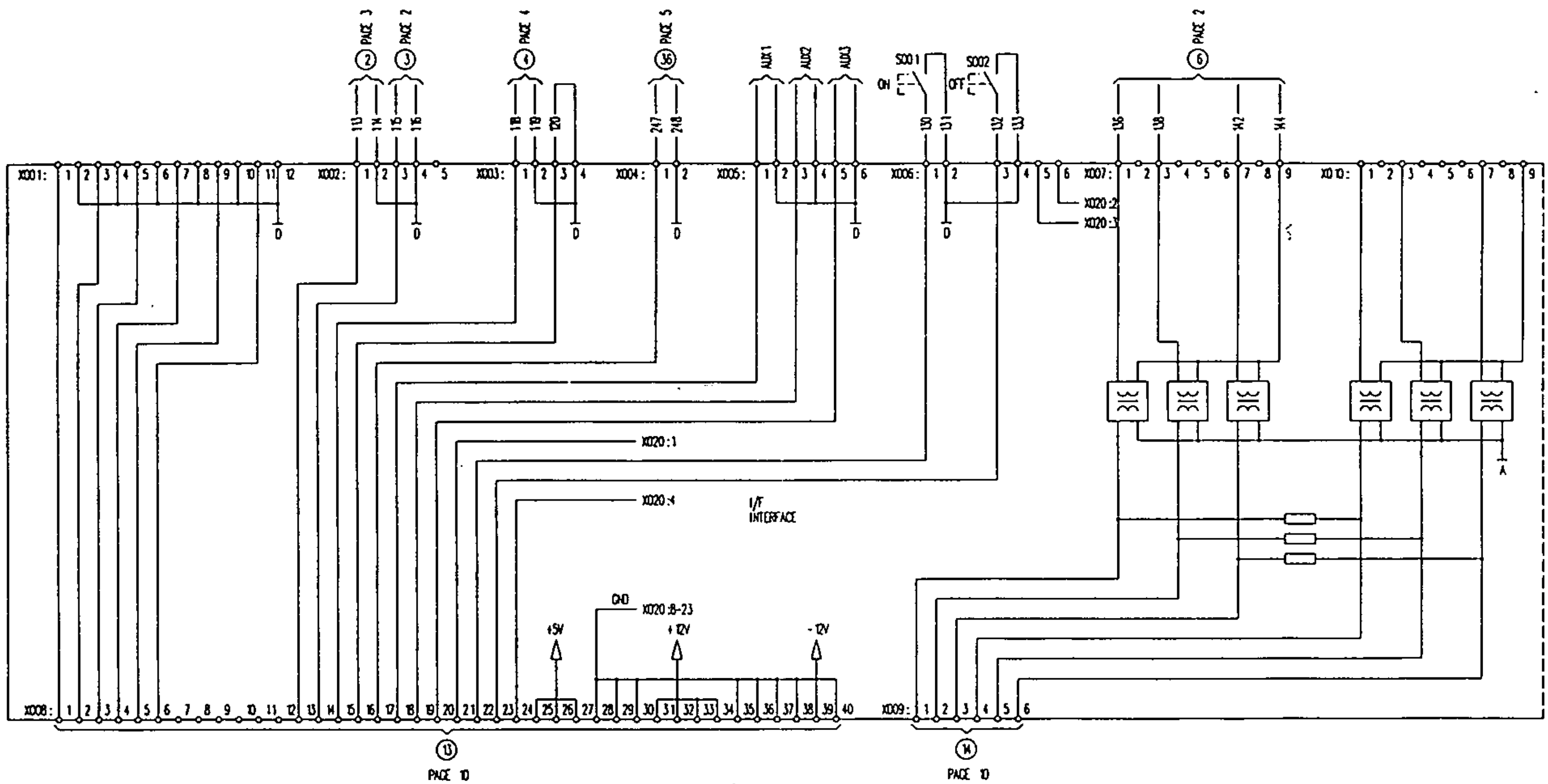
SCALE		TITLE
		MAIN CIRCUIT DIAGRAM DP320-330 BC, UL
PAGE 6 OF 11		DRAWING NO. 8.000.596

S109



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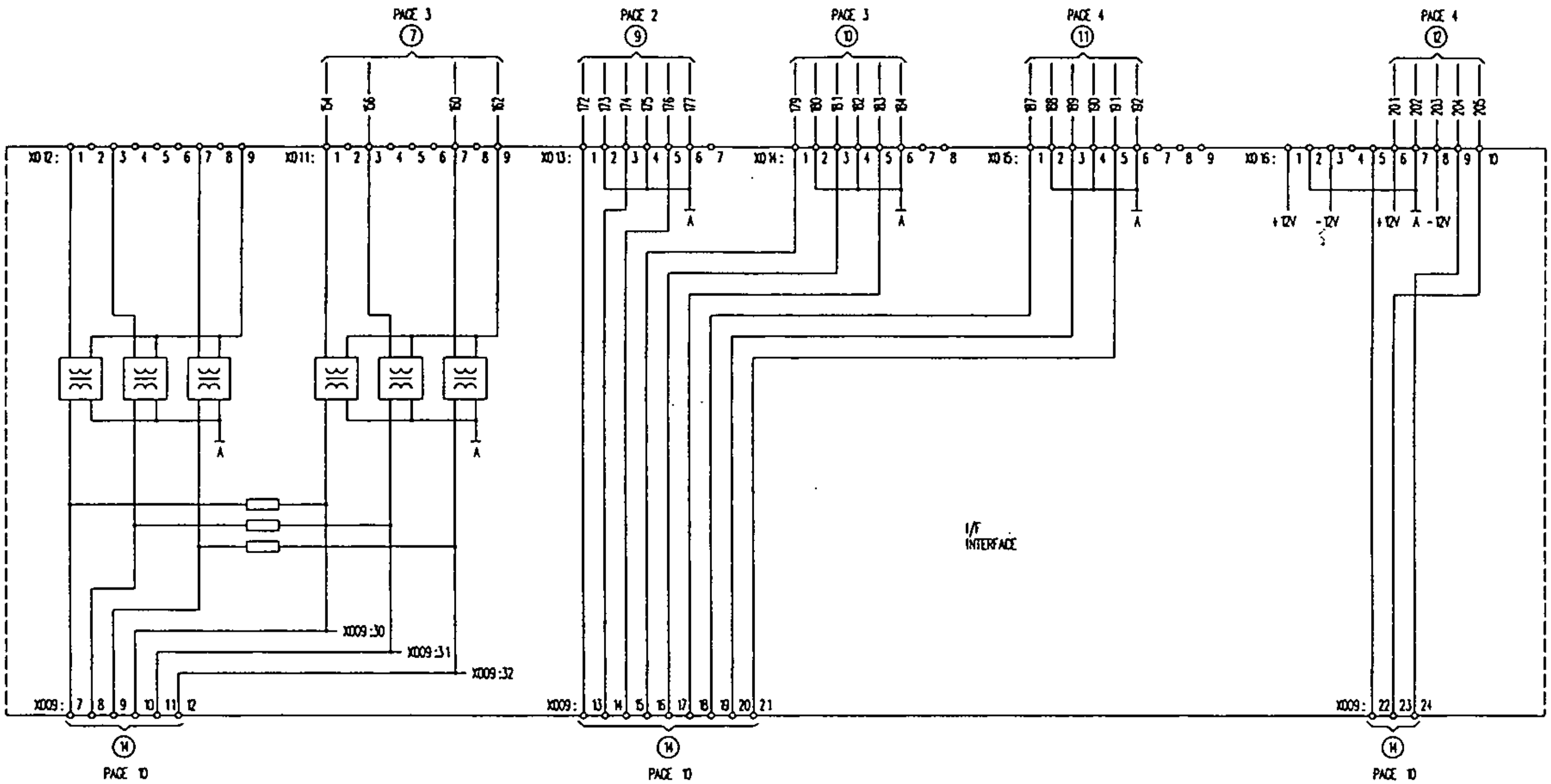
				CHECKED	15.06.95	
				ISSUE NO.	02	

SCALE		TITLE
		MAIN CIRCUIT DIAGRAM DP320-330 BC, UL
PAGE 7 OF 11		DRAWING NO. 8.000.596

S139



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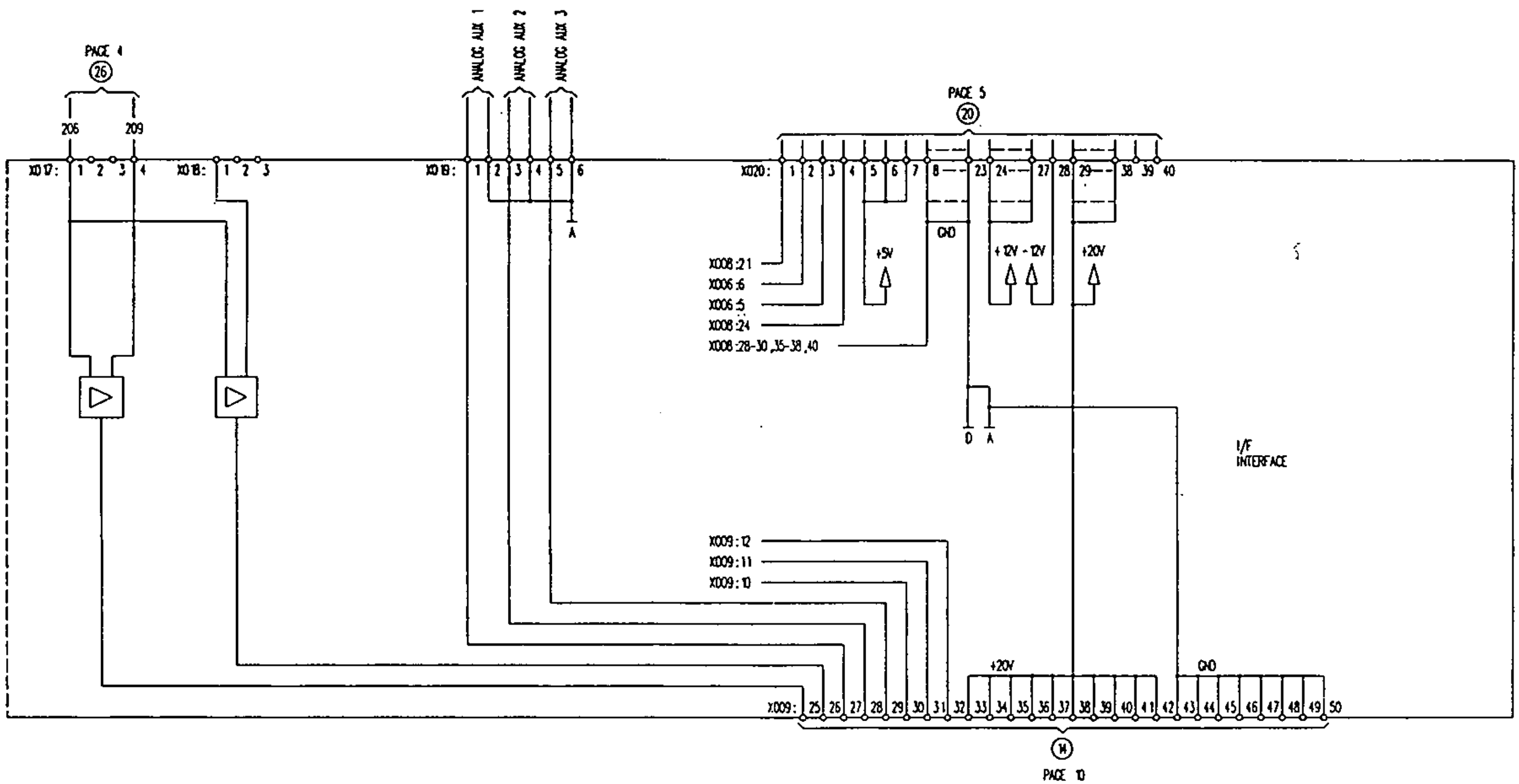
				ISSUE NO.	02	

SCALE		TITLE MAIN CIRCUIT DIAGRAM DP320-330 BC, UL
PAGE 8 OF 11		DRAWING NO. 8.000.596

519



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
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				CHECKED	15.06.95	
				ISSUE NO.	02	

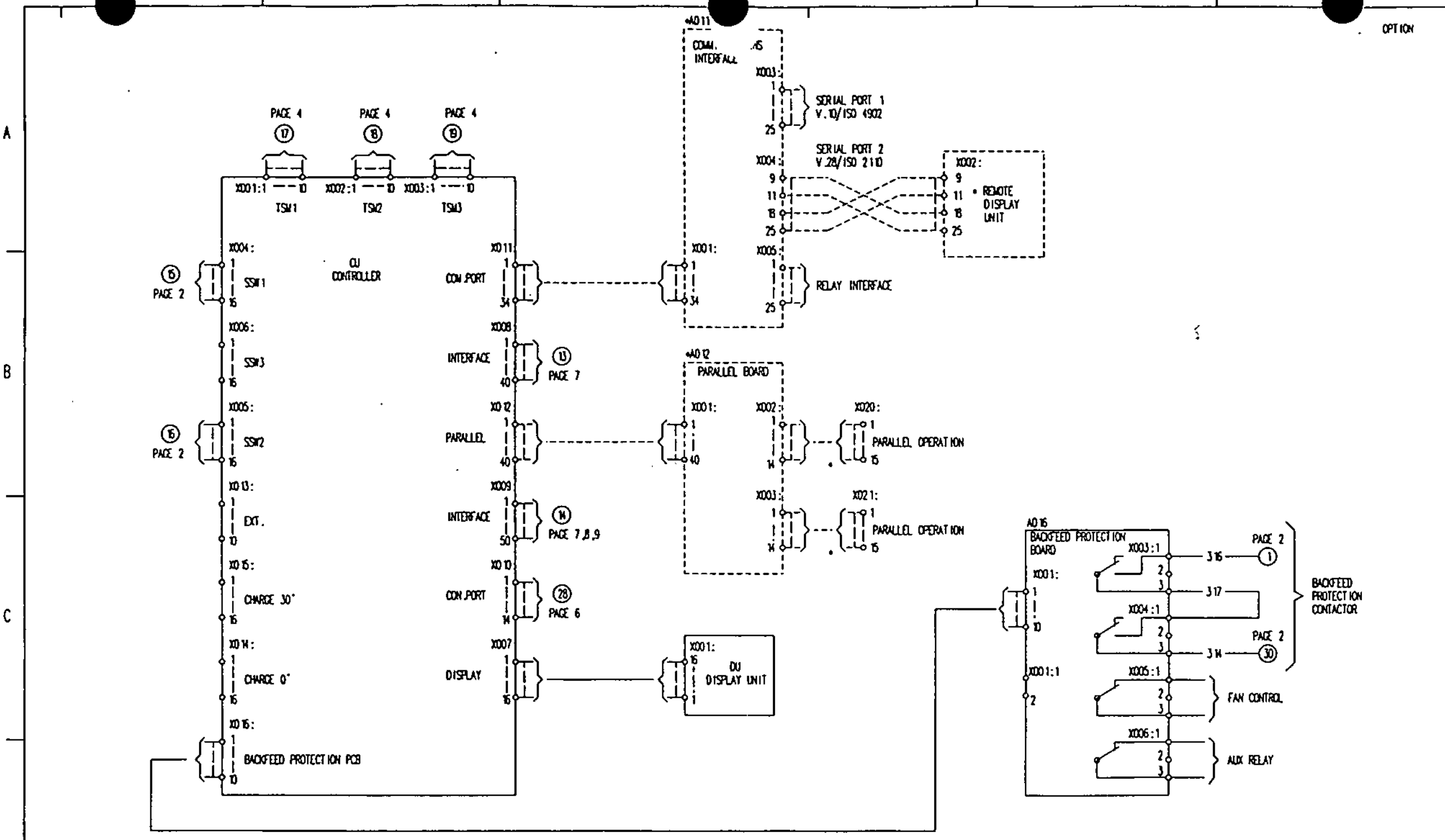
SCALE

TITLE
MAIN CIRCUIT DIAGRAM
DP320-330 BC, UL

PAGE 9 OF 11

DRAWING NO. 8.000.596

S139



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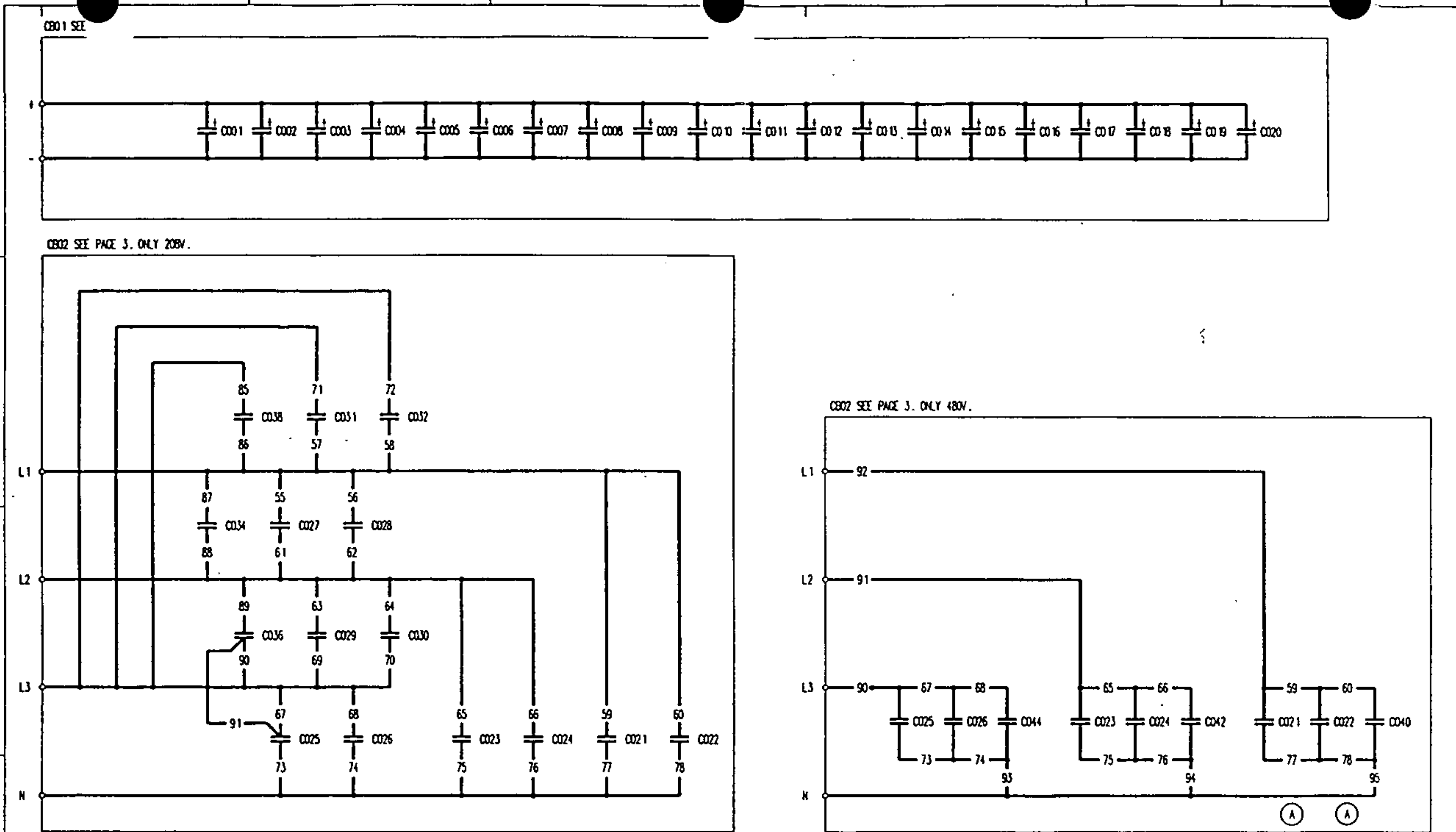
				CHECKED	15.06.95	
				ISSUE NO.	02	

SCALE		TITLE
		MAIN CIRCUIT DIAGRAM DP320-330BC, UL
PAGE 10 OF 11		DRAWING NO. 8.000.596

S139



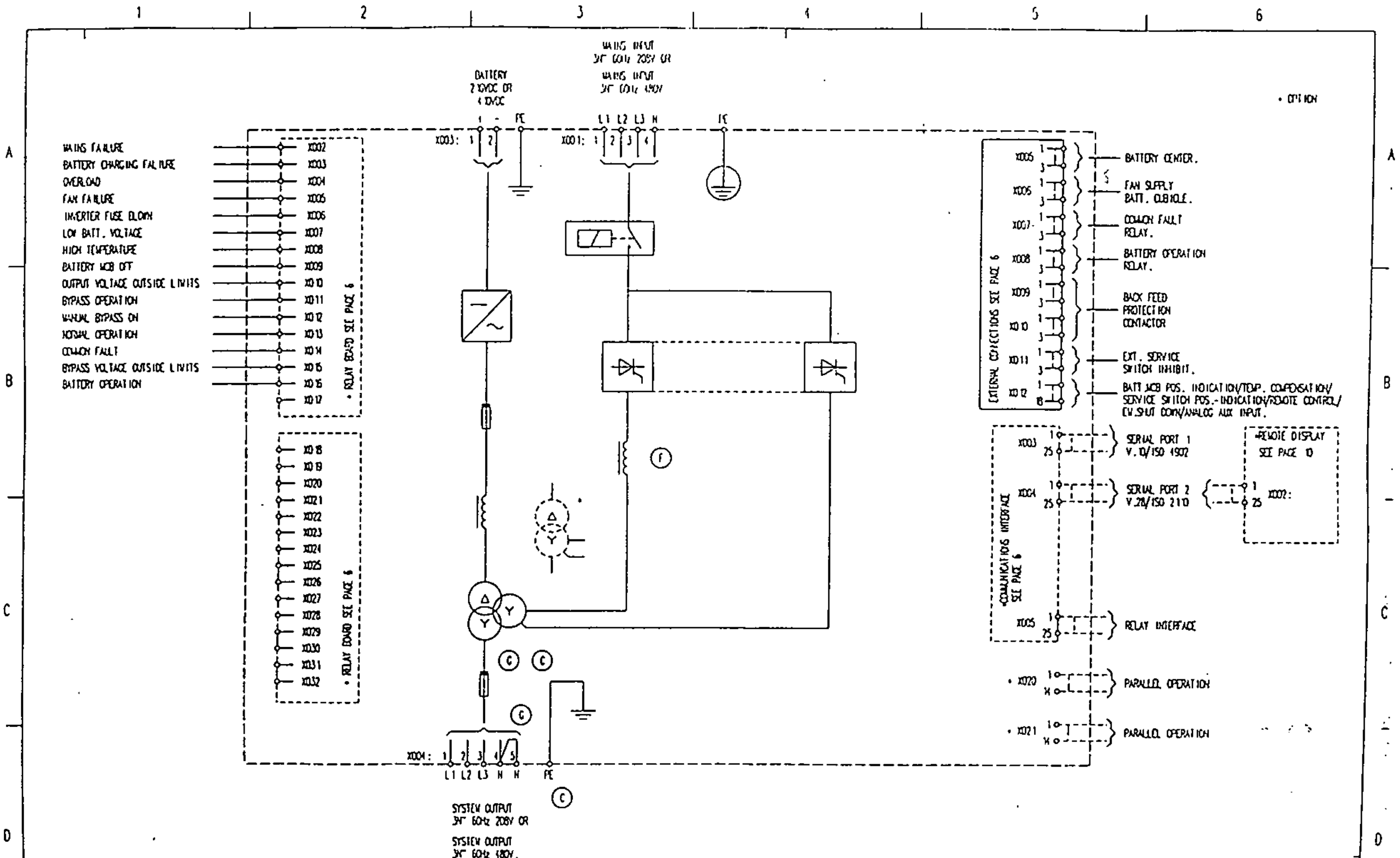
MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
A	77 WAS 73, 78 WAS 74.	15.06.95	CF	DRAWN	23.03.95	CF
				CHECKED	15.06.95	
				ISSUE NO.	02	

SCALE

TITLE MAIN CIRCUIT DIAGRAM DP320-330BC, UL

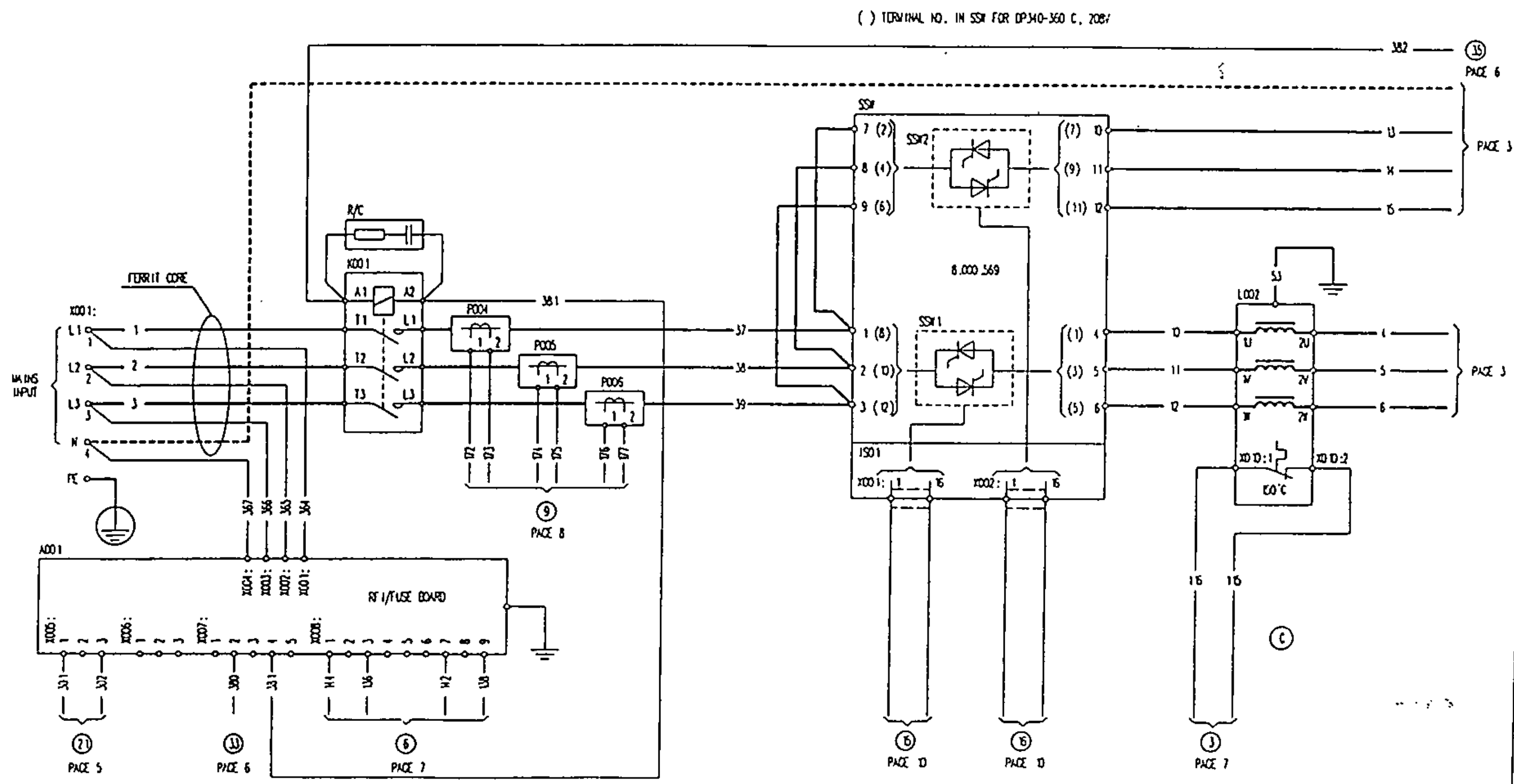
PAGE 11 OF 11

DRAWING NO. 8.000.596



MRK.	CORRECTION	DATE	SIGN.	MRK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	EARTH SIGN ADDED. CONNECTIONS DELETED.	27.10.94	CF	C	EARTH SIGN AT TRANSFORMER DELETED.	18.01.95	CF	DRAWN	12.09.94	CF
F	CHOKE MOVED FROM BEHIND SSW TO IN							CHECKED	07.02.95	
	FRONT OF SSW.	05.12.94	CF					ISSUE NO.	09	
G	1 MORE N-TERM. AND CONN. FOR DO, ADD.	18.01.95	CF							

SCALE		TITLE	Main Circuit Diagram OP 340-360 C, UL
Page 1 of 10		DRAWING NO.	8.000.572



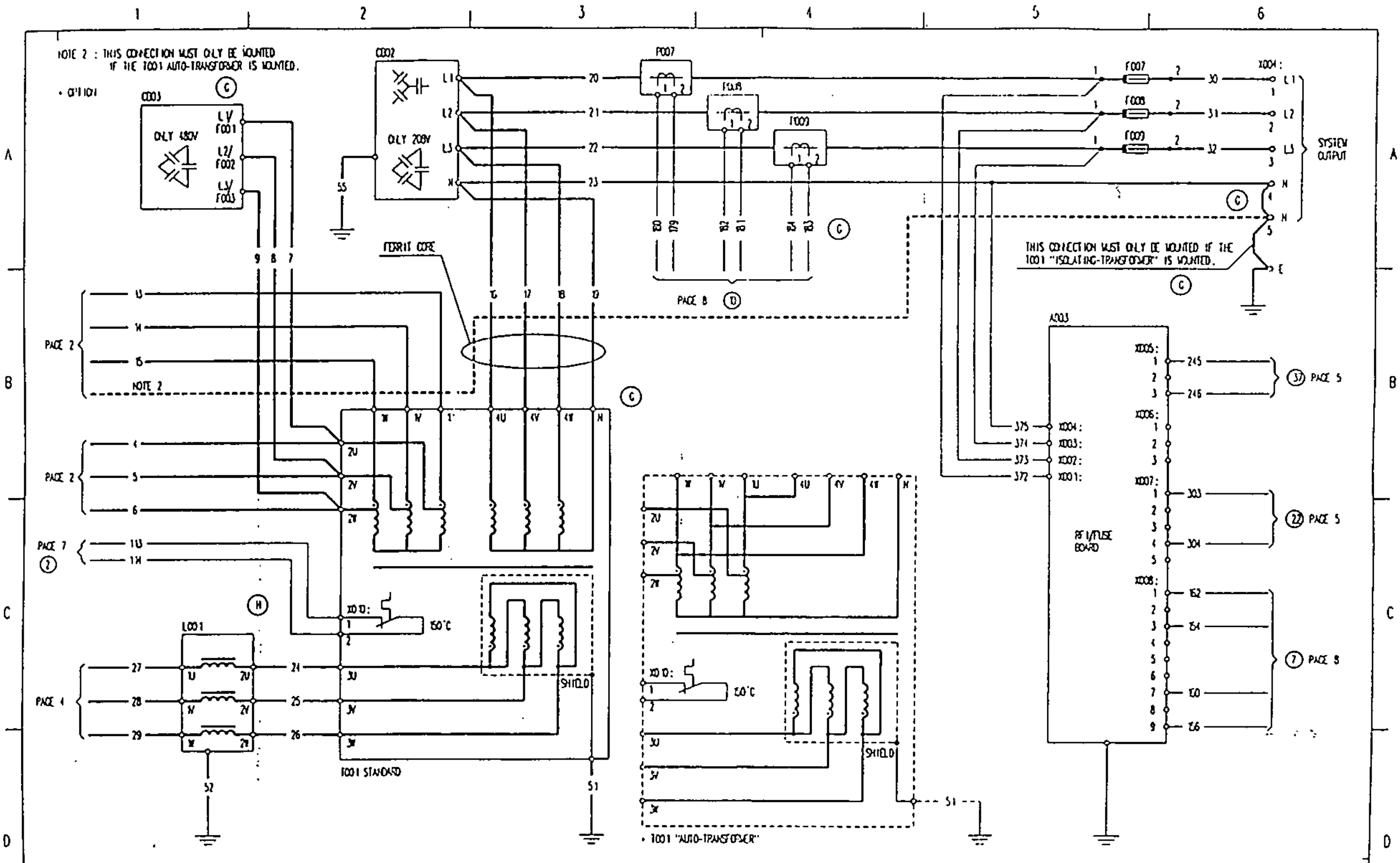
MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	WIRE NO. 305, L003 XO10:1 AND 2 DEL.	27.10.94	CF	DRAWN	12.09.94	CF
				CHECKED	07.02.95	
				ISSUE NO.	03	

SCALE

TITLE Main Circuit Diagram DP 340-360 C, UL

PAGE 2 OF 10

DRAWING NO. 8.000.572



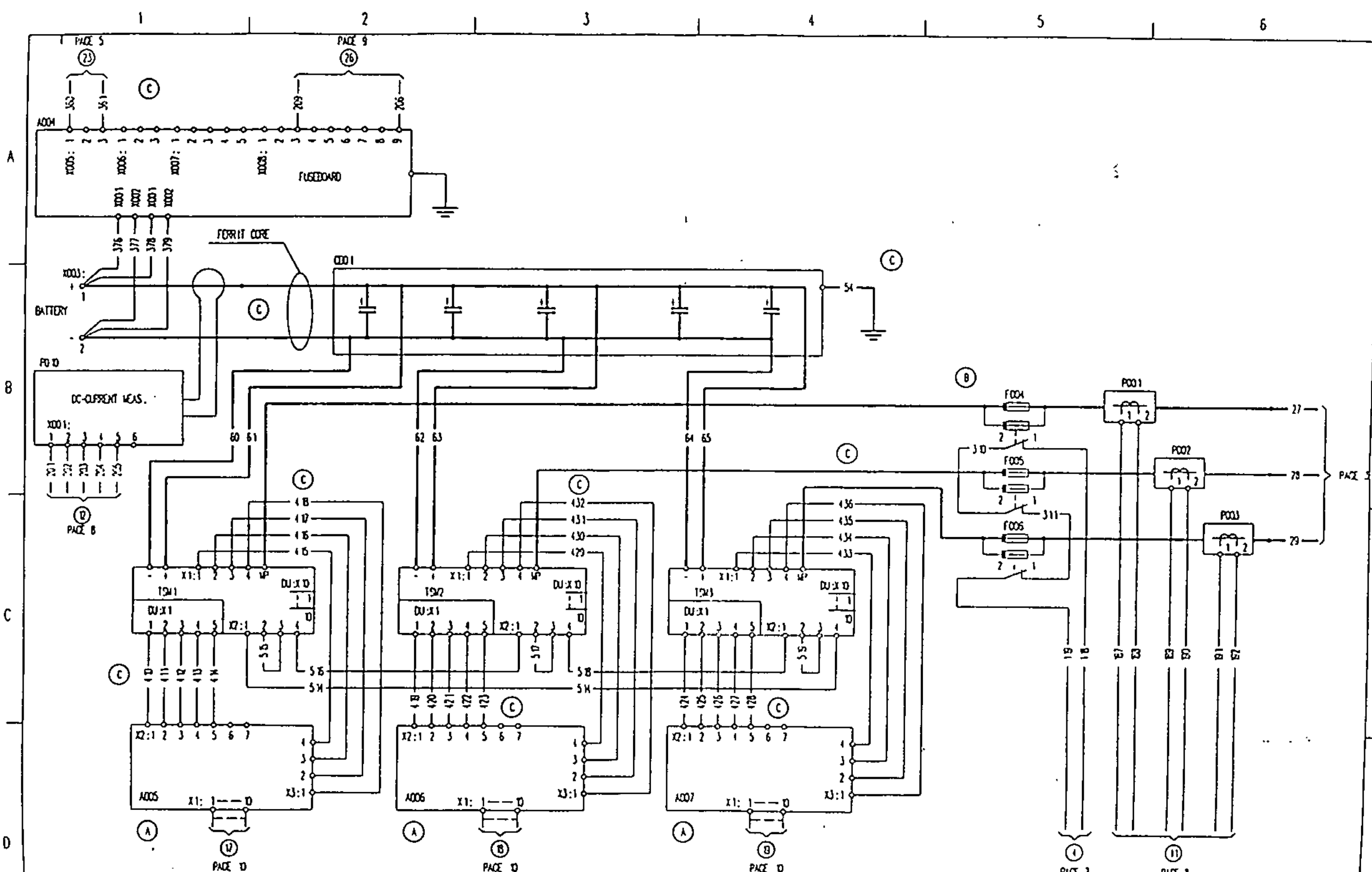
MRK.	CORRECTION	DATE	SIGN.	MRK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
G	WIRE NO. 179/180, 181/182, 183/184 INTERCHANGED. 1 MORE			H	WIRE NO. 3W DEL. 1H. 5H. ON L001 DEL.			DRAWN	12.09.94	CF
	CONN. 4 TEXT FOR 00 ADD. EARTH-SIGN AT TRAFO DELETED.				WIRE NO. 1W MOVED FROM L001 TO T001.	07.02.95	CF	CHECKED	07.02.95	
	CONN. FOR AUTO-TRANS. MOVED. F001, F002 AND F003 ADD.							ISSUE NO.	09	
	AT L1, L2 AND L3 AT C003.	18.01.95	CF							

SCALE

TITLE: Main Circuit Diagram DP 340-360 C, UL

PAGE 3 OF 10

DRAWING NO. 8.000.572



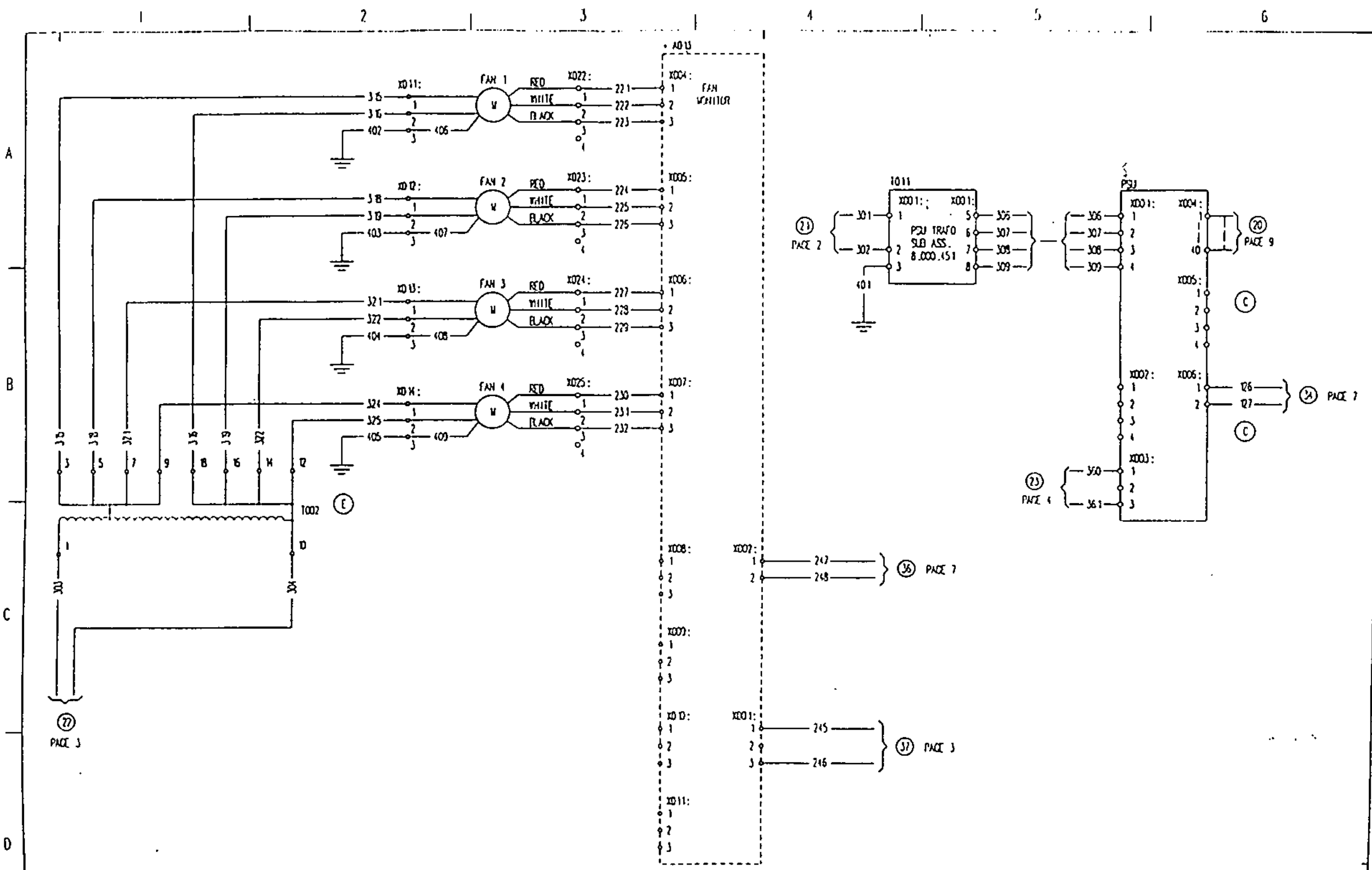
MARK.	CORRECTION	DATE	SIGN.	MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
A	A005 WAS A004, A006 WAS A005 AND	23.09.94	CF	C	WIRE NO. 34, 35, 362 AND 363 DELETED.			DRAWN	12.09.94	CF.
	A007 WAS A006.				WIRE NO. 1 - 44 CHANGED TO NEW WIRE NO			CHECKED	07.02.95	
B	F004 WAS F001, F005 WAS F002 AND	29.09.94	CF		WIRE NO. 54 ADDED.	27.10.94	CF	ISSUE NO.	09	
	F006 WAS F003.									

SCALE

TITLE Main Circuit Diagram
DP 340-360 C, UL

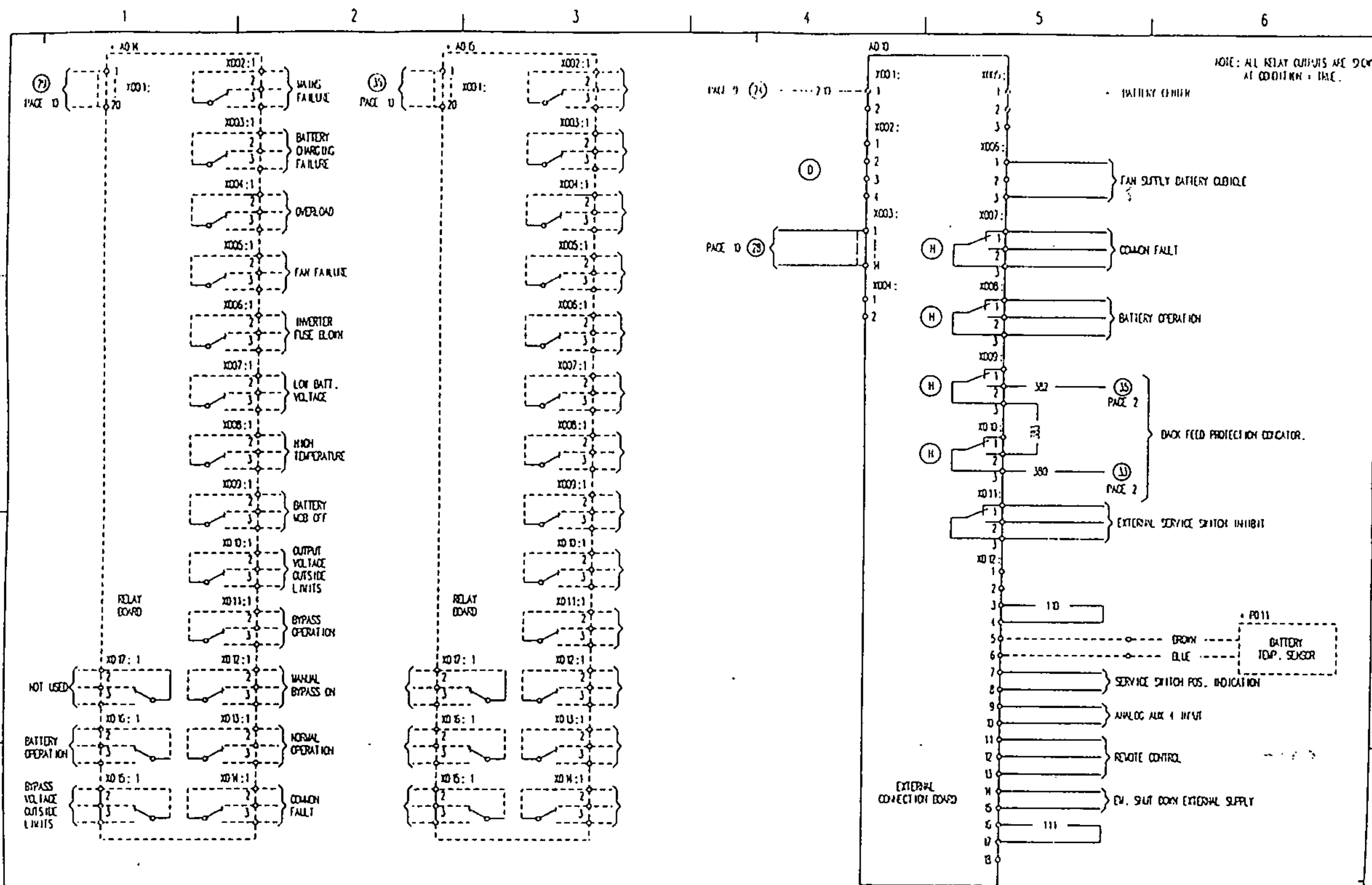
PAGE 4 OF 10

DRAWING NO. 8.000.572



MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
C	WIRE NO. 219 -> 127. WIRE NO. 345 AND			DRAWN	12.09.94	CF
	346 DELETED.	27.10.94	CF	CHECKED	07.02.95	
E	TERMINAL NO. ON T002 CHANGED.	29.11.94	CF	ISSUE NO.	09	

SCALE	DG/ISO 128	TITLE
		Main Circuit Diagram DP 340-360 C, UL
PAGE 5 OF 10		DRAWING NO. 8.000.572



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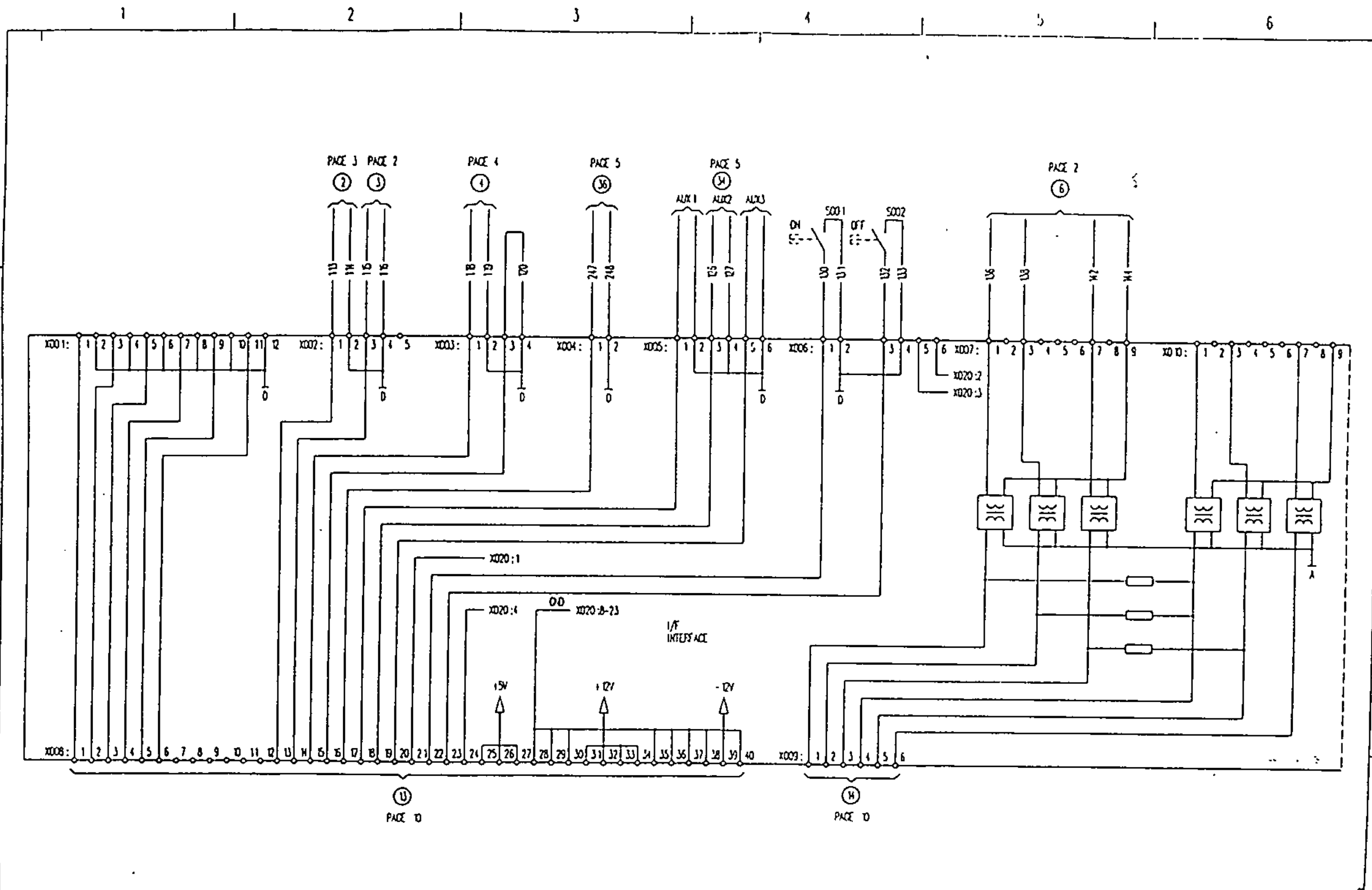
SCALE		TITLE	Main Circuit Diagram OP 340-360 C, UL
Page 6 of 10		DRAWING NO.	8.000.572



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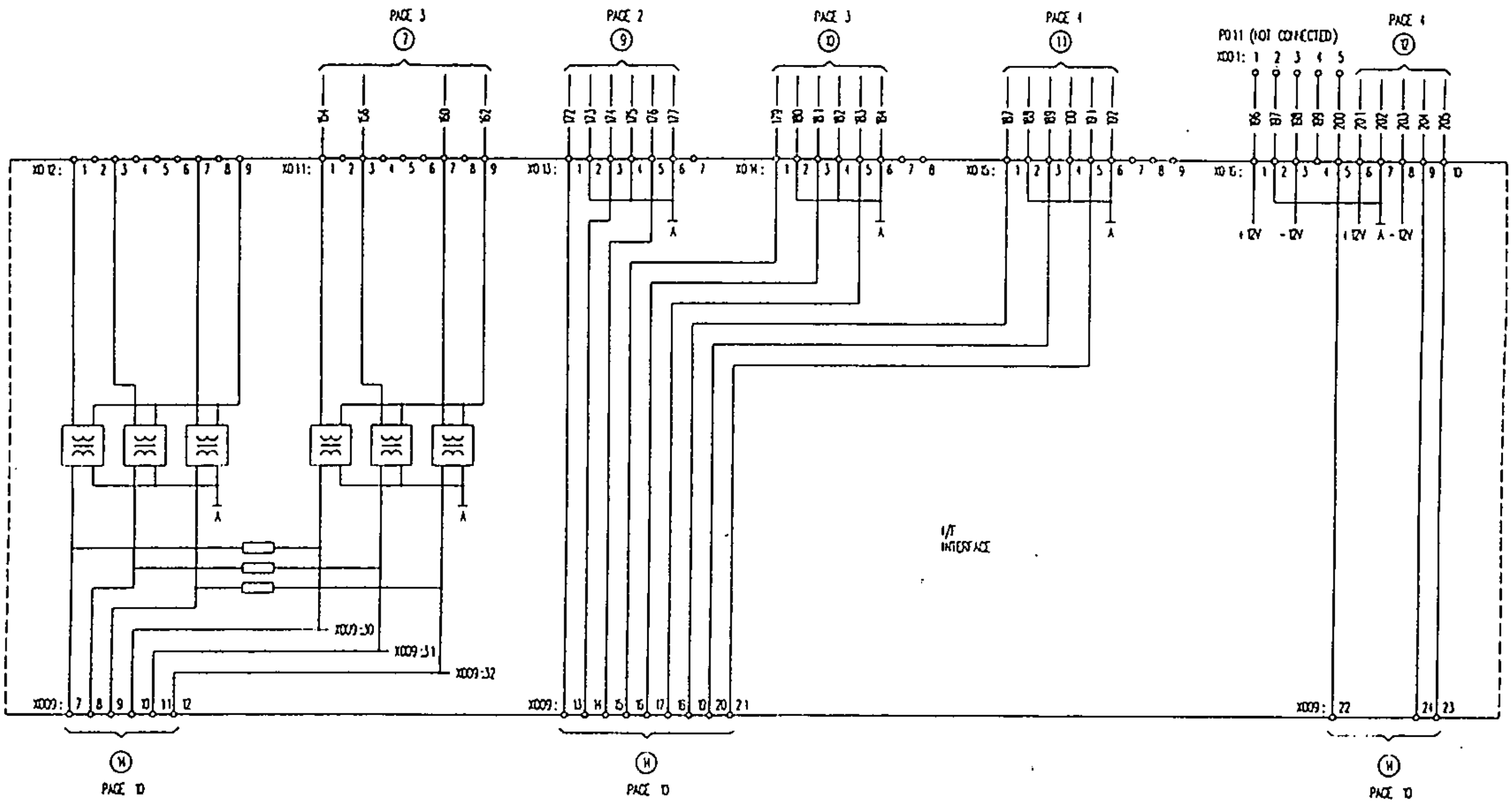
SCALE	TITLE
	Main Circuit Diagram DP 340-360 C, UL
Page 7 of 10	DRAWING NO. 8.000.572



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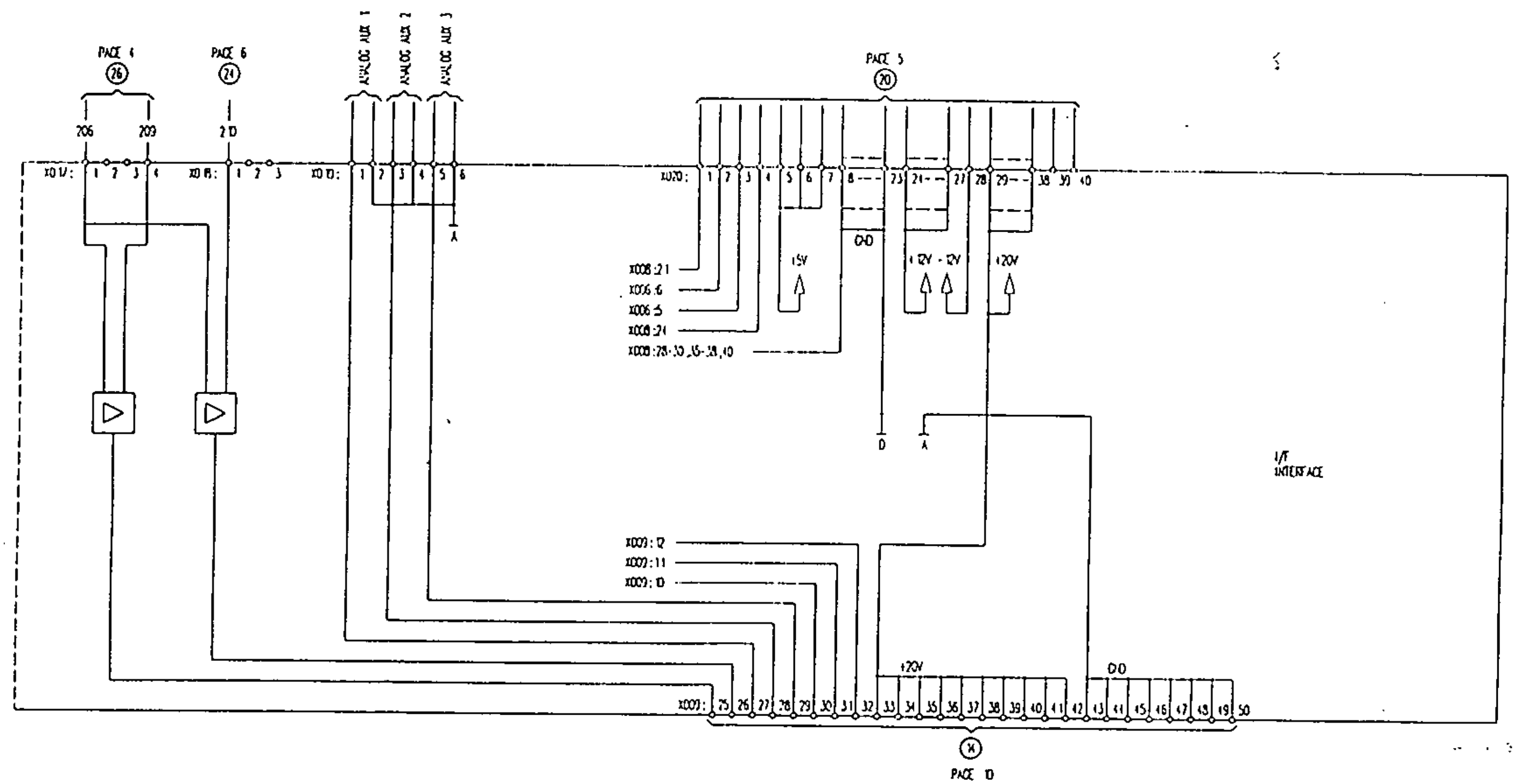
SCALE	TITLE
	Main Circuit Diagram DP 340-360 C, U
Page 8 of 10	DRAWING NO. 8.000.572



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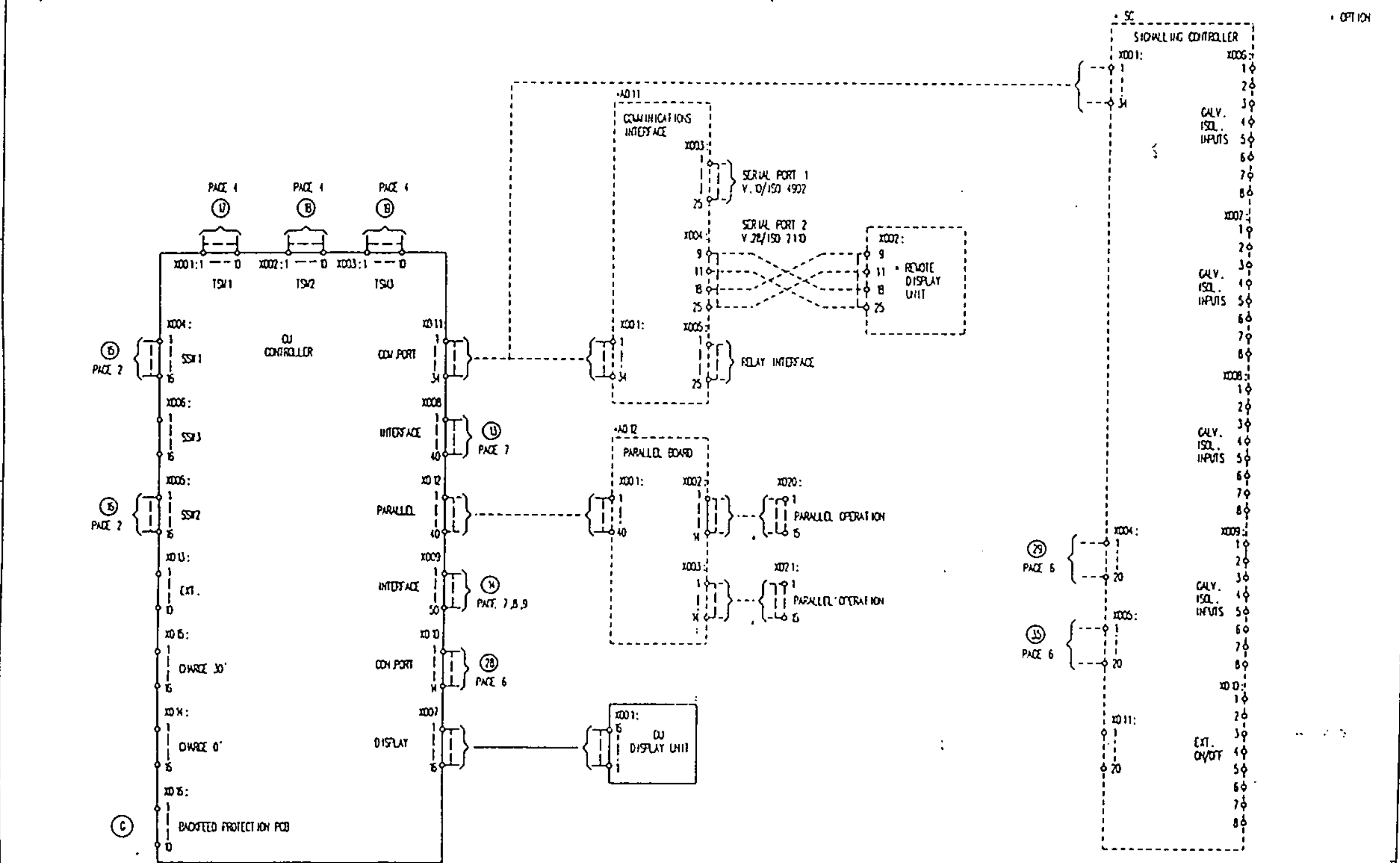
SCALE

TITLE Main Circuit Diagram DP 340-360 C, UL

Page 9 of 10

DRAWING NO. 8.000.572



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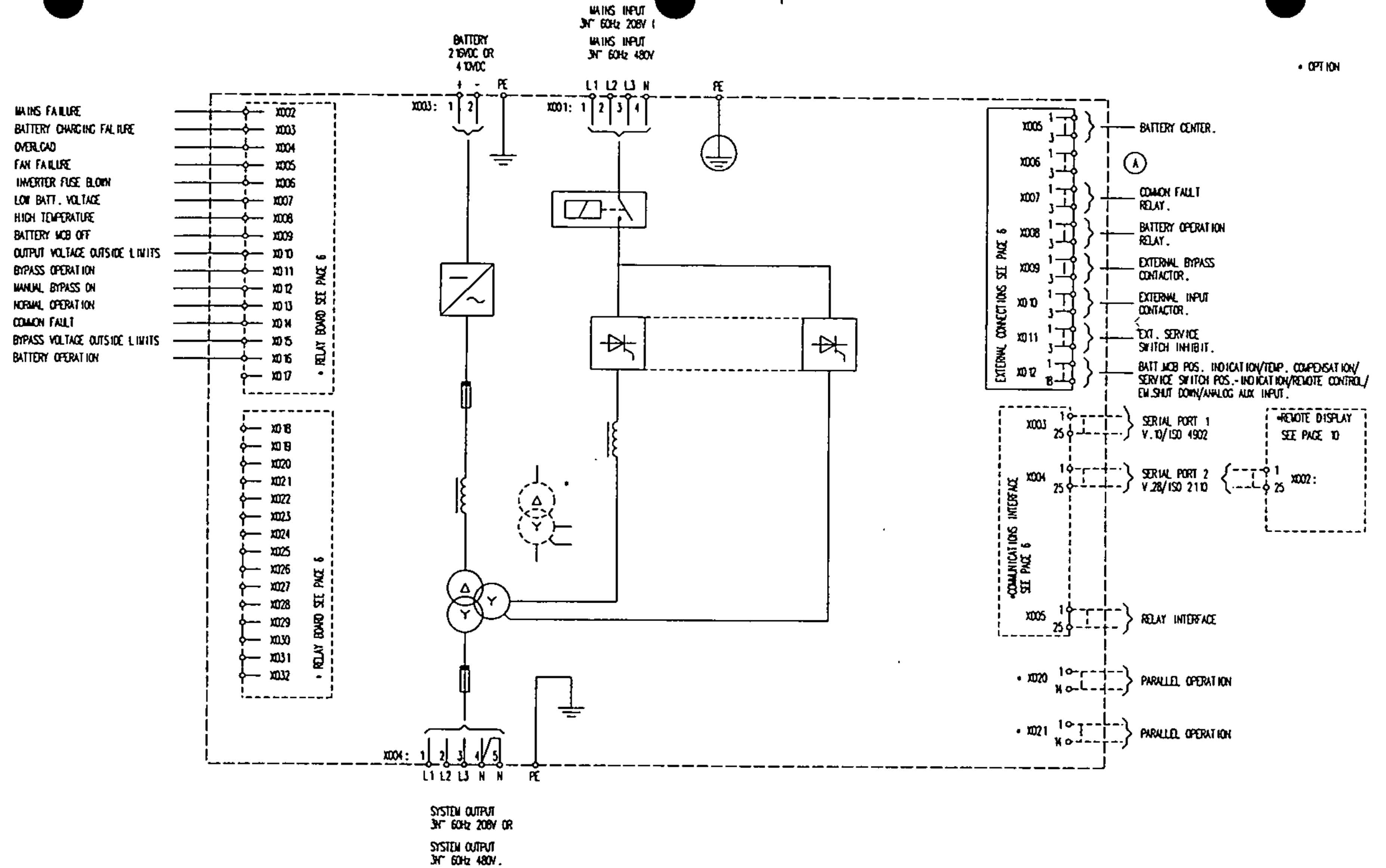
SCALE	TITLE
	Main Circuit Diagram DP 340-360 C, UL
Page 10 of 10	DRAWING NO. 8.000.572



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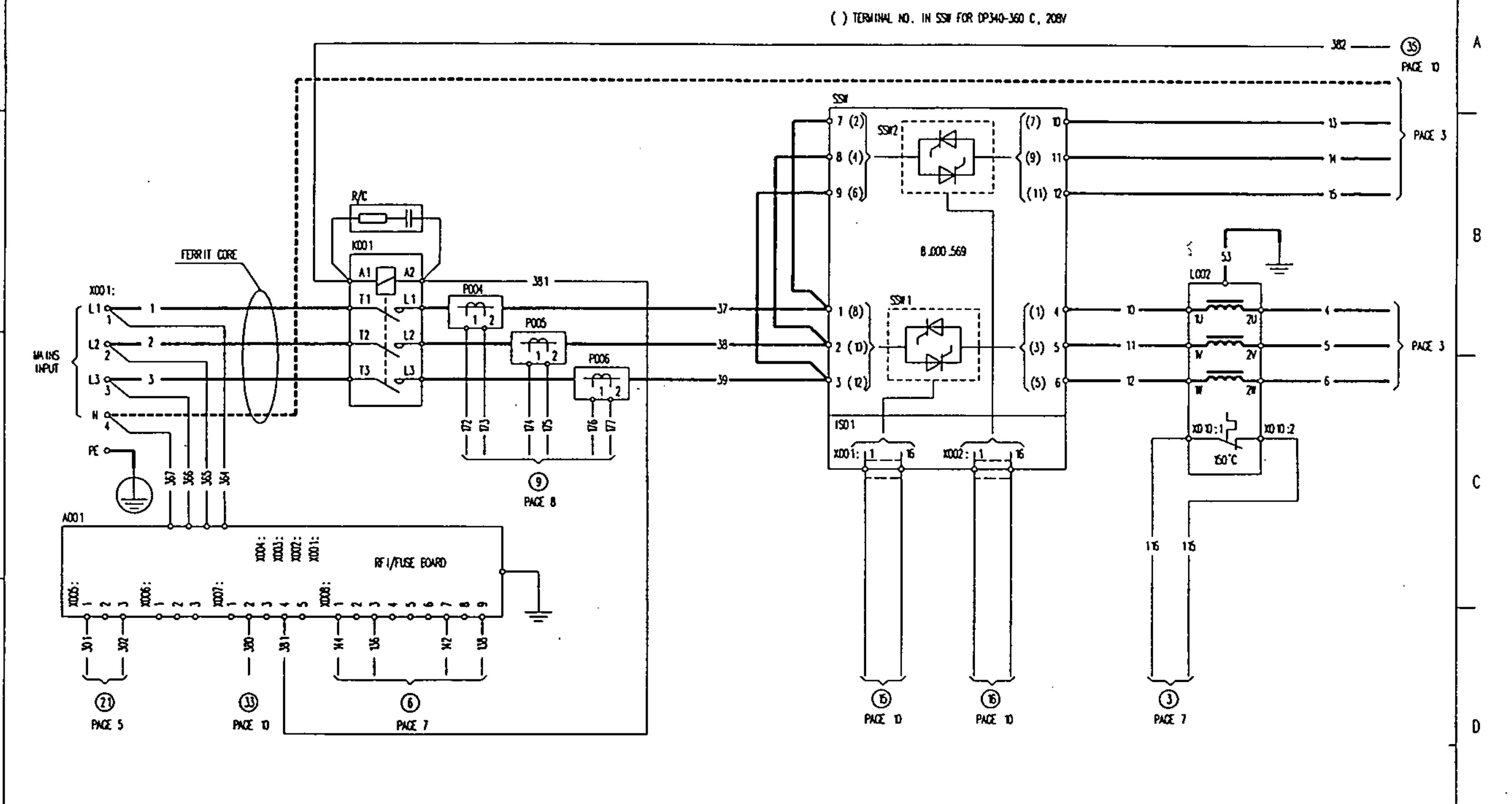
SCALE		TITLE	Main Circuit Diagram DP340-360C, UL
Page 1 of 10		DRAWING NO.	8.000.597

S139



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PAGE 2 OF 10		DRAWING NO. 8.000.597

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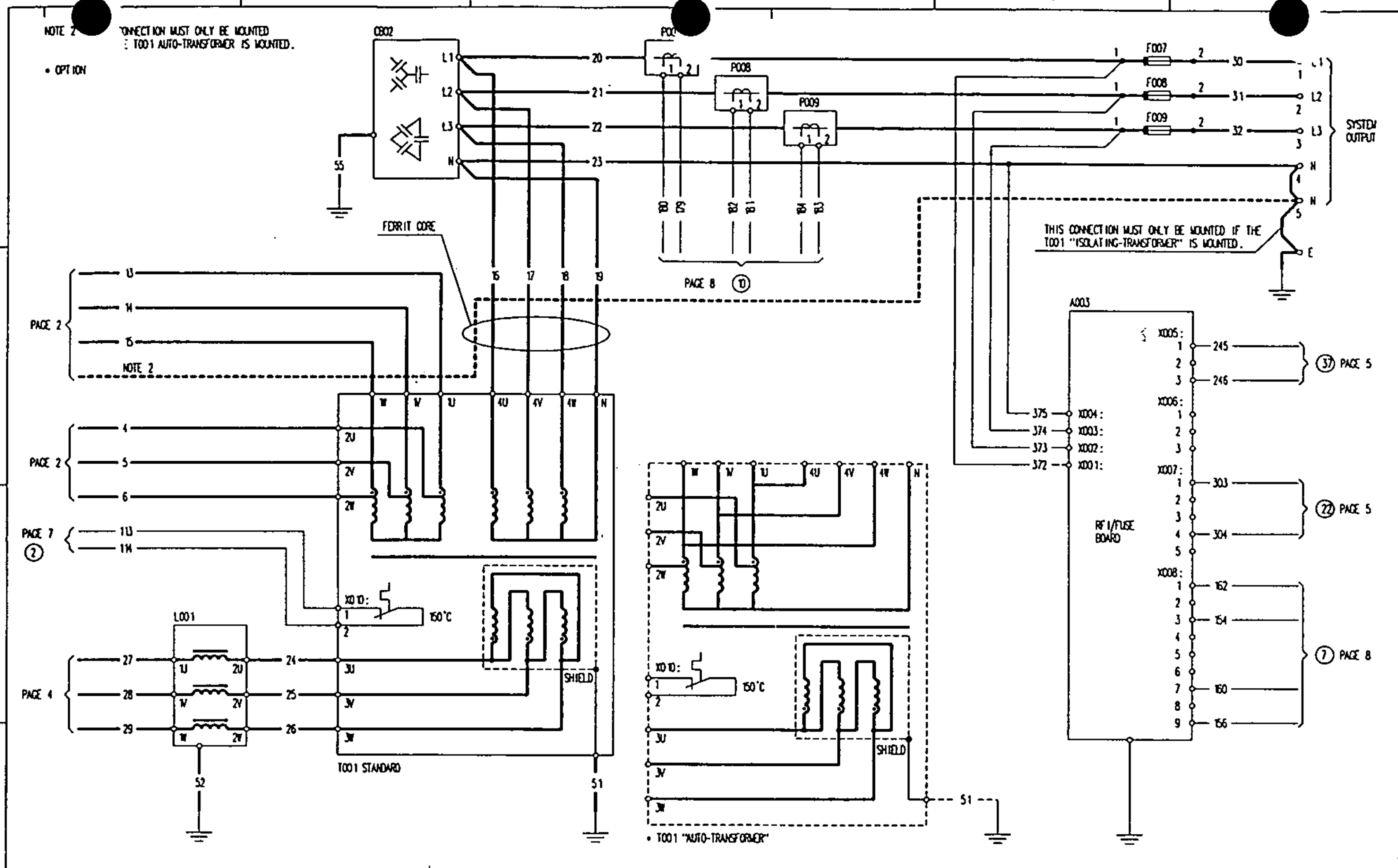

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SCALE		TITLE
		Main Circuit Diagram DP340-360C, UL
PAGE 3 OF 10		DRAWING NO. 8.000.597

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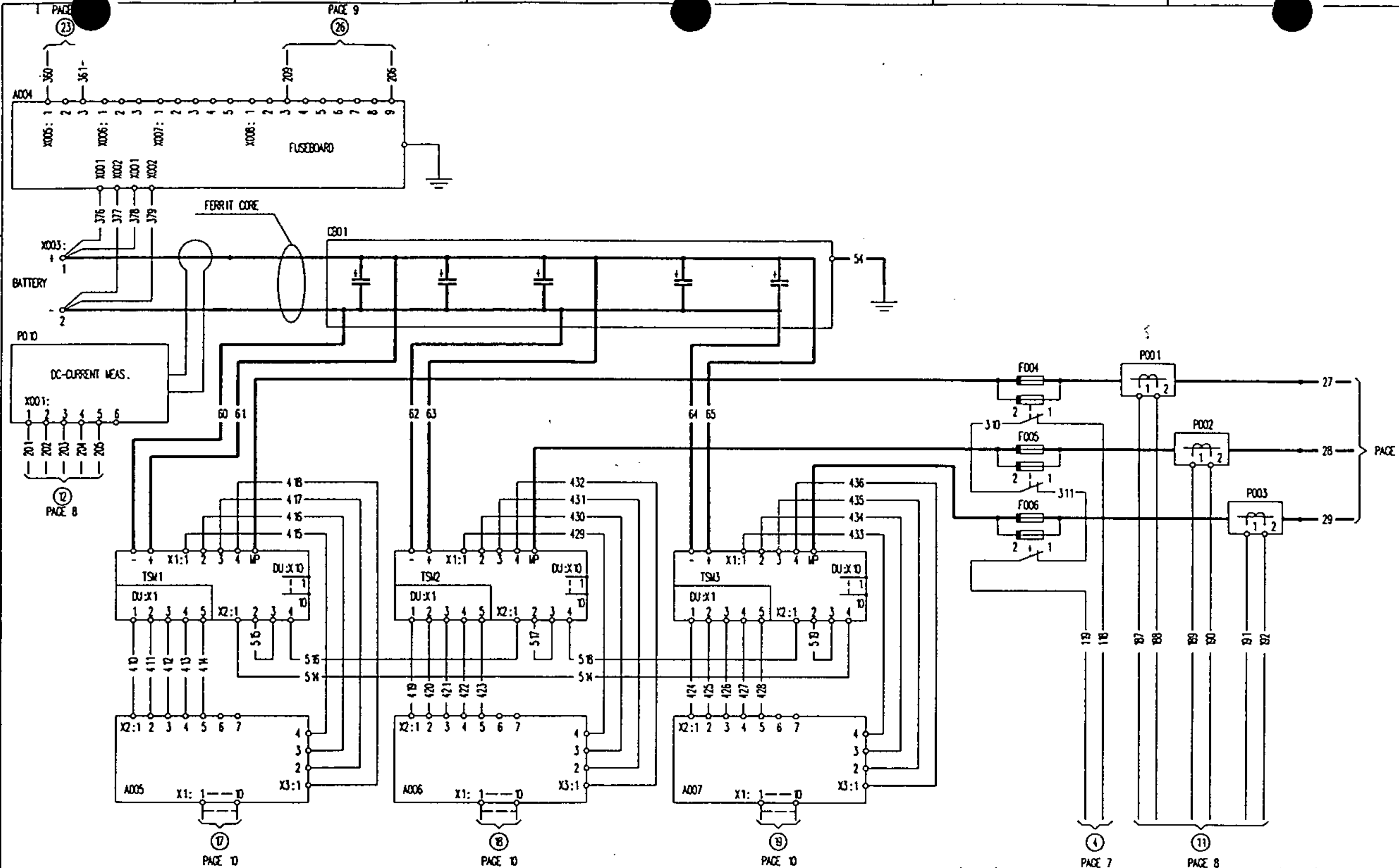

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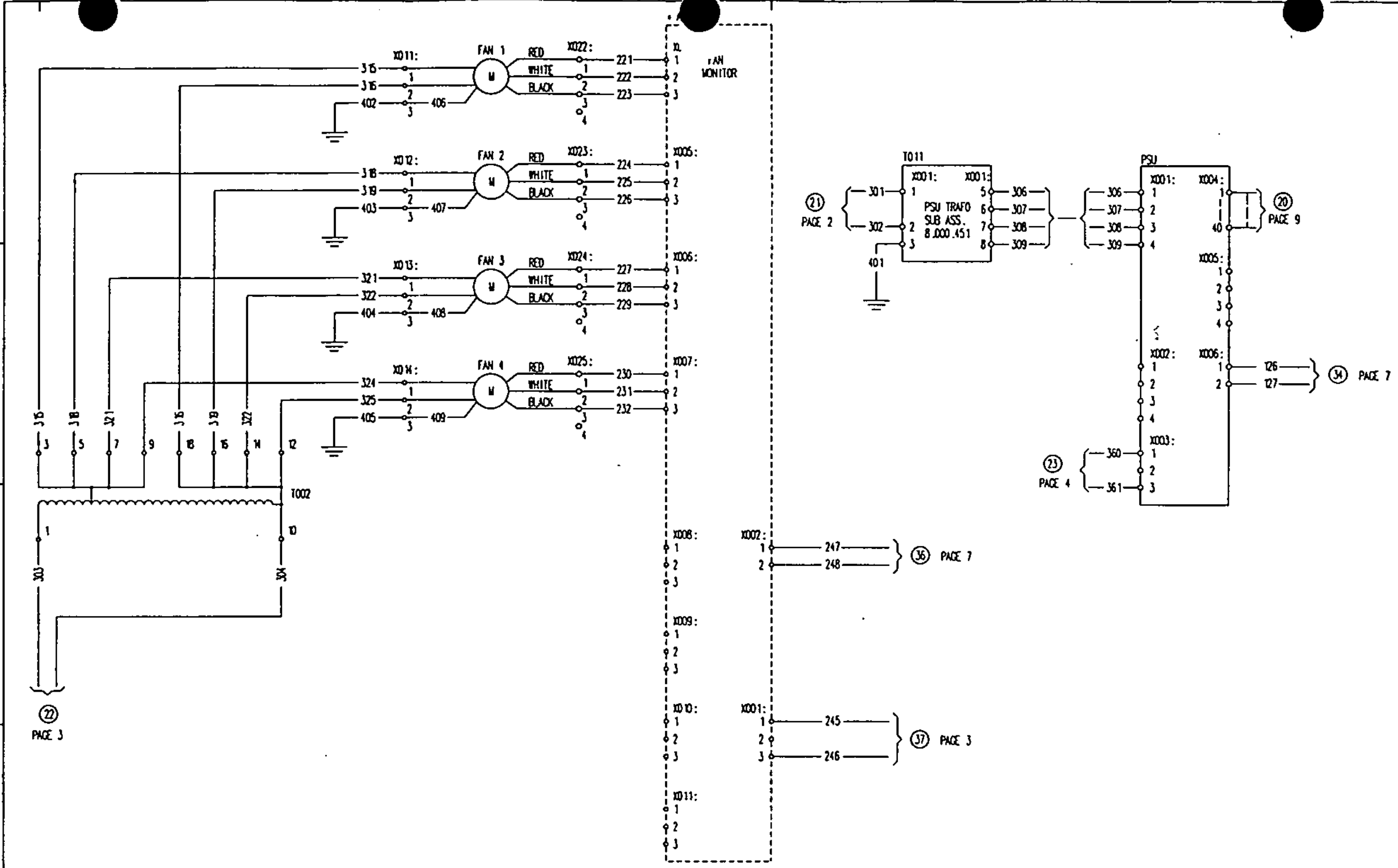
SCALE

TITLE Main Circuit Diagram DP340-360C, UL

PAGE 4 OF 10

DRAWING NO. 8.000.597

S139



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SCALE	DS/ISO 128	TITLE
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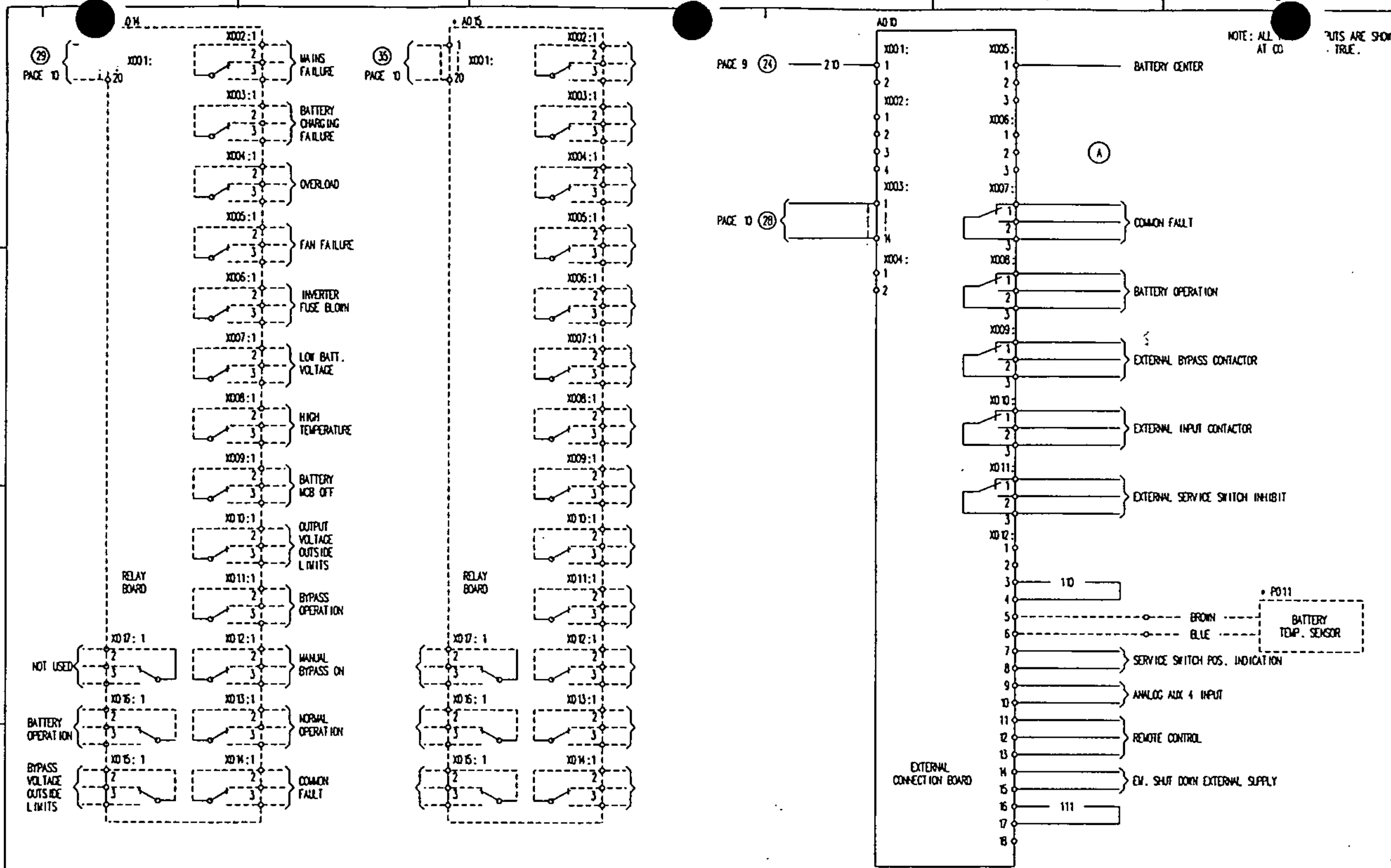
PAGE 5 OF 10		DRAWING NO. 8.000.597

6900036/01



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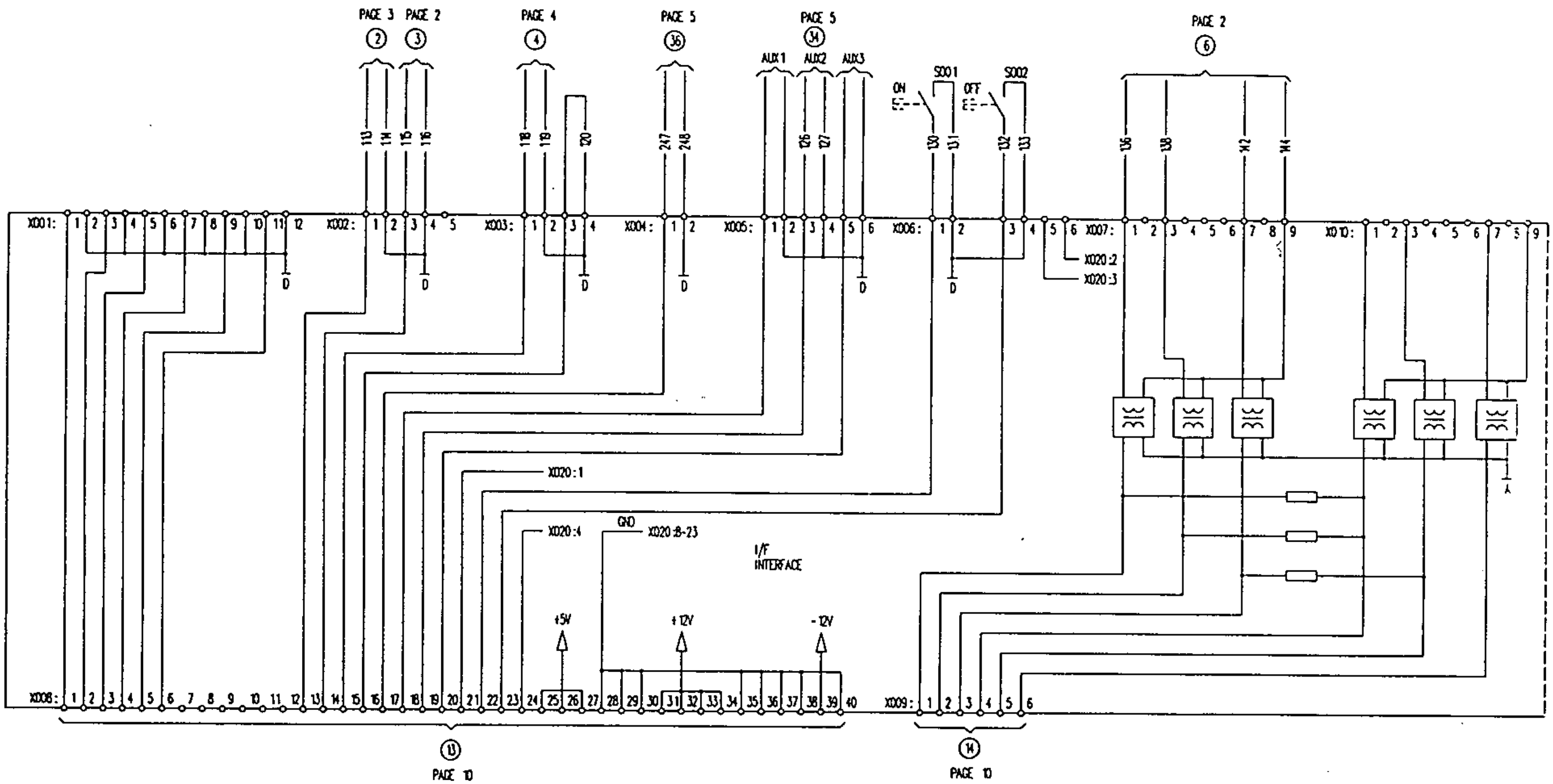
SCALE

TITLE Main Circuit Diagram DP340-360C, UL

Page 6 of 10

DRAWING NO. 8.000.597

S139



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SCALE		TITLE Main Circuit Diagram DP340-360C, UL
Page 7 of 10		DRAWING NO. 8.000.597

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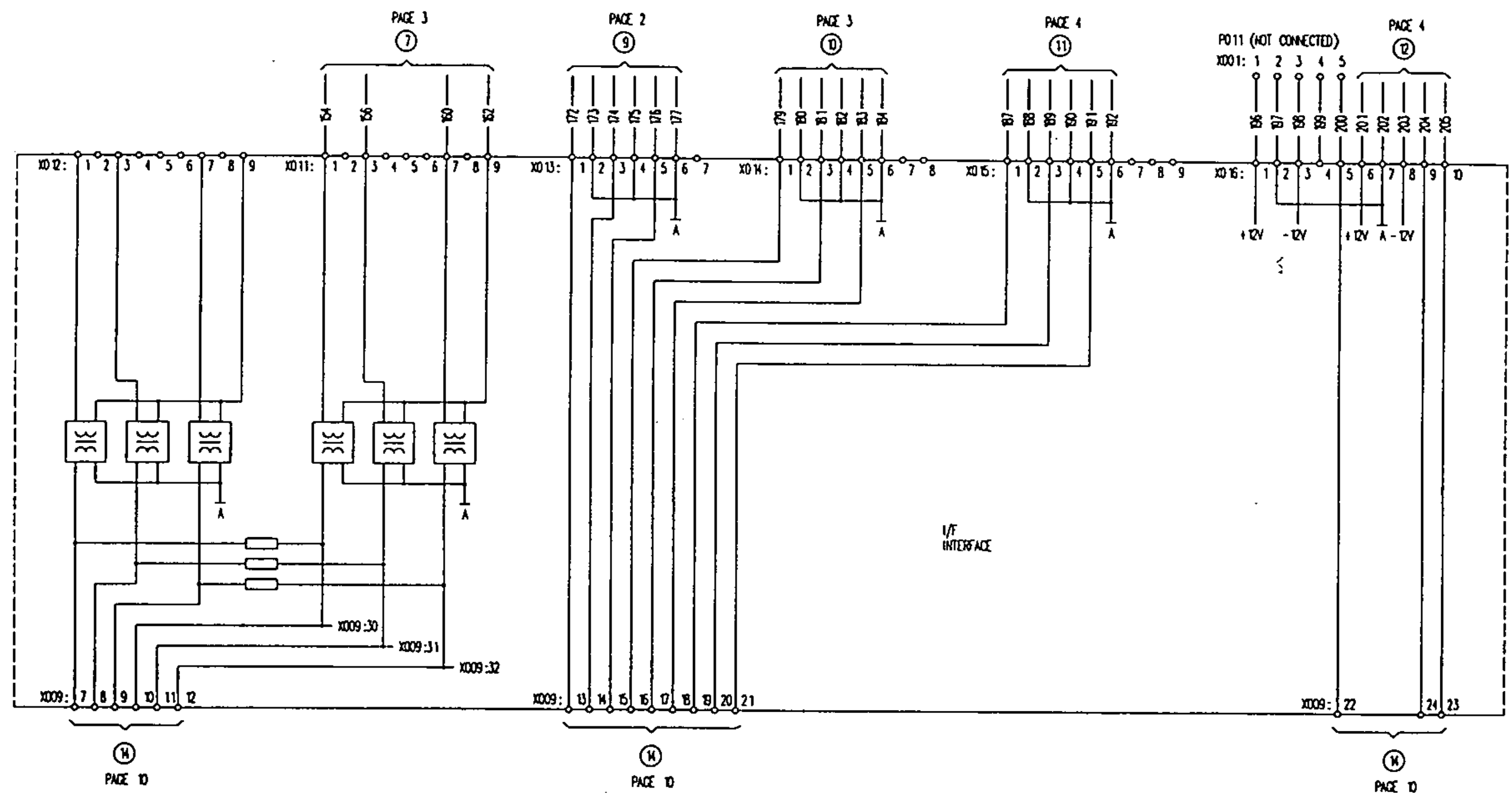

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SCALE

TITLE Main Circuit Diagram DP340-360C, UL

Page 8 of 10

DRAWING NO. 8.000.597

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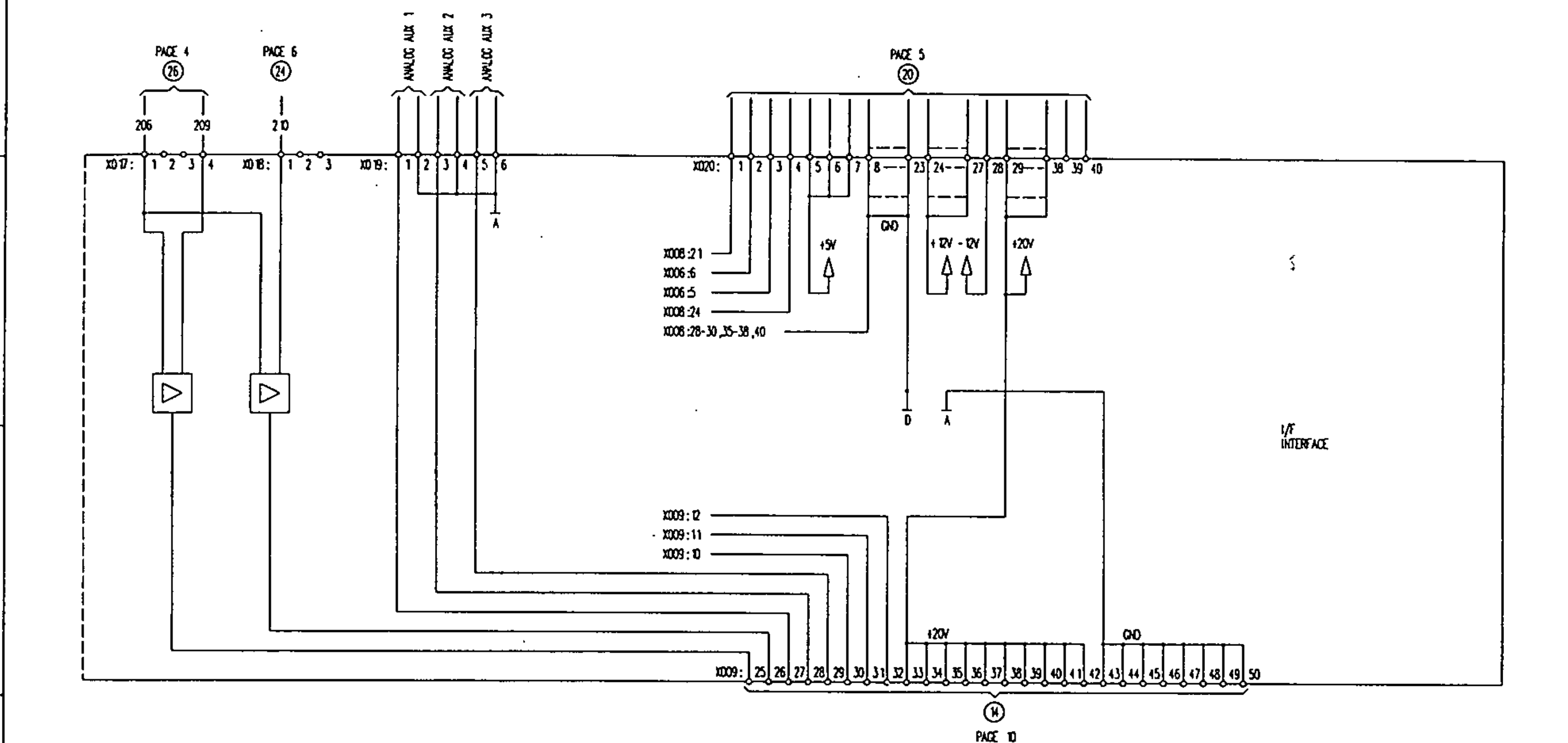

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SCALE		TITLE Main Circuit Diagram OP340-360C, UL
Page 9 of 10		DRAWING NO. 8.000.597

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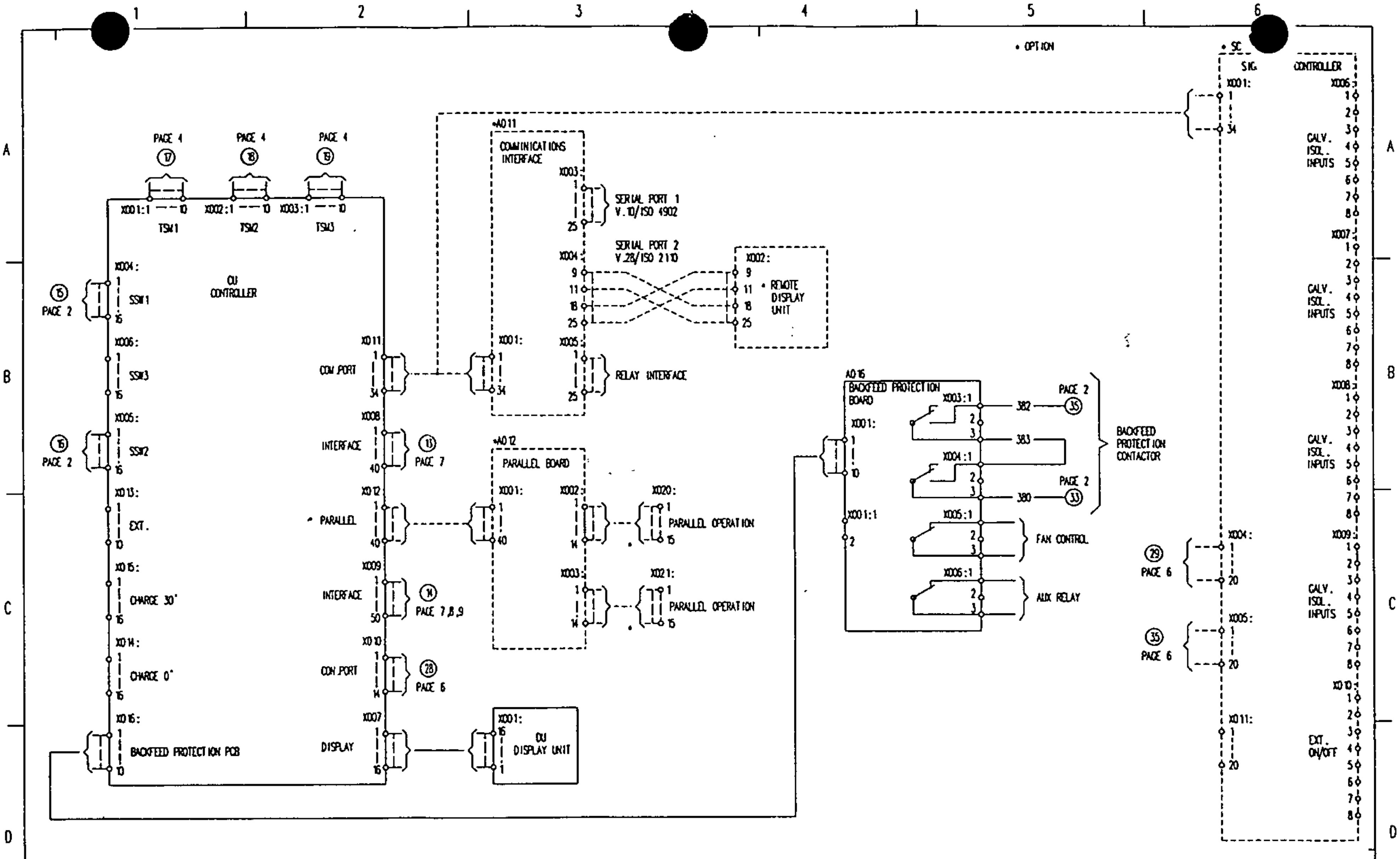

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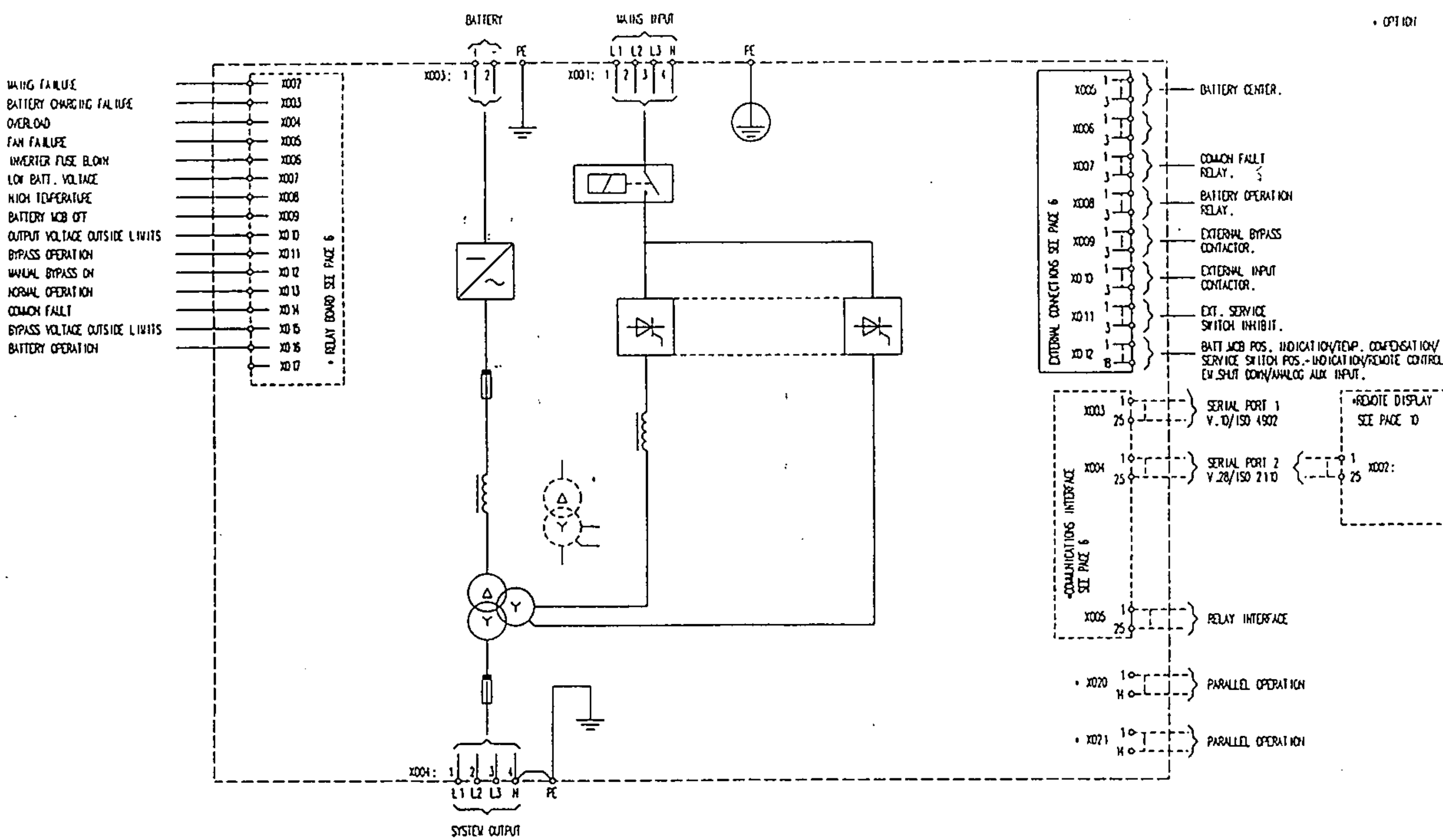

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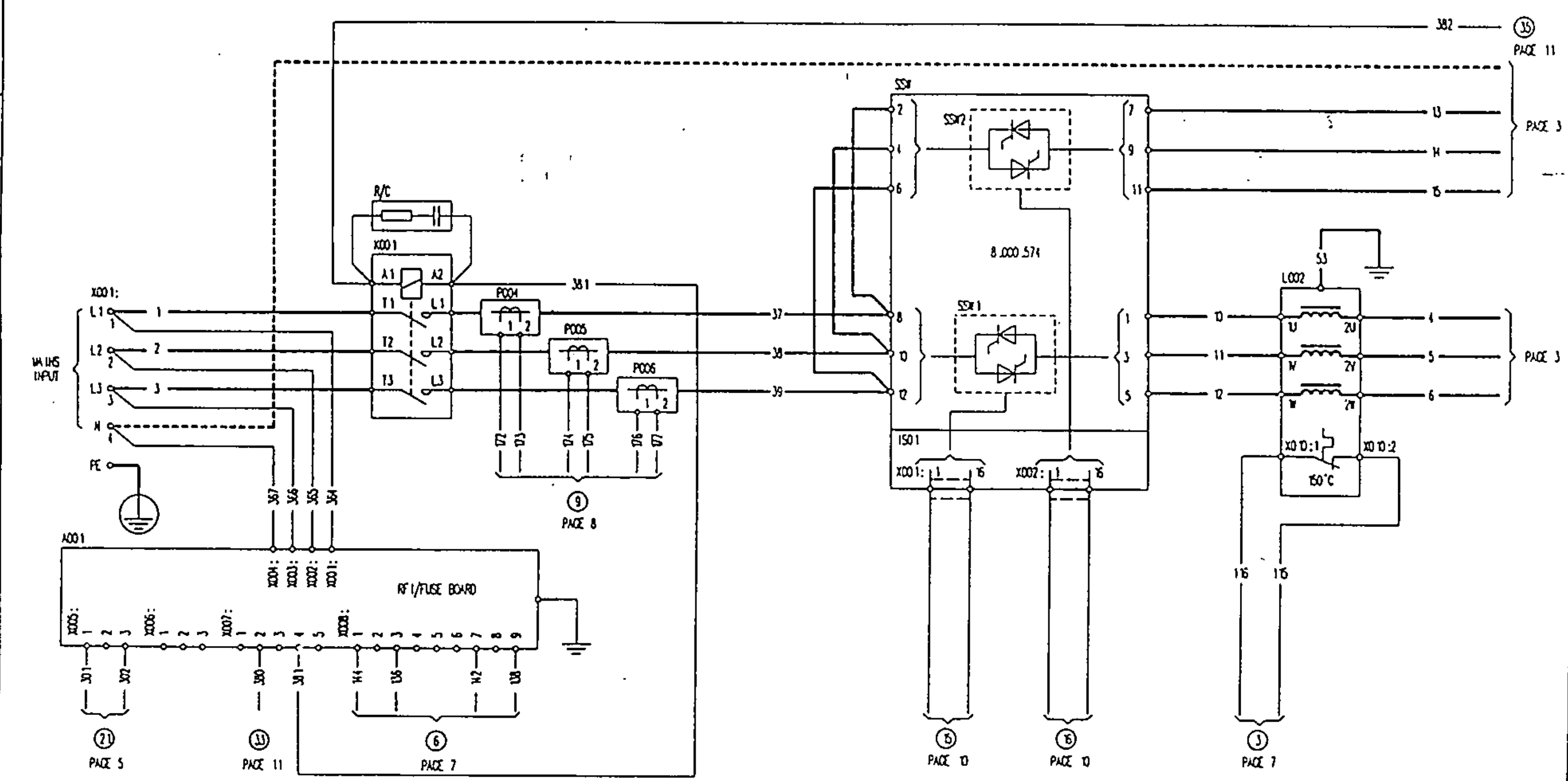
Page 1 of 11		DRAWING NO.	8.000.583



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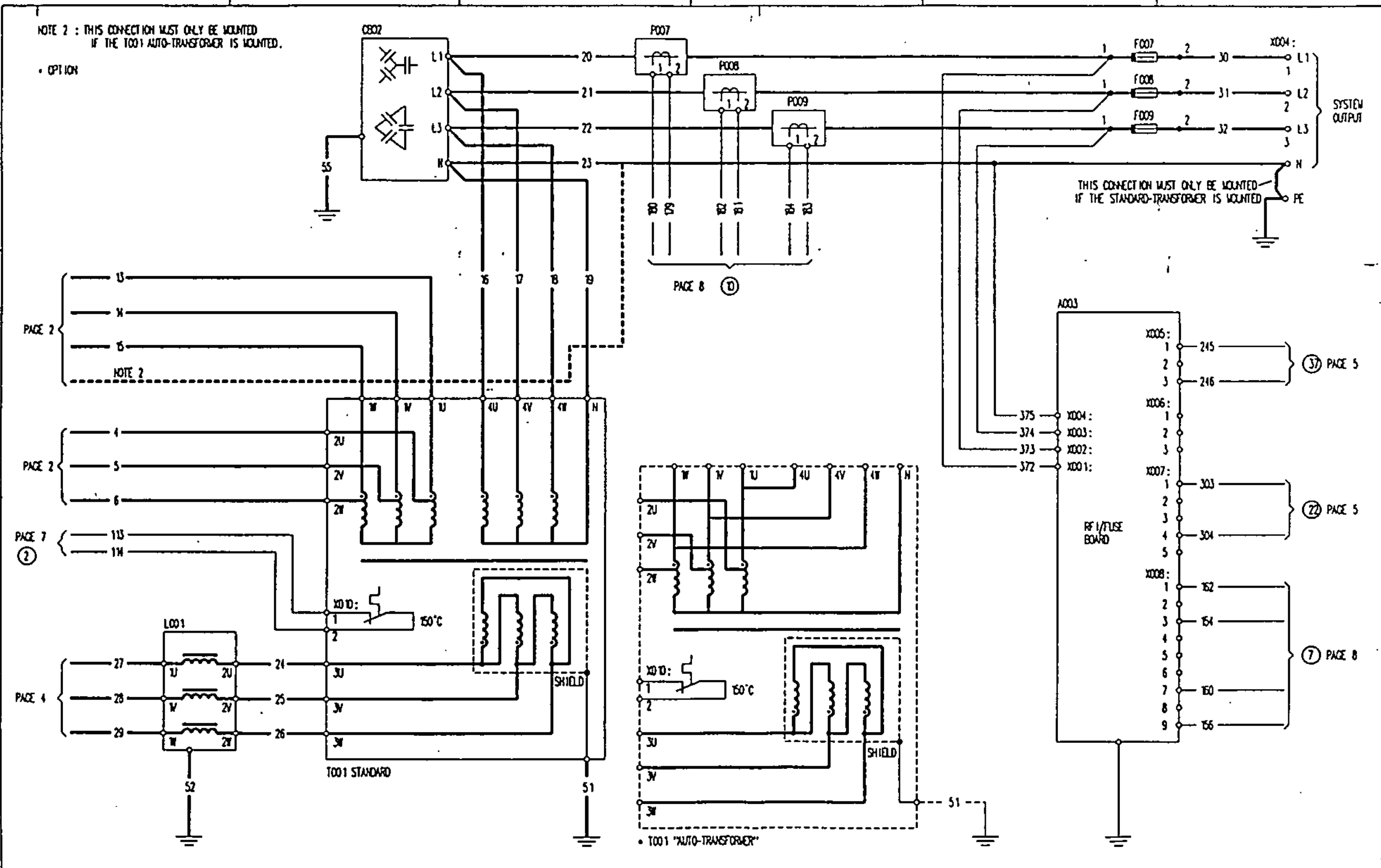

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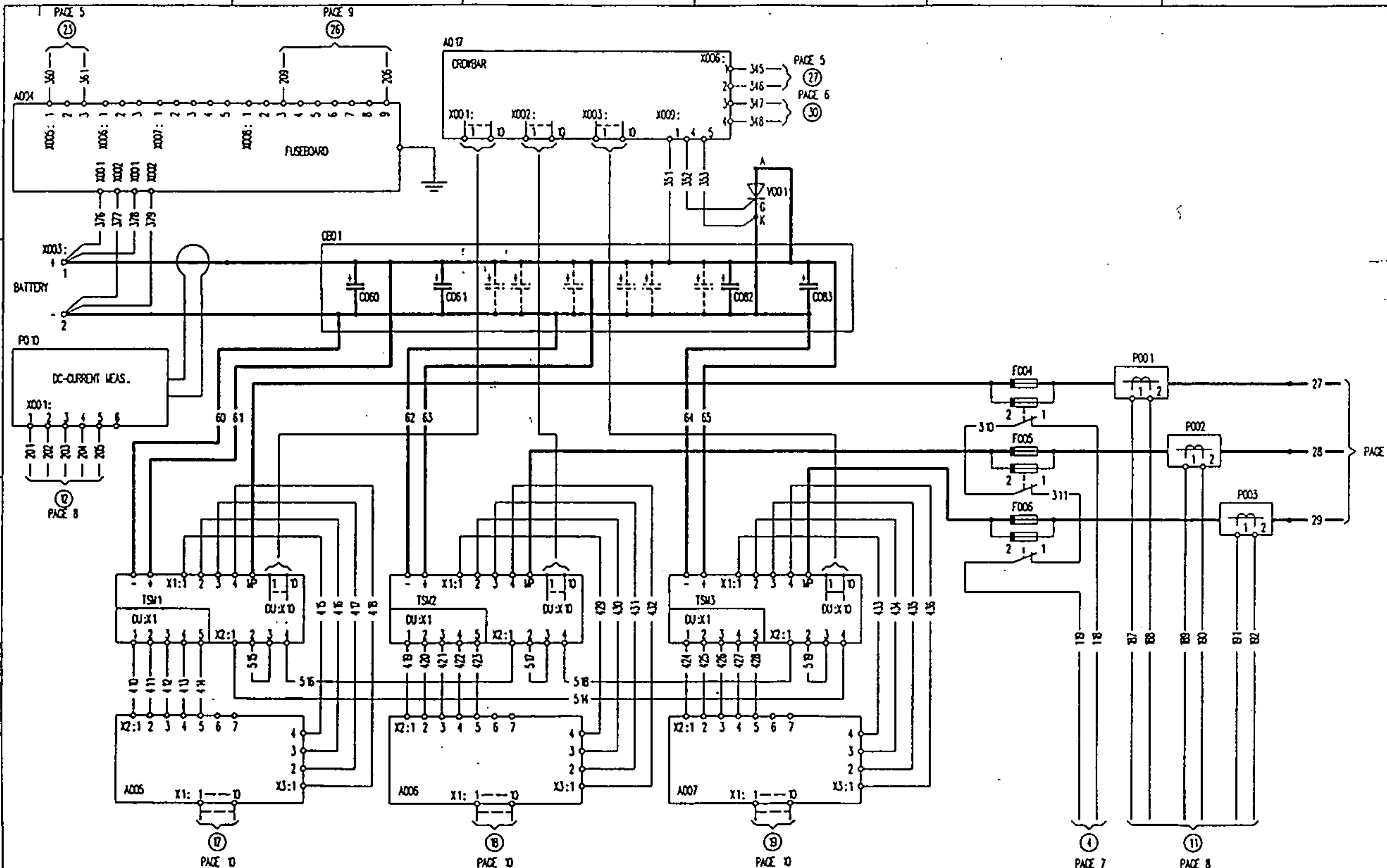
PAGE 3 OF 11		DRAWING NO. 8.000.583



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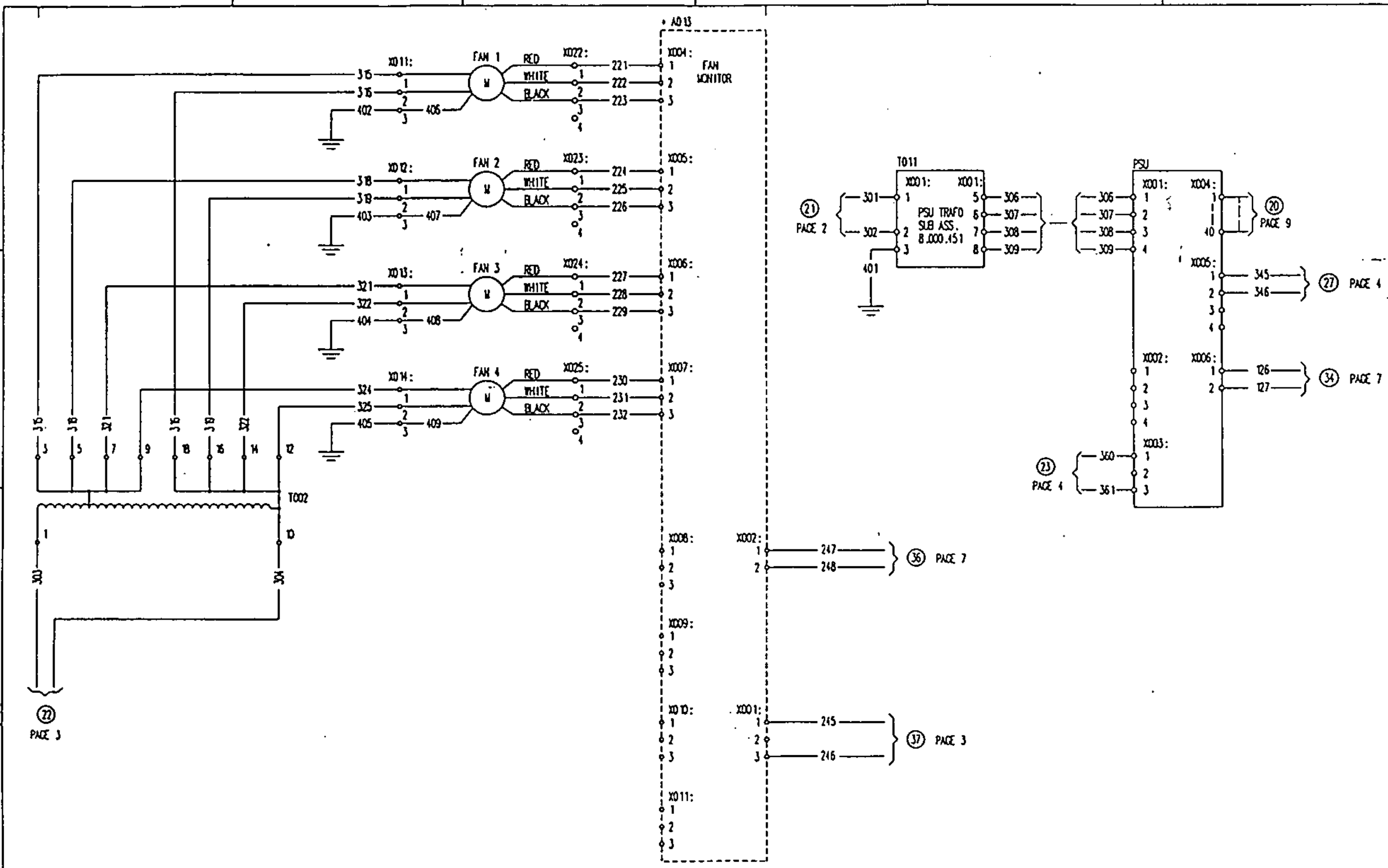
SCALE	TITLE
PAGE 4 OF 11	Main Circuit Diagram DP 380-3100 C, UL
	DRAWING NO. 8.000.583



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SCALE	DS/ISO 128	TITLE
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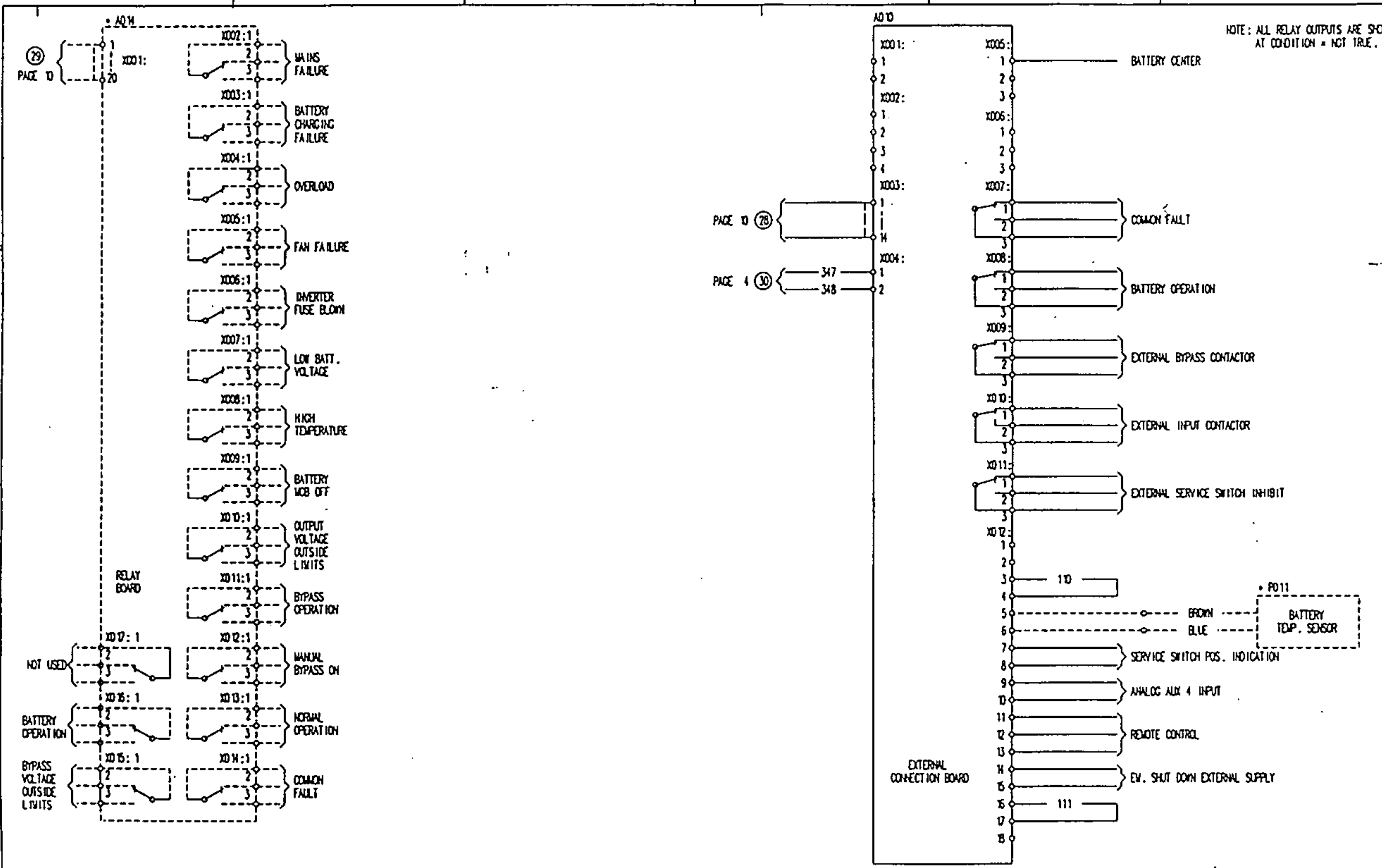
PAGE 5 OF 11		DRAWING NO. 8.000.583

69C0036/01



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SCALE	TITLE
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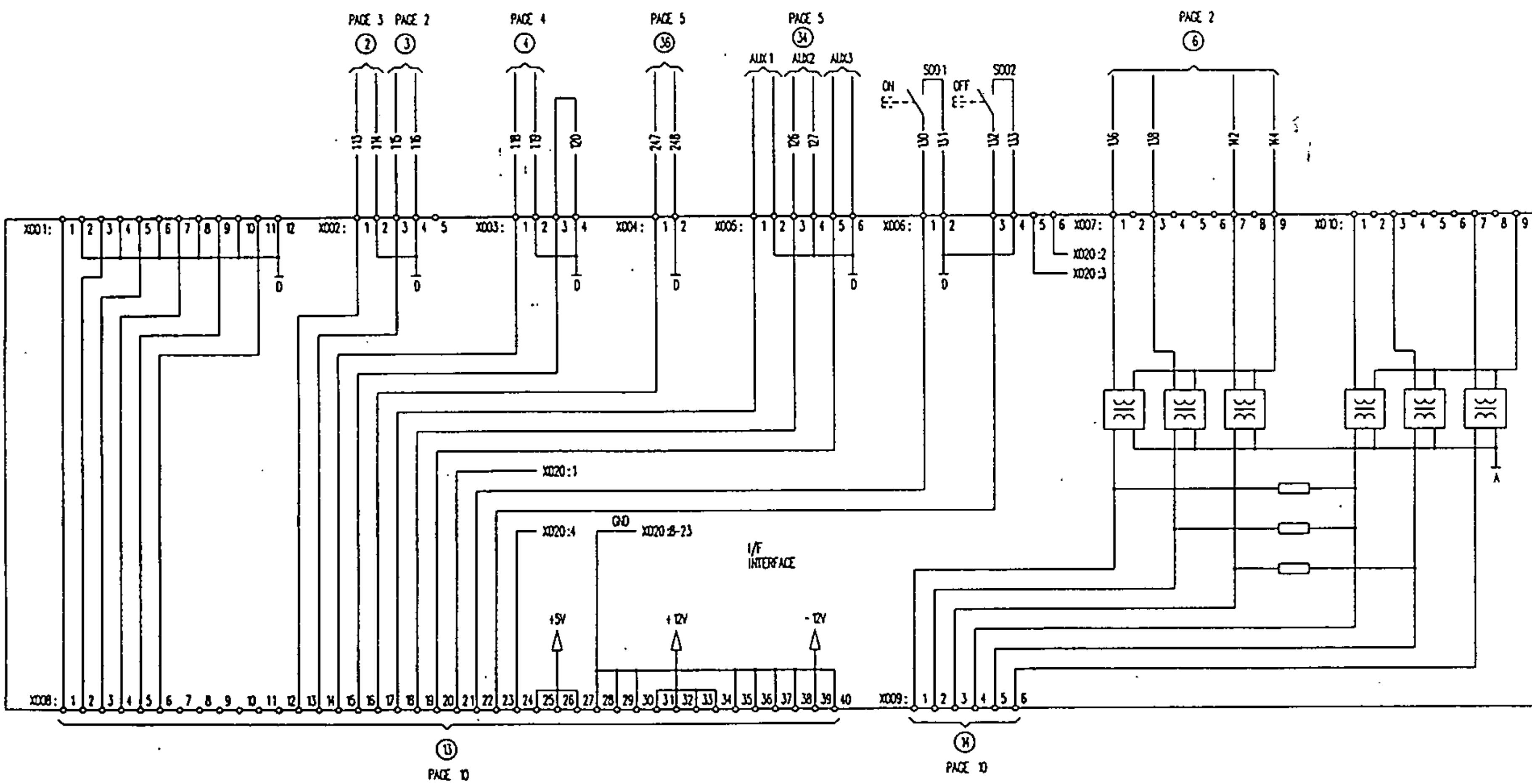
Page 6 of 11	DRAWING NO. 8.000.583



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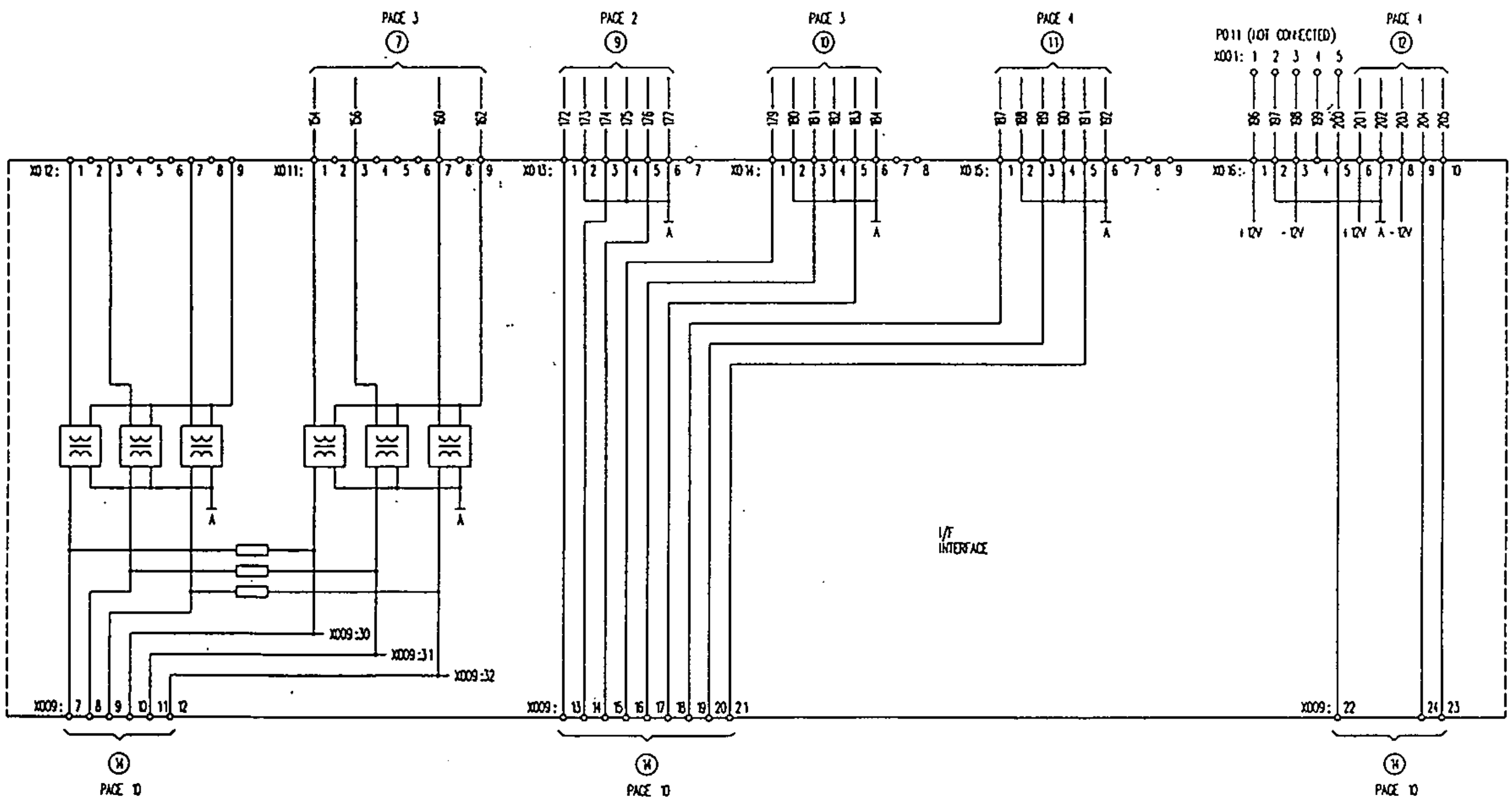
Page 7 of 11	DRAWING NO. 8.000.583



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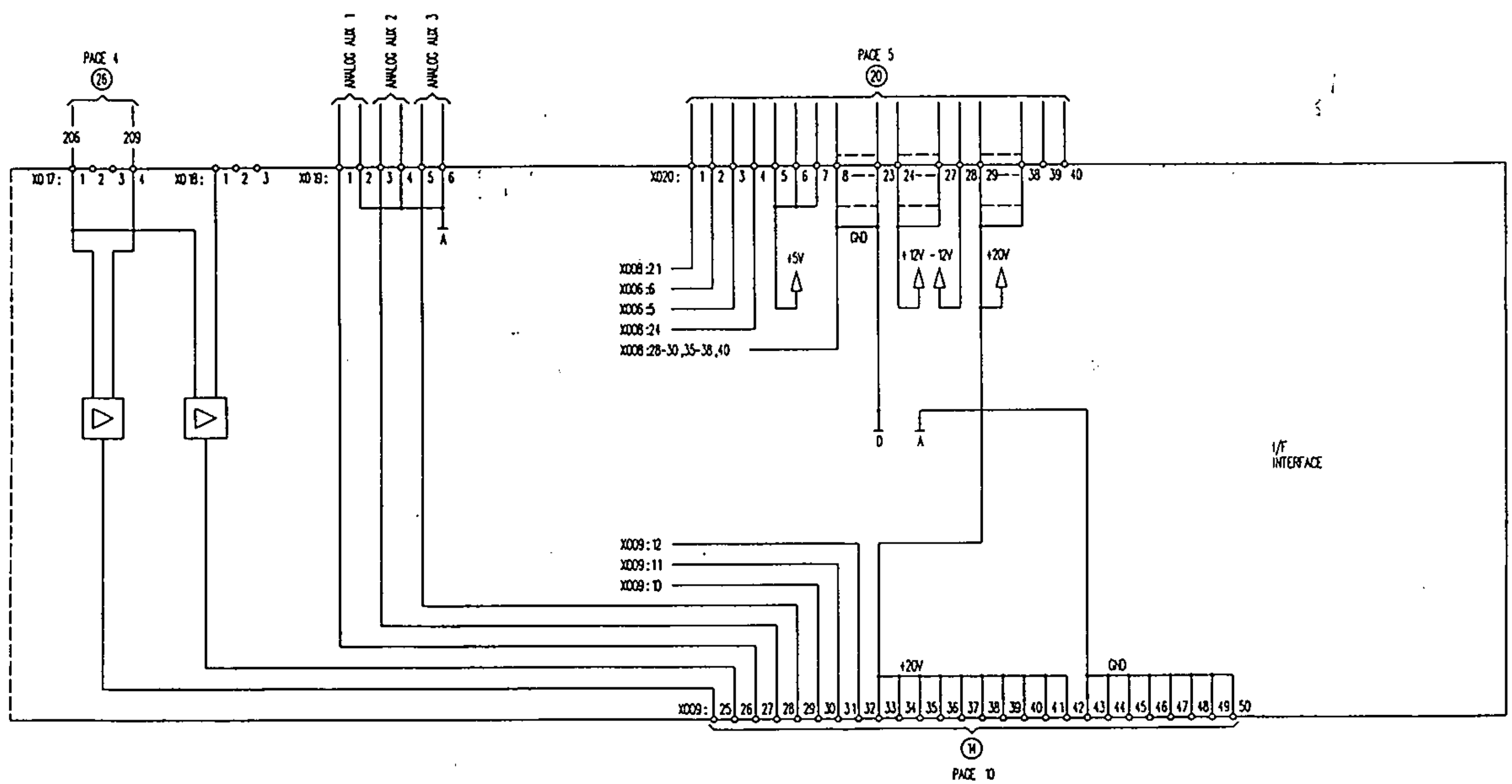
Page 8 of 11		DRAWING NO. 8.000.583



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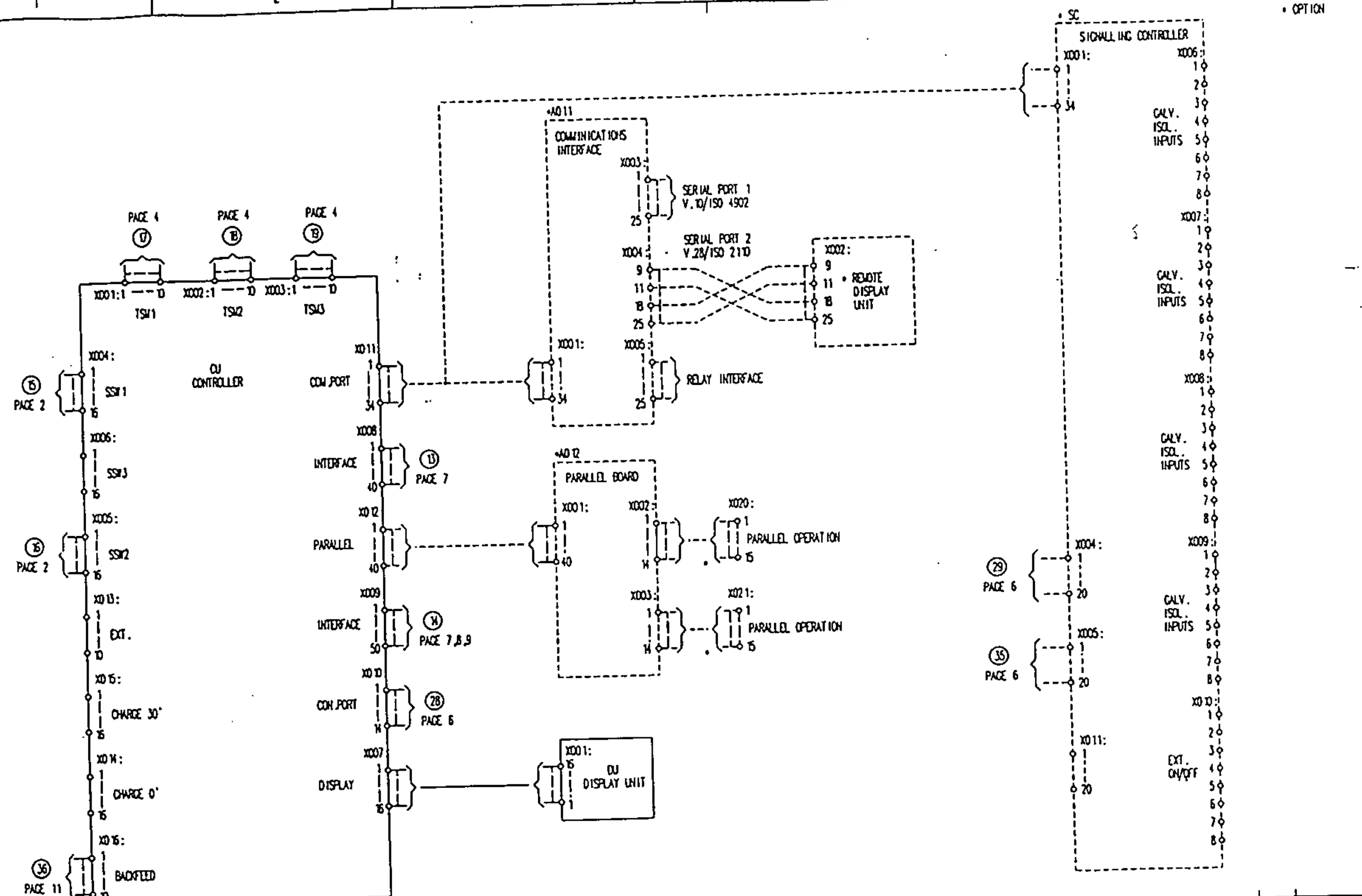
Page 9 of 11		DRAWING NO.	8.000.583



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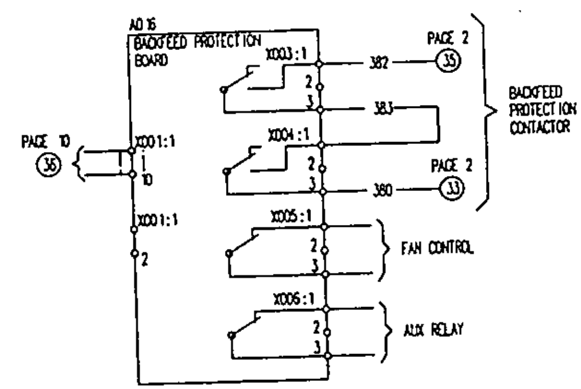
SCALE	TITLE
	Main Circuit Diagram DP 380-3100 C, UL
Page 10 of 11	DRAWING NO. 8.000.583



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CONTACTOR	: K001
MEA. UNITS	: P001-P011
FUSES	: F001-F007
TRANSFORMERS	: T011
POWER SWITCHES	: TSW1-TSW3

MARK.	CORRECTION	DATE	SIGN.

	DATE	SIGN.
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CHECKED	95.03.28	SC
ISSUE NO.	01	

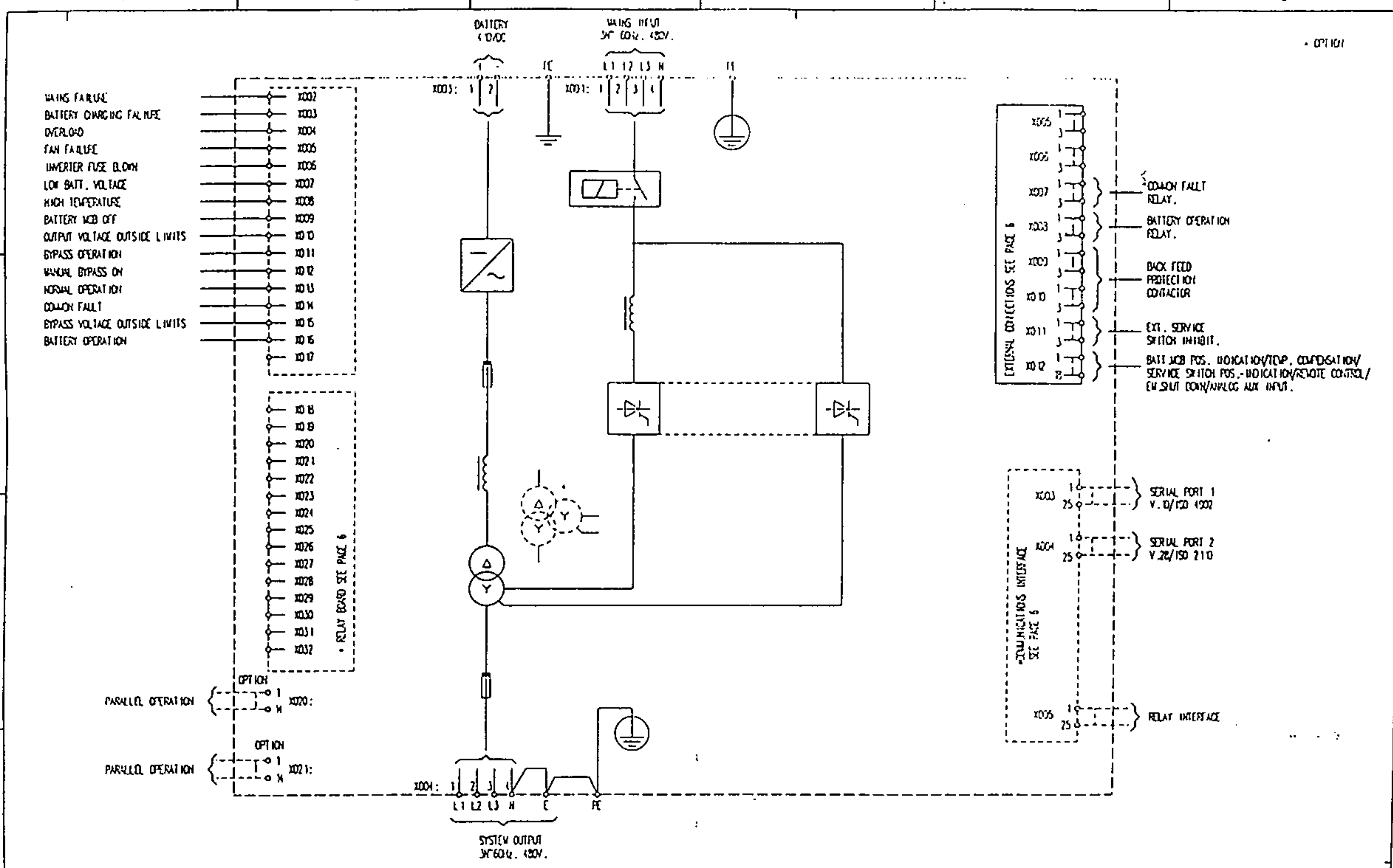
SCALE

TITLE Main Circuit Diagram DP 380-3100 C, UL

Page 11 of 11

DRAWING NO. 8.000.583

509



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SCALE

TITLE: Main Circuit Diagram DP 3120-3220 BEST.

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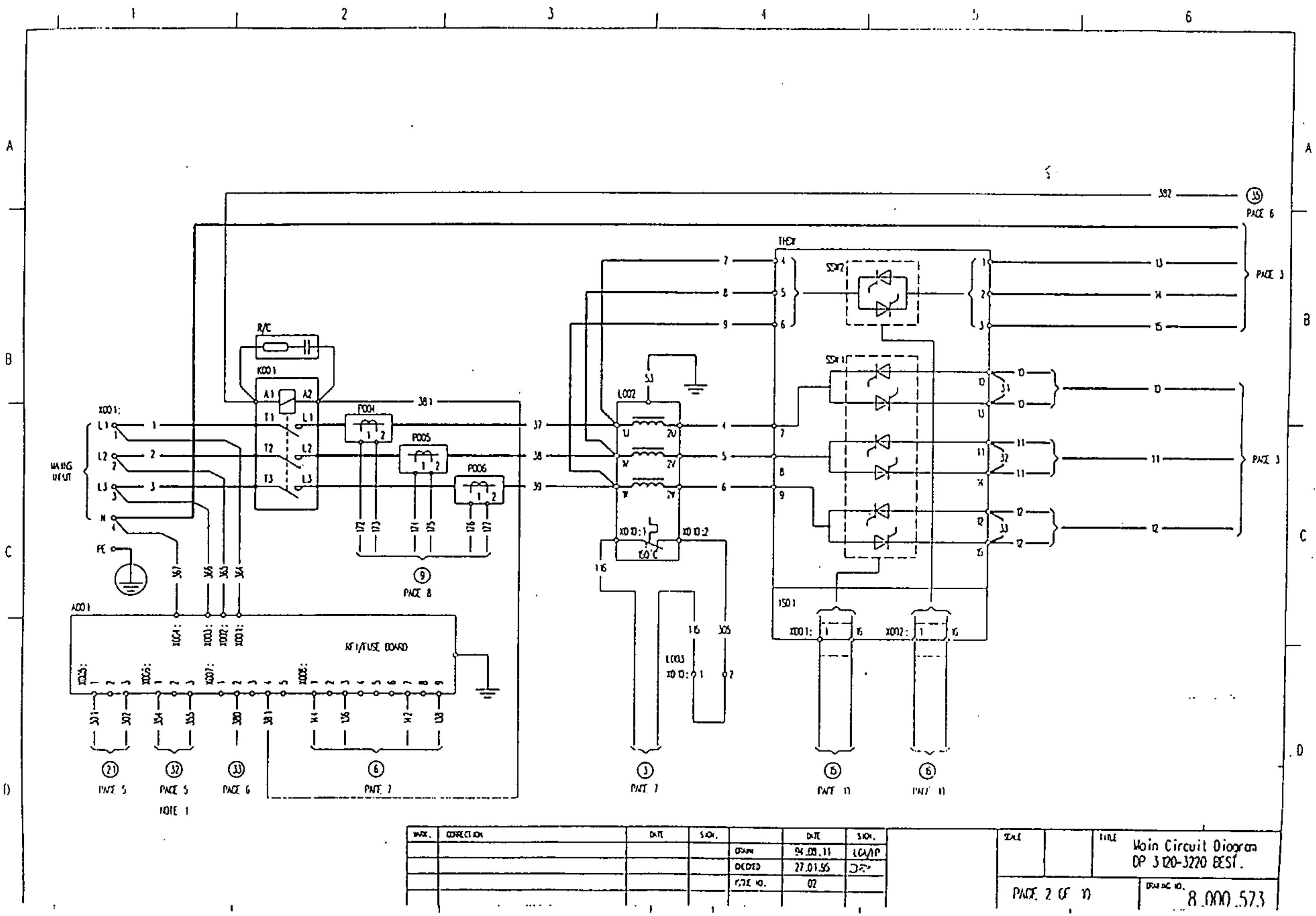
DRAWING NO. 8.000.573



Main Circuit Diagram
DP 3120-3220 BEST.
PAGE 2 OF 10
8.000.573
DRAWN 94.08.11
CHECKED 27.01.95
CODE NO. 02
MAINS INPUT
RFI/FUSE BOARD
A001
K001
R/C
P004
P005
P006
L002
L003
THCK
SCR1
SCR2
TSD1
PE
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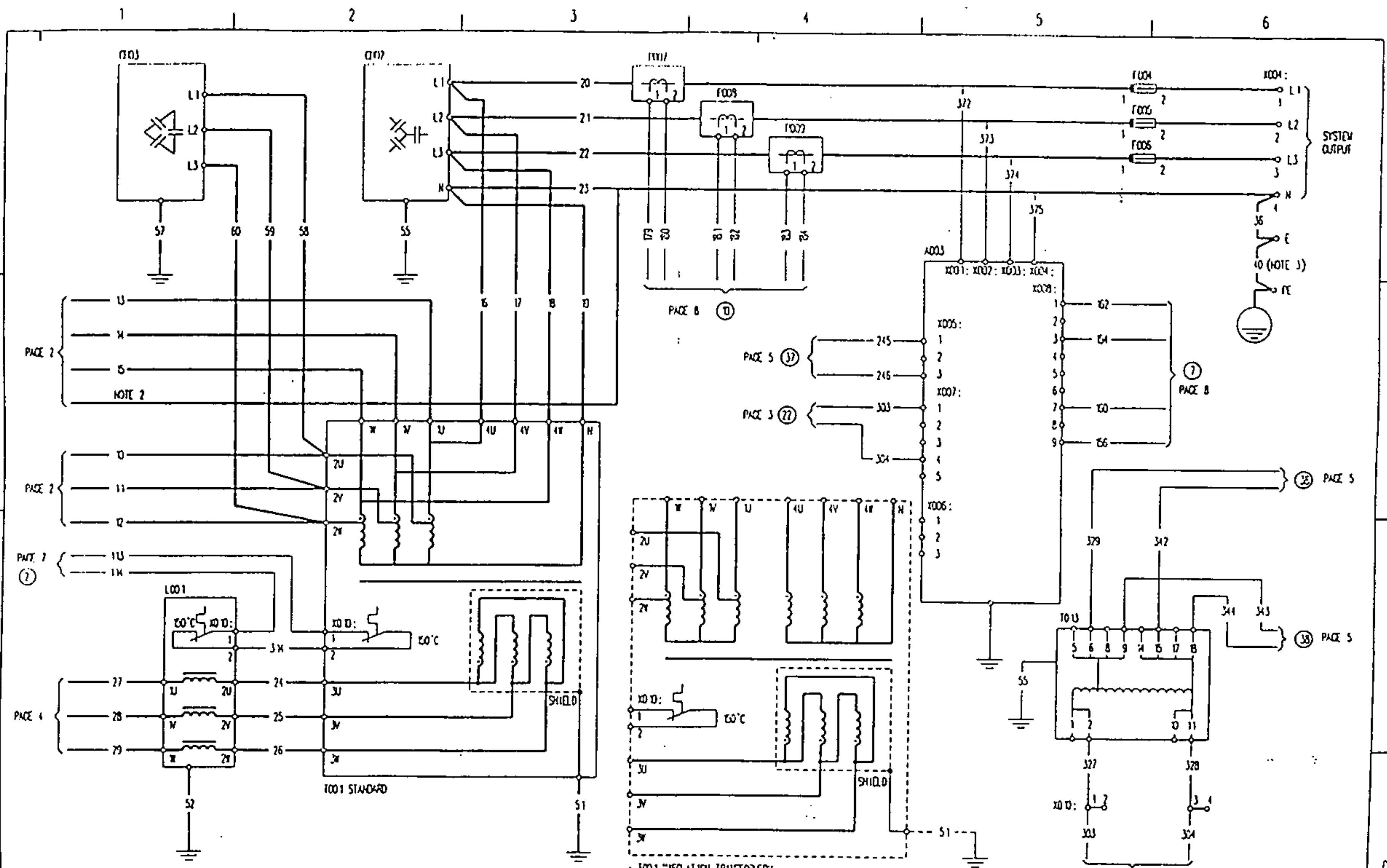
NOTE 1



NOTE 2 : THIS CONNECTION MUST ONLY BE MOUNTED IF THE T001 STANDARD TRANSFORMER IS MOUNTED.

• OPTION

NOTE 3 : THIS CONNECTION MUST ONLY BE MOUNTED IF T001 ISOLATED TRANSFORMER IS MOUNTED.

MARK	CORRECTION	DATE	SIGN.		DATE	SIGN.
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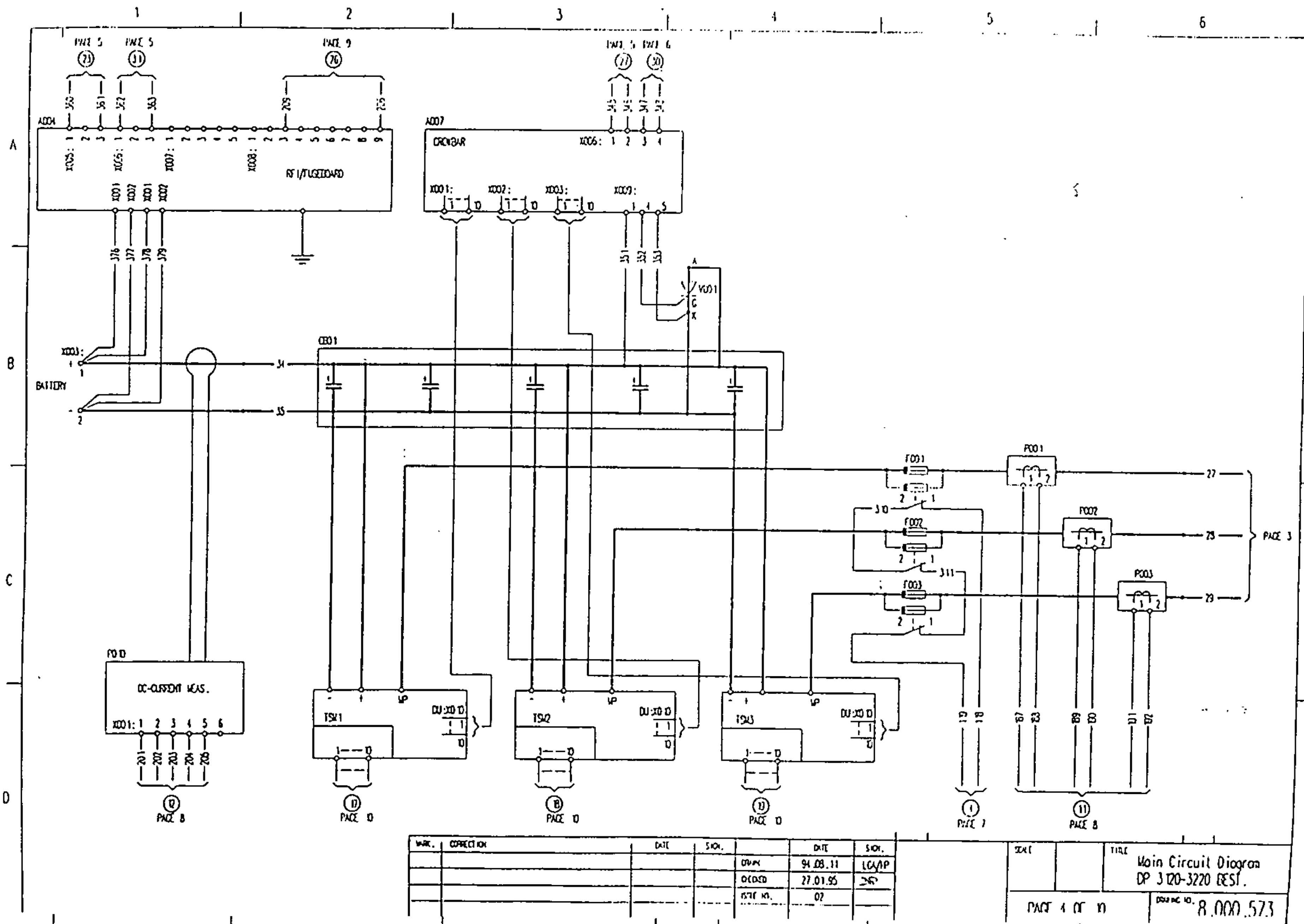
SCALE

TITLE: Main Circuit Diagram DP 3120-3220 BEST.

PAGE 3 OF 10

DRAWING NO. 8.000.573


A004
RFI/FUSEBOARD
A007
CROWBAR
BATTERY
CE01
VU01
DC-CURRENT MEAS.
TSU1
TSU2
TSU3
F001
F002
F003
P001
P002
P003
PAGE 3
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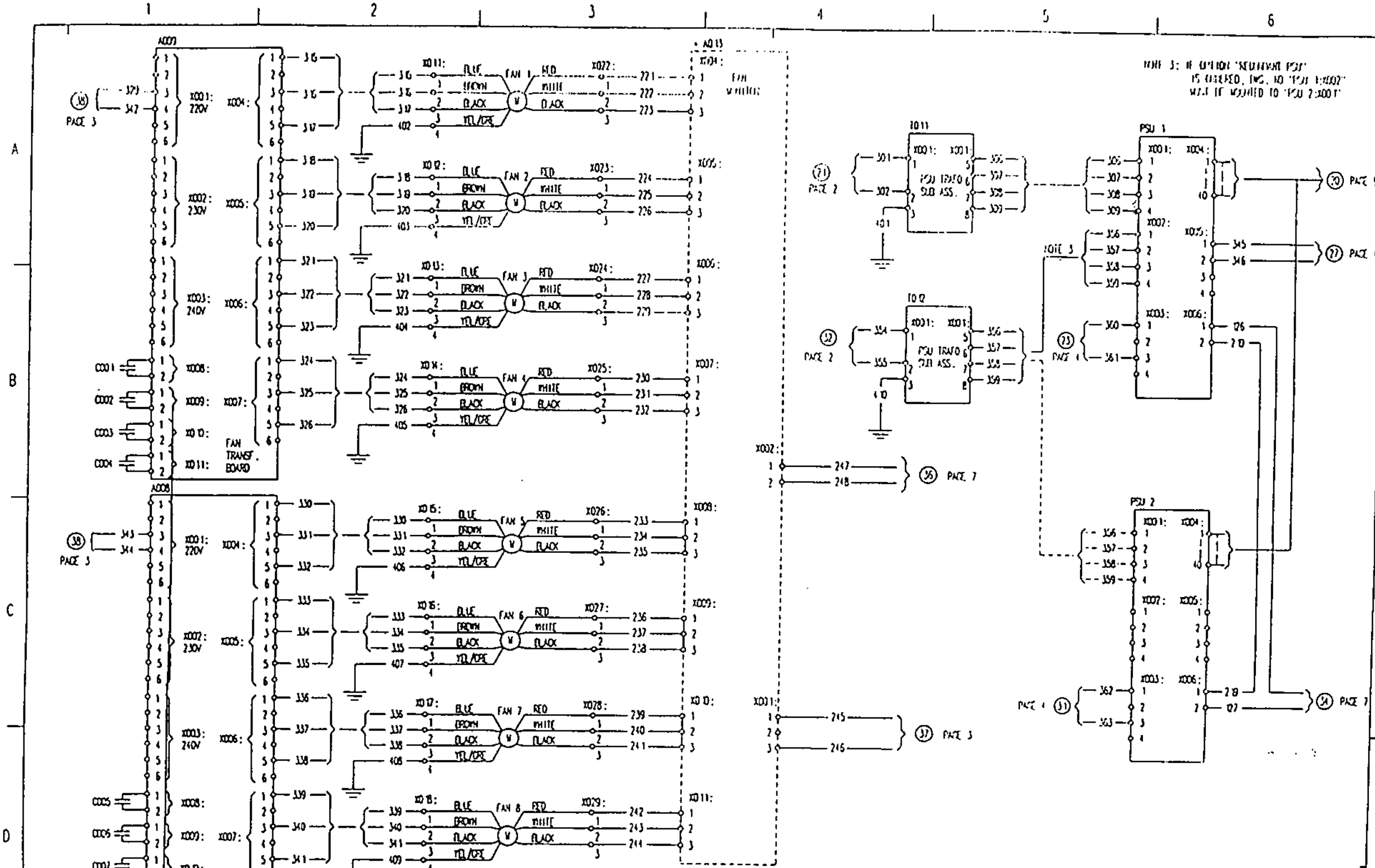
Main Circuit Diagram
DP 3120-3220 BEST.
PAGE 4 OF 10
8.000.573
94.08.11
27.01.95
LG/AP
02



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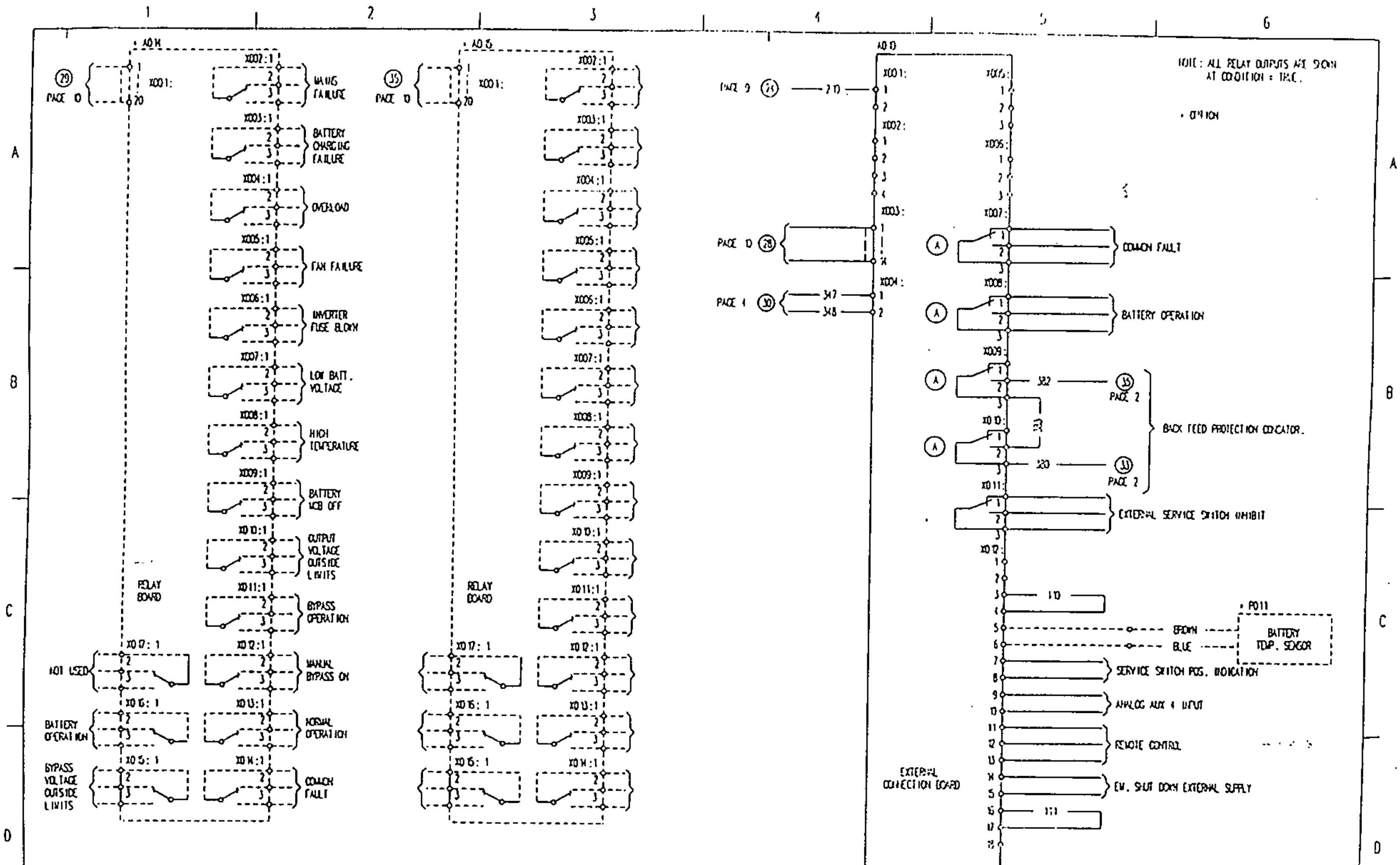
PAGE 5 OF 10		DRAWING NO. 8.000.573

67000.35/01



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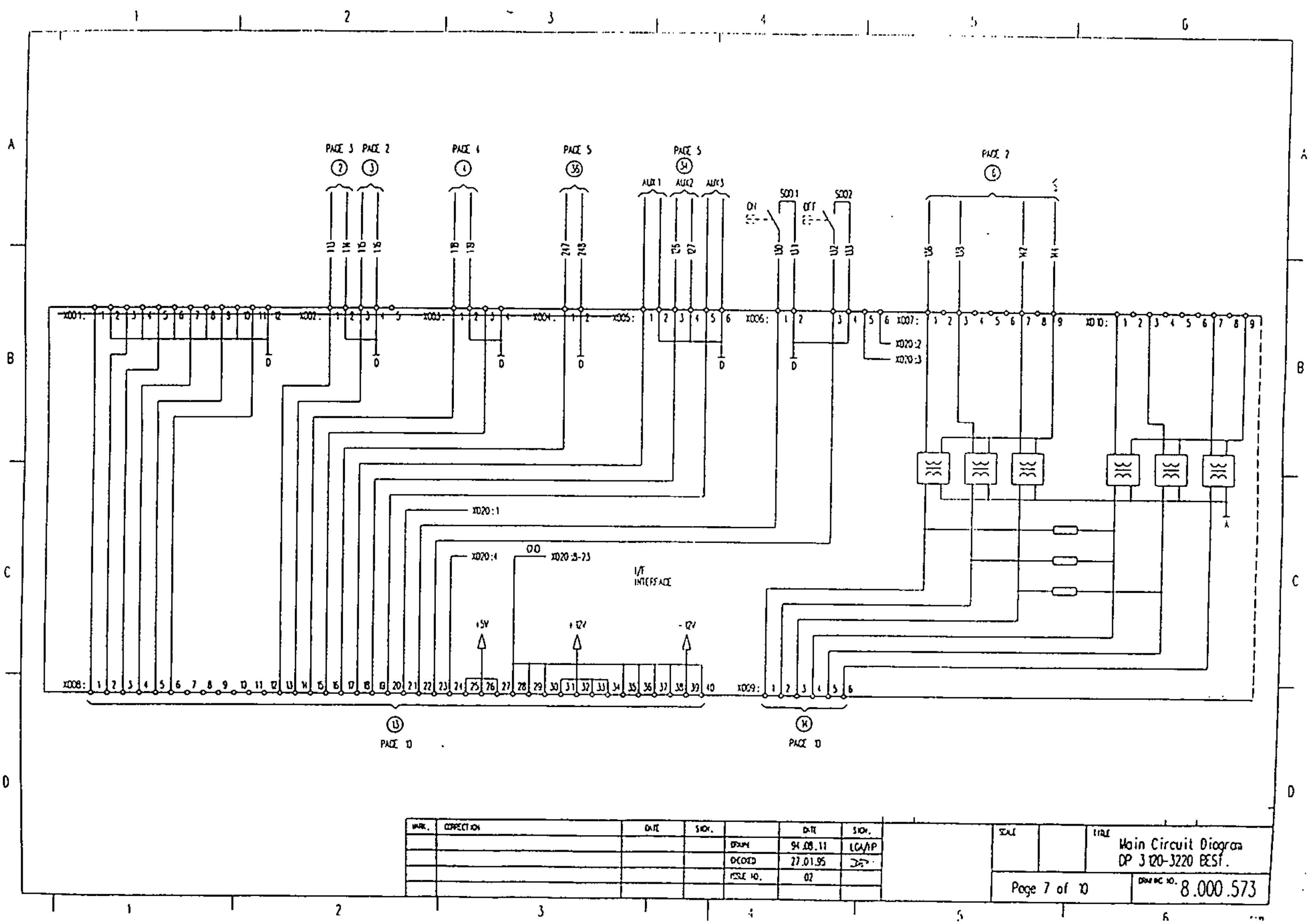
SCALE	TITLE
	Main Circuit Diagram DP 3120-3220 BEST.
Page: 6 of 10	DRAWING NO. 8.000.573



PAGE 3
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AUX 1
AUX2
AUX3
ON
S001
OFF
S002
X001:
X002:
X003:
X004:
X005:
X006:
X007:
X010:
X020:2
X020:3
X020:1
X020:4
X020:5-23
I/F
INTERFACE
+5V
+12V
-12V
X008:
X009:
PAGE 10
PAGE 10
MARK.
CORRECTION
DATE
SIGN.
DRAWN
94.08.11
LCA/IP
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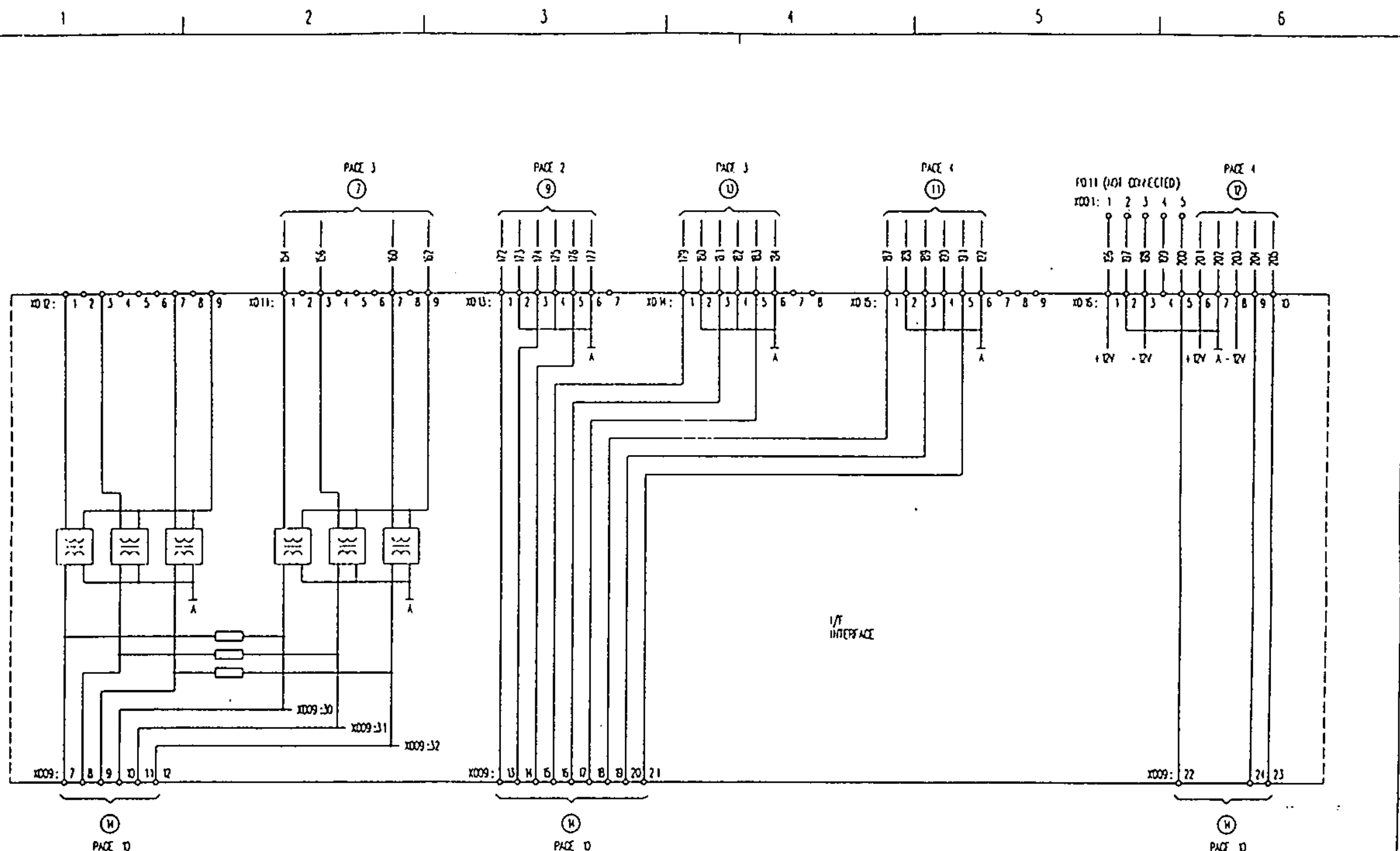
02
SCALE
TITLE
Main Circuit Diagram
DP 3120-3220 BEST.
Page 7 of 10
DRAWING NO. 8.000.573



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SCALE		TITLE
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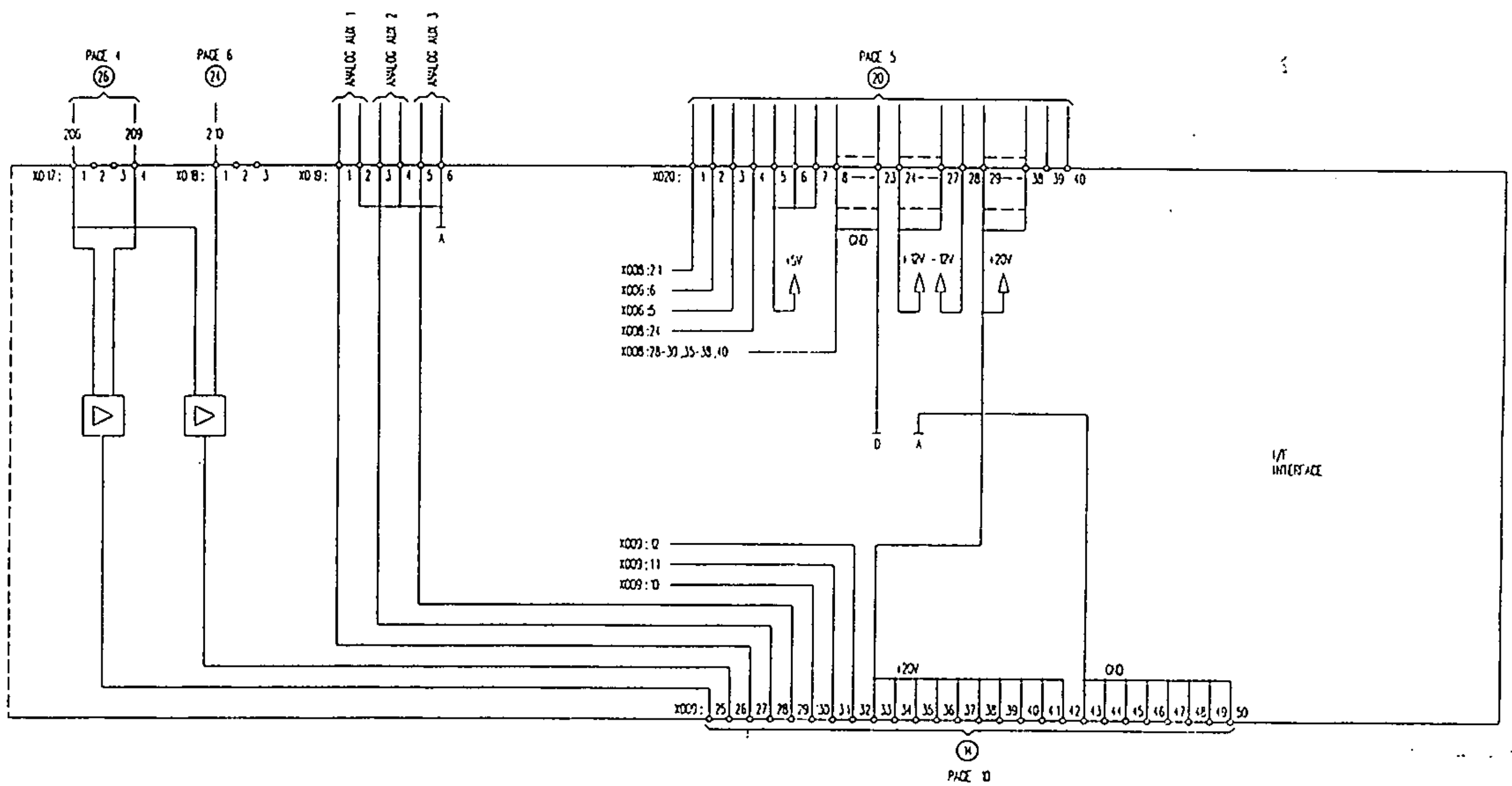
Page 8 of 10		DRAWING NO. 8.000.573



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				ISSUE NO.	02	

SCALE

TITLE Main Circuit Diagram DP 3120-3220 EEST.

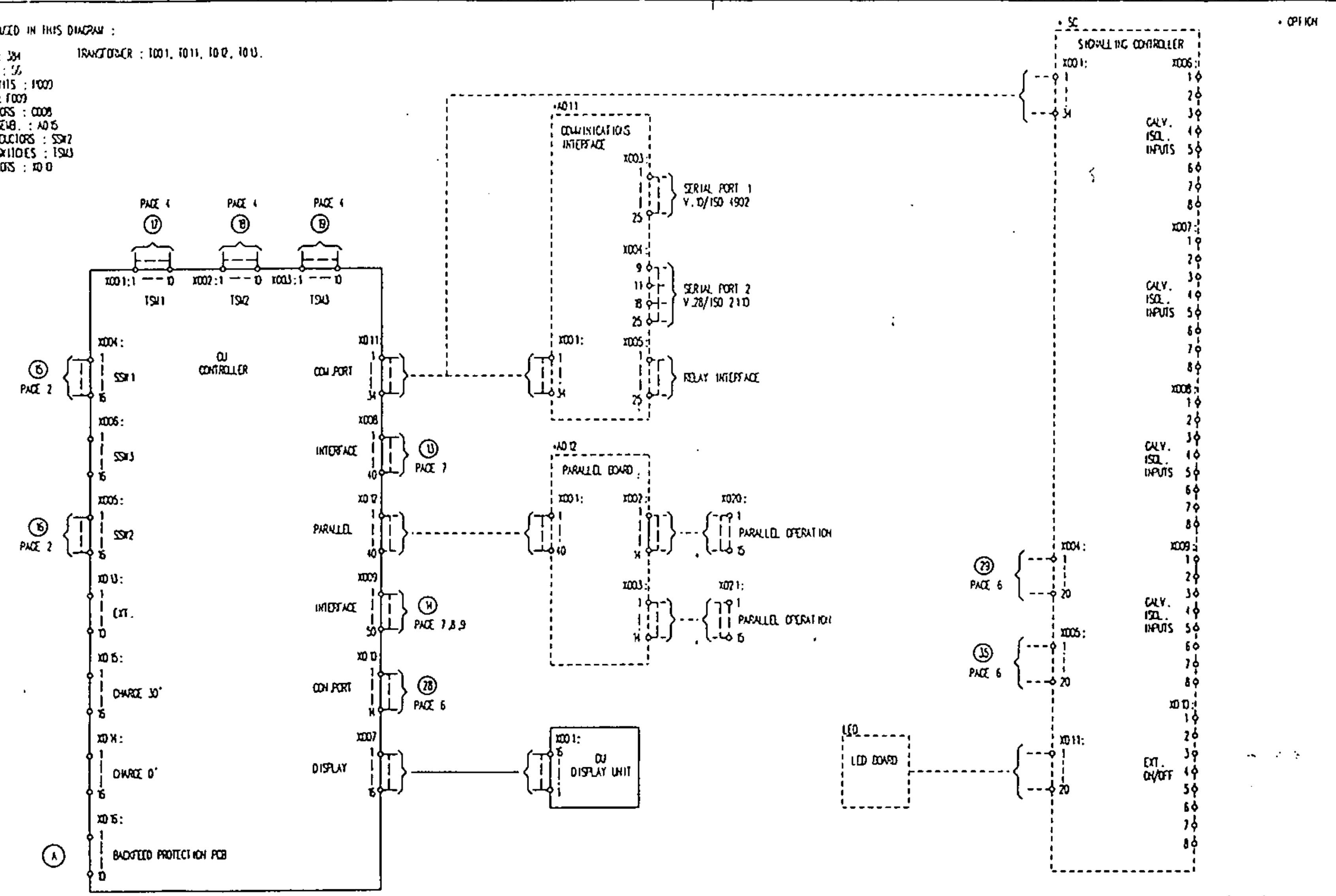
Page 9 of 10

DRAWING NO. 8.000.573

ID NO. USED IN THIS DIAGRAM :

WIRES : 384
CABLES : 56
MEAS UNITS : P009
FUSES : F009
CAPACITORS : C008
SUB ASSEMB. : A015
SEMICONDUCTORS : SSR2
POWER SWITCHES : TSW3
CONNECTORS : X010

TRANSFORMER : T001, T011, T012, T013.



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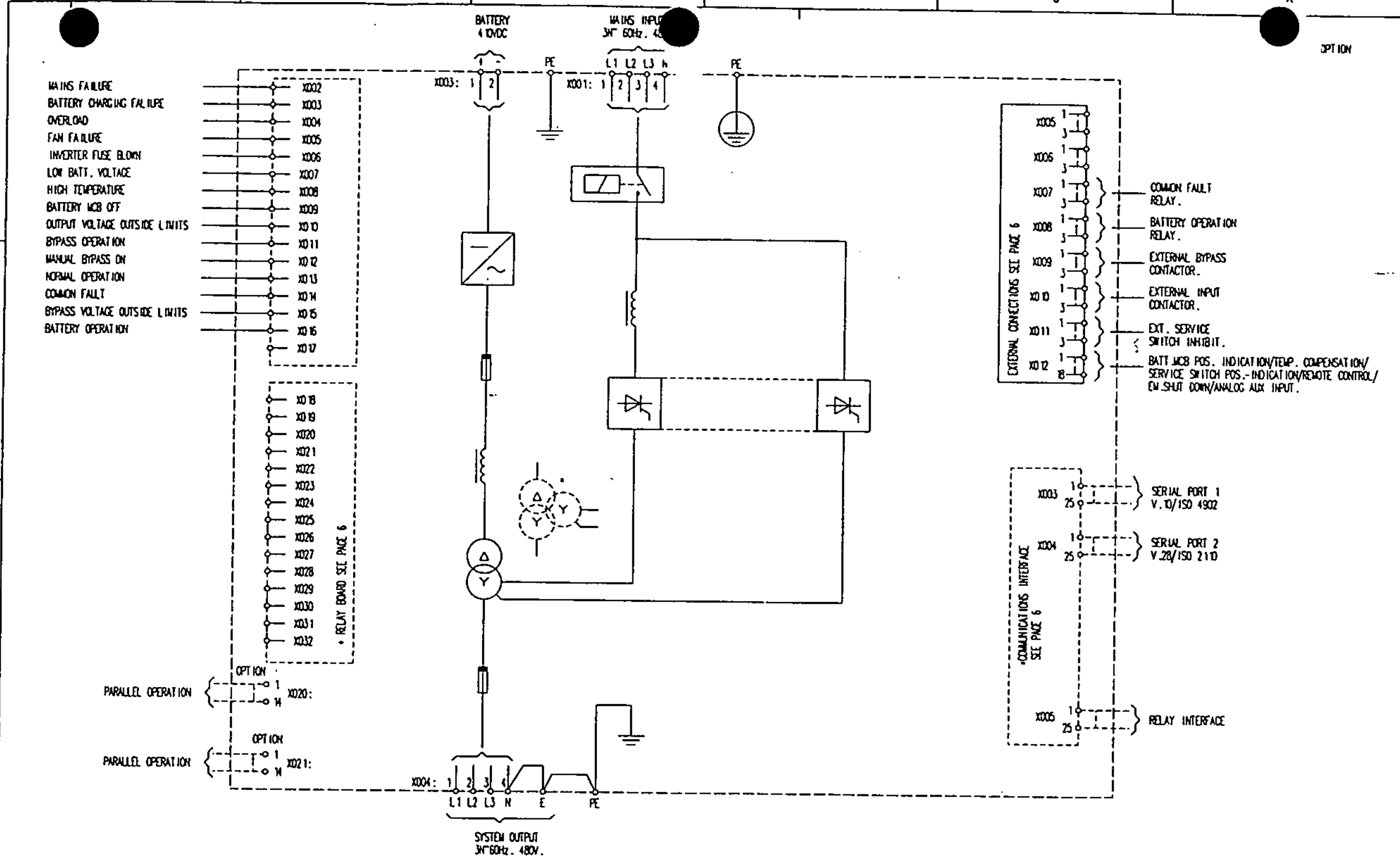
SCALE		TITLE
		Main Circuit Diagram DP 3120-3220 BEST.
Page 10 of 10		DRAWING NO. 8.000.573



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SCALE		TITLE
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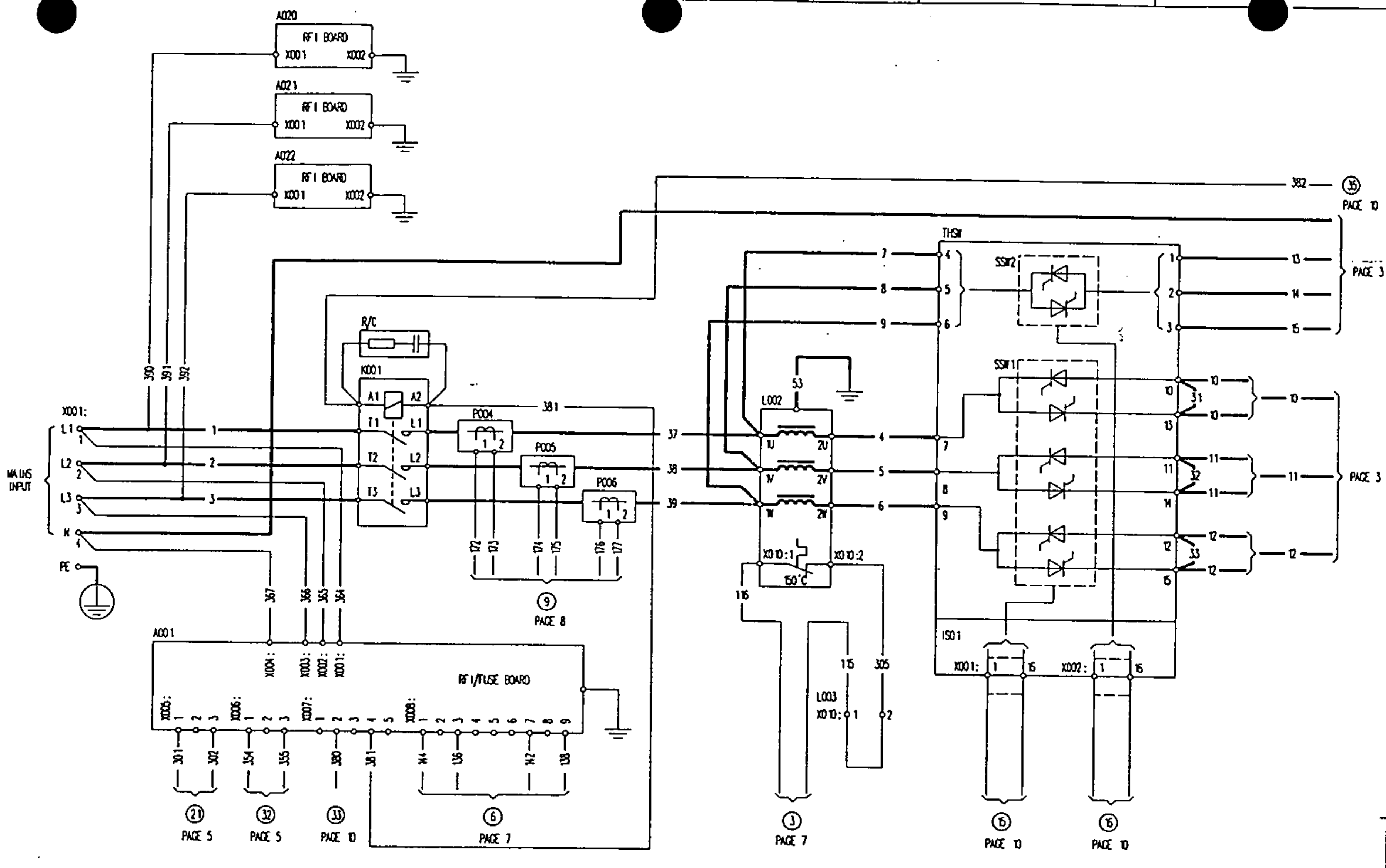
Page 1 of 10		DRAWING NO. 8.000.598

S139



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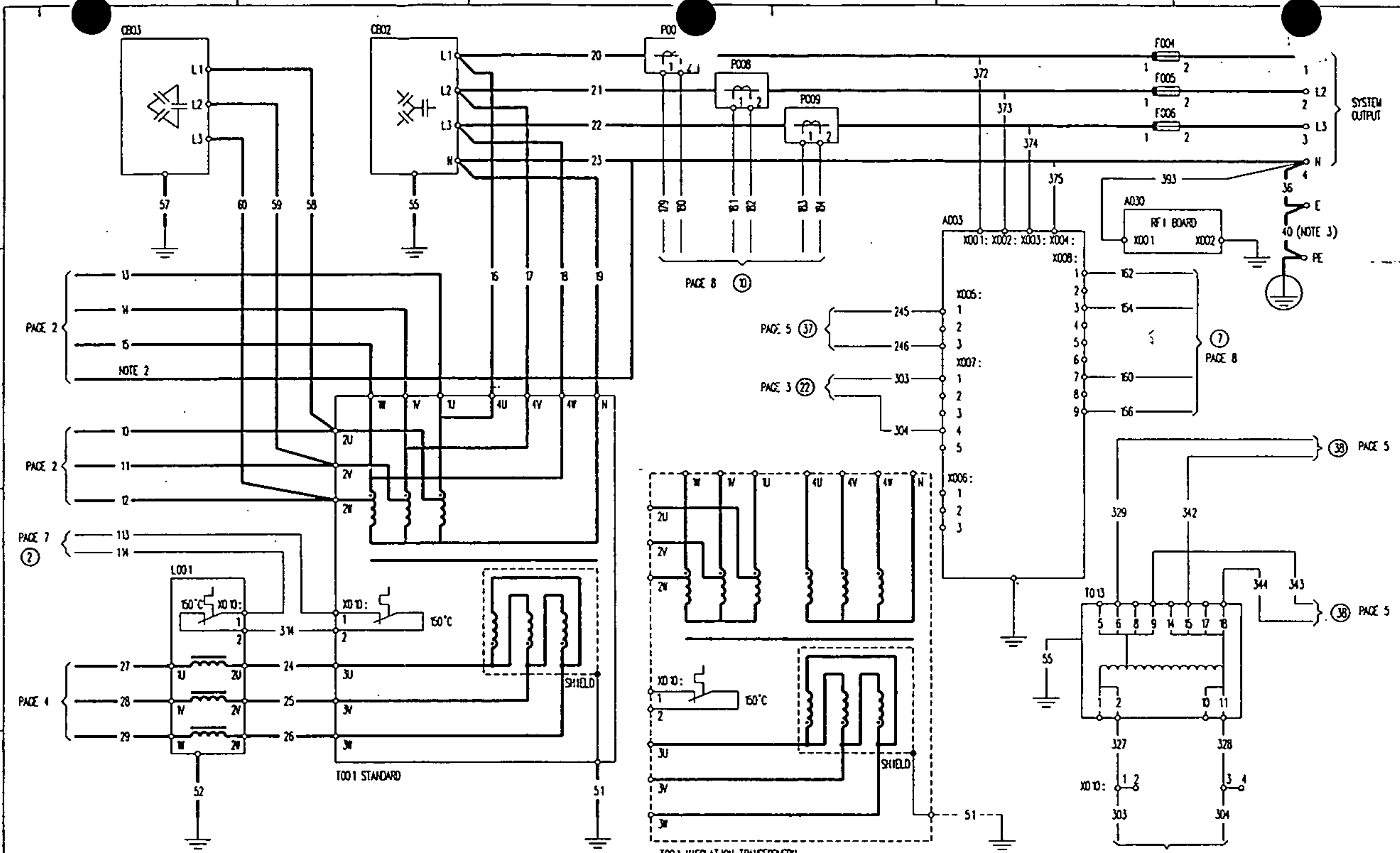
5109



NOTE 2 : THIS CONNECTION MUST ONLY BE MOUNTED IF THE T001 STANDARD TRANSFORMER IS MOUNTED.

• OPTION

NOTE 3 : THIS CONNECTION MUST ONLY BE MOUNTED IF T001 ISOLATED TRANSFORMER IS MOUNTED.

MARK.	CORRECTION	DATE	SIGN.		DATE	SIGN.
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SCALE

TITLE Main Circuit Diagram DP 3120-3220, UL

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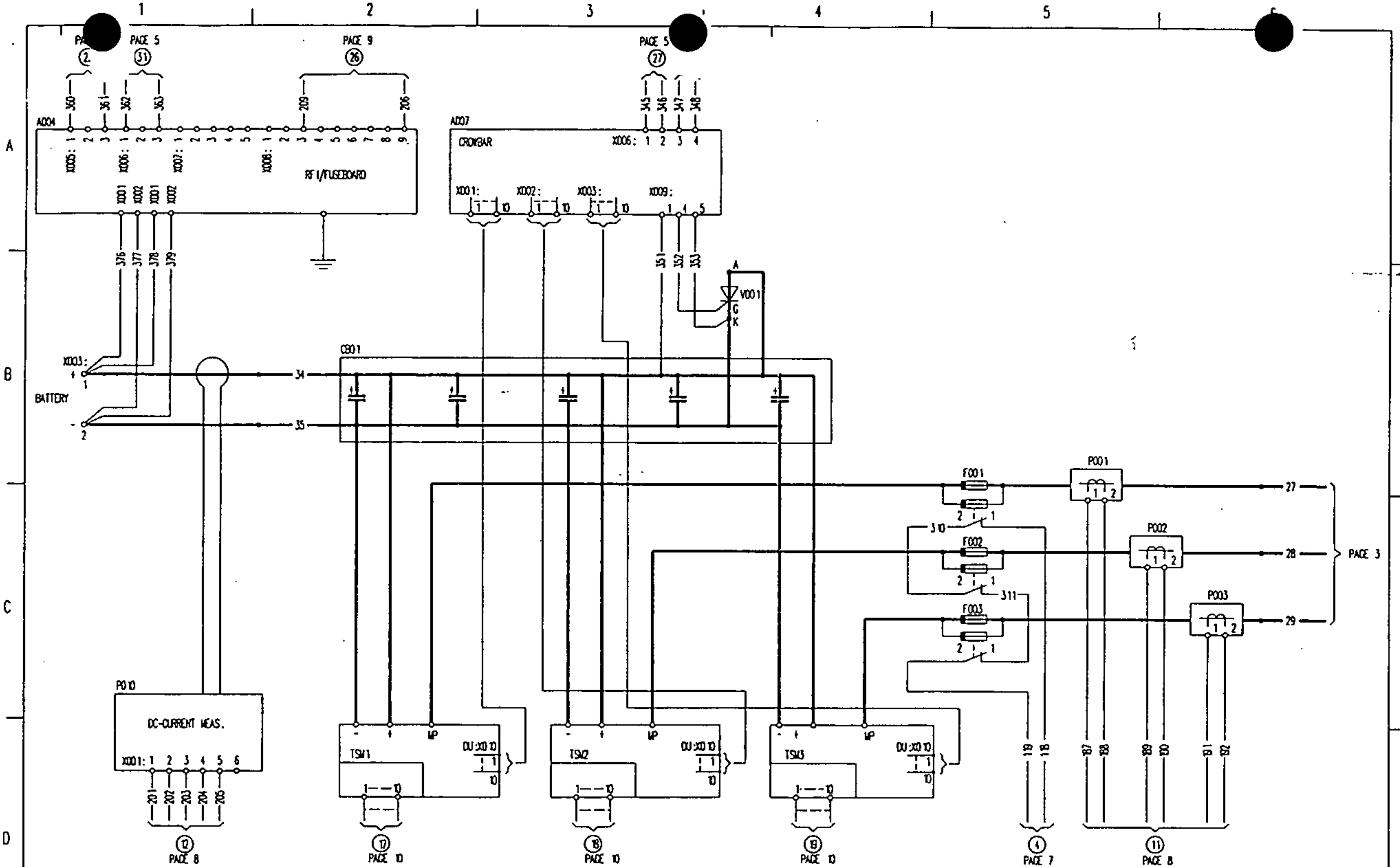
5139



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TITLE Main Circuit Diagram DP 3120-3220, UL

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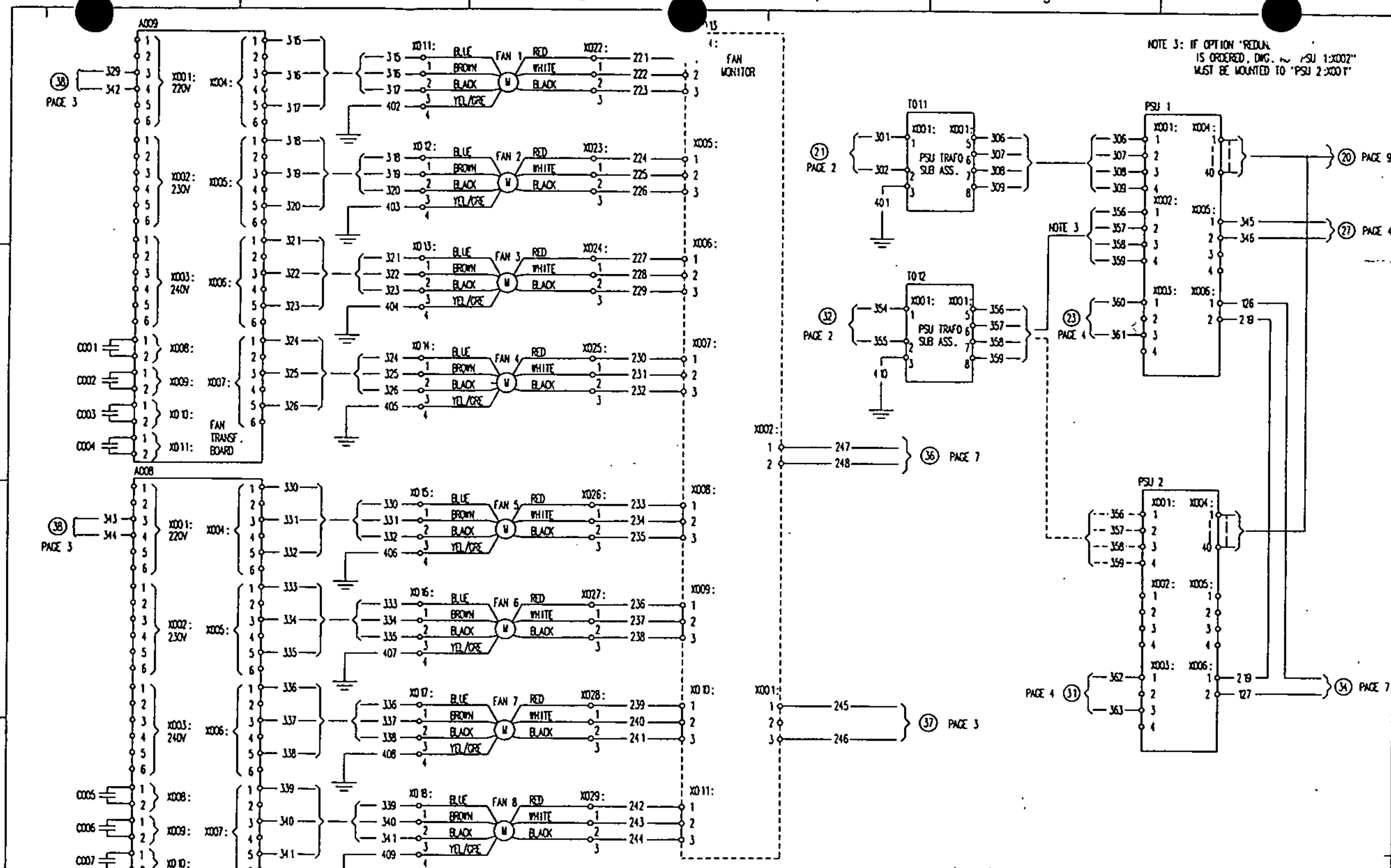
S139



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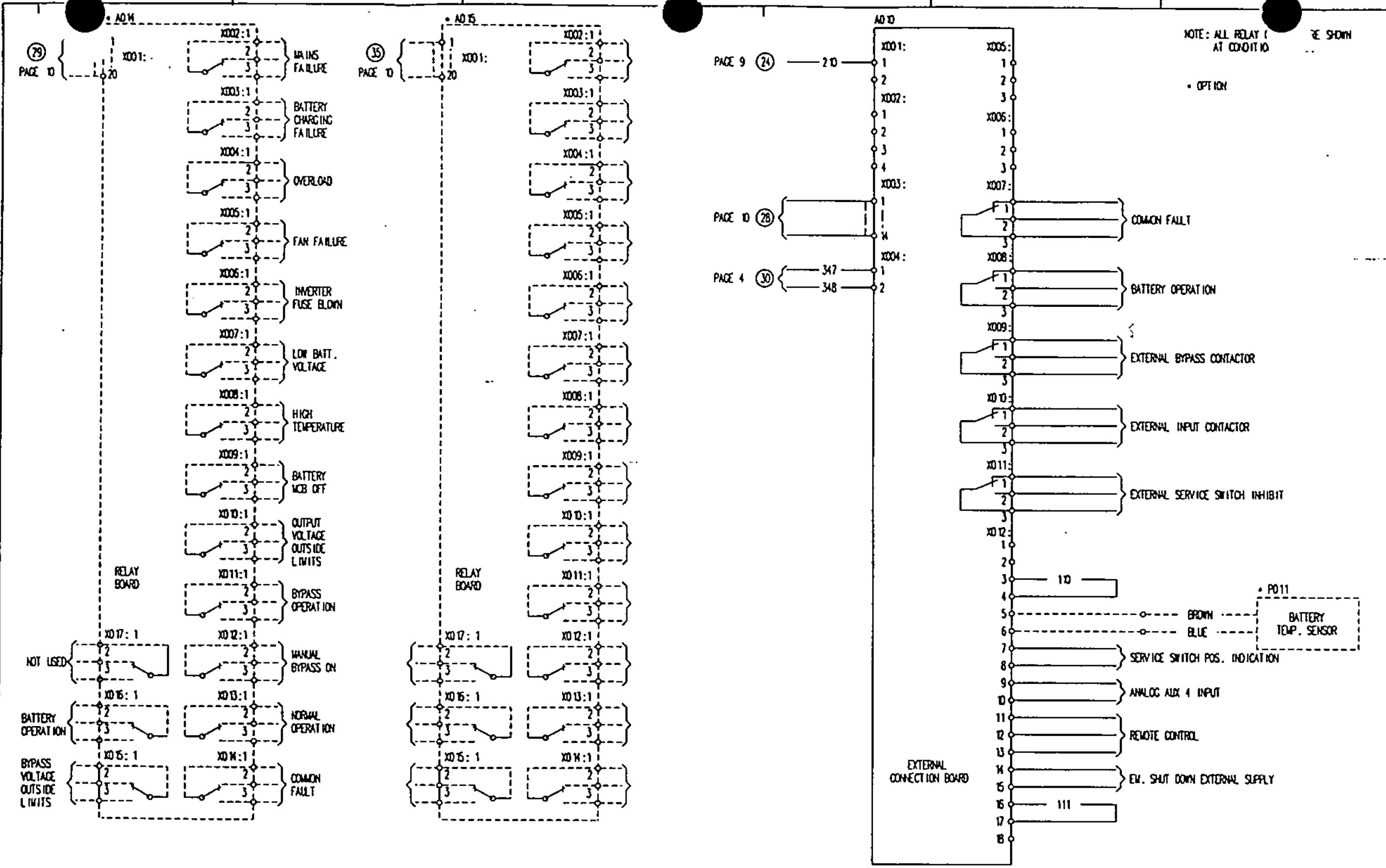

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	Main Circuit Diagram DP 3120-3220, UL
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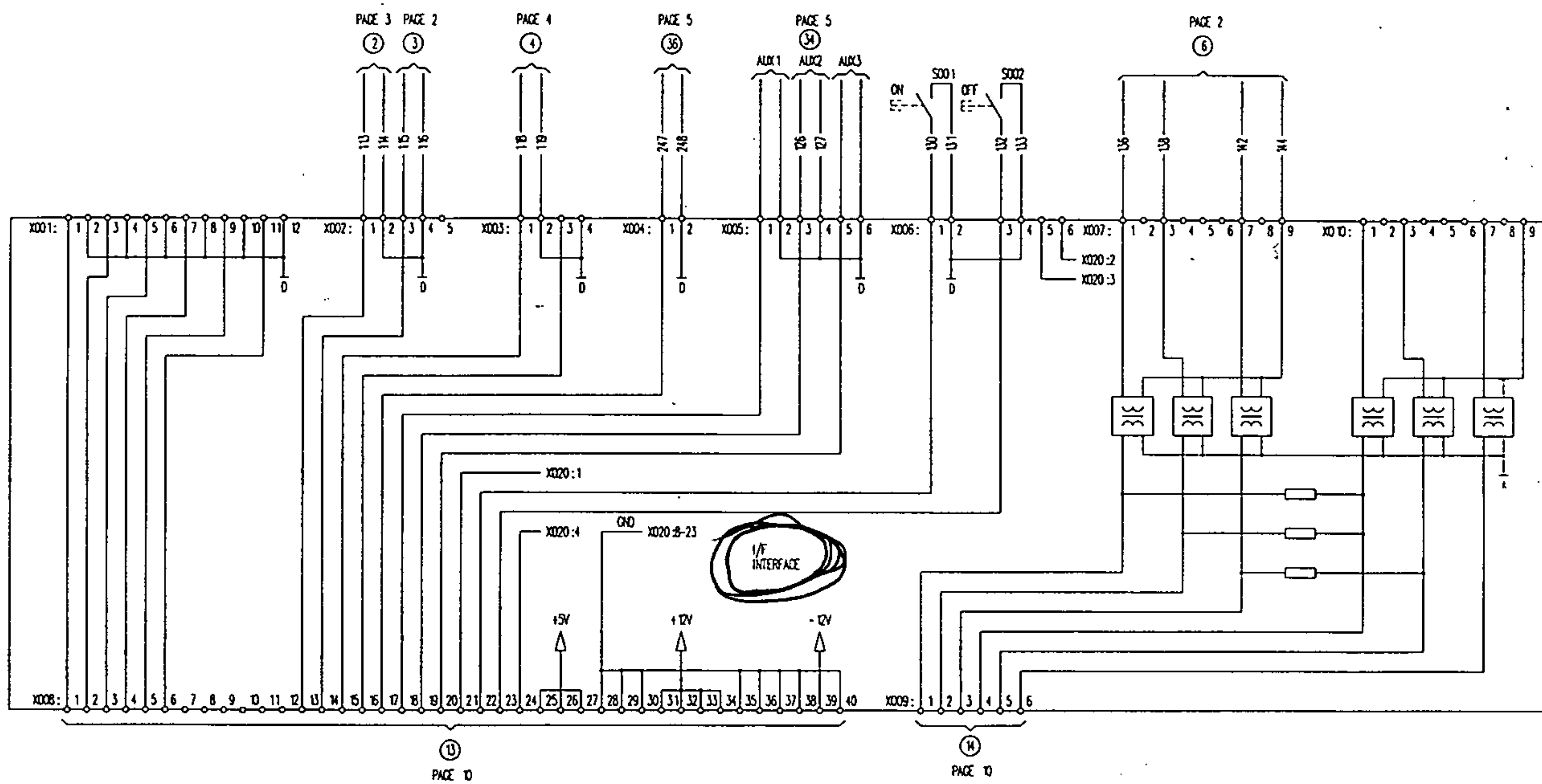
519



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SCALE		TITLE
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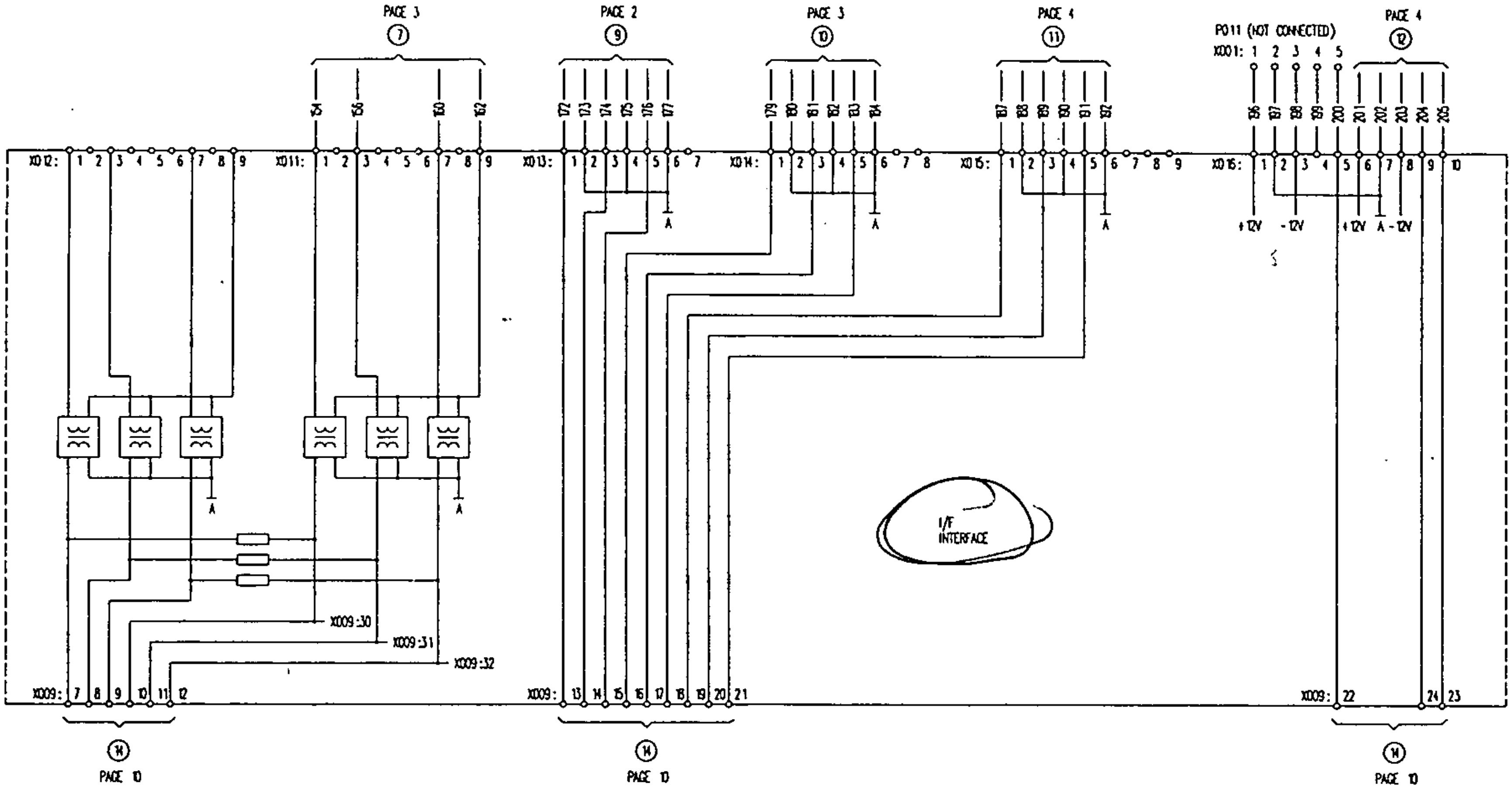
Page 7 of 10		DRAWING NO. 8.000.598

S 03



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TITLE Main Circuit Diagram DP 3120-3220, UL

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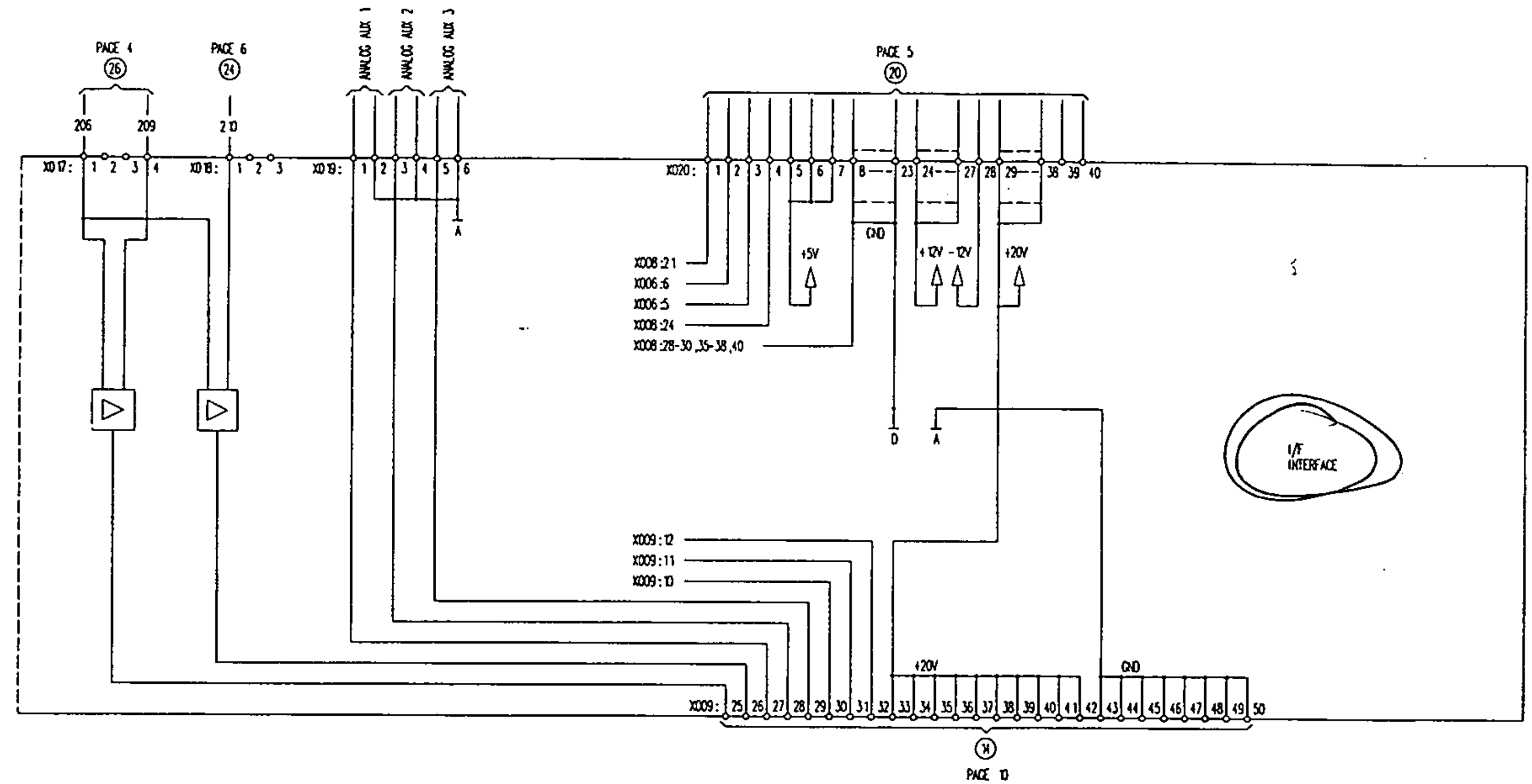

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TITLE Main Circuit Diagram DP 3120-3220, UL

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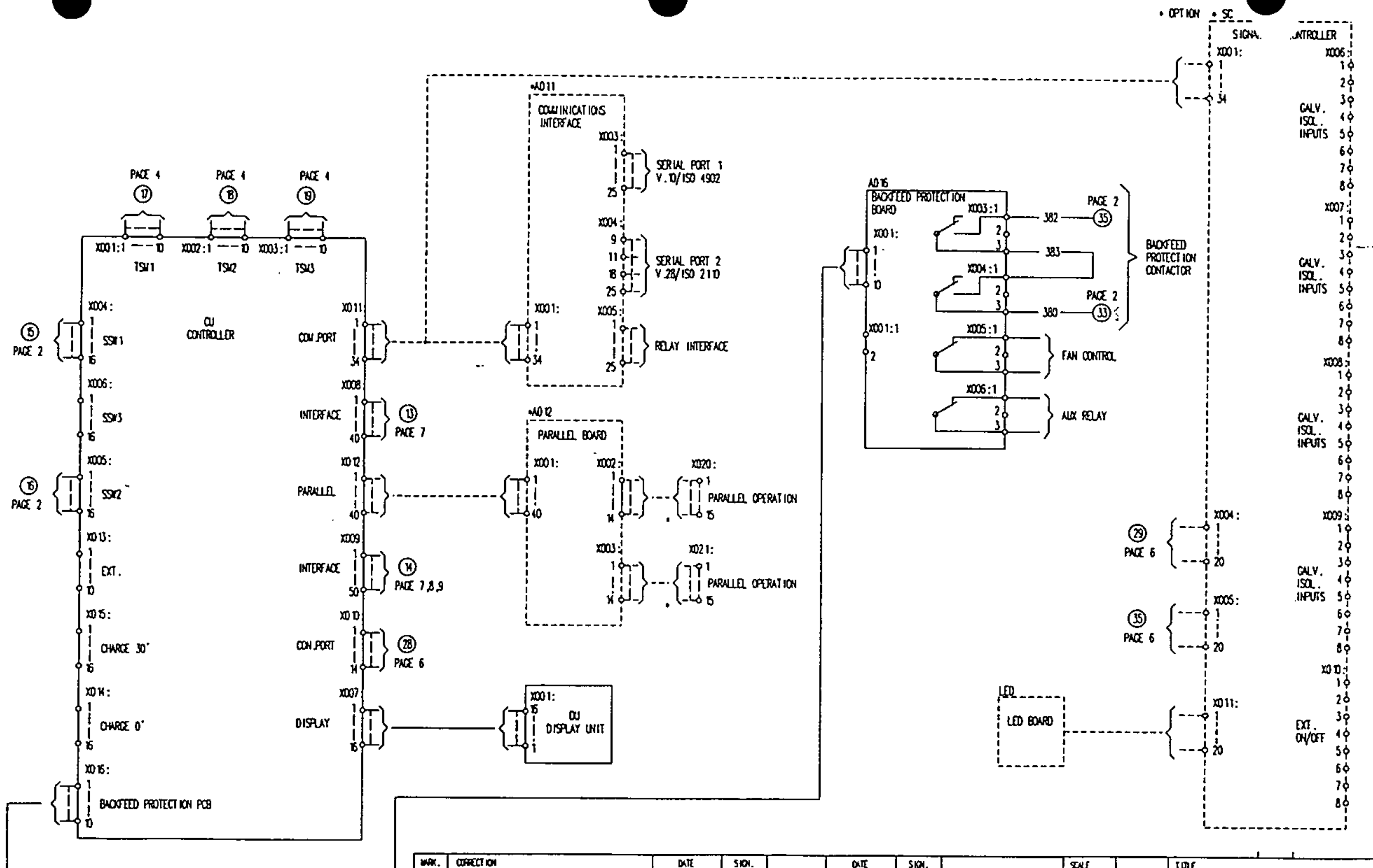

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SCALE

TITLE Main Circuit Diagram DP 3120-3220, UL

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S139

UNITY/I Three Phase Available Models

UT310

UT315

UT320

UT330

UT340

UT360

UT380

UT3100

UT3120

UT3160

UT3220

Domestic UNITYI/3Phase Serial Number

Serial Number example: LA0150

(2) Alpha digits followed by (4) numerical digits

This Serial Number format ensures it is a 60Hz UPS

First Digit

"L" means Low Voltage (208Vac) "H" means High Voltage (480Vac)

Second Digit

- A = UT310 = 10kVA
- B = UT315 = 15kVA
- C = UT320 = 20kVA
- D = UT330 = 30kVA
- E = UT340 = 40kVA
- F = UT360 = 60kVA
- G = UT380 = 80kVA
- H = UT3100 = 100kVA
- I = UT3120 = 120kVA
- J = UT3160 = 160kVA
- K = UT3220 = 220kVA

Remaining Digits

Numerical indicator of sequential production process by model

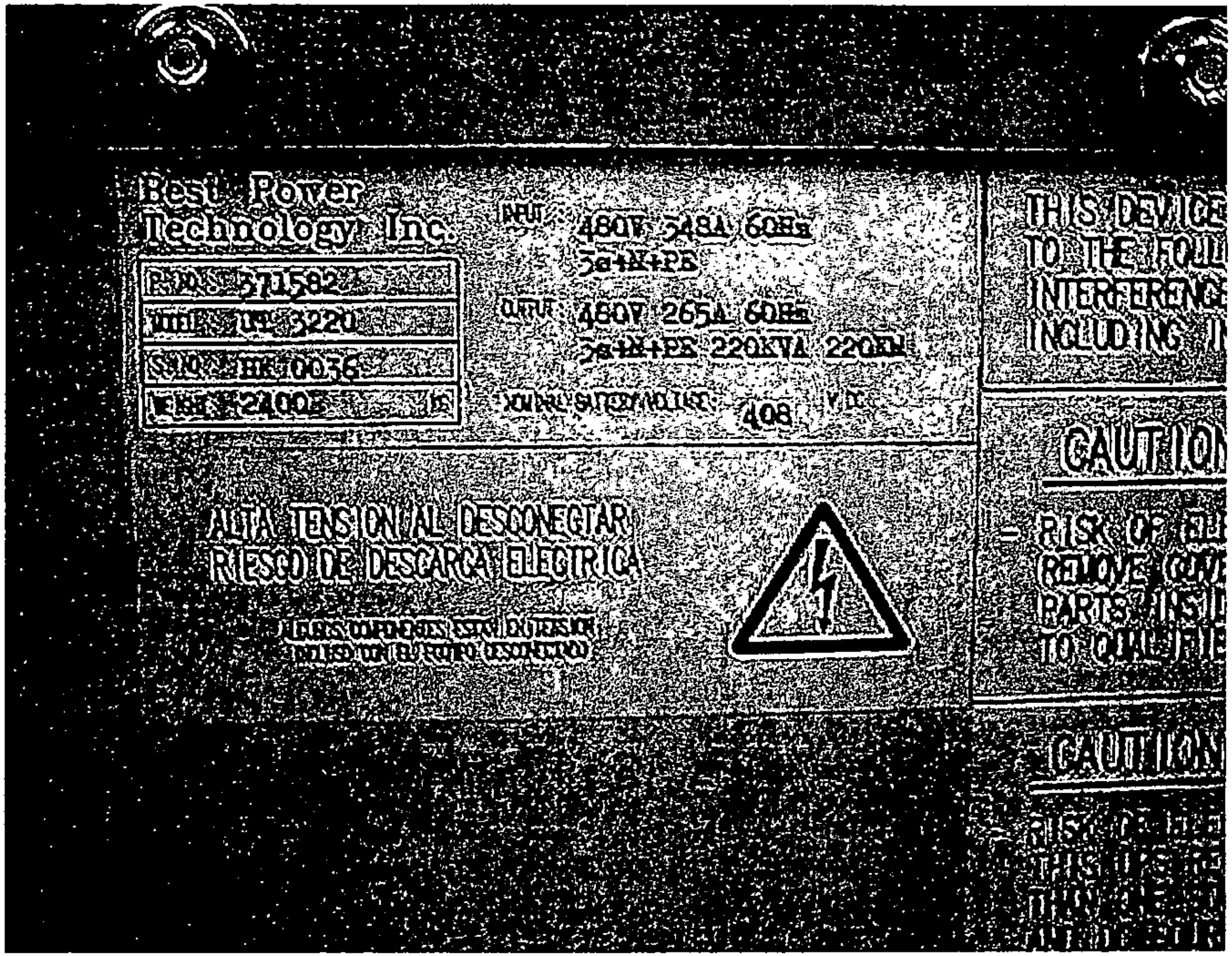
Serial Numbers for Non-UL Unity I Three Phase

Serial Number sequence remains the same but Serial Number has (3) leading Alpha digits.

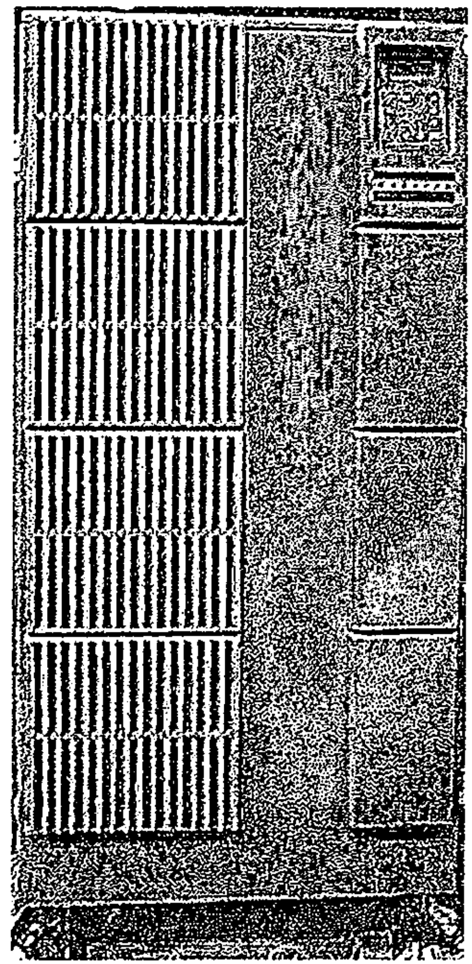
Example: BEC0282

- "B" = 50Hz or 60Hz (not UL Listed)
- "E" = 40kVA
- "C" = Product line series, all non-UL Silcon units sold by Best Power are "C" Series
- Remaining digits are numerical sequence

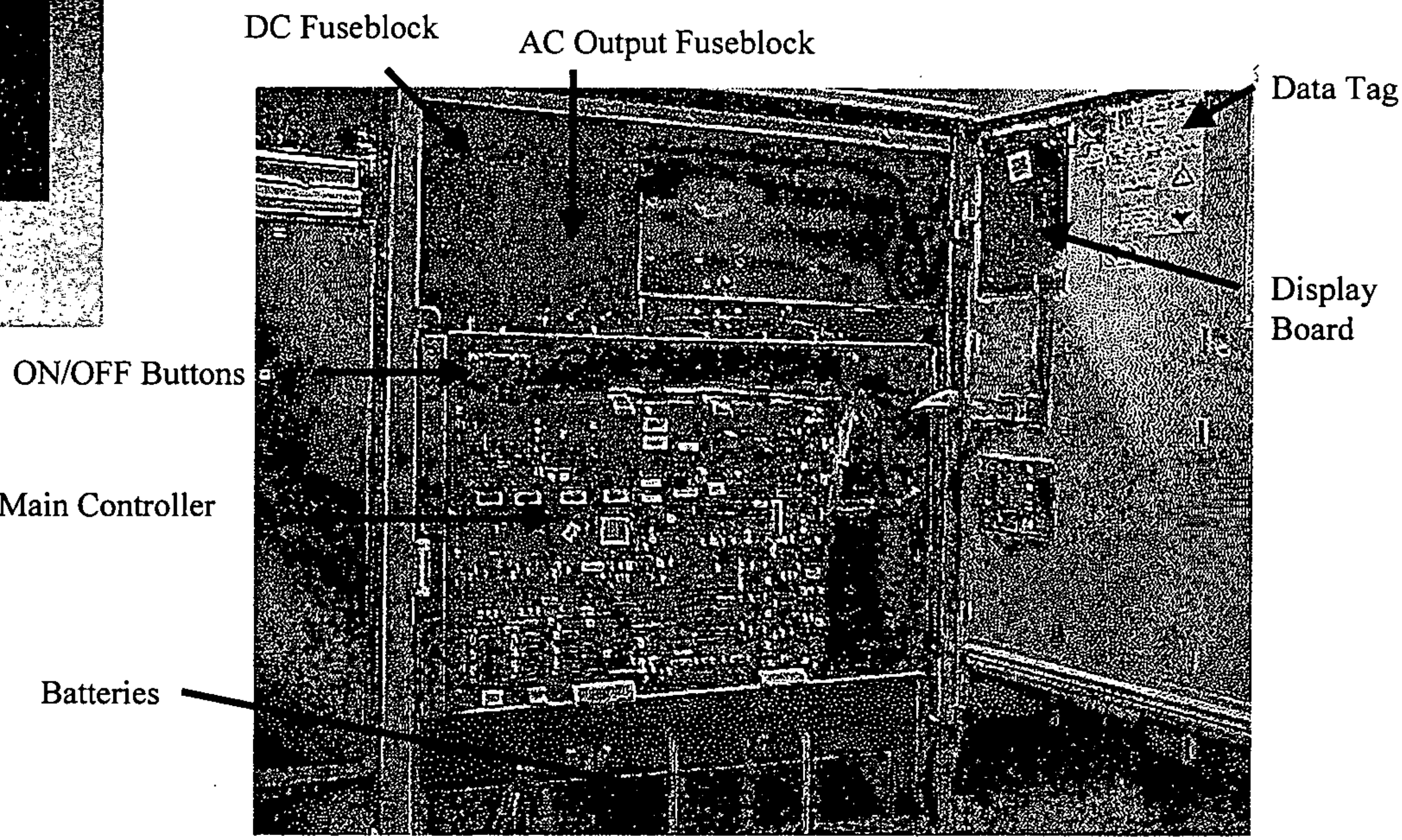
Data Plate


Best Power
Technology Inc.
371582
3220
HK 10036
24005
480V 348A 60Hz
3ø+N+PE
480V 265A 60Hz
3ø+N+PE 220KVA 220KW
408
ALTA TENSION AL DESCONECTAR
RIESGO DE DESCARGA ELECTRICA
CAUTION
CAUTION

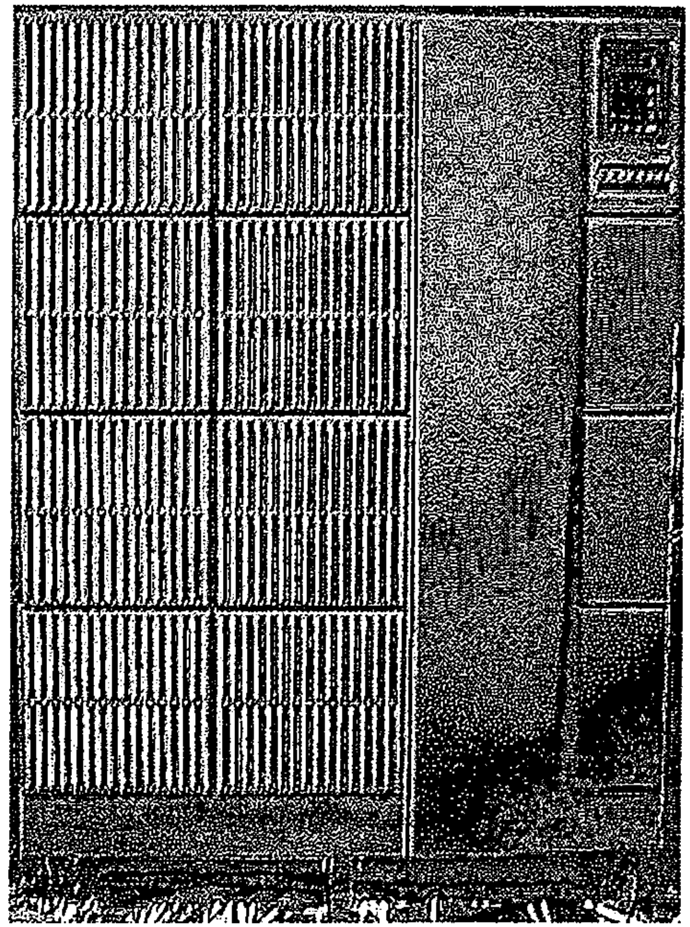
UT310 / UT315



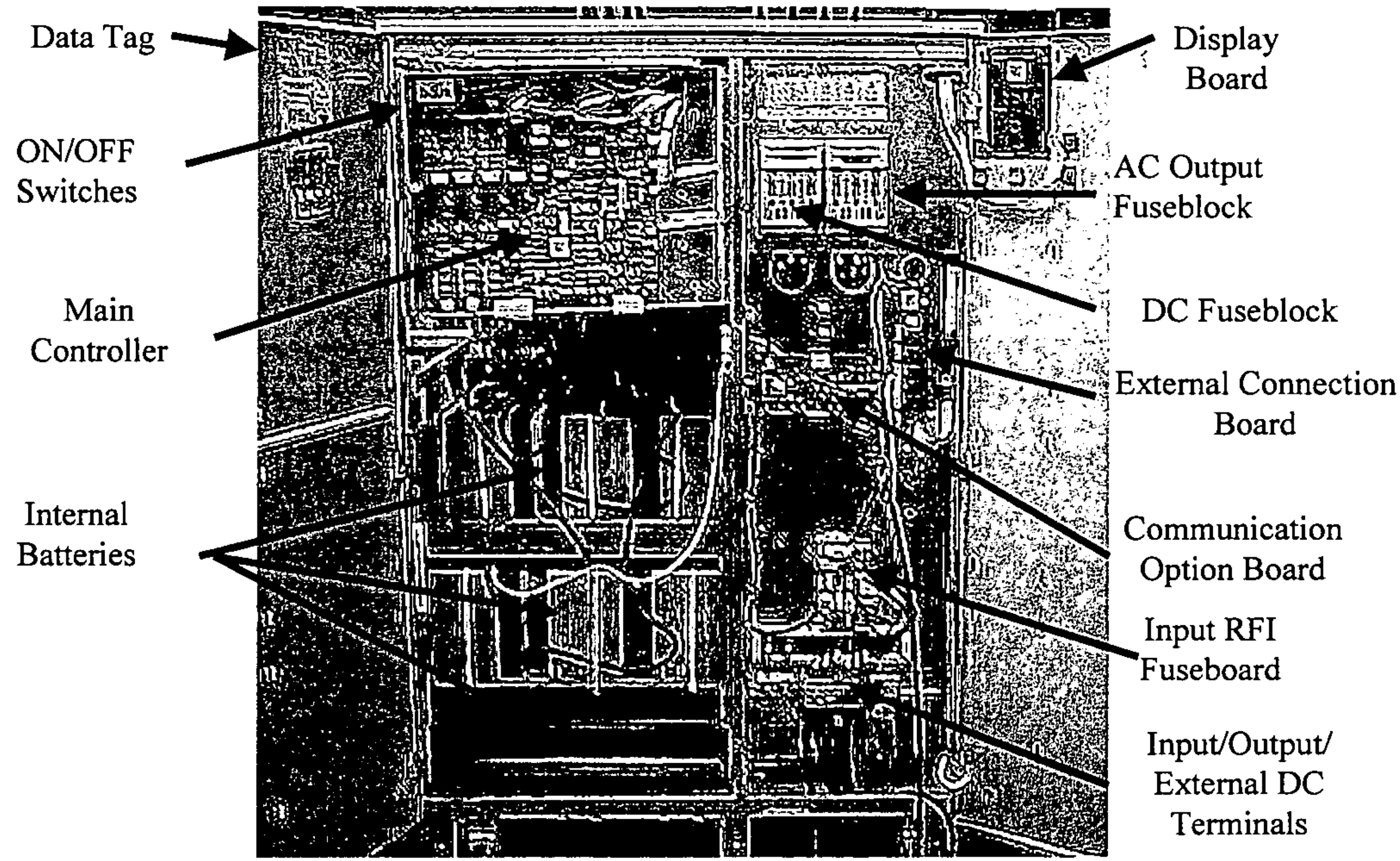
UT310/UT315 Electronics Door



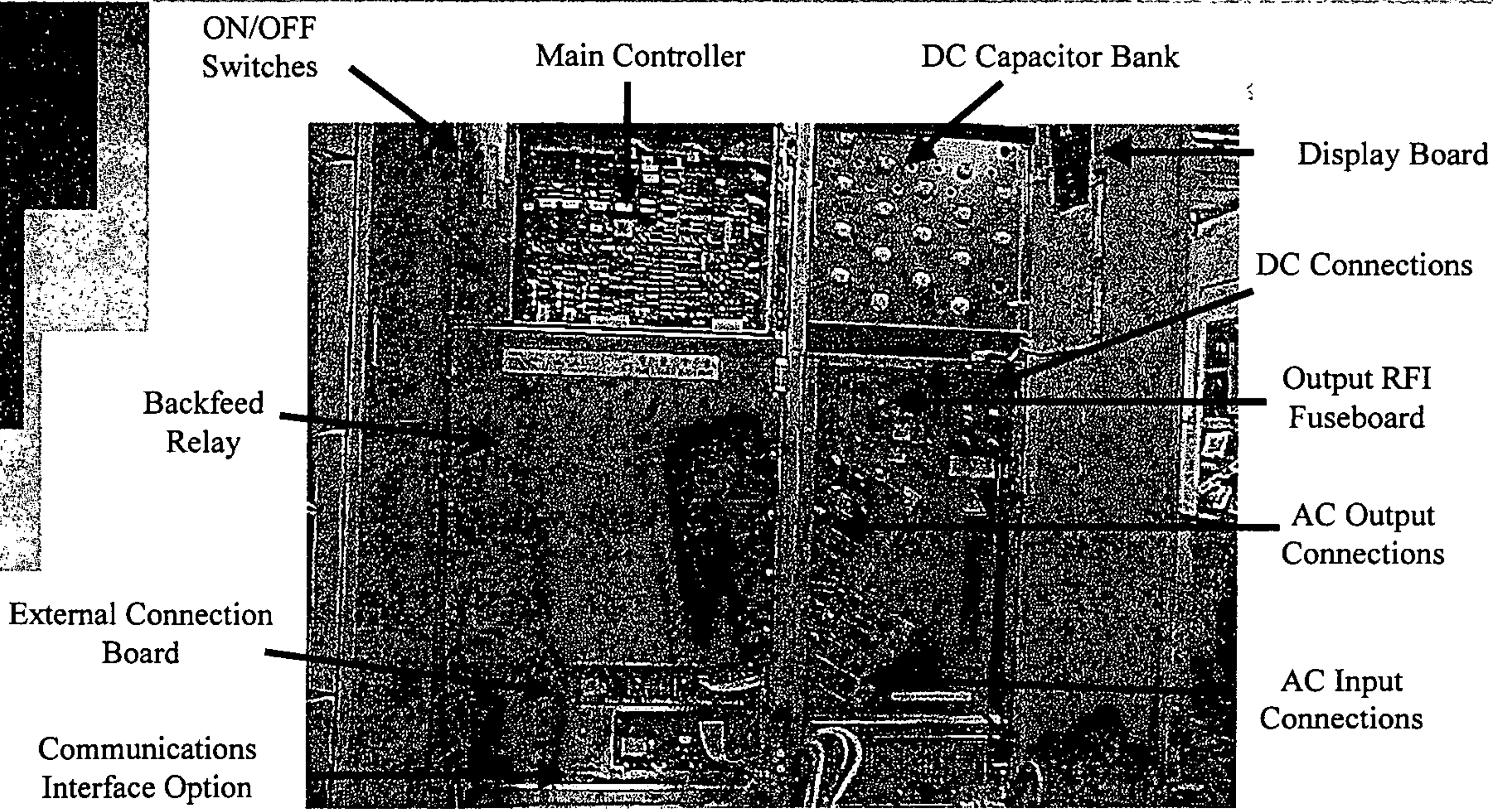
UT320 / UT330 / UT340
UT360 / UT380 / UT3100



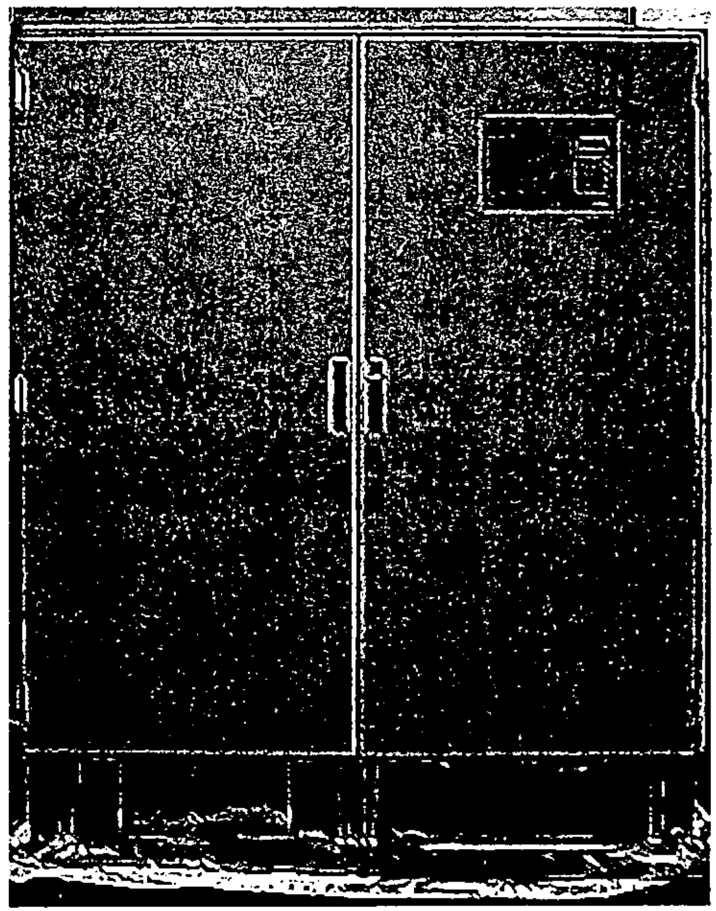
UT320 / UT330
Front View



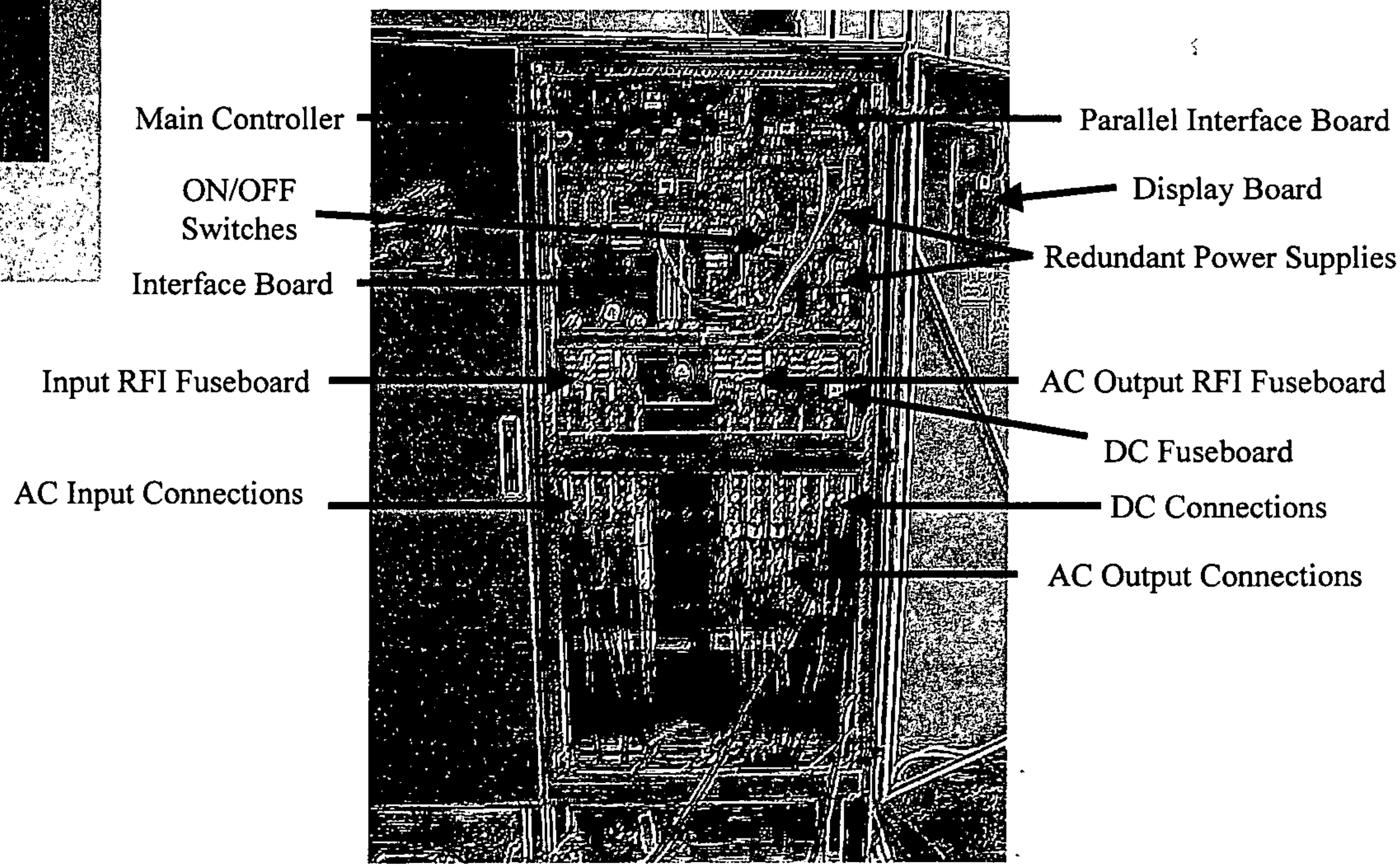
UT340-UT360 Open Front



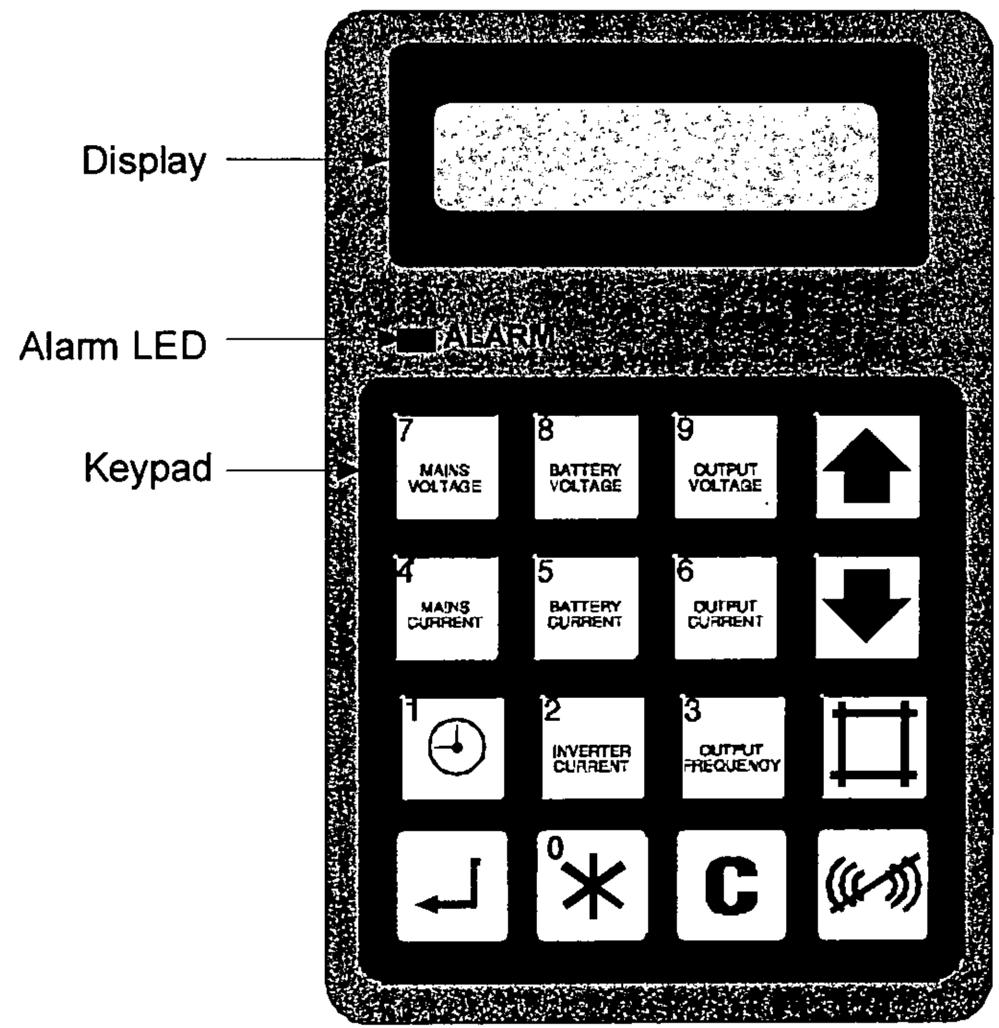
UT3120 / UT3160 / UT3220



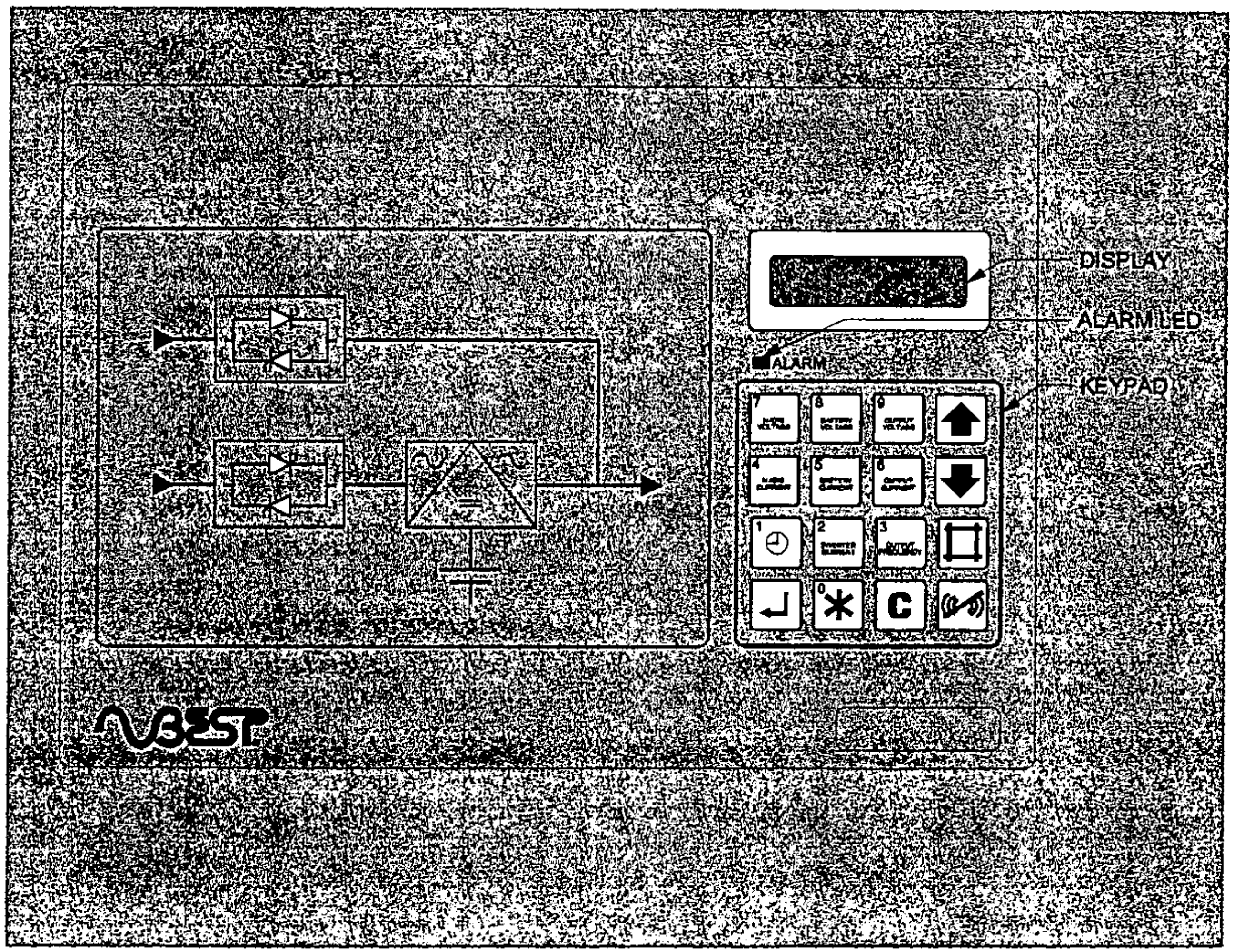
UT3120 / UT3160 / UT3220
Open Electronics Compartment



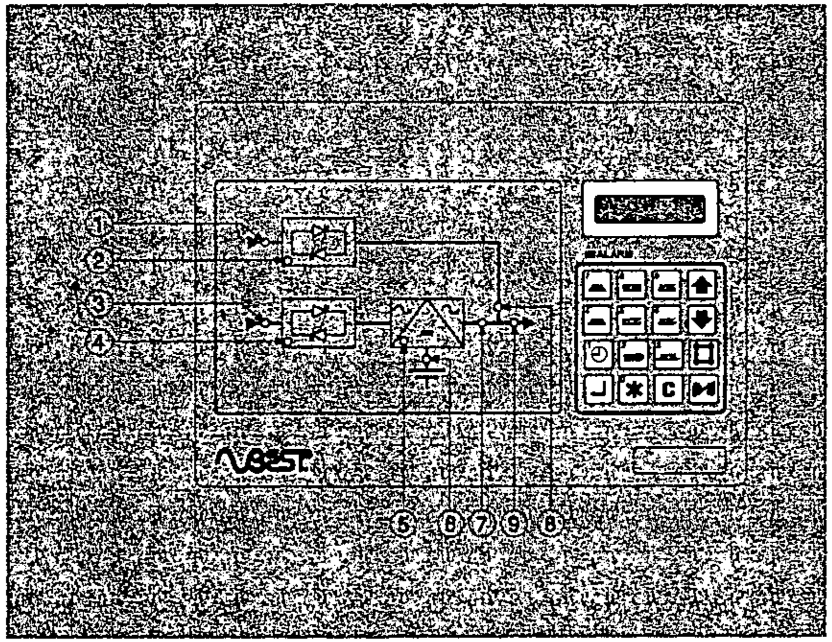
UT310 - UT3100 KEYPAD



UT3120 - UT3220
STANDARD KEYPAD



UT3120 - UT3220 OPTIONAL KEYPAD



LED	What It Means When It's Green	What It Means When It's Red
1.	The bypass mains (voltage) is acceptable.	The bypass mains (voltage) has failed.
2.	This LED is never green.	There is a bypass static switch alarm.
3.	Mains (AC input) is acceptable.	Mains (AC input) has failed.
4.	This LED is never green.	There is a mains static switch alarm or charge regulation
5.	This LED is never green.	There is an inverter alarm.
6.	The battery is connected and working.	The battery is disconnected or there is a battery alarm.
7.	The inverter is on.	This LED is never red.
8.	The bypass is on.	This LED is never red.
9.	Output voltage is acceptable.	Output voltage is outside tolerance: it is outside of the uni programmed limits.

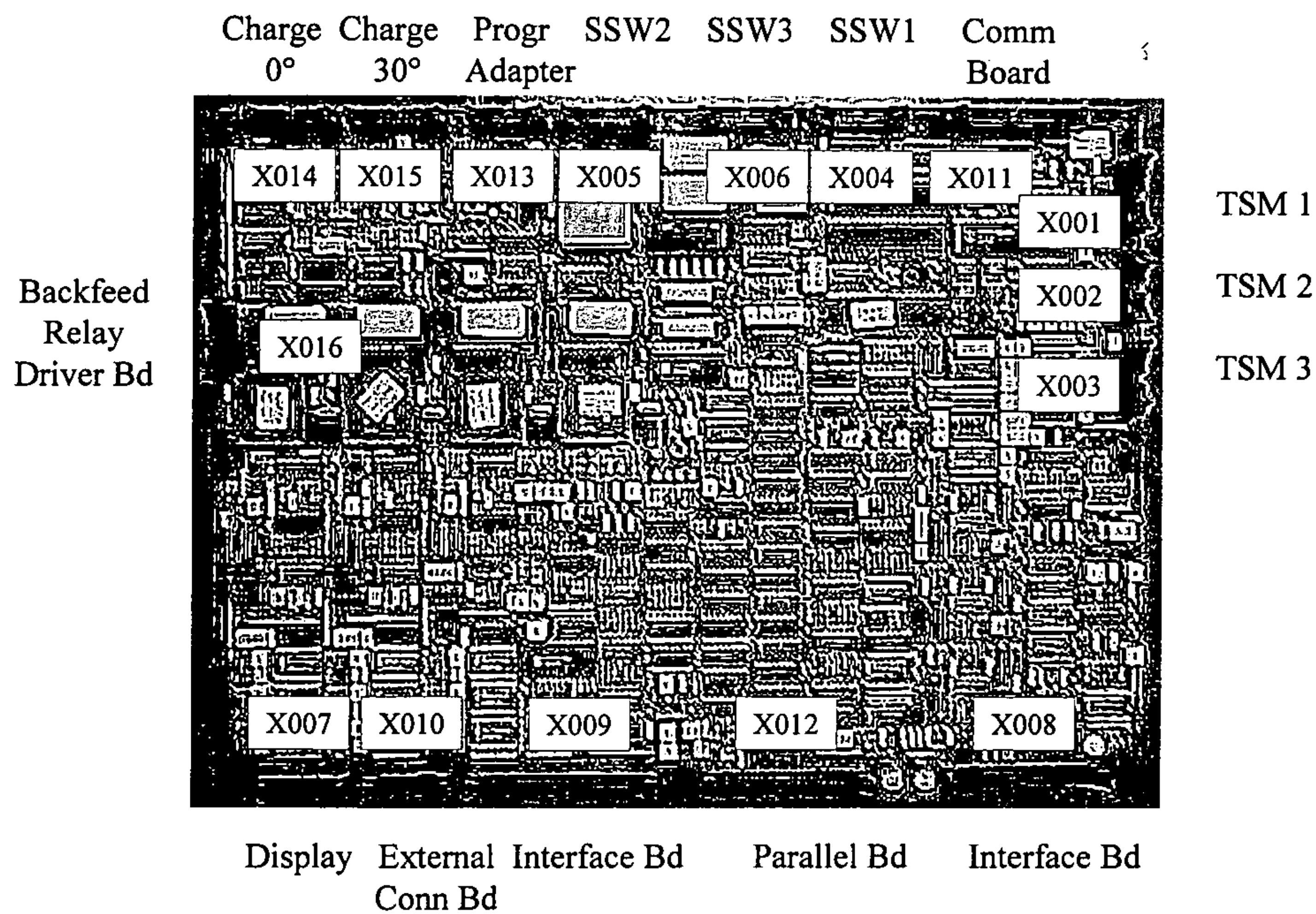
Unity/I Three Phase Major System Components

- Mains Choke (L002)
- Inverter Choke (L001)
- AC Capacitors (CB02)
- DC Capacitors (CB03)
- Current Transformer Unit (P00x)
- Controller Unit (CU)
- Power Supply (PSU)
- Interface Board (I/F)
- External Connection Board (A010)
- Transistor Switching Module (TSM)
- Static Switch Module (SSW)
- Input/Output RFI/Fuse Board (A001and A003)
- DC Fuse Board (A004)

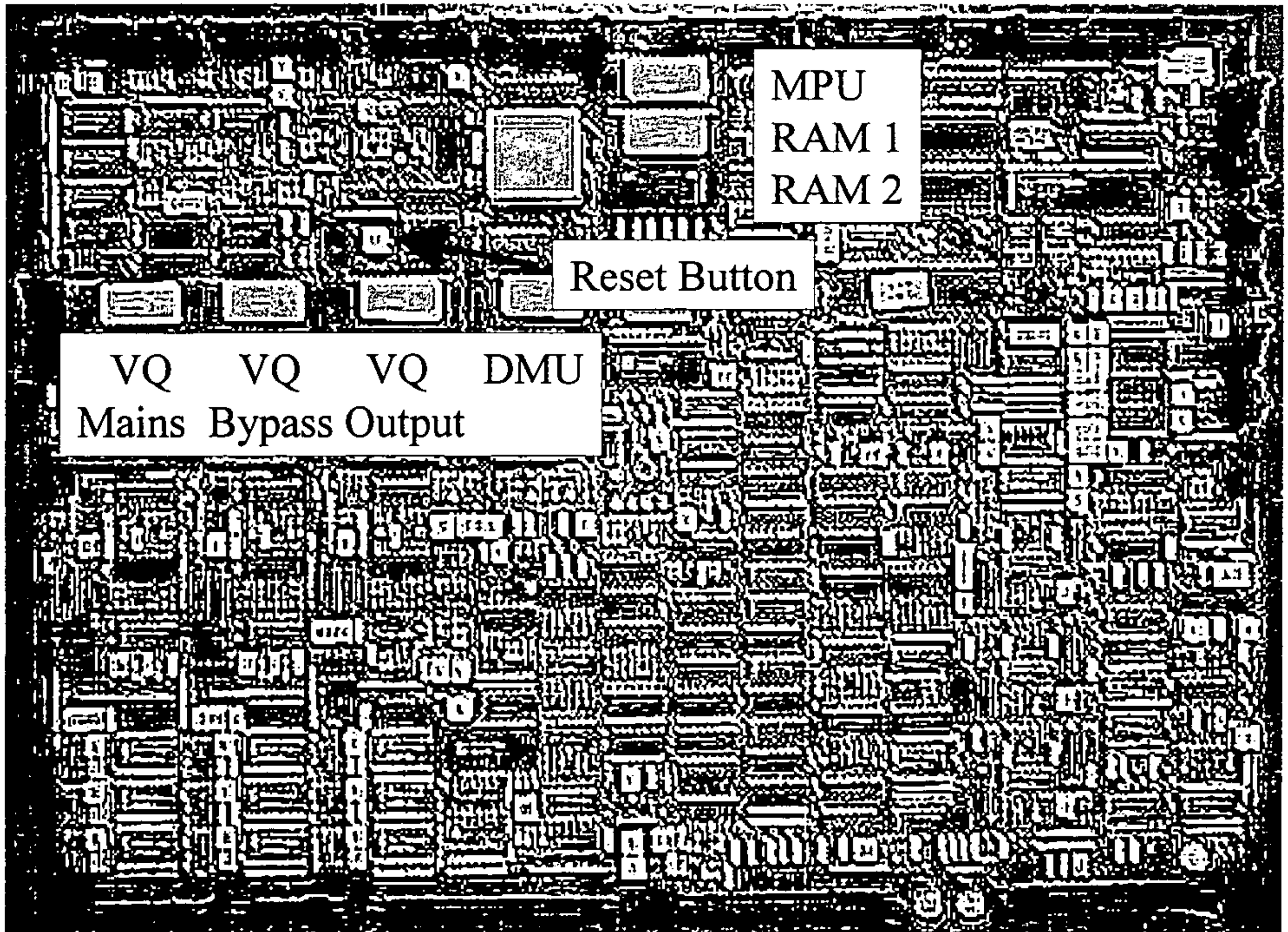
Unity/I Three Phase
OPTIONAL EQUIPMENT

- Communication Interface (A011)
- Parallel Interface (A012)
- Fan Monitor (A013)
- Relay Board (A015, A016)

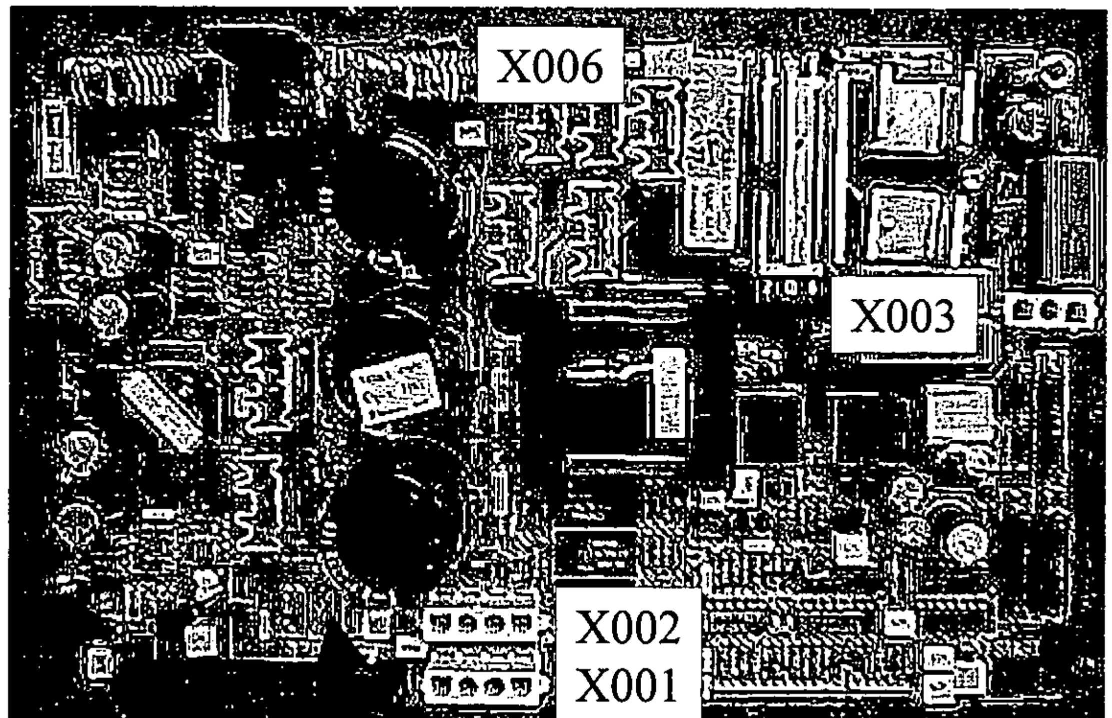
Controller Unit (CU) Connections



Controller Unit (CU) Firmware

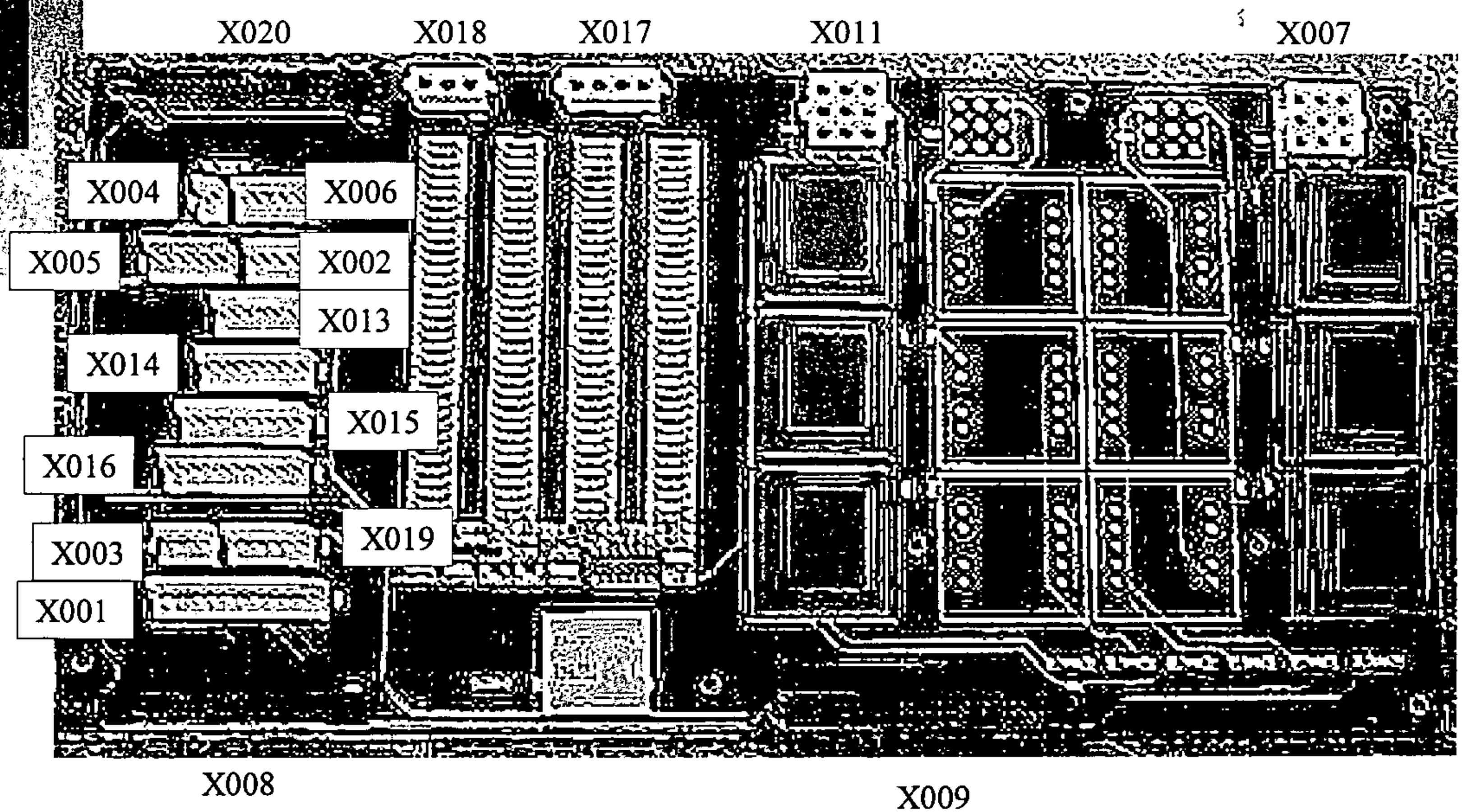


PSU (Power Supply Unit)



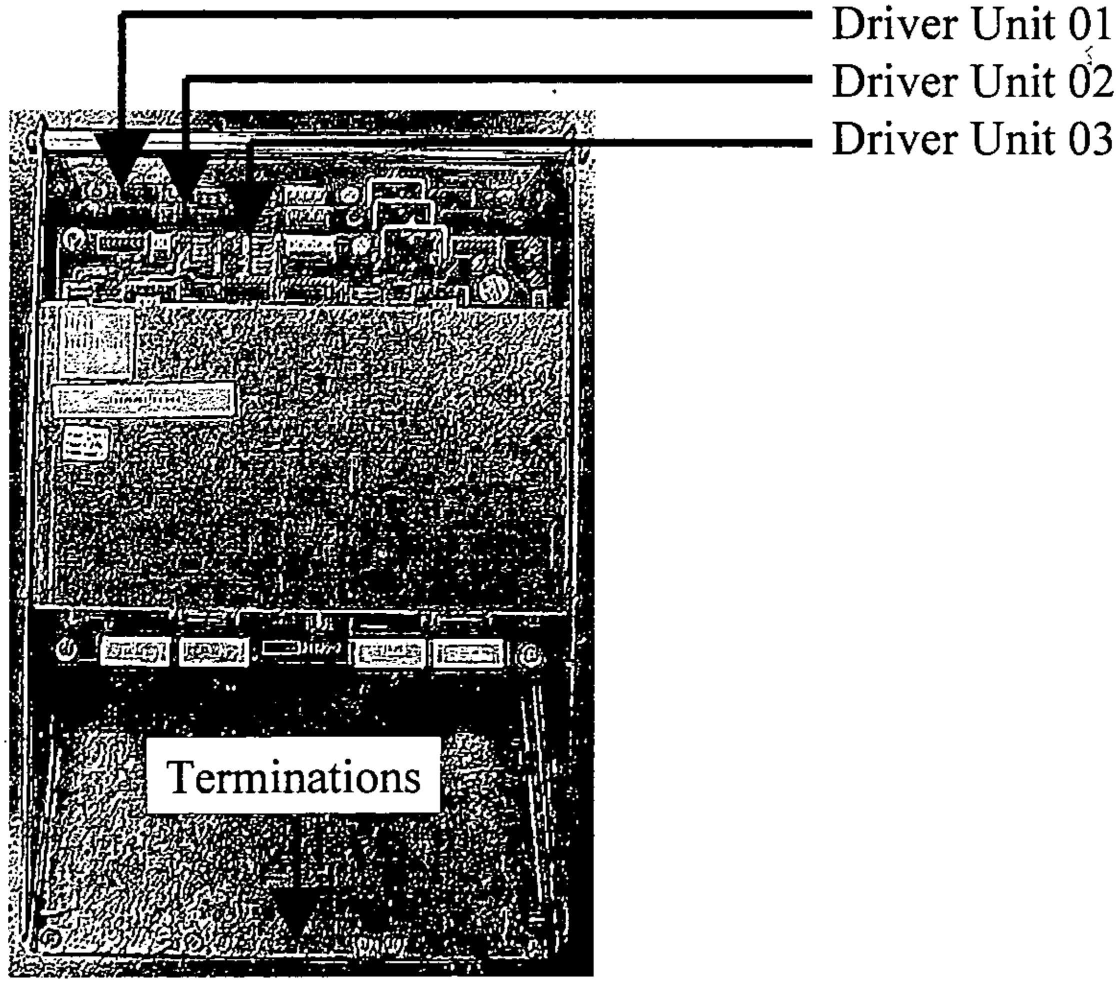
Voltage Test Points
Ground=X005; Pin 1
+5VDC=V065 Heatsink
+12VDC=V061 Heatsink
-12VDC=V067 Heatsink
+20VDC=X005; Pin 2

Interface Board

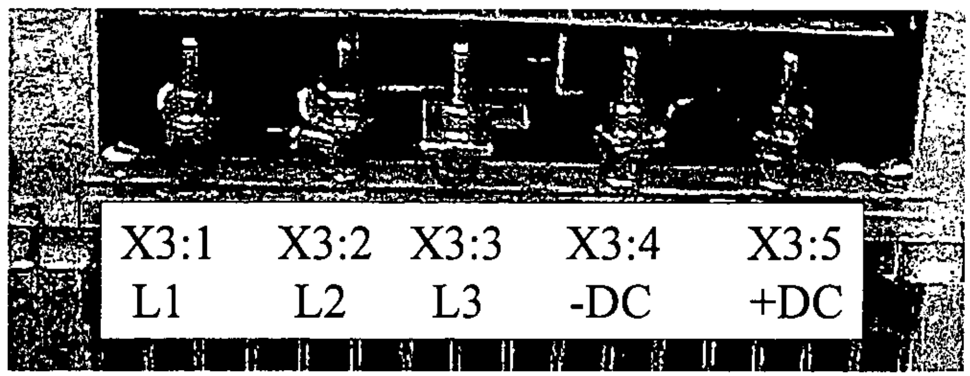


External Connection Board

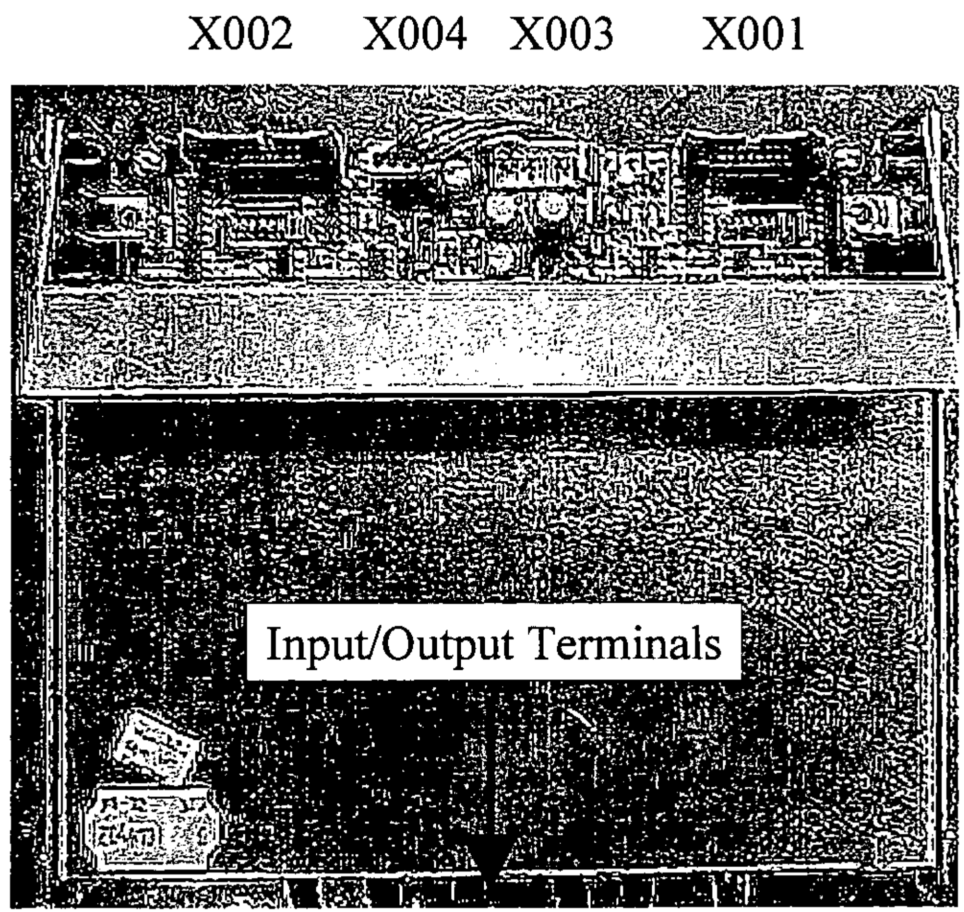
UT310-UT330 TSM



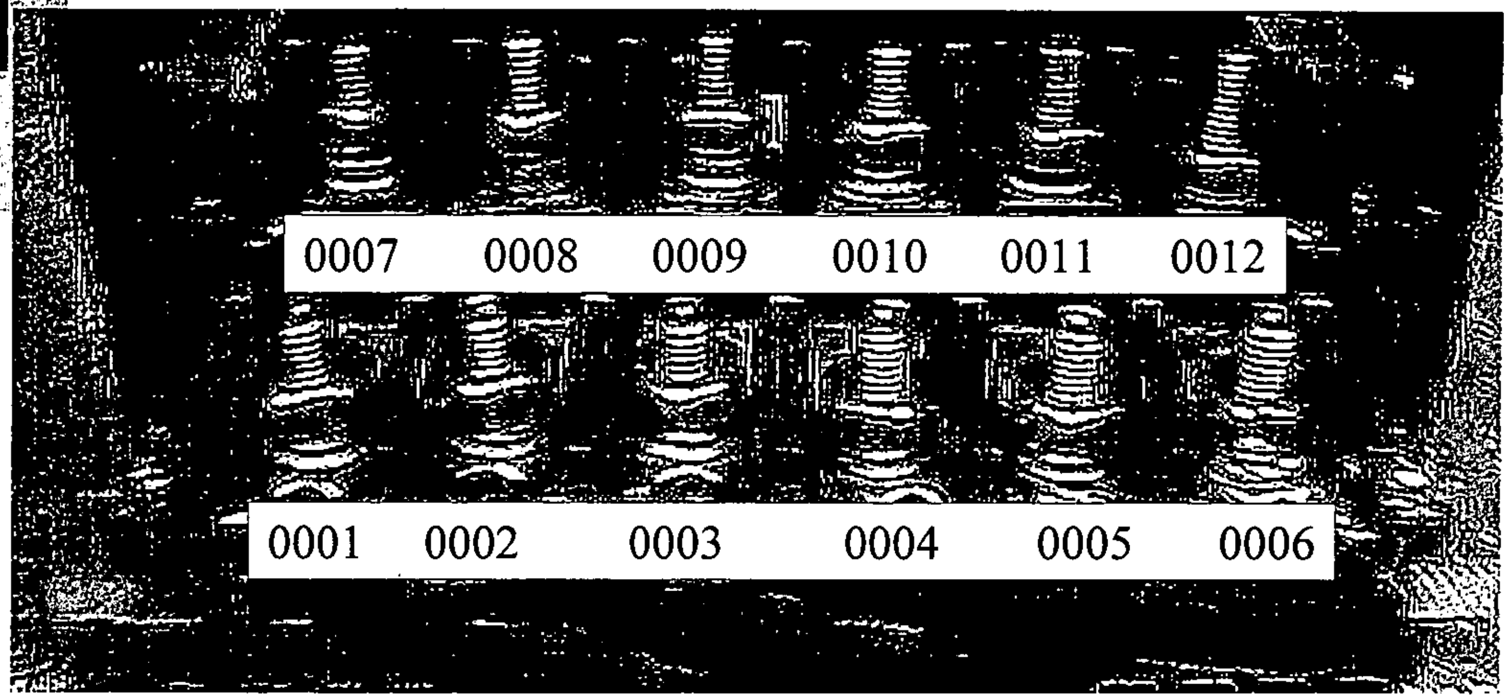
UT310-UT330 TSM Terminations



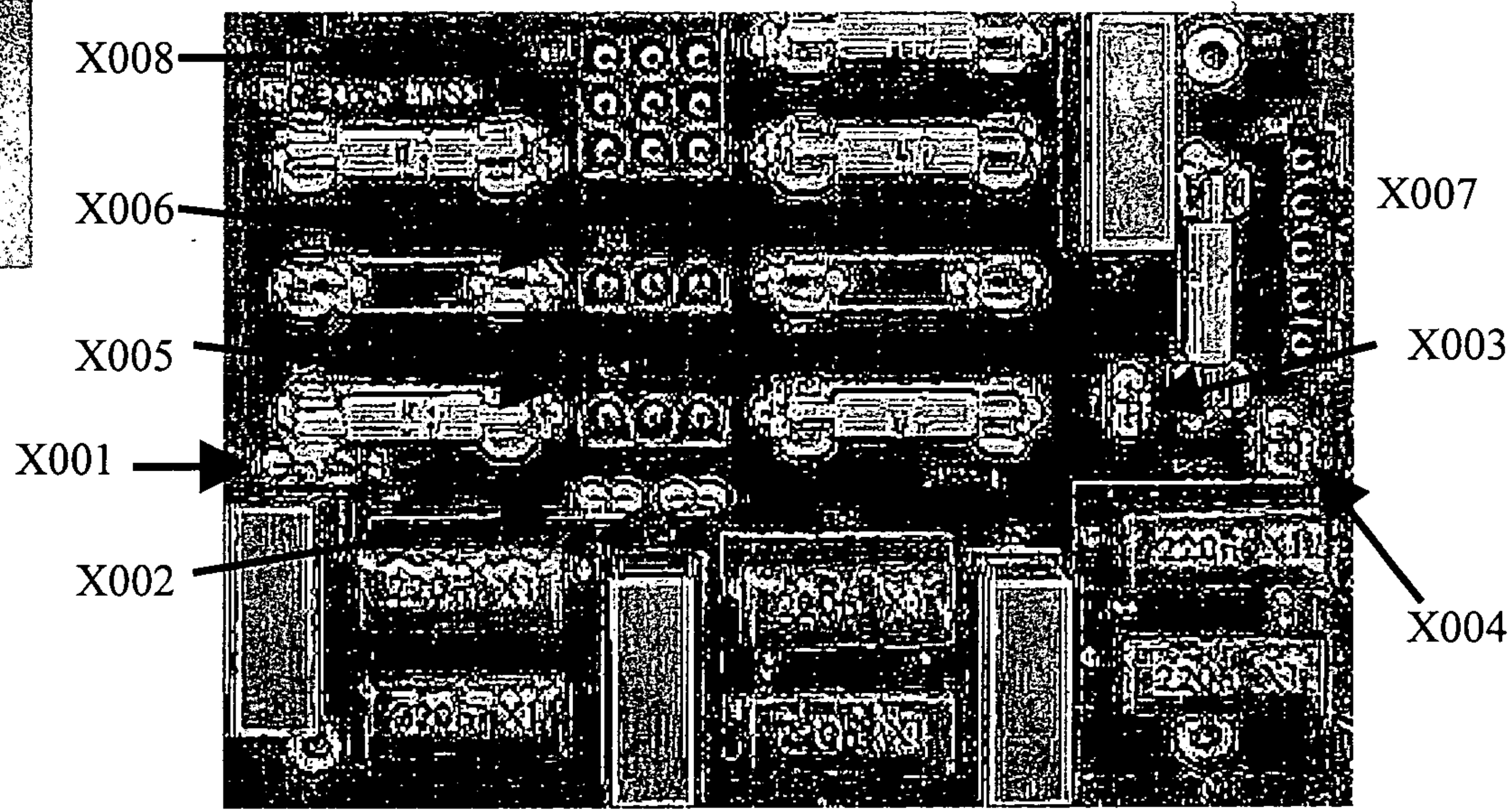
Static Switch Module (UT340/UT360)



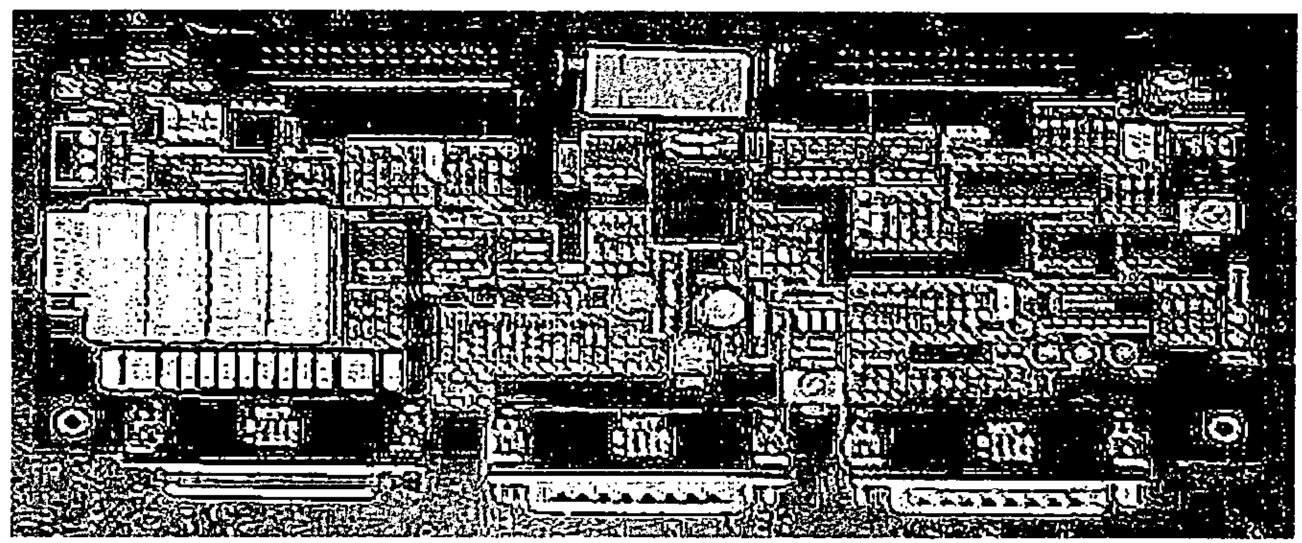
Static Switch Module Terminations (UT340/UT360)



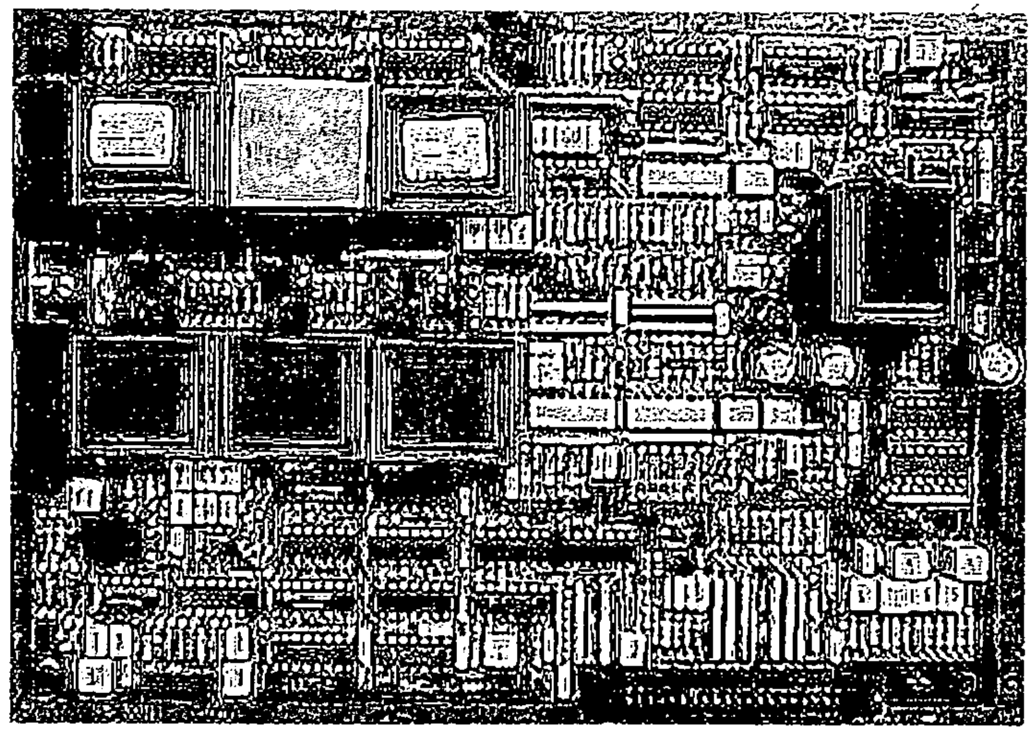
Input/Output RFI Fuse Board



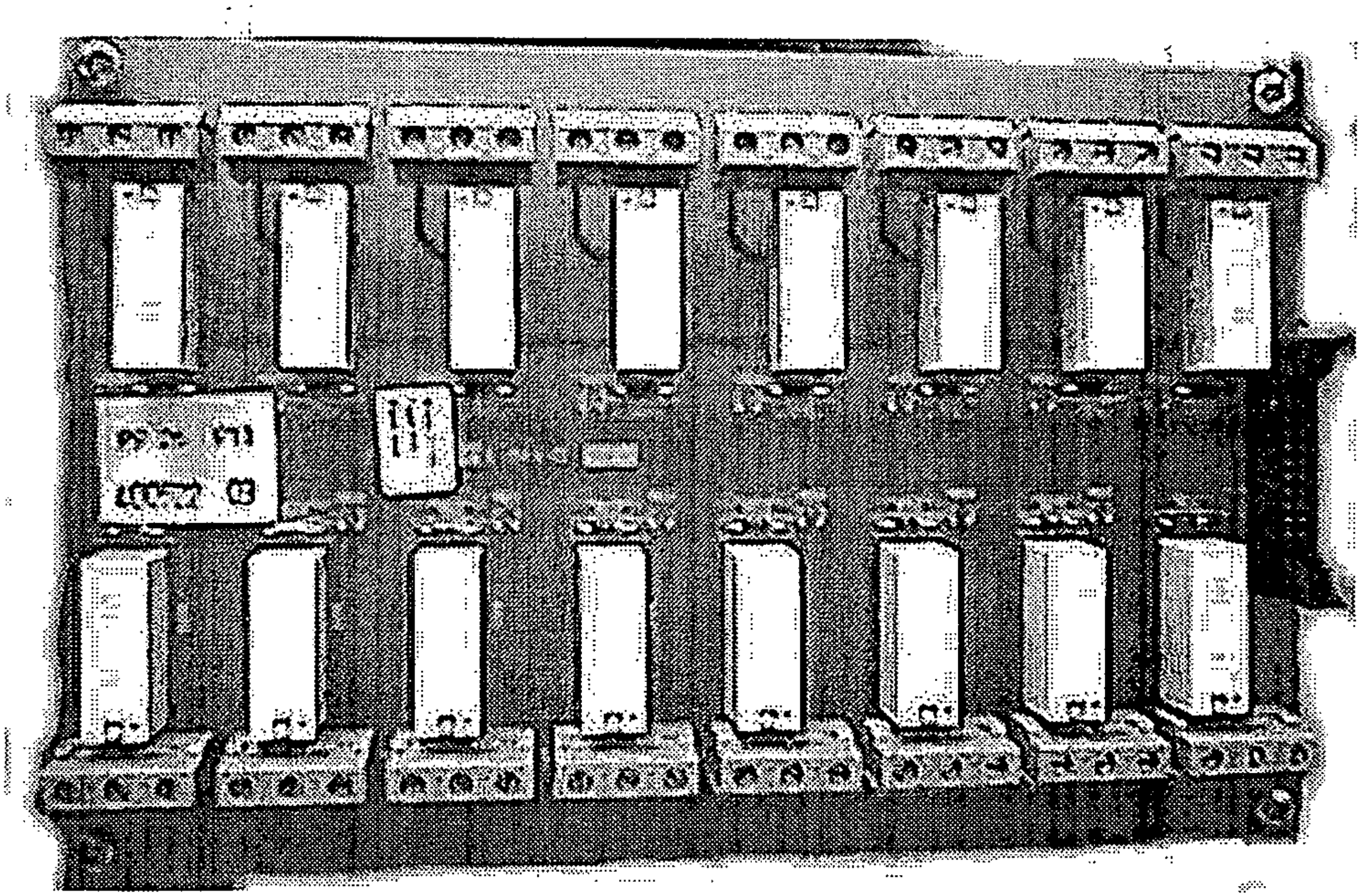
Communication Interface Option Board



Parallel Interface Board



Relay Option Board



Best Power
UNINTERRUPTIBLE POWER SYSTEMS

Startup and Warranty Validation Form For Unity/I Three Phase Models

Service Order Number:________

Technician:________________________ Technician ID: ____________ Territory:____________

LOCATION OF SYSTEM:

Model Number:________________________ Serial Number:________________________
Company Name:________________________ Phone Number:________________________
Address:____
____
____

Contact Name: ____
Date of Service: ____________________________ Time of Service:____________

INSTALLING ELECTRICIAN:

Company Name:____
Electrician Name: ______________________________Phone Number: ______________________
Authorization to service/test UPS.(Contact Signature):________________________________

SECTION A: ENVIRONMENT / UPS SPECS

1. What type of room is the UPS located in (i.e., computer room, equipment room)? ______________
2. Is this room climate controlled, cool and dry? .... ☐Yes ☐No
3. Is the UPS environment clean and free from dust and dirt? .... ☐Yes ☐No
4. Is there sufficient clearance around the unit for service?..................................... ☐Yes ☐No
5. Is there any sign of damage to the UPS? .... ☐Yes ☐No
   If YES explain:____
   ____
   ____
   ____
6. Customer concerns:____
   ____
   ____
   ____
   ____

SECTION B: INPUT TRANSFORMER

1. Is a transformer installed for the Bypass/UPS? (Transformer may be inside bypass assy.)... ☐Yes ☐No
   Note: IF NO, continue with Section C.
2. What is the transformer overcurrent protection on the primary? ______________________ Amps
3. What size is the transformer? (KVA/KW).. ______/______
4. What is the transformer type?... ____________
5. Does the transformer have an equipment ground conductor? .... ☐Yes ☐No
6. Does the transformer have a N- G bond? .... ☐Yes ☐No
7. Is the transformer secondary connected to a grounding electrode? .... ☐Yes ☐No
8. What is being used as the ground electrode? ☐building steel ☐ground rod ☐cold water pipe ☐grid
9. Are all ground wires the same size as the phase conductors? .... ☐Yes ☐No
10. If no to question B9, what size are the ground wires? (Equipment/electrode) ______/______AWG
11. Does the transformer have overcurrent protection on the secondary conductors? .... ☐Yes ☐No
12. What is the size of this breaker or fuse referenced in question B11? .... ________Amps

SECTION C: MAINTENANCE BYPASS CABINET/AC DISCONNECT

1. Is there an external bypass switch being used? (This unit does not have an Internal Bypass Switch)☐Yes ☐No

2. What type of external bypass switch are you using? ☐ MBB (Make Before Break) ☐ BBM (Break Before Make)
3. What style of external bypass switch are you using? ☐ Rotary Bypass ☐Three (3) Breaker Bypass
4. If there is a BEST bypass switch record the switch model # ________________
   switch serial # ________________ fuse part # ________________
5. Is the bypass/AC disconnect switch visible from the UPS? (NEC110-3b) .... ☐Yes ☐No
6. What size is the overcurrent protection for the conductors leading to the bypass assembly?. ________Amps
7. Are the bypass assembly input conductors in conduit?.......................... ☐Yes ☐No
8. What size conductors are providing power to the Bypass Cabinet? .... ________AWG
9. Is there a neutral conductor run with the phase conductors to the bypass cabinet? .... ☐Yes ☐No
   A) What size is the neutral conductor? .... ________AWG
10. Is there an equipment ground conductor in the same conduit as the phase conductors?...... ☐Yes ☐No
    A) What size is the ground conductor?.......................... ________AWG
11. What size are the conductors from the bypass assembly to the load panel? .... ________AWG

SECTION D: UPS INPUT

1. Are the UPS input conductors in conduit?.......................... ☐Yes ☐No
2. What size conductors are providing power to the UPS from the Bypass Cabinet? .... ________AWG
3. Is there a neutral conductor run with the phase conductors to the UPS? .... ☐Yes ☐No
   A) What size is the neutral conductor? .... ________AWG
4. Is there an equipment ground conductor in the same conduit as the phase conductors? .... ☐Yes ☐No
   A) What size is the ground conductor?.......................... ________AWG
5. Is there a ground conductor from the UPS to a grounding electrode? (NEC 250-26)........... ☐Yes ☐No
   A) What size is this grounding electrode conductor? .... ________AWG
   B) What is the grounding electrode? ☐building steel ☐ground rod ☐cold water pipe ☐grid
   C) Is this conductor in conduit? .... ☐Yes ☐No
   D) Are there any other wires in this conduit? .... ☐Yes ☐No
      1) If yes, what are these wires?________________________________

SECTION E: UPS OUTPUT

1. Are the UPS output conductors in conduit?.......................... ☐Yes ☐No
2. Are the UPS input and UPS output conductors in separate conduits? (NEC 110-3b) .... ☐Yes ☐No
3. What size conductors are run from the UPS output to the Bypass Cabinet? .... ________AWG
4. Is there a neutral conductor run with the phase conductors from the UPS output? .... ☐Yes ☐No
   A) What size is the neutral conductor? .... ________AWG
5. Is there an equipment ground conductor in the same conduit as the phase conductors? .... ☐Yes ☐No
   A) What size is the conductor?.......................... ________AWG
6. Is there overcurrent protection between the UPS output and external bypass switch?........... ☐Yes ☐No
   (NEC 240-21) (Best rotary bypass switches have fuses inside the cabinet that satisfy this requirement.)
   A) What is the rating of the overcurrent device?.......................... ________Amps

SECTION F: BATTERIES

1. Battery Type:____________ Number of Batteries:____________ ☐Internal ☐External
   NOTE: If Internal Batteries skip to SECTION G.
2. Are the batteries installed in the battery cabinet correctly?.......................... ☐Yes ☐No
3. What is the nominal DC voltage of the UPS?.......................... ________VDC
4. What is the measured DC voltage at the UPS? .... ________VDC
3. Is there sufficient clearance for ventilation and maintenance between the cabinets? .... ☐Yes ☐No
4. Are the battery cables in conduit? .... ☐Yes ☐No
5. Has an equipment ground conductor been run between the battery cabinets and UPS?.......... ☐Yes ☐No
   A) What size is this grounding conductor?.......................... ________AWG
7. Is there a DC Disconnect with overcurrent protection installed?.......................... ☐Yes ☐No
   A) What rating is this overcurrent protection?.......................... ________Amps
8. Is there a DC Precharge installed? .... ☐Yes ☐No

SECTION G: GENERATOR

1. Will an emergency generator provide power to the UPS? .... ☐Yes ☐No
   NOTE: If NO, proceed to SECTION G.

2. Is it a Three-Phase generator? ☐Yes ☐No
3. What is the generator rating? ______KVA/KW
4. What type of governor does the generator have? ______
5. Does the output of the generator provide a neutral? ☐Yes ☐No
6. How much generator capacity is in use before the UPS is installed? ______KVA
7. Can a test be run during the UPS startup? ☐Yes ☐No
8. Did the UPS accept Generator? ☐Yes ☐No

SECTION H: PHASING CHECK

****

Follow the procedures in the Planning & Installation Manual to start the UPS and place it in Static Bypass before continuing with the phase check for the Maintenance Bypass Cabinet (MBC).

****

****** *Do not switch the Bypass Switch until* ******
****** *the Phase check is complete* ******

1. Make sure the measured voltages are close to the nominal voltage (there will be slight differences). Use a true RMS Digital AC voltmeter to measure the phase-to-neutral voltage between the points below.

MAINS INPUT
L1 to neutral ______ VAC
L2 to neutral ______ VAC
L3 to neutral ______ VAC

INPUT TO UPS
L1 to neutral ______ VAC
L2 to neutral ______ VAC
L3 to neutral ______ VAC

UPS OUTPUT
L1 to neutral ______ VAC
L2 to neutral ______ VAC
L3 to neutral ______ VAC

OUTPUT TO CRITICAL LOADS
L1 to neutral ______ VAC
L2 to neutral ______ VAC
L3 to neutral ______ VAC

2. Make sure the AC voltages from the UPS output and the AC line input to the bypass cabinet are in phase. These readings must not be more than 10 VAC for 208 VAC nominal input (25 VAC for 480 VAC nominal input). If they are, call BEST's Technical Support Center or your local BEST office.

UPS INPUT to UPS OUTPUT
L1 input to L1 output ______ VAC
L2 input to L2 output ______ VAC
L3 input to L3 output ______ VAC

MAINS INPUT to CRITICAL LOAD OUTPUT
L1 input to L1 output ______ VAC
L2 input to L2 output ______ VAC
L3 input to L3 output ______ VAC

MAINS INPUT to UPS OUTPUT
L1 input to L1 output ______ VAC
L2 input to L2 output ______ VAC
L3 input to L3 output ______ VAC

UPS OUTPUT to CRITICAL LOAD OUTPUT
L1 output to L1 output ______ VAC
L2 output to L2 output ______ VAC
L3 output to L3 output ______ VAC

3. Measure neutral to ground voltages. The voltage for N input to N output should not exceed the voltage of N input to ground. If it does, call BEST's Technical Support Center.

N input to ground ______ VAC
N output to ground ______ VAC
N input to N output ______ VAC

4. If all of your readings from the voltage phase check are acceptable, check to make sure the UPS is in the "Static Bypass Mode" or program the UPS into this mode (Refer to the Planning & Installation Manual for information on how to program the UPS into Static Bypass Mode). Using the External Bypass Assembly, switch the loads to and from the UPS several times to verify that proper switching occurs.
5. Program the UPS into Normal Operation (Refer to the Planning & Installation manual for information on how to program the UPS into Normal Operation).

6. Verify proper UPS output while in normal operation by measuring the output with a true RMS voltmeter.

UPS OUTPUT

L1 to Neutral__________VAC
L2 to Neutral__________VAC
L3 to Neutral__________VAC

7. System test the UPS by simulating a power outage and verify that proper switching occurs. (Without Loads)
8. System test the UPS by simulating a power outage and verify that proper switching occurs. (With Loads)
9. If a generator is being used and question #G8 was answered yes, run the generator test now.
10. Document any problems during Startup:____

____
____
____
____
____
____
____

11. Make a rough sketch of the floor plan showing the location of the UPS, Battery System, Maintenance Bypass Cabinet, Service and Load panels, and the EPO if used.

SECTION I: UPS CHECKS

1. Are the fans operating properly? .... ☐Yes ☐No
2. With the UPS supplying power to the loads, meter the output neutral current ________AMPS
7. What is the part number of the UPS controller board? Please circle appropriate number.
   (#0400526 / #0400653)
8. What are the revision numbers listed on the following firmware chips located on the UPS controller board:

Chip #	Description	Rev. #	Chip #	Description	Rev. #
24000/24038	MPU	______	24003/24032	PLD1	______
24001/24040	VQ1	______	24004/24043	PLD2	______
24001/24040	VQ2	______	24005/24044	PLD3	______
24001/24040	VQ3	______	24007/24052	RAM1	______
24002/24041	DMU	______			

4. Record all values listed below:

**** VERIFY THAT STEP #54 IS SET TO A VALUE OF "100"****

PARAMETER	Unit Value	292929 STACK	Unit Setting	292929 STACK	Unit Setting
Load Power %		Step 1		Step 48	
Mains Voltage	/ /	Step 2		Step 49	
Battery Voltage		Step 3		Step 50	
Output Voltage	/ /	Step 4		Step 51	
Mains Current	/ /	Step 5		Step 52	
Battery Current		Step 6		Step 53	
Output Current	/ /	Step 7		Step 54	
Time and Date	/	Step 8		Step 55	
Inverter Current	/ /	Step 9		Step 56	
Output Frequency		Step 10		Step 57	
#8/#5 Battery Temp		Step 11		Step 58	
		Step 12		Step 59	
		Step 13		Step 60	
# STACK		Step 14		Step 61	
SECOND LANGUAGE		Step 15		Step 62	
ADAPTIVE SLEWRATE		Step 16		Step 63	
BATTERY MONITOR RESET		Step 17		Step 64	
BATTERY MONITOR TEST		Step 18		Step 65	
BATTERY CAPACITY TEST		Step 19		Step 66	
M3 STARTUP		Step 20		Step 67	
AUTO BOOST CHARGER		Step 21		Step 68	
BOOST CHARGE		Step 22		Step 69	
BYPASS OPERATION		Step 23		Step 70	
AUTOSTART		Step 24		Step 71	
		Step 25		Step 72	
		Step 26		Step 73	
282828 STACK		Step 27		Step 74	
BOOST CHARGE TIME		Step 28		Step 75	
LOW BATTERY SHUTDOWN		Step 29		Step 76	
LOW BATTERY WARNING		Step 30		Step 77	
CHARGE CURRENT MAX.		Step 31		Step 78	
BOOST CHARGE VOLTAGE		Step 32		Step 79	
NORMAL CHARGE VOLTAGE		Step 33		Step 80	
REMOTE SHUT DOWN TIME		Step 34		Step 81	
REMOTE SHUT DOWN POLARITY		Step 35		Step 82	
REMOTE SHUT DOWN		Step 36		Step 83	
AUTO BATTERY MONITOR		Step 37		Step 84	
HIGH BATTERY TEMPERATURE		Step 38		Step 85	
BATTERY BACK-UP TIME		Step 39		Step 86	
INVERTER & BYPASS		Step 40		Step 87	
SLEW RATE		Step 41		Step 88	
		Step 42		Step 89	
		Step 43		Step 90	
		Step 44		Step 91	
		Step 45		Step 92	
		Step 46		Step 93	
		Step 47		Step 94	

THE FOLLOWING OPERATIONS AND DISPLAYS WERE EXPLAINED TO THE CUSTOMER AND WAS UNDERSTOOD.

- ☐ KEYPAD OPERATION
- ☐ STARTUP AND SHUTDOWN PROCEDURES
- ☐ HOW TO BYPASS THE LOADS
- ☐ HAVE SERIAL NUMBER READY WHEN CALLING BEST
- ☐ WHEN TO SHUTDOWN THE UPS
- ☐ ALARM LED INDICATOR
- ☐ VIEWING AND SILENCING ALARMS

______________________________ SITE REPRESENTATIVE

______________________________ SERVICE REPRESENTATIVE

TRAVEL TIME:______________________

TIME ON-SITE:______________________

SPECIFICATION CHECKLIST
THREE-PHASE SITE SURVEY

Please complete this form and return it via fax to Best Power Worldwide Service to assist Best Power in determining the proper unit for the proposed application. A true RMS Digital Multimeter should be used for all voltage and current measurements. Please include the phone number for the contact person to enable Best Power to discuss the results. If you have any questions, call Best Power Worldwide Service.

SITE INFORMATION:		RETURN TO:	
COMPANY:		COMPANY:	Best Power Worldwide Service
ADDRESS:		ADDRESS:	P.O. Box 11 Necedah, WI 54645
PHONE:		PHONE:	1-800-356-5737
FAX:		FAX:	1-608-565-2509
SITE CONTACT:		ATTN:	

SECTION A: UPS Requirement

1. Why is a UPS requested for this application? ______________________

2. What is the desired full load runtime duration for this UPS?............ _____ Minutes

SECTION B: Site Information

1. What type of transformer installation will supply power to the UPS?
   ☐ Delta ☐ Wye ☐ Corner-Grounded Delta ☐ Other, Specify ____________

NOTE: Supply transformers may be installed in several configurations, depending on what type of transformer is installed. If unsure of the transformer configuration, consult an electrician.

2. Please record the following information from the electrical panel that will be supplying power to the UPS. Voltage and current measurements must be taken using a true RMS Digital Multimeter.
   A. What is the main overcurrent device rating? .... _______ Amps
   B. What is the measured panel output voltage?............ _______ VAC
   C. What is the measured panel output current at this time? .... _______ Amps

3. Will the UPS receive power from a standby generator?............ ☐Yes ☐No
   A. If Yes,
      i. Who is the generator manufacturer? .... __________
      ii. What is the generator model number?............ __________
      iii. What is the generator fuel type and rating?.. Fuel type: ________; Rating: _____ kW/_____ kVA
      iv. What type of governor does the generator have? .... ☐ Mechanical ☐ Electronic
      v. Is it a Three-Phase generator?............ ☐Yes ☐No
      vi. Does the output of the generator provide a neutral?............ ☐Yes ☐No
      vii. How much generator capacity is currently being used?............ _____ kVA

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

SPECIFICATION CHECKLIST
THREE-PHASE SITE SURVEY

SECTION C: UPS Location

1. What type of room will the UPS located in (i.e., computer room, equipment room)? .... ______________
2. Will the room be climate controlled, cool and dry? .... ☐Yes ☐No
   A. If Yes,
      i. What is the rated air flow? .... _____ ft^3/Min; _____ $tons^3$/Hr
      ii. What is the rated BTU capability? .... _____ BTU/Hr
3. What type of floor will the UPS be installed on? (i.e. concrete, brick, raised floor, etc.) ..... ______________
4. What is the floor load rating? .... ________ lb./inch
5. If an external battery system is required, what length of cable will be required between the UPS and the battery system? (Include any risers.) .... ______ ft.
   A. What type of floor will the battery system be installed on (i.e. concrete, brick, raised floor)? __________
   B. What is the floor load rating? .... _______ lb./inch
6. Will the UPS environment be clean and free from dust and dirt? .... ☐Yes ☐No
7. Will there be sufficient clearance around the unit for service? .... ☐Yes ☐No
8. What is the estimated length of cable required between the UPS and the load equipment distribution panels? (Include any risers.) .... Panel # 1: _______ ft.
   Additional Panel #2 (if applicable): _______ ft.
   Additional Panel #3 (if applicable): _______ ft.
   Additional Panel #4 (if applicable): _______ ft.
   Additional Panel #5 (if applicable): _______ ft.
   Additional Panel #6 (if applicable): _______ ft.
   Additional Panel #7 (if applicable): _______ ft.

SECTION D: FLOOR PLAN SKETCH

1. Make a rough sketch of the proposed floor plan showing the location of the UPS, Battery System, Maintenance Cabinet, Service and Load panels, and the EPO and Generator if they will be used.

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SPECIFICATION CHECKLIST
THREE-PHASE SITE SURVEY

SECTION E: Connected Loads

1. What type of equipment will the UPS be supporting (computer, motor controls, lighting, etc.)? ____________

____

____

____

2. Please record the following information from the existing load panel(s) that will be powered by the UPS.
3. Voltage and current measurements must be taken using a true RMS Digital Multimeter.
4. New panels or additional loads to the existing panels are addressed in the next item.

Load Panel(s)	Main Overcurrent Rating	Measured Panel Input Voltage	Measured Panel Output Current per Phase
Panel #1	______ Amps	______ VAC	____/____/____
Panel #2	______ Amps	______ VAC	____/____/____
Panel #3	______ Amps	______ VAC	____/____/____
Panel #4	______ Amps	______ VAC	____/____/____
Panel #5	______ Amps	______ VAC	____/____/____
Panel #6	______ Amps	______ VAC	____/____/____

5. Please record the following information for ALL new equipment that will be added to the existing or to new load panels that will be powered by the UPS.

Panel #	Manufacturer	Model #	Input Voltage	Amps	VA	Qty	Total VA
						TOTAL	

SPECIFICATION CHECKLIST
THREE-PHASE SITE SURVEY

SECTION F: Additional UPS Features

1. Please indicate all desired UPS options for this application.
   ☐ Communication Option
   Allows remote monitoring of the UPS through software or relay activated monitoring.
   ☐ Fan Monitor Option
   Monitors the fan speed to detect fan problems before unit overheating occurs.
   ☐ Parallel UPS Option
   Allows for system expandability and / or a redundant (N + 1) installation useful for critical load applications. For more information, contact Best Power Application Engineering personnel.
   ☐ Battery Charger Temperature Compensation
   Standard in 10kW - 30kW systems with internal batteries only; An option for all external battery applications.
   ☐ IP21 Enclosure
   Water resistant cover mounted on top of the UPS; Recommended for sites with overhead sprinkler systems.
   ☐ Second Language Display; Please specify second language desired: ________________
   English is the primary with Spanish installed as the secondary language unless another language is requested. Contact Best Power for language choices.
   ☐ LED Front Panel (120KVA - 220KVA only)
   Visual display indicating the status of the UPS modules.
   ☐ Relay Board (40KVA - 220KVA only)
   Provides multiple relay contact closure signals for remote status monitoring/evaluation.
2. Please indicate the desired UPS Interface/Monitoring options for this application.

A.	☐ RS232 Communication	G.	☐ SNMP Adapter
B.	☐ IBM AS/400 Interface Kit	H.	☐ Banyan Vine (standard Vine cable kit)
C.	☐ Sun OS/Solaris 3.5" disk	I.	☐ LanManager V2.0+, Windows NT V4.0+
D.	☐ CheckUPS DEC Axp/Vms TK-50	J.	☐ Novell netware cable kit (PS/2 mouse port)
E.	☐ CheckUPS DEC Van/Vms CD	K.	☐ Novell netware monitor card cable kit
F.	☐ Unix/Xenix & compatibles 3.5"disk	L.	☐ SFA:________________

SECTION G: Customer Concerns / Questions

1. Customer concerns: ____
2. Customer questions: ____

________________________ Site Representative

________________________ Best Power Representative

Travel Time: ____________

Time On-Site: ____________

INSTRUCTIONS TO COMPLETE THREE PHASE SITE SURVEY (UTT-0603A)

ITEM 1. Complete all customer contact information

ITEM 2. Let us know if there is a specific reason you are investigating a UPS purchase. This will assist BEST in determining the proper configuration for your application.

ITEM 3. Supply transformers may be installed in several configurations depending on what type of transformer you have (Delta, Wye, corner-grounded Delta, etc.). If unsure of your transformer configuration consult your local electrician.

ITEM 4. This information should be taken from the electrical panel that will be supplying the UPS. Voltage and current measurements must be taken using a true RMS Digital Multimeter.

ITEM 5. Load rating and/or construction material of the floor that will be supporting the UPS is extremely important in determining the UPS configuration.

ITEM6. If an external battery system will be used, what is the distance between the UPS and the battery system? This should be the **length of cable** needed to connect the UPS and battery system.

ITEM 7. Load rating and/or construction material of the floor that will be supporting the Battery System is extremely important in determining the proper UPS configuration.

ITEM 8. What is the distance between the UPS and the Load Equipment supply panel(s). This should be the **length of cable** needed to connect these panel(s).

ITEM 9. What type of equipment will the UPS be supporting (computer, motor controls, lighting, etc.)?

ITEM 10. The UPS must be kept in a clean, cool and environmentally controlled area. What is the cooling capacity being supplied to the UPS area:

ITEM 11. Desired UPS runtime @ full load will assist BEST in determining the proper configuration for your application.

ITEM 12. For use with existing installations. What are the ratings and measurements of the load panels to be powered by the UPS: This data is extremely important in determining the correct UPS model. If you will be adding additional loads to the existing panels please complete the "UPS SIZING REQUIREMENT WORKSHEET" with the proper data on equipment to be added.

ITEM 13. Complete this section if the UPS will receive power from an emergency generator. This will ensure special UPS programming for increased generator compatibility.

ITEM 14. Place a mark in the box for any desired option, Please specify a second language preference.

- Communication Option - Available on all models, it allows remote monitoring of the UPS using software or relay activated monitoring.
- Fan Monitor - Monitors fan speed to detect fan problems before unit overheating occurs.
- Parallel UPS - This product may be installed in parallel creating a redundant (N + 1) installation useful for critical load applications. For more information on this option contact Application Engineering at BEST.
- Battery Charger Temperature Compensation - Standard in the 10KVA-30KVA using internal batteries, this is an option on all external battery system application.
- IP21 Enclosure - Water resistant cover mounted on top of the UPS, this is recommended for sites using overhead sprinkler systems.
- Second Language - This product has the capability of operating in an alternative language. English will be primary and Spanish will be installed as secondary unless another language is requested.
- LED Front Panel - Available on 120KVA-220KVA models, this option shows the status of UPS modules.
- Relay Board - Available on 40KVA-220KVA models, this option provides multiple relay contact closure signals for remote status monitoring/evaluation.

ITEM 15. Interface Option(s) - Place a mark in the box of any desired interface package.

UPS SIZING REQUIREMENT WORKSHEET - Designed for use in establishing new installation or expansion requirements, this worksheet is comprised of columns for volts, amps and VA (volt-amps). Load equipment may be listed as amps or VA depending upon the manufacturer. Either method of rating is acceptable although if both ratings are given it may assist BEST in ensuring the correct unit sizing for your application. If no ratings are available on the product or from the vendor, complete the manufacturer and model information and return the worksheet to BEST. This worksheet may be used at any time, even to establish the unit sizing for an existing installation with no anticipated load additions. For additional copies contact BEST at (800) 356-5794.

If you have any questions of difficulties when completing these publications, contact BEST POWER at (800) 356-5794.

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VER SYSTEMS

THREE PHASE WIRING PRECHECK

Please complete this form and return it via fax to the Service Department at Best Power when the UPS is set in place and all wiring is complete. Please include the phone number for the contact person to enable Best Power to schedule the Factory Startup Service. Refer to the instructions in the Planning and Installation Manual provided with the UPS if you have any questions..

TO:	RETURN TO:
COMPANY:	COMPANY: Best Power Service Department
ADDRESS:	ADDRESS: P.O. Box 11 Necedah, WI 54646
PHONE:	PHONE: 1-800-356-5737
FAX:	FAX: 1-608-565-2509
ATTN:	ATTN:
UPS SERIAL #:	REFERENCE #:

SECTION A:

1. Is all equipment free of shipping damage? ☐ Yes ☐ No*
2. Is the UPS unboxed and set in place? ☐ Yes ☐ No*
3. What type of room is the UPS located in (i.e., computer room or equipment room)? ____________
4. Is this room climate controlled and dry? ☐ Yes ☐ No* Temp Range Hi ____°F / Lo ____°F
5. What is the input service to the UPS? Voltage: L - L ______V , L - N______V
6. What is the transformer type: ☐ Wye ☐ Delta.
7. Is the system single or dual feed? ☐ Single ☐ Dual
8. What is the type and size of the overcurrent protection to the Bypass? ☐Fuse ☐Breaker ______AMP
9. What is the type and size of the overcurrent protection to the UPS? ☐Fuse ☐Breaker ______AMP
10. If fed from a service panel, what size is the main breaker? ______Amps

SECTION B:

1. Is there maintenance clearance per the equipment installation instructions? ☐Yes ☐No*
2. Is there an external bypass switch being used? ☐Yes ☐No*
3. Is the bypass switch supplied by Best Power? ☐Yes ☐No*
4. Is the bypass/AC disconnect switch visible from the unit? ☐Yes ☐No*
5. What size conductors are providing power to the UPS/Bypass switch? _______/_______AWG
6. Are the UPS AC input and output in separate conduits? (NEC 110-3b) ☐Yes ☐No*
7. Is the input phase rotation clockwise A-B-C? ☐Yes ☐No*
8. What size conductors are being used for the UPS output? ________AWG
9. Is a neutral conductor run with the phase conductors? Input ☐Yes ☐No* / Output ☐Yes ☐No*
   A. What size is the neutral conductor? Input _______AWG / Output _______AWG
10. Is there an equipment grounding conductor pulled with the UPS phase conductors? ☐Yes ☐No*
    A. What size is the conductor? ________AWG
11. Is there a UPS grounding electrode conductor to a grounding electrode? ☐Yes ☐No
    A. What size is this grounding electrode conductor? ________AWG
    B. What is being used as this grounding electrode (NEC 250-26b and c)? ____________
    C. Is this conductor in metal conduit? ☐Yes* ☐No
    D. Are there any other wires in this conduit? ☐Yes* ☐No
12. Are all control wires between the UPS and Bypass switch installed? ☐Yes ☐No*

SECTION C:

1. Is this unit using external batteries? If no skip to SECTION D. ☐Yes ☐No
   - A. Is there sufficient clearance for ventilation and maintenance between the cabinets? ☐Yes ☐No*
   - B. Are the batteries supplied by Best Power? ☐Yes ☐No*
   - C. Are the battery cables in conduit? ☐Yes ☐No*
   - D. What size are the battery cable conductors? ________AWG
   - E. Has equipment ground conductor been run between the battery cabinet and UPS? ☐Yes ☐No*
   - F. What size is this grounding conductor? ________AWG
   - G. Is there a BEST DC Disconnect with overcurrent protection installed? ☐Yes ☐No*
   - H. What is the type and size of the overcurrent protection? ☐Fuse ☐Breaker ________AMP
   - I. Is there a BEST DC Precharge installed? ☐Yes ☐No*
   - J. Are all control wires between the UPS and Battery cabinet installed? ☐Yes* ☐No

SECTION D:

1. Will an emergency gènerator provide power to the UPS ☐Yes ☐No
2. What is the generator rating? Fuel type __________ _______/_______KW/ KVA
3. What type of governor does the generator have? ☐ Mechanical ☐ Electronic
4. Is it a Three-Phase generator? ☐Yes ☐No*
5. Does the output of the generator provide a neutral? ☐Yes ☐No*
6. Is the generator output phase rotation clockwise A-B-C? ☐Yes ☐No*
7. How much generator capacity was used before the installation of the UPS ________ KVA
8. What is the non-UPS load on the generator? ________ KVA
9. Can a generator test be run during UPS startup? ☐Yes ☐No*

Please answer all questions on all pages. If any answers have a *, please call Best Power Service Department at 1-800-356-5737 to clarify UPS and NEC requirements before scheduling the Startup

Installation Comment:____
____
____
____
____

Is UPS installation complete and comply with all applicable NEC and Local Electrical codes? ☐Yes ☐No*
INSTALLING ELECTRICIAN (signature):________________________________ Date:____________
COMPANY AND PHONE:____
SCHEDULING CONTACT:____
SCHEDULING CONTACT'S PHONE NUMBER:_____________________________________
REQUESTED STARTUP DATE:____
(This is not a confirmation of scheduling! Best Power requires 3-5 business days advance scheduling notice.)
WILL AN ELECTRICIAN BE AVAILABLE DURING THE STARTUP? ☐Yes ☐No*
NOTE: If a Factory Startup Option is purchased, all wiring must be complete and correct prior to Best Power's scheduled arrival or additional customer expense may be incurred.

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Battery Assurance Program Inspection Report

Date Completed	Service Order #

UPS Serial #	Type of Inspection	Standard ☐	Premium ☐	Service Call ☐	Other ☐
Contractor	Battery Info	No. Cells	Type Model	Charging Equip (Model & Ser #)	

Customer (Name , Address and phone #)
____
____
____
____

Charge Current: ____________Amps
Charge Voltage: ____________Volts
Ripple Current: ____________Amps
Ripple Voltage: ____________Volts
Average AC µAmps: ________ Amps

Summary of Inspection Results

Battery Voltages	Total	High	Low	Connection Resistances	Avg	High	%High	Low
From UPS Display				Intercell				
From Volt Meter				Intertier				
				Interrack/cab				

	OK	Not OK		OK	Not OK
1. Cleanliness	☐	☐	13. Resistance (Connector)	☐	☐
2. Ventilation	☐	☐	14. Terminals	☐	☐
3. Charging Equipment	☐	☐	15. Connectors & Bolts	☐	☐
4. Floating Voltage	☐	☐	16. Flame Arrestors	☐	☐
5. Racks (corrosion, etc)	☐	☐	17. Covers (cracks, dirt, leaks)	☐	☐
6. Voltage (Cell)	☐	☐	18. Jars (cracked, leaks)	☐	☐
7. Gravity (Cell)	☐	☐	19. Seals	☐	☐
8. Cell Impedance__________	☐	☐	20. Positives	☐	☐
9. Room Temp__________	☐	☐	21. Negatives	☐	☐
10. Post Temperature ________	☐	☐	22. Separators	☐	☐
11. Elect Level (Cell) ________	☐	☐	23. Sediment	☐	☐
12. Torque ________inch lbs	☐	☐	24. Other ____________	☐	☐
	☐	☐		☐	☐

Explanation of items checked "Not OK" above & Remarks:
____
____
____
____
____
____
____
____

Customer Signature ____________________ Date ________

UPS Serial #________________

Battery Inspection Report

Cell No	Volts DC	Temp	Cell Impedance	Conn Resist	Date Code	Spec Grav
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
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23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Cell No	Volts DC	Temp	Cell Impedance	Conn Resist	Date Cod	Spec Grav
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
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Best Power
UNINTERRUPTIBLE POWER SYSTEMS

Field Calibration Procedure

RECOMMENDED TOOLS		
DMM w/Leads	Torx T20 (10K-15KVA)	8mm Nut Driver (40K-100KVA)
AC/DC Current Probe	Torx T25 (20K-30KVA	10mm Nut Driver (40K-100KVA)
12" Jumper Wires	Torx T30 (120K-220KVA)	#2 Phillips Screwdriver (40K-100KVA)

1) **Read entire procedure before starting. Call Best Power with any questions before starting this process.**

2) With unit running in Normal Operation, verify the following (actual vs. displayed):

Parameter	Tolerance
Input Voltage	± 2%
Output Voltage	± 1%
Input Current (actual vs displayed)	± 5%
Output Current	± 2%
Inverter Current	± 10%
Battery Voltage	± 2VDC
Battery Float Voltage	± 1VDC of nominal
Battery Discharge Current	± 5ADC
Battery Temp (Option)	± 2°C
DC Charge Current Limit	±1 ADC of Nominal
Zero Phase Offset	+0, -1 Amp

NOTE Perform only the following steps in which actual vs. displayed values were out of tolerance. All Loads used must be non-critical. If critical load is in operation, place it on maintenance bypass.

3) Ensure all monitor software or contacts are disabled before proceeding with calibration.
If unit is in parallel configuration, turn off logic power supply and disconnect ribbon cable from main controller connector X012, then turn logic power back on.

4) **Input and Output voltage :**

A) Place UPS in battery operation with no output load connected.

B) Meter output voltage L1 to N using RMS digital voltmeter. Enter different values in Step 48 (292929 Stack) until L1 is at nominal voltage (120.3Vac or 277.6Vac referenced to neutral).

C) Press '#' key.

D) Meter output voltage L2 to N using RMS digital voltmeter. Enter different values in Step 49 (292929 Stack) until L2 is at nominal voltage (120.3Vac or 277.6Vac referenced to neutral).

E) Press '#' key.

F) Meter output voltage L3 to N using RMS digital voltmeter. Enter different values in Step 50 (292929 Stack) until L3 is at nominal voltage (120.3Vac or 277.6Vac referenced to neutral).

G) Press '#' key.

H) Change Step 54 (292929 Stack) to 000 and press '#' key.

I) Place UPS in standby, disconnect input Mains. Manually disconnect input neutral from UPS.

J) Jumper UPS input to UPS output (L1 in to L1out, L2 in to L2out, L3 in to L3out, and N in to N out).

K) Disconnect Backfeed Relay supply on Input RFI/Fuse Board (X007 in standard unit or X006 with CPO-1153 installed (No Neutral Option)).

L) Place UPS in battery operation. **Do not turn on mains input at this time.**

M) The only active alarm in the Alarm Log should be 'Synchronization Error'.

N) Enter password 191919. Wait for 1 minute.

O) Verify the mains input and output voltage displayed value is within tolerance of metered value.

P) Place UPS in standby, remove UPS input to UPS output jumpers and reinstall input neutral.

Q) Reconnect Backfeed Relay supply on Input RFI/Fuse Board.

R) Change Step 54 (292929 Stack) to 100 and press '#' key.

S) Turn ON AC Mains voltage.

T) Place UPS in normal operation.

U) Using the keypad, verify voltages are within tolerance.

5) **Input Current:**

A) Place UPS in normal operation.

B) Load UPS with as close to 100% load as possible. Do not calibrate input current if load is under 50%. ****NOTE**** If load is not available, Mains Current can be **measured but not calibrated** with no load on UPS and unit running in Normal Operation.

C) Measure input current on L1 to nearest tenth of an amp.

D) Enter this value in step 43 as a 6 digit number (3 digits before decimal and 3 digits after). i.e. 46.5 amps is entered as 046500.

E) Verify Inverter Current and Output Current are now correct, ensure all load is off UPS and enter password 181818, if they are not correct proceed to step 6.

6) **Inverter Current:**

A) Place UPS in normal operation.

B) Load UPS with as close to 100% load as possible. Do not calibrate inverter current if load is under 50%. **NOTE** If load is not available, inverter current can be **measured but not calibrated** with no load on UPS and unit running in Normal Operation.

C) Place UPS in battery operation.

D) Measure inverter current on L1 to nearest tenth of an amp.

E) In step 44 (292929 Stack), enter this value as a 6 digit number (3 digits before decimal and 3 digits after). i.e. 120.3 amps is entered as 120300.

F) If output current is correct, ensure all load is off UPS and enter password 181818, if output current is not correct proceed to step 7.

7) **Output Current:**

A) Place UPS in normal operation.

B) Load UPS with as close to 100% load as possible. **Do not** calibrate output current if load is under 50%.

C) Measure output current on L1 to nearest tenth of an amp.

D) In step 45 (292929 Stack), enter this value as a 6 digit number (3 digits before decimal and 3 digits after). i.e. 42.1 amps is entered as 042100.

E) Verify step 46 (292929 Stack) is set to unit nominal output current. This value can be found on specification label inside the front door and in the Planning and Installation Manual. This value, if changed, must be entered using 6 digits (3 before decimal place and 3 after). i.e.: nominal current is 55.5 amps entered as 055500.

F) Ensure all load is off UPS and enter password 181818.

8) **Battery Voltage:**

A) Disconnect battery temperature sensor if connected (Located on external connection board). Be sure to document sensor polarity (wire color). Internal batteries proceed to Step C.

B) External batteries only - Turn off UPS and remove control wires from external connection board, X012 pins 3 and 4. Place jumper between these pins.

C) Place UPS in normal operation with no output load.

D) Document 'Normal Charge Voltage' and 'Boost Charge Voltage' from Service Stack (282828).

E) Disconnect battery supply (remove DC fuses or open DC breaker).

F) Measure float charge voltage of UPS (DC cap voltage) to nearest tenth of a volt.

G) Enter this value in Step 23 (292929 Stack) as a 6 digit number (3 digits before decimal and 3 digits after). i.e. 246.5 volts is entered as 246500.

H) After this calibration, charger setting for 'Normal Charge Voltage' and 'Boost Charge Voltage' will need to be reset in Service Stack to original voltages and written in memory.

I) Reconnect battery supply.

J) Place UPS in standby.

K) Silence any audible alarm. Go to Step 24, press '#' key , wait for audible alarm.

L) Enter appropriate value into Step 25 (292929 Stack):

10K-60K	=	300
80K-100K	=	500
120K-220K	=	550

M) Go to Step 26, press '#' key and wait for audible alarm. If alarm does not occur within 2 minutes repeat Step K.

N) Go to Step 27, press '#' key and wait for audible alarm. If alarm does not occur within 2 minutes repeat Step K once, continue if still no audible alarm.

O) Place UPS in normal operation.

P) Disconnect battery supply (remove DC fuses or open DC breaker).

Q) Ensure that UPS Battery Voltage is floating at programmed 'Normal Charge Voltage'.

R) Reinstall battery temperature sensor. Verify it is installed with correct polarity.

S) Remove jumper and reinstall wires on external connection board, X012 pins 3&4 if applicable.

T) Reconnect DC supply to UPS (Fuses or DC Breaker).

9) **Battery Discharge Current:**

A) Place UPS in normal operation.

B) Load UPS with as close to 100% load as possible. **Do not** calibrate battery current if load is under 50%.

C) Place UPS in battery operation.

D) Measure battery current to nearest tenth of an amp.

E) Enter this value in Step 38 (292929 Stack) as a 6 digit number (3 digits before decimal and 3 digits after). i.e. 043.5 amps is entered as 043500.

F) Apply AC mains input.

10) **Battery Temperature:**

A) Measure ambient temperature of battery compartment in Celsius to nearest tenth of a degree.

B) Enter this value in Step 42 (292929 Stack) as a 6 digit number (3 digits before decimal and 3 digits after). i.e. 23.4°C is entered as 023400.

) DC Charger Current Limit

A) Verify DC voltage stays below 'Normal Charge Voltage' thoughout test.
B) Place UPS in normal operation.
C) With batteries discharged, meter charge current.
D) In Step 28 (292929 Stack), enter metered value to nearest tenth of an amp using 6 digits (i.e. 10.3 amps entered as 010300).
E) Still with batteries discharged, meter charge current (it changed in step D).
E) In Step 39 (292929 Stack), enter metered value to nearest tenth of an amp using 6 digits (i.e. 12.4 amps entered as 012400).
F) In Service Stack (282828) 'Charge Current Max' must be reset to nominal value listed in the table at the end of this process.

12) Adjust Zero Phase Offset – This adjustment is extremely critical to correct functioning of DC charge circuitry.

A) Place UPS in normal operation with no output load.
B) Verify proper nominal charge current limit. Record this current measurement.
C) Change 'Normal Charge Voltage' (282828 Stack) to the nominal DC bus level that is correct for your unit (216/360/408).
D) Verify battery voltage is decreasing. Discharge current should be the same as recorded 'Charge Current Limit'. (Unit is actually charging batteries at a negative DC voltage).
E) If adjustment is needed, go to Step 51 (292929 Stack). Increase discharge current by entering a higher value or decrease discharge current by entering a lower value (i.e. Step 51 at 108, Enter 1,0,9 and current will increase). If exact current cannot be attained, enter appropriate value in Step 51 (292929 Stack) so discharge current is slightly below 'Charge Current Limit' from step B.
F) Press '#' key when desired value has been reached.
G) Change 'Normal Charge Voltage' (282828 Stack) parameter back to original value.

13. **Verify the following parameters:**

STACK	LOCATION	VALUE
#	M3 Startup	OFF
#	Autoboost Charger	OFF
#	Boost Charge	OFF
#	Auto Restart	OFF (Default)
282828	Normal Charge Voltage	10K-60K = 246 80K-100K = 410 120K-220K = 467
282828	Boost Charge Voltage	10K-60K = 246 80K-100K = 410 120K-220K = 467
282828	Charger Current Max.	10K = 6 80K = 25 15K = 8 100K = 30 20K = 10 120K = 30 30K = 15 160K = 45 40K = 20 220K = 55 60K = 30
282828	Low Battery Warning	10K-30K = 190 40K-60K = 191 80K-100K = 318 120K-220K = 369
282828	Low Battery Shutdown	10K-30K = 170 40K-60K = 181 80K-100K = 306 120K-220K = 348
282828	High Battery Temperature	35°C
292929	Step 1 System Type	001=Single Unit (Default) 005=Parallel Unit 009=Economy Operation
292929	Step 2 System Size	10KVA = 010 80KVA =080 15KVA = 015 100KVA = 100 20KVA = 020 120KVA = 120 30KVA = 030 160KVA = 160 40KVA = 040 220KVA = 220 60KVA = 060
292929	Step 3 Nominal Input Voltage	208=208/Y120Vac 480=480/Y277Vac
292929	Step 4 Nominal Output Voltage	208=208/Y120Vac 480=480/Y277Vac
292929	Step 5 System Frequency	060=60Hz
292929	Step 6 TSM Blocking Interval	050=10K-60KVA 070=80K-100KVA 030=120K-220KVA
292929*	Step 8 Mains Frequency Tolerance	005 (Default)

292929*	Step 9 Mains Momentary Detector-Upper	125 (Default)
292929*	Step 10 Mains Momentary Detector-Lower	075 (Default)
292929*	Step 11 Mains Average Detector-Upper	110 (Default)
292929*	Step 12 Mains Average Detector-Lower	085 (Default)
292929*	Step 13 Bypass Frequency Tolerance	005 (Default)
292929*	Step 14 Bypass Momentary Detector-Upper	125 (Default)
292929*	Step 15 Bypass Momentary Detector-Lower	075 (Default)
292929*	Step 16 Bypass Average Detector-Upper	110 (Default)
292929*	Step 17 Bypass Average Detector-Lower	085 (Default)
292929*	Step 18 Output Frequency Tolerance	005 (Default)
292929*	Step 19 Output Momentary Detector-Upper	125 (Default)
292929*	Step 20 Output Momentary Detector-Lower	075 (Default)
292929*	Step 21 Output Average Detector-Upper	110 (Default)
292929*	Step 22 Output Average Detector-Lower	085 (Default)
292929	Step 54 Missing Phase Detector	100
292929	Step 59 Time For Output Under-voltage	005
292929	Step 69 Redundant PSU	000= No 001= Yes
292929	Step 70 Fan Monitor Option	000= No 001= Yes
292929	Step 72 Overload Set point for Parallel Oper.	101 (Default-Consult Best if not)
292929	Step 81 Backfeed Contactor Control	001= External connection Bd. 002= Backfeed Driver Bd.
292929	Step 82 Bypass Voltage	208=208/Y120Vac 480=480/Y277Vac
292929	Step 83 Temperature Compensation	324=10K-60KVA 540=80K-100KVA 612=120K-220KVA
292929	Step 87 Date	Enter Proper Date (YYMMDD)
292929	Step 88 Time	Enter Proper Time (24 Hr clock)
292929*	Step 90 Soft Start For Generator- Enable	000=OFF 001=ON (Default)
292929*	Step 91 Soft Start For Generator- Time	000=10 second walk in (Default) 001=20 second walk in
292929	Step 93 Temperature Sensor Enable	000=Not Installed 001=Installed

* These may need to be changed if the UPS input is connected to a generator or other unstable power source. See proper procedure to change these for generator settings.

If Steps 8 - 22 are changed a VQ Adjustment (181818) must be entered before new programming becomes active. The loads should be off or in maintenance bypass during this process.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UNITY/1 THREE PHASE

Procedure for making Generator Compatibility Programming

This procedure explains how to adjust specific parameter settings on the BEST UNITY/I Three-Phase UPS for installations with a generator backup power source connected. If you have any questions about this procedure, call Best Power Worldwide Service at 1-800-356-5737 (USA or Canada) or 1-608-565-2100.

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Section 100: Starting the Unit

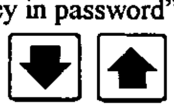
1. If load equipment is in maintenance bypass, or load equipment is off, proceed to Section 200.
2. If load equipment is being powered by the UPS, verify customer will allow maintenance bypass of load equipment. Refer to Section 500 of the Planning and Installation Manual for instructions.
   - Leave UPS in Normal Operation or Static Bypass Operation with loads in maintenance bypass.
3. If load equipment cannot be placed on bypass, it will have to be powered down.

The following parameter settings will allow the UNITY/I Three-Phase product to operate properly with most generator applications. However, some generators may require additional parameter setting changes. If completion of Section 200 has not resolved the problem, proceed to Section 300 for maximum settings.

Section 200: Programming the Standard Generator Settings

When entering values into the following parameters, all 3 digits must be entered.

While in Bypass Operation, use keypad to perform the following changes:

1. Changing required User Parameter.
   - Display User Parameter list by depressing: 
   - Use arrow keys  to scroll through User Parameter list until display shows "Adaptive Slewrate: OFF"
   - If "Adaptive Slewrate: ON", switch this parameter "OFF" by pressing: 
   - Exit User Parameter list by pressing: 
2. Changing required Service Parameter.
   - Display Service Parameter list by simultaneously depressing:  and . The display will show: "Key in password". Enter password "282828".
   - Use arrow keys  to display "Slewrate" Parameter
   - Enter "003" using the digits on the keypad.

- Accept this setting by pressing:
- Exit User Parameter list by pressing:

3. Changing required Calibration Steps.
   - Display Calibration Steps by simultaneously depressing: 1 and 2 INVERTER CURRENT
   - Display will show: "Key in password". Enter password "292929".
   - Use arrow keys to display the following steps. After entering required information, use arrow keys to display the next step.

Step 8 - Mains Frequency Detector -	Enter "005"
Step 9 - Upper MAINS Fast Detector -	Enter "135"
Step 10 - Lower MAINS Fast Detector -	Enter "070"
Step 11 - Upper MAINS Average Detector -	Enter "113"
Step 12 - Lower MAINS Average Detector -	Enter "085"
Step 13 - BYPASS Frequency Detector -	Enter "006"
Step 14 - Upper BYPASS Fast Detector -	Enter "140"
Step 15 - Lower BYPASS Fast Detector -	Enter "060"
Step 16 - Upper BYPASS Average Detector -	Enter "113"
Step 17 - Lower BYPASS Average Detector -	Enter "084"
Step 18 - Output Frequency Detector -	Enter "006"
Step 19 - Upper OUTPUT Fast Detector -	Enter "140"
Step 20 - Lower OUTPUT Fast Detector -	Enter "060"
Step 21 - Upper OUTPUT Average Detector -	Enter "113"
Step 22 - Lower OUTPUT Average Detector -	Enter "084"
Step 54 - Missing Phase Detector -	Enter "100" then press
Step 90 - Soft Start / Diesel Operation -	Enter "001"
Step 91 - Soft Start Time / Diesel Operation -	Enter "000"

Review all steps to ensure changes have been entered correctly and unit has accepted them.

Exit Calibration Steps by pressing:

Go to Section 400.

Section 300: Programming the Maximum Generator Settings

When entering values into the following parameters, all 3 digits must be entered.
*****Do Not Perform Section 300, unless there are difficulties in Section 500.**
While in Bypass Operation, use keypad to perform the following programming changes:

1. Changing required User Parameter.
   - Display User Parameter list by depressing:
   - Use arrow keys to scroll User Parameter list
   - Scroll until display shows : "Adaptive Slewrate: OFF"
   - If it shows "Adaptive Slewrate: ON", switch parameter "OFF" by pressing:
   - Exit User Parameter list by pressing:
2. Changing required Service Parameter.
   - Display Service Parameter list by simultaneously depressing: and

   Display will show: "Key in password". Enter password "282828".
   - Use arrow keys to display "Slewrate" Parameter
   - Enter "004" using the keypad., press:
   - Exit Service Parameter list by pressing:
3. Changing required Calibration Steps.
   - Display Calibration Steps by simultaneously depressing: and
   - Display will show: "Key in password". Enter password "292929".
   - Use arrow keys to display the following steps. After entering required information, use arrow keys to display the next step.

Step 8 - Mains Frequency Detector -	Enter "006"
Step 9 - Upper MAINS Fast Detector -	Enter "150"
Step 10 - Lower MAINS Fast Detector -	Enter "060"
Step 11 - Upper MAINS Average Detector -	Enter "114"
Step 12 - Lower MAINS Average Detector -	Enter "084"
Step 13 - BYPASS Frequency Detector -	Enter "006"
Step 14 - Upper BYPASS Fast Detector -	Enter "150"
Step 15 - Lower BYPASS Fast Detector -	Enter "060"
Step 16 - Upper BYPASS Average Detector -	Enter "114"
Step 17 - Lower BYPASS Average Detector -	Enter "084"
Step 18 - Output Frequency Detector -	Enter "006"
Step 19 - Upper OUTPUT Fast Detector -	Enter "150"
Step 20 - Lower OUTPUT Fast Detector -	Enter "060"
Step 21 - Upper OUTPUT Average Detector -	Enter "114"
Step 22 - Lower OUTPUT Average Detector -	Enter "084"
Step 54 - Missing Phase Detector -	Enter "200" then press
Step 90 - Soft Start / Diesel Operation -	Enter "001"
Step 91 - Soft Start Time / Diesel Operation -	Enter "001"

Review all steps to ensure that the values have been entered correctly and the unit has acknowledged them.

Exit Calibration Steps by pressing:

Section 400: Making the Voltage Quality (VQ) Adjustments

1. ~~Change operating mode from Bypass Operation to Standby Operation by pressing red OFF button.~~
2. Make the VQ Adjustment by simultaneously depressing: 1 and 2 INVERTER CURRENT

The display will show: "Key in password". Enter password "181818". Wait approximately 30 seconds until display reads "Standby".

Section 500: Resuming Normal Operation

1. Test all operating modes for proper operation.
   - Normal Operation
   - Battery Operation
   - Bypass Operation
   - Standby

If all operating modes are functioning properly, proceed with step 2

2. Place maintenance bypass switch to UPS position. For instructions refer to Section 600 of your Planning and Installation Manual. Leave unit operating in Normal Operation.
3. If load equipment was powered down, have customer power load equipment up.
4. Return UPS to Normal Operation and verify operation with Generator.

Section 600: Parameter Settings Table

Parameter Type	Description	Default Value	Standard Generator Setting	Maximum Generator Setting
User Parameter	Adaptive Slewrate	ON	OFF	OFF
Service Parameter	Slewrate	002 ↩	003 ↩	004 ↩
Calibration Step	Step 8 - Mains Frequency Detector	005	005	006
Calibration Step	Step - 9 Upper MAINS Fast Detector	125	135	150
Calibration Step	Step 10 - Lower MAINS Fast Detector	075	070	060
Calibration Step	Step 11 - Upper MAINS Average Detector	110	113	114
Calibration Step	Step 12 - Lower MAINS Average Detector	085	085	084
Calibration Step	Step 13 - BYPASS Frequency Detector	005	006	006
Calibration Step	Step 14 - Upper BYPASS Fast Detector	125	140	150
Calibration Step	Step 15 - Lower BYPASS Fast Detector	075	060	060
Calibration Step	Step 16 - Upper BYPASS Average Detector	110	113	114
Calibration Step	Step 17 - Lower BYPASS Average Detector	090	084	084
Calibration Step	Step 18 - OUTPUT Frequency Detector	005	006	006
Calibration Step	Step 19 - Upper OUTPUT Fast Detector	125	140	150
Calibration Step	Step 20 - Lower OUTPUT Fast Detector	075	060	060
Calibration Step	Step 21 - Upper OUTPUT Average Detector	110	113	114
Calibration Step	Step 22 - Lower OUTPUT Average Detector	090	084	084
Calibration Step	Step 54 - Missing Phase Detector	100 #	100 #	200 #
Calibration Step	Step 90 - Soft Start / Diesel Operation	000	001	001
Calibration Step	Step 91 - Soft Start Time / Diesel Operation	000	000	001

Procedure For Installing The Fan Monitor Option In The Three Phase Unit.

Process #: 28
Rev #: A

Parts Needed		
Qty.	Best Part #	Description
*1	0900954	Fan Monitor (10K-15K 208V)
*1	0901068	Fan Monitor (10K-15K 480V)
*1	0400649	Fan Monitor (20K-30K 208V)
*1	0400647	Fan Monitor (20K-30K 480V)
*1	0901035	Fan Monitor (40K-60K 208V)
*1	0901010	Fan Monitor (40K-100K 480V)
*1	0901036	Fan Monitor (120K-220K 480V)

* NOTE: Only one of these items will be used dependent on what unit is being used.

Tools Needed	
Qty.	Description
*1	T20 Torx Driver
*1	T25 Torx Driver (10K-30KVA)
*1	T30 Torx Driver (120K-220KVA)
*1	8mm Nut Driver (40K-100KVA)

* NOTE: Only some of these items will be used dependent on what unit is being used.

Procedure:

Procedure For Setting The Date And Time On The Three Phase Unit.

Process #: 19
Rev #: A

Parts Needed		
Qty.	Best Part #	Discription
N/A	N/A	N/A

Tools Needed	
Qty.	Discription
N/A	N/A

Procedure:

1) Apply power to the UPS (You do not need to turn on the unit).
2) Wait for the display to show [STANDBY].
3) Press and release the [1] and [2] keys at the same time.
4) Enter the password [292929].
5) Use the down arrow key to go to step 88.
6) Enter the hour (2 digits based on 24 hour clock), minute (2 digits), and seconds (2 digits). When done, press [#] key to lock in the settings.
7) Use the down arrow key to go to step 87.
8) Enter the year (2 digits), month (2 digits), and day (2 digits). When done, press [#] key to lock in the settings.
9) Press the return arrow to return to the default display.
10) Press the [1] key to confirm the clock is set correctly and is counting.

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POWER SYSTEMS

UTT 601
August 1994

BATTERY MONITOR RESET
UNITY/I™ Series 300

Some of the first few three-phase UNITY/I Series 300 units shipped (UT310, UT315, UT320, and UT330) include a battery monitor alarm that calculates total battery capacity. However, even if normal battery conditions occur at initial set-up, the alarm sounds. The software in later units allow the user to access the battery monitor reset without a password. This UTT describes how to reset the Battery Monitor Alarm from the alarm log for units where the battery monitor reset parameter is unaccessible by the user without a password.

When the alarm sounds, press [🔇] to silence the alarm and follow these steps:

1. Press [1] and [2 INVERTER CURRENT] simultaneously. The display shows "**Key in password**."
2. Enter "282828" using the keypad.
3. Use the [↑] or [↓] key to select "Battery Monitor Reset".
4. When "Battery Monitor Reset" is displayed on the screen, press [1].
5. Press [↵] to exit this mode.

The alarm is now reset and the message is removed from the alarm log. However, if the unit is **completely** shut off and turned back on, the alarm may need to be reset again.

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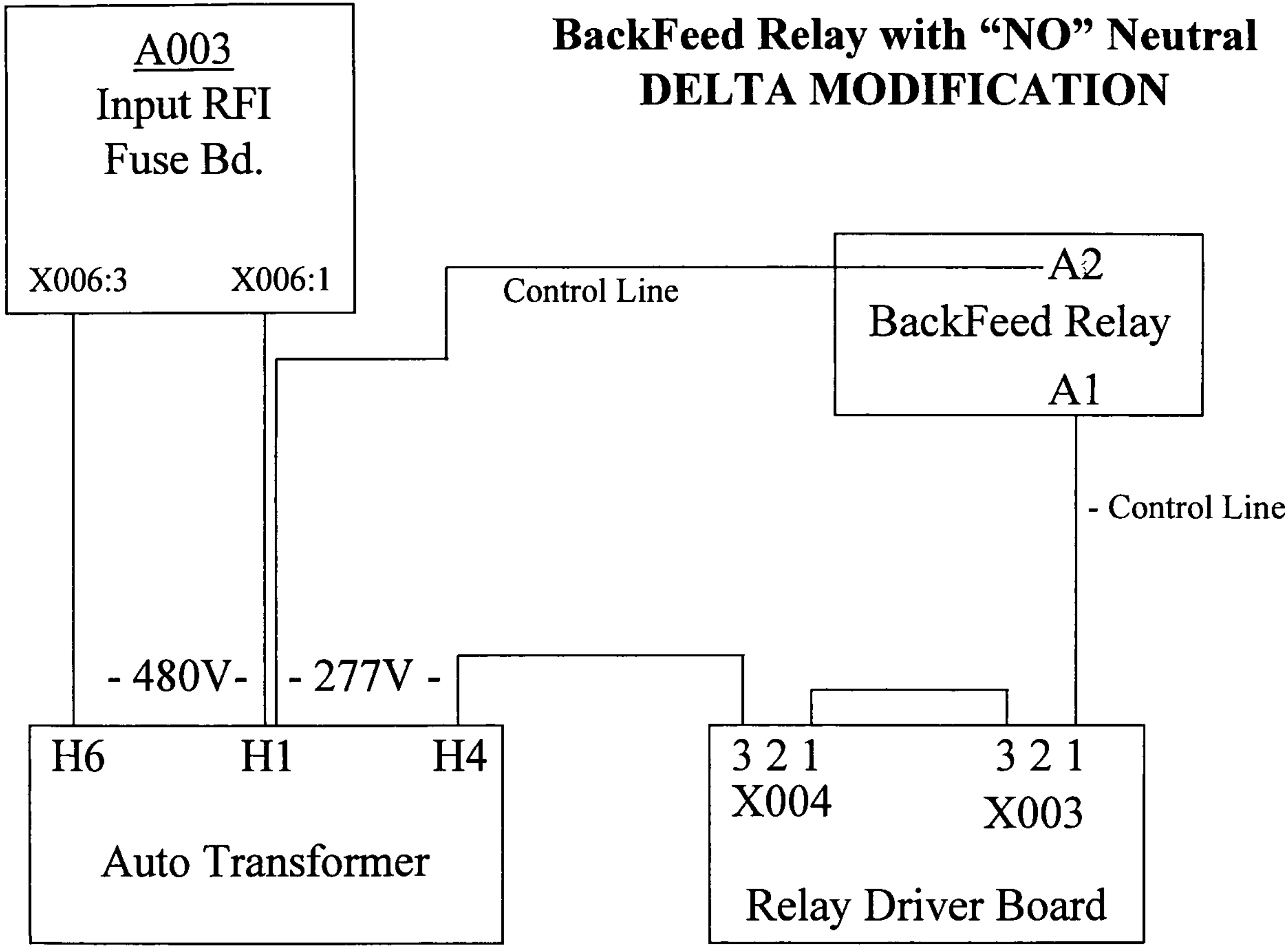
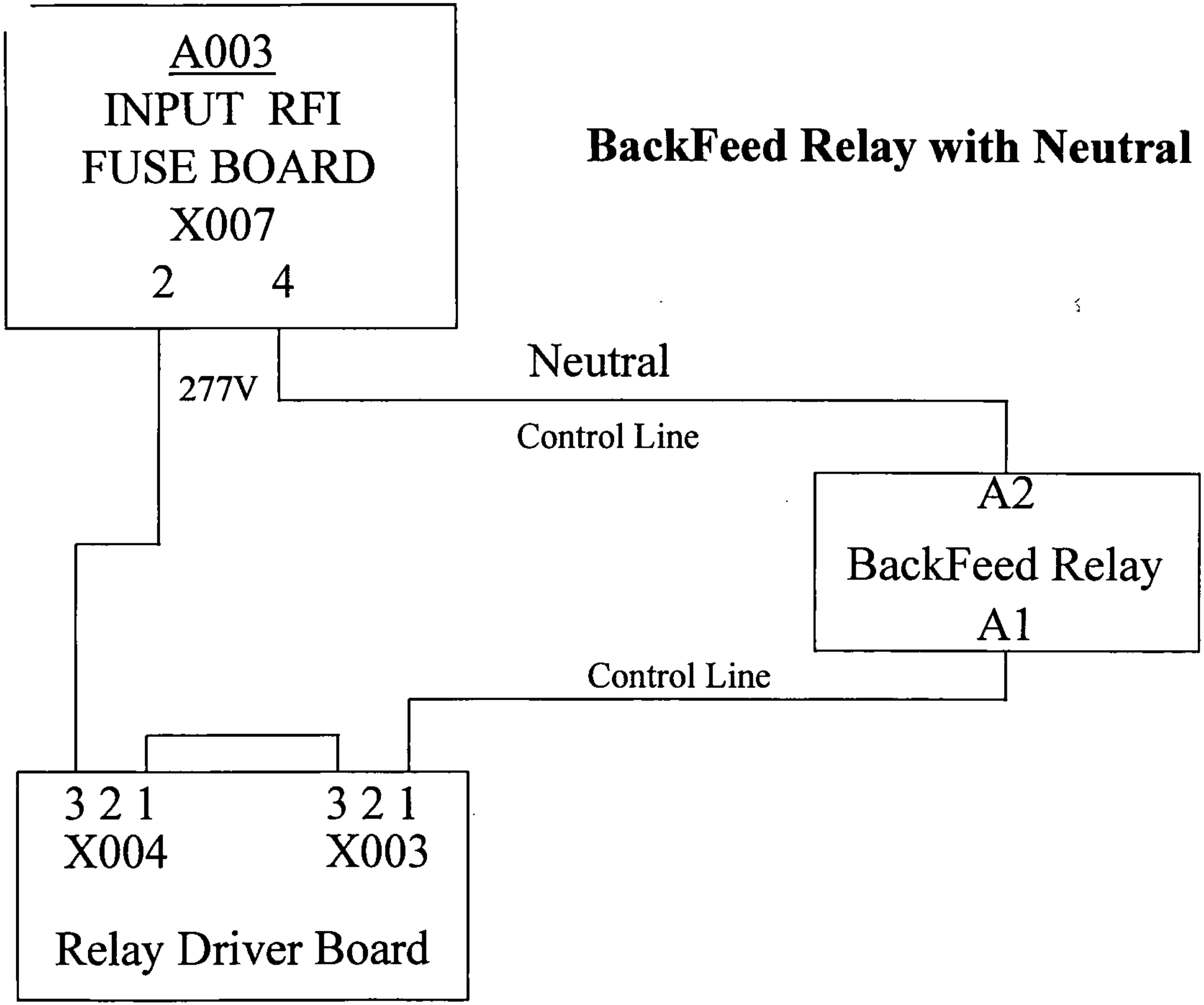
N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

BackFeed Relay with "NO" Neutral
DELTA MODIFICATION



BackFeed Relay with Neutral



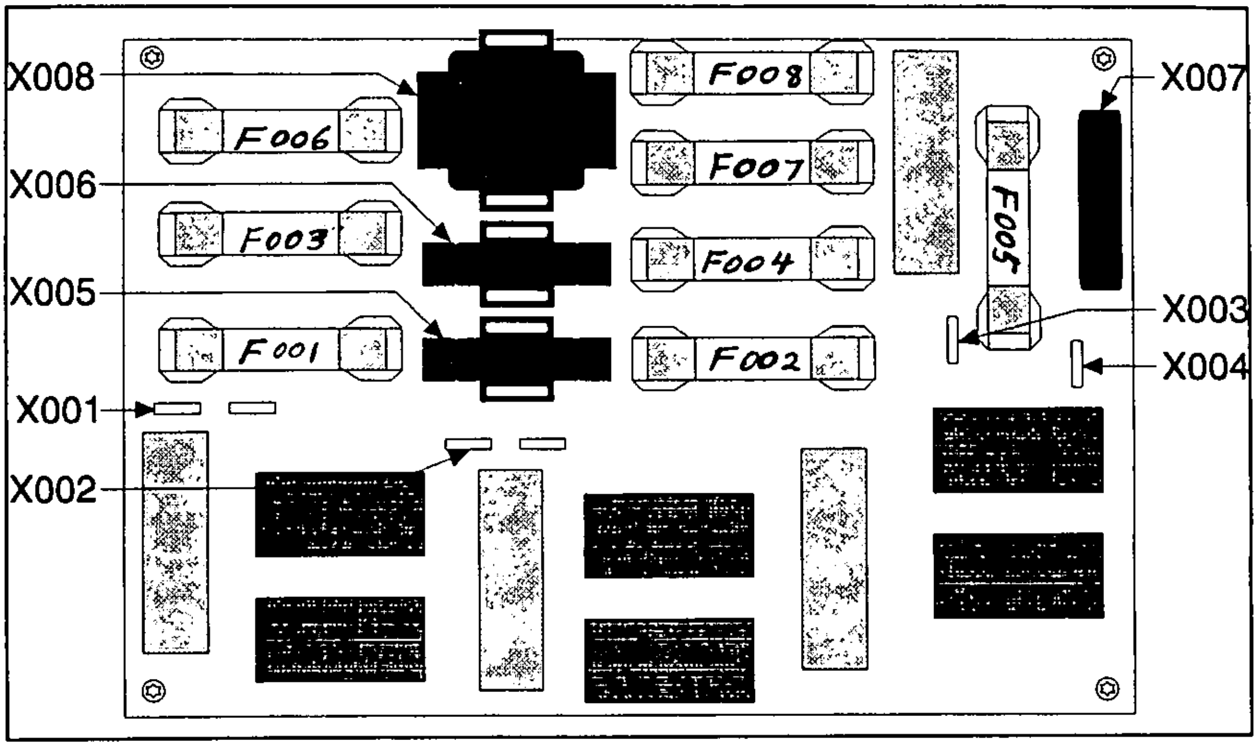


Figure 1 - RFI/Fuse Board

CPO-1153 A

UNITY / I THREE PHASE

DELTA MODIFICATION UT310 - UT315

PROCEDURE

Purpose:

This CPO covers all the UT300 and UT3000 series 480vac units, where the site installation is a four wire or Delta. This is done because of the voltage rating of the relays on the backfeed relay driver board. In the absense of a Neutral wire in a Delta, the Line to Line voltage is 480vac which exceeds the relay ratings. To compensate for this, the input side of an isolation transformer is used as an autotransformer to step down the Line to Line voltage of 480vac (applied to taps H1 and H6) to 277vac (taps H1 and H4), which provides a virtual or floating Nuetral. See XFMR DWG.

Installation:

NOTE: **MAKE SURE THE UNIT IS FUNCTIONING PROPERLY BEFORE MAKING ANY MODIFICATIONS**

WARNING: **BE SURE TO DISCONNECT ALL AC AND DC POWER SOURCES BEFORE ATTEMPTING TO MODIFY UNIT. FAILURE TO DO SO COULD RESULT IN ELECTRICAL SHOCK.**

1. Open front doors and remove RFI shielding panels.

NOTE: **MAKE SURE THAT YOU HAVE AN ESD STRAP ON AND ARE PROPERLY GROUNDED BEFORE PROCEDING FAILURE TO DO SO COULD RESULT IN DAMAGE TO THE EQUIPMENT**

2. Remove the CU (control) board.

3. Tape up the transformer mounting template.

4. Centerpunch then drill mounting holes making sure that there isn't anything behind the area being drilled. Use 3/16" bit Now remove the template.

5. Mount the transformer (XFMR T050CK) on rear of control panel door where the holes were drilled. Use hardware BNH-0199 bolts, BNN-0010 nuts, and BNW-0250 washers.

6. Reinstall the control board.

7. Locate the A001 board and remove the connector at X007.

8. Mark with numbers the wires connected to pins two and four for later connection.

9. Cut off the X007 connector keeping the cutter flush to the connector. Strip off 1/4" from the end of the wires. Crimp on CNS-0329 spade terminals.

10. Connect the wire that was at pin 2 on the connector to H4 on the transformer and the wire that was at pin 4 on the connector to H1 on the transformer.

11. Cut 2 {**}" pieces of #18 AWG THHN (WIR-0280). Strip 1/4" off of both ends of each wire and crimp on CNS-0329 Spade terminals to one end of each wire and CNC-0530 pin to the other end.

12. Connect the spade terminals to H1 and H6 on the transformer.

13. Connect the other end of the wire that is at H6 to pin three of the CNC-0531 connector and the other end of the wire that is at H1 to pin one of the CNC-0531.

14. Connect the CNC-0531 connector to X006 on the A001 board.

15. Remove the fuse at F005 on the A001 board and place at F004, and add a fuse (0017080 5A 500V) at F003.

16. Tye wrap the wire bundle neatly. (use TYE-0001).

17. Reinstall the RFI shielding panels.

CPO-1153 B

UNITY / I THREE PHASE

DELTA MODIFICATION UT320 - UT330

PROCEDURE

Purpose:

This CPO covers all the UT300 and UT3000 series 480vac units, where the site installation is a four wire or Delta. This is done because of the voltage rating of the relays on the backfeed relay driver board. In the absense of a Neutral wire in a Delta, the Line to Line voltage is 480vac which exceeds the relay ratings. To compensate for this, the input side of an isolation transformer is used as an autotransformer to step down the Line to Line voltage of 480vac (applied to taps H1 and H6) to 277vac (taps H1 and H4), which provides a virtual or floating Nuetral. See XFMR DWG.

Installation:

NOTE: **MAKE SURE THE UNIT IS FUNCTIONING PROPERLY BEFORE MAKING ANY MODIFICATIONS**

WARNING: **BE SURE TO DISCONNECT ALL AC AND DC POWER SOURCES BEFORE ATTEMPTING TO MODIFY UNIT. FAILURE TO DO SO COULD RESULT IN ELECTRICAL SHOCK.**

1. Open front doors and remove RFI shielding panels.

NOTE: **MAKE SURE THAT YOU HAVE AN ESD STRAP ON AND ARE PROPERLY GROUNDED BEFORE PROCEDING FAILURE TO DO SO COULD RESULT IN DAMAGE TO THE EQUIPMENT**

2. Remove the CU (control) board.

3. Tape up the transformer mounting template.

4. Centerpunch then drill mounting holes making sure that there isn't anything behind the area being drilled. Use 3/16" bit Now remove the template.

5. Mount the transformer (XFMR T100CK) on rear of control panel door where the holes were drilled. Use hardware BNH-0199 bolts, BNN-0010 nuts, and BNW-0250 washers.

6. Reinstall the control board.

7. Locate the A001 board and remove the connector at X007.

8. Mark with numbers the wires connected to pins two and four for later connection.

9. Cut off the X007 connector keeping the cutter flush to the connector. Strip off 1/4" from the end of the wires. Crimp on CNS-0329 spade terminals.

10. Connect the wire that was at pin 2 on the connector to H4 on the transformer and the wire that was at pin 4 on the connector to H1 on the transformer.

11. Cut 2 {**}" pieces of #18 AWG THHN (WIR-0280). Strip 1/4" off of both ends of each wire and crimp on CNS-0329 Spade terminals to one end of each wire and CNC-0530 pin to the other end.

12. Connect the spade terminals to H1 and H6 on the transformer.

13. Connect the other end of the wire that is at H6 to pin three of the CNC-0531 connector and the other end of the wire that is at H1 to pin one of the CNC-0531.

14. Connect the CNC-0531 connector to X006 on the A001 board.

15. Remove the fuse at F005 on the A001 board and place at F004, and add a fuse (0017080 5A 500V) at F003.

16. Tye wrap the wire bundle neatly. (use TYE-0001).

17. Reinstall the RFI shielding panels.

CPO-1153 C & D

UNITY / I THREE PHASE

DELTA MODIFICATION UT340 - UT3100

PROCEDURE

Purpose:

This CPO covers all the UT300 and UT3000 series 480vac units, where the site installation is a four wire or Delta. This is done because of the voltage rating of the relays on the backfeed relay driver board. In the absense of a Neutral wire in a Delta, the Line to Line voltage is 480vac which exceeds the relay ratings. To compensate for this, the input side of an isolation transformer is used as an autotransformer to step down the Line to Line voltage of 480vac (applied to taps H1 and H6) to 277vac (taps H1 and H4), which provides a virtual or floating Nuetral. See XFMR DWG.

Installation:

NOTE: MAKE SURE THE UNIT IS FUNCTIONING PROPERLY BEFORE MAKING ANY MODIFICATIONS

WARNING: BE SURE TO DISCONNECT ALL AC AND DC POWER BEFORE ATTEMPTING TO MODIFY UNIT. FAILURE TO DO SO COULD LEAD TO ELECTRICAL SHOCK.

1. Open front doors and remove RFI shielding panels.

2. Remove the A003 board.

3. Remove the connectors to A001.

4. Locate the connector X007 and number mark the wires connected to pins two and four for later connection.

5. Tape up the transformer mounting template.

6. Centerpunch then drill mounting holes making sure that there isn't anything behind the area being drilled. Use 3/16" bit Now remove the template.

7. Cut off the connector which was located at X007 of board A001 such that the wires are flush to the connector. Strip off 1/4" from the end of the wires. Crimp on CNS-0329 spade terminals.
8. Remove tye wraps strips from wire bundle up to the control panel door.
9. Connect the wire that was at pin 2 on the X007 connector to H4 on the transformer and the wire that was at pin 4 on the connector to H1 on the transformer. (For CPO-1153C use XFMR T150CK, for CPO-1153D use XFMR T200CK)
10. Cut 2 40" pieces of #18 AWG THHN (WIR-0280). Strip 1/4" off of both ends of each wire and crimp on CNS-0329 Spade terminals to one end of each wire and CNC-0530 pin to the other end.
11. Connect the spade terminals to H1 and H6 on the transformer.
12. Connect the other end of the wire that is at H6 to pin three of the CNC-0531 connector and the other end of the wire that is at H1 to pin one of the CNC-0531.
13. Connect the CNC-0531 connector to X006 on the A001 board.
14. Remove the fuse at F005 on the A001 board and place at F004, and add a fuse (0017080 5A 500V) at F003.
15. Mount the transformer on the rear side of the panel where the holes were previously drilled out. Use hardware BNH-0199 bolts, BNN-0010 nut, and BNW-0250 washer.
16. Remount the A003 board.
17. Reconnect the connectors to the A001 board. Make sure that there is the connection to X006 and not X007.
18. Tye wrap the wire bundle neatly. (use TYE-0001).
19. Reinstall the RFI shielding panels.

CPO-1153 E & F

UNITY / I THREE PHASE

DELTA MODIFICATION   UT3120 - UT3220

PROCEDURE

Purpose:

This CPO covers all the UT300 and UT3000 series 480vac units, where the site installation is a four wire or Delta. This is done because of the voltage rating of the relays on the backfeed relay driver board. In the absence of a Neutral wire in a Delta, the Line to Line voltage is 480vac which exceeds the relay ratings. To compensate for this, the input side of an isolation transformer is used as an autotransformer to step down the Line to Line voltage of 480vac (applied to taps H1 and H6) to 277vac (taps H1 and H4), which provides a virtual or floating Nuetral. See XFMR DWG.

Installation:

NOTE: **MAKE SURE THE UNIT IS FUNCTIONING PROPERLY BEFORE MAKING ANY MODIFICATIONS**

WARNING: BE SURE TO DISCONNECT ALL AC AND DC POWER SOURCES BEFORE ATTEMPTING TO MODIFY UNIT. FAILURE TO DO SO COULD RESULT IN ELECTRICAL SHOCK.

1. Open front doors and remove RFI shielding panels.

. If possible, remove the rear panel or the left side panel. This will facilitate mounting the transformer, and avoid the need to remove internal cables at the TSM's.

. Remove the A011 board (if installed).

. Tape up the transformer mounting template.

. Locate the A001 board and remove the connector at X007.

. Number mark the wires connected to pins two and four for later connection.

. Centerpunch then drill mounting holes making sure that there isn't anything behind the area being drilled. Use 3/16" bit Now remove the template.

. Cut off the X007 connector, of board A001, keeping the cutter flush to the connector. Strip off 1/4" from the end of the wires. Crimp on CNS-0329 spade terminals.

- Connect the wire that was at pin 2 on the connector to H4 on the transformer and the wire that was at pin 4 on the connector to H1 on the transformer. (For CPO-1153E use XFMR T750CK, for CPO-1153F use XFMR T200CK)

- Mount a double fuse holders (BNH-0491) on front just below control panel door between P006 and P007. See Dwg.

- Cut 2 12" pieces of #14 AWG THHN (WIR-0206) for CPO-1153E and #18 AWG THHN (WIR- 0280) for CPO 1153F. Strip 1/4" off of both ends of each wire and crimp on CNF-0385 Fast-On terminals.

- Connect one piece of wire from P004 to the bottom fuse holder and the other from P005 to the top fuse holder.

- Cut 2 72" pieces of #14 AWG THHN (WIR-0206) for CPO-1153E and #18 AWG THHN (WIR-0280) for CPO 1153F. Strip 1/4" off of both ends of each wire and crimp on CNF-0385 Fast-On terminals to one end of each wire and CNR-0006 Ring Terminal to the other end.

- Connected the Fast-On terminals to the fuse holders.

- Route these wires through the wire race way behind the panel containing the fuse holders you just mounted. To do this lift up on the top cover of the wire race way. Replace the cover after tie wrapping the wires to the existing wire bundle (use TYE-0001).

- Connect the wires Ring terminals to the transformer at taps H1 and H6.

- Mount the transformer on the rear side of the panel where the holes were previously drilled out. Use hardware BNH-0199 bolts, BNN-0010 nut, and BNW-0250 washer. *Install the transformer from the rear of the unit, otherwise it will be necessary to disconnect the cables going to the TSM module directly over the area to be worked in*

- Install the two fuses into the fuseholder that was installed (use FUS-0263).

- Reinstall the rear or side panel (if removed).

- Reinnstall the RFI shielding panels

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Functional Description of Calibration

Calibration of the system is performed using the display unit, access to an area of calibration is given through entry of a password. In the calibration stack there are a number of steps or settings that can be altered. The calibration stack is password protected. However, after the password is entered, the steps are not protected, meaning that anything can be entered with any possible consequence.

The calibration must only be performed by trained personnel.

Entry into the calibration stack takes place by pushing "1" and "2" simultaneously, after which the message "Key in password" will be displayed. Enter the correct password (292929) and the calibration stack is shown. "Step 1" will be displayed at first, then it is possible to move to other Steps using the display cursor keys.

Password for calibration stack: 292929

In all steps a number will be entered as a calibration. This number always consists of three figures. i.e. If a measurement only consists of two digits, a "0" has to precede the two digits (ex. 045). A leading "0" will not be displayed but still must be entered.

In some cases a four-figure number is needed. In these cases the number must be entered in two groups of 3 digits. When this is done the text in the display will be "Step X XXX.X00". When the three whole numbers are entered, this number will be shown in the display, and "0" will be shown in the decimal value. After that the decimal value is entered, rounded to an even 10th, so that only the most significant figure is saved (ex. 045.400 is the entry for 45.4).

The new entered number is saved in memory when the 3rd (or 6th) figure is entered. If a keying error occurs before saving, use the arrow keys to leave and return to the Step. Then repeat the entering of the new number.

In the last category of calibrations "#" has to be entered, after which the calibration automatically takes place. When "#" is pressed it will be shown in the display indicating that the calibration has taken place. If "#" is not shown, press it again.

Changes to Steps 7 - 22 will not take affect until a VQ Adjustment (**Password 181818**) or a VQ Calibration (**Password 191919**) is performed.

Manual Calibration: When a system is manually adjusted/calibrated, for the first time or after new memory or VQ IC 's are installed, the calibration must be carried out in the following succession:

* Do these in the sequence below, or it won't work!!

Step: 1, 2, 3, 4, 82, 5, 6, 54, 55, 56, 57, 58, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 80, 81, 84, 23, 24, 25, 26, 27, 28, 48, 49, 50, (enter 300 in step 59 for test), 31, 32, 33, 34, 35, 36, 37, 53, 59, 38, 39, 42, 43, 44, 45, 46, 47, 51, 52, 62, 63, 64, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, VQ Calibration, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93.

Repair parts are pre-tested and do not require manual calibration, although calibration 'fine-tuning' may be required for maximum functionality. *See the "Field Calibration Procedure" for additional details.* Any custom calibrations, such as generator compatibility programming, will have to be performed upon installation of a replacement controller.

STEP 1 SETUP OF SYSTEM TYPE

- Place system in Standby.
- Enter new value for type of system.
- Default value is 001 for Unity/I system, single module. See following table for optional settings.

001	Single Unity/I
005	Unity/I – Installed in parallel configuration
009	Single Unity/I – Economy Operation
013	Unity/I – Installed in parallel configuration, Economy Operation

NOTE: All systems in a parallel installation MUST be programmed the same.

STEP 2 SETUP OF SYSTEM SIZE

- Place system in Standby.
- Enter system size in kVA.
- Default value is actual system capacity.

010	10kVA		080	80kVA
015	15kVA		100	100kVA
020	20kVA		120	120kVA
030	30kVA		160	160kVA
040	40kVA		220	220kVA
060	60kVA			

STEP 3 SETUP OF INPUT VOLTAGE

- Place system in Standby.
- Enter nominal input voltage, *Phase to Phase*.
- Default value is true nominal input voltage.
  208 for 208Vac
  220 for 220Vac
  380 for 380Vac
  400 for 400Vac
  415 for 415Vac
  450 for 450Vac
  480 for 480Vac

STEP 4 SETUP OF OUTPUT VOLTAGE

- Place system in Standby.
- Enter nominal input voltage, *Phase to Phase*.
- Default value is true nominal input voltage.
  208 for 208Vac
  220 for 220Vac
  380 for 380Vac
  400 for 400Vac
  415 for 415Vac
  450 for 450Vac
  480 for 480Vac

STEP 5 SETUP OF SYSTEM FREQUENCY

- Place system in Standby.
- Enter value for nominal frequency of system.
- Default is nominal system frequency.
  050 for 50Hz
  060 for 60Hz

STEP 6 SETUP OF BLOCKING INTERVAL FOR TSM

- Place system in Standby.
- Enter value for blocking interval.
- Default value is the correct interval for the system size.
  050 for 50μsec = 10-60kVA
  070 for 70μsec = 80-100kVA
  030 for 30μsec = 120-220kVA

STEP 7 UPPER SHUTDOWN FOR UPS CHARGER

DO NOT change

- Not used in Unity/I Three Phase units, do not change.
- Default value is 221.

STEP 8 FREQUENCY TOLERANCE FOR "MAINS" VOLTAGE DETECTOR

- Enter frequency tolerance for "MAINS" voltage detector.
- Default value is 005.
  001 = nominal frequency ±0.5%
  002 = nominal frequency ±1.0%
  003 = nominal frequency ±2.0%
  004 = nominal frequency ±4.0%
  005 = nominal frequency ±6.0%
  006 = nominal frequency ±8.0%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered. (181818)

STEP 9 UPPER LIMIT FOR "MAINS" MOMENTARY VOLTAGE DETECTOR

- Enter the upper limit for "MAINS" momentary detector.
- Default value is 125.
  Minimum value is 100 = nominal input voltage +0%
  Maximum value is 150 = nominal input voltage +50%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 10 LOWER LIMIT FOR "MAINS" MOMENTARY VOLTAGE DETECTOR

- Enter lower limit for "MAINS" momentary voltage detector.
- Default value is 075.

  Minimum value is 100 = nominal input voltage -0%
  Maximum value is 050 = nominal input voltage -50%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 11 UPPER LIMIT FOR "MAINS" AVERAGE VOLTAGE DETECTOR

- Enter upper limit for "MAINS" average voltage detector.
- Default value is 110.

  Minimum value is 100 = nominal input voltage +0%
  Maximum value is 116 = nominal input voltage +16%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 12 LOWER LIMIT FOR "MAINS" AVERAGE VOLTAGE DETECTOR

- Enter lower limit for "MAINS" average voltage detector.
- Default value is 085.

  Minimum value is 100 = nominal input voltage -0%
  Maximum value is 084 = nominal input voltage -16%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 13 FREQUENCY TOLERANCE FOR "BYPASS" VOLTAGE DETECTOR

- Enter frequency tolerance for "BYPASS" voltage detector.
- Default value is 005.

  001 = nominal frequency ±0.5%
  002 = nominal frequency ±1.0%
  003 = nominal frequency ±2.0%
  004 = nominal frequency ±4.0%
  005 = nominal frequency ±6.0%
  006 = nominal frequency ±8.0%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 14 UPPER LIMIT FOR "BYPASS" MOMENTARY VOLTAGE DETECTOR

- Enter the upper limit for "BYPASS" momentary detector.
- Default value is 125.

  Minimum value is 100 = nominal input voltage +0%
  Maximum value is 150 = nominal input voltage +50%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 15 LOWER LIMIT FOR "BYPASS" MOMENTARY VOLTAGE DETECTOR

- Enter lower limit for "BYPASS" momentary voltage detector.
- Default value is 075.

  Minimum value is 100 = nominal input voltage -0%
  Maximum value is 050 = nominal input voltage -50%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 16 UPPER LIMIT FOR "BYPASS" AVERAGE VOLTAGE DETECTOR

- Enter upper limit for "BYPASS" average voltage detector.
- Default value is 110.

  Minimum value is 100 = nominal input voltage +0%
  Maximum value is 116 = nominal input voltage +16%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 17 LOWER LIMIT FOR "BYPASS" AVERAGE VOLTAGE DETECTOR

- Enter lower limit for "BYPASS" average voltage detector.
- Default value is 090.

  Minimum value is 100 = nominal input voltage -0%
  Maximum value is 084 = nominal input voltage -16%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 18 FREQUENCY TOLERANCE FOR "OUTPUT" VOLTAGE DETECTOR

- Enter frequency tolerance for "OUTPUT" voltage detector.
- Default value is 005.

  001 = nominal frequency ±0.5%
  002 = nominal frequency ±1.0%
  003 = nominal frequency ±2.0%
  004 = nominal frequency ±4.0%
  005 = nominal frequency ±6.0%
  006 = nominal frequency ±8.0%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 19 UPPER LIMIT FOR "OUTPUT" MOMENTARY VOLTAGE DETECTOR

- Enter the upper limit for "OUTPUT" momentary detector.
- Default value is 125.

  Minimum value is 100 = nominal output voltage +0%
  Maximum value is 150 = nominal output voltage +50%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 20 **LOWER LIMIT FOR "OUTPUT" MOMENTARY VOLTAGE DETECTOR**

- Enter lower limit for "OUTPUT" momentary voltage detector.
- Default value is 075.
  Minimum value is 100 = nominal output voltage -0%
  Maximum value is 050 = nominal output voltage -50%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 21 **UPPER LIMIT FOR "OUTPUT" AVERAGE VOLTAGE DETECTOR**

- Enter upper limit for "OUTPUT" average voltage detector.
- Default value is 110.
  Minimum value is 100 = nominal output voltage +0%
  Maximum value is 116 = nominal output voltage +16%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 22 **LOWER LIMIT FOR "OUTPUT" AVERAGE VOLTAGE DETECTOR**

- Enter lower limit for "OUTPUT" average voltage detector.
- Default value is 090.
  Minimum value is 100 = nominal output voltage -0%
  Maximum value is 084 = nominal output voltage -16%

NOTE: The new values entered in Steps 8-22 become operational after the password for VQ Adjustment of VQ Calibration is entered.

STEP 23 **CALIBRATION OF CHARGE VOLTAGE & DC VOLTAGE DISPLAY**

- Disconnect battery temperature probe (if it is installed) and place UPS in normal operation.
- Disconnect the battery (open DC fuseholder or turn DC disconnect off).
- Measure battery voltage with one significant figure after the decimal point. The measurement must be taken on the top side of the fuseholder. (The easiest place to access this DC voltage may be between X001 and X002 on the DC Fuseboard or across the DC capacitors.)
- Enter the value of the whole number (3 digits) and then enter the decimal value (3 digits). Example: 226.4VDC is entered as 226400.
- Reconnect the battery supply.
- After this calibration, the value for "Normal Charge Voltage" and Boost Charge Voltage" must be reset to the correct value.
- Default value is the actual charger DC voltage.

STEP 24 CALIBRATION OF HIGH DC VOLTAGE SHUTDOWN LEVEL

This calibration *must not be performed* until Step 23 is completed.

- Place system in Standby.
- Check that the "HIGH DC" signal is (X008: Pin 24 on the interface board) is a logic low. Verifying that the LED on the controller, labeled H001 DC Fault, is not illuminated will normally be sufficient.
- Verify the DC voltage is nominal ±15% and stable.
- Press "#".
- When the display gives an audible alarm, the calibration is complete.

STEP 25 CHANGING HIGH DC VOLTAGE SHUTDOWN LEVEL FOR INVERTER

This calibration *must not be performed* until Step 24 is completed.

- Enter new value for high battery shutdown (in VDC).
- Default value is correct value for system size.

  300 for 10-60kVA systems

  490 for 80-100kVA systems

  550 for 120-220kVA systems

STEP 26 CALIBRATION OF LOW DC VOLTAGE WARNING LEVEL

This calibration *must not be performed* until Step 23 is completed.

- Place system in Standby.
- Check that DC voltage is nominal ±15% and stable.
- Press "#".
- When the display gives an audible alarm, the calibration is complete.

STEP 27 CALIBRATION OF LOW DC VOLTAGE SHUTDOWN LEVEL

This calibration *must not be performed* until Step 23 is completed.

- Place system in Standby.
- Check that DC voltage is nominal ±15% and stable.
- Press "#".
- When the display gives an audible alarm, the calibration is complete.

STEP 28 CALIBRATION OF CHARGING CURRENT LIMITER

- Discharge the batteries about 1 minute by disconnecting AC mains.
- Reconnect AC mains, allowing system to return to normal operation.
- Measure battery current with one significant digit after the decimal point.
- Enter the value of the whole number (3 digits) and then enter the decimal value (3 digits). If the new number is not entered into the display unit it means the system is not in charger current limit, and the calibration must be repeated, but this time discharge the batteries for 2 minutes or more.
- After this calibration, the value for "Charge Current Max" in the Service Stack will be changed and must be reprogrammed. Actual charger current maximum will adjust to the new value after programming is completed.
- Default value is actual measured charging current limit value.

STEP 29 CALIBRATION OF TOTAL DC CURRENT LIMIT LEVEL

- Not used in Unity/I Three Phase units, do not change.
- Default value is 017.000

STEP 30 CHANGING TOTAL DC CURRENT LIMIT LEVEL

- Not used in Unity/I Three Phase units, do not change.
- Default value is 170.

STEP 31 CALIBRATION OF INVERTER CURRENT LIMITER 150% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 155% - 165% load.
- Enter various values until the output current is 150% nominal ±1%.
- Press "#" key.
- Default value is 192.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 155% - 165% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 32 CALIBRATION OF INVERTER CURRENT LIMITER 125% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 130% - 140% load.
- Enter various values until the output current is 125% nominal 1%.
- Press "#" key.
- Default value is 133.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 130% - 140% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 33 CALIBRATION OF INVERTER CURRENT LIMITER 105% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 110% - 120% load.
- Enter various values until the output current is 105% nominal ±1%.
- Press "#" key.
- Default value is 091.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 110% - 120% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 34 CALIBRATION OF CURRENT LIMITER 100% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 110% - 120% load.
- Enter various values until the output current is 100% nominal +2% - 0%.
- Press "#" key.
- Default value is 091.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 110% - 120% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 35 CALIBRATION OF CURRENT LIMITER 110% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 115% - 125% load.
- Enter various values until the output current is 110% nominal ±1%.
- Press "#" key.
- Default value is 091.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 115% - 125% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 36 CALIBRATION OF CURRENT LIMITER 120% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 125% - 130% load.
- Enter various values until the output current is 120% nominal ±1%.
- Press "#" key.
- Default value is 133.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 125% - 130% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 37 CALIBRATION OF CURRENT LIMITER 130% LEVEL

This step *must not be performed* until steps 48, 49 and 50 are completed.

- If parallel system, remove parallel communication cable (X012) on main controller.
- Disconnect mains and bypass inputs, unit will go to battery operation.
- Load unit with 135% - 145% load.
- Enter various values until the output current is 130% nominal ±1%.
- Press "#" key.
- Default value is 133.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 135% - 145% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 38 CALIBRATION OF DISCHARGE CURRENT FOR DISPLAY

- Load the unit with 90 – 100% load.
- Place unit in battery operation.
- Measure the battery current with one significant digit after the decimal point.
- Enter the whole value as (3) digits and then enter the decimal value as (3) digits.
- Default value is the actual measured DC current.

STEP 39 CALIBRATION OF BATTERY CHARGE CURRENT FOR DISPLAY

- Discharge batteries for at least one minute by placing unit in battery operation.
- Set the unit in normal operation again.
- Measure the battery current with one significant digit after the decimal point.
- Enter the whole value as (3) digits and then enter the decimal value as (3) digits.
- Default value is the actual measured DC current.

STEP 40 CALIBRATION OF TOTAL DC CURRENT FOR DISPLAY

- Not used in Unity/I Three Phase units, do not change.
- Default value is 160.000.

STEP 41 CALIBRATION OF TOTAL DC CURRENT OFFSET FOR DISPLAY

- Not used in Unity/I Three Phase units, do not change.

STEP 42 CALIBRATION OF BATTERY TEMPERATURE FOR DISPLAY

- Only calibrate if battery temperature sensor is connected.
- Measure the ambient temperature ±0.5° C.
- Default value is actual measured temperature.

STEP 43 CALIBRATION OF MAINS CURRENT FOR DISPLAY

- Set unit is normal operation.
- Load unit with 100 – 110% load.
- Measure the current on mains input L1 with one significant digit after the decimal point.
- Enter the value of the whole number as (3) digits and the decimal value as (3) digits.
- Default value is actual measured AC current.

STEP 44 CALIBRATION OF INVERTER CURRENT FOR DISPLAY

- Set the unit in normal operation with no load applied.
- Measure L1 inverter current with one significant digit after the decimal point
- Enter the value if the whole number as (3) digits and the decimal value as (3) digits.
- Default value is 180.0 (approximate value for UT330).

NOTE: If inverter current cannot be measured use following formula to calculate current.

Inverter current L1 = X015:1 (mv) * A/mv

X015: 1 is actual measured AC voltage at X015:1 on the interface board (in mv).

A/mv is selected from following table:

10kVA = 0.0356 A/mv	80kVA = 0.1697 A/mv
15kVA = 0.0564 A/mv	100kVA = 0.2118 A/mv
20kVA = 0.0717 A/mv	120kVA = 0.2340 A/mv
30kVA = 0.1068 A/mv	160kVA = 0.3130 A/mv
40kVA = 0.1423 A/mv	220kVA = 0.4290 A/mv
60kVA = 0.2135 A/mv	

STEP 45 CALIBRATION OF OUTPUT CURRENT FOR DISPLAY

- Place unit in Normal Operation.
- Load unit with 90-100% load.
- Measure output RMS current on L1 with one significant digit after the decimal point.
- Enter the value if the whole number as (3) digits and the decimal value as (3) digits.
- Default value is actual measured output RMS current.

STEP 46 SET-UP OF NOMINAL OUTPUT CURRENT

- Place unit in Standby.
- Locate correct nominal output current from table below.
- Enter the output current whole number as (3) digits and the decimal value as (3) digits.
- Default value is correct reference number from table below.

Unit Size	208Vac	220Vac	380Vac	400Vac	415Vac	450Vac	480Vac
10kVA	027.800	026.300	015.200	014.500	013.900	012.900	012.000
15kVA	041.700	039.400	022.700	021.700	020.800	019.300	018.100
20kVA	055.600	052.500	030.300	029.000	027.800	025.700	024.100
30kVA	083.300	078.700	045.500	043.500	041.700	038.600	036.100
40kVA	111.100	105.000	060.600	058.000	055.600	051.500	048.100
60kVA	166.700	157.500	090.900	087.000	083.300	077.200	072.200
80kVA	----------	-----------	121.200	115.900	111.100	103.000	096.300
100kVA	-----------	-----------	151.200	144.900	138.900	128.700	120.300
120kVA	-----------	-----------	181.800	173.900	166.700	154.400	144.400
160kVA	-----------	-----------	242.400	231.900	222.200	206.000	192.500
220kVA	-----------	-----------	333.300	318.800	305.600	283.100	264.700

STEP 47 CALIBRATION OF OUTPUT PEAK CURRENT FOR DISPLAY

- Place the unit in Normal Operation.
- Load unit with 90-100% *resistive* load.
- Measure the output peak current on output L1 with one significant digit after the decimal point.
- Enter measured output peak current whole number as (3) digits and the decimal value as (3) digits.
- Default value is the actual measured peak current.

NOTE: If peak current cannot be measured it can be calculated as: ($I_{PK} = I_{RMS} * 1.414$).

STEP 48 ADJUSTMENT OF OUTPUT VOLTAGE L1

- Place the unit in Normal Operation.
- Load unit with 90-100% load.
- Measure voltage between output L1 and output Neutral.
- Enter various values until actual output voltage is correct (120.3Vac or 277.6Vac).
- Press "#".
- Default value is 128.
  Minimum value is 000.
  Maximum value is 255.

NOTE: Voltage adjustment is approximately 0.1Vac / digit for units <380Vac.
Voltage adjustment is approximately 0.2Vac / digit for units >380Vac.

STEP 49 ADJUSTMENT OF OUTPUT VOLTAGE L2

- Place the unit in Normal Operation.
- Load unit with 90-100% load.
- Measure voltage between output L2 and output Neutral.
- Enter various values until actual output voltage is correct (120.3Vac or 277.6Vac).
- Press "#".
- Default value is 128.
  Minimum value is 000.
  Maximum value is 255.

NOTE: Voltage adjustment is approximately 0.1Vac / digit for units <380Vac.
Voltage adjustment is approximately 0.2Vac / digit for units >380Vac.

STEP 50 ADJUSTMENT OF OUTPUT VOLTAGE L3

- Place the unit in Normal Operation.
- Load unit with 90-100% load.
- Measure voltage between output L3 and output Neutral.
- Enter various values until actual output voltage is correct (120.3Vac or 277.6Vac).
- Press "#".
- Default value is 128.
  Minimum value is 000.
  Maximum value is 255.

NOTE: Voltage adjustment is approximately 0.1Vac / digit for units <380Vac.
Voltage adjustment is approximately 0.2Vac / digit for units >380Vac.

STEP 51 CALIBRATION OF ZERO PHASE

This calibration ***must not be performed*** until steps 48, 49 and 50 are completed.
In order to complete this procedure, the battery voltage has to be higher than nominal battery voltage.

- Change "Normal Charge Voltage" in the Service Parameters to the nominal battery voltage (216, 360 or 408) to ensure the charge function is disabled.
- Place the unit in Normal Operation.
- Measure the DC current into the battery plant.
- Enter various values until the input DC current is equal to the nominal charge current.
- Press "#".
- Default value is 120.
  Minimum value is 000.
  Maximum value is 255.

STEP 52 CALIBRATION OF INVERTER VOLTAGE ADAPTION

This calibration is only performed if optional SSW3 is installed (parallel systems with 5 or more units installed).
This calibration ***must not be performed*** until steps 48, 49 and 50 are completed.

- Measure the voltage across SSW3.
- Place the unit in Static Bypass using the keypad.
- Enter various values until the voltage across SSW3 is as little as possible.
- Press "#".
- Default value is 128.
  Minimum value is 000.
  Maximum value is 255.

STEP 53 CALIBRATION OF PEAK CURRENT LEVEL

This step must not be performed until Step 31 is completed.

- Disconnect mains and bypass input voltage.
- Load the unit with 155 – 165% load. Unit should current limit at 150% nominal load.
- Enter new value, changing in small increments, until output voltage is just beginning to decrease.
- Press "#" (2) times.
- Default value is 198.
  Minimum value is 000.
  Maximum value is 255.

NOTE: If 135% - 145% load is not available, connect output phases (L1, L2, and L3) to ground.

STEP 54 SETUP OF MISSING PHASE DETECTOR

- Enter value for missing phase detector.
- Press "#".
- Default value is 100.

NOTE: If 000 is entered unit will not accept mains or bypass input.

STEP 55 SETUP OF OUTPUT VOLTAGE REFERENCE

- Enter value for Vout reference.
- Press "#".
- Default is correct value for nominal input voltage from following table.

  138 for 208Vac
  138 for 220Vac
  127 for 380Vac
  133 for 400Vac
  138 for 415Vac
  122 for 450Vac
  133 for 480Vac

STEP 56 SETUP IF SSW3 IS INSTALLED

- Place unit in Standby.
- Default value is 0.

  Enter 000 if SSW3 is not installed.
  Enter 001 if SSW3 is installed.

STEP 57 SETUP IF INTERNAL MAINTENANCE BYPASS SWITCH IS INSTALLED

- Place unit in Standby.
- Default value is 0.

  Enter 000 if internal maintenance bypass is not installed.
  Enter 001 if internal maintenance bypass is installed.

STEP 58 SETUP IF POSITION OF EXTERNAL MAINTENANCE BYPASS SWITCH IS MONITORED

- Place unit in Standby.
- Default value is 0.

  Enter 000 if position of external maintenance bypass switch is not monitored.
  Enter 001 if position of external maintenance bypass switch is monitored.

STEP 59 SETUP OF TIME BEFORE SHUTDOWN DUE TO OUTPUT OUT OF TOLERANCE

- Place unit in Standby.
- Enter the number of seconds unit will be allowed to provide output voltage that is too low or high before going to Standby.
- Default value is 005 for 5 seconds.

  Minimum value is 0 seconds.
  Maximum value is 327 seconds.

STEP 60 SETUP IF CHARGE 0° IS INSTALLED

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

STEP 61 SETUP IF CHARGE 30° IS INSTALLED

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

STEP 62 SETUP OF OFFLINE TIME IN ECONOMY OPERATION

- Place unit in Standby.
- Enter number of days between automatic charge cycles with unit programmed for Economy operation.
- Default value is 7 days.

STEP 63 SETUP OF CHARGER/BATTERY OPERATION RELATIONSHIP IN ECONOMY

- Place unit in Standby.
- Enter the number of minutes of charging time for each minute of battery discharge time. Charging time begins after unit leaves charger current limit.
- Default value is 060 for 60 minutes of float charger for each minute of battery operation.
  Minimum value is 000.
  Maximum value is 255.

STEP 64 SETUP OF CHARGING TIME IN ECONOMY OPERATION

- Place unit in Standby.
- Enter number of hours for automatic charging cycle in Economy operation.
- Default value is 008 for 8 hours charge cycle.
  Minimum value is 000.
  Maximum value is 255.

STEP 65 RESET OF PENDLE LOCK

- Resolve cause of unit pendle.
- Press "#", unit will return to automatic operation.

STEP 66 SETUP OF TEMPERATURE SURVEY OF SSW2

- Place system in Standby.
- Default value is 001.
  Enter 000 if temperature survey of SSW2 is not wanted.
  Enter 001 if temperature survey of SSW2 is wanted.

STEP 67 SETUP IF INTERNAL BYPASS TRANSFORMER IS PRESENT.

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

STEP 68 SETUP OF LIMIT IN GENES STACK

- Place unit in Standby.
- Default value is 000.
  Enter 000 if Service Parameters are restricted to factory limits.
  Enter 001 if Service Parameters are not restricted to factory limits.

STEP 69 SETUP IF REDUNDANT POWER SUPPLY IS PRESENT

- Place unit in Standby.
- Default value is 000 for 10-100kVA and 001 for 120–220kVA.
  Enter 000 if redundant PSU is not installed.
  Enter 001 if redundant PSU is installed.

STEP 70 SETUP IF FAN MONITOR IS PRESENT

- Default value is 000.
  Enter 000 if fan monitor option is not installed.
  Enter 001 if fan monitor option is installed.

STEP 71 SETUP IF "AUX" OR "BATT" GROUNDING IS IN USE

- Default value is 000.
  Enter 000 if "AUX" or "BATT" grounding is not present.
  Enter 001 if "AUX" grounding is present.
  Enter 002 if "BATT" grounding is present.

STEP 72 SETUP OVERLOAD ALARM LEVEL (X012: 20) IN PARALLEL OPERATION

- Default value is 101.
- Enter desired level for alarm level in % of nominal load.

STEP 73 SETUP IF START ON LOW BATTERY VOLTAGE IS NOT ALLOWED

- Place unit in Standby.
- Default value is 000.
  Enter 000 if unit startup on low battery voltage is allowed.
  Enter 001 if unit startup on low battery voltage is not allowed.

STEP 74 SETUP OF LINEDROP COMPENSATION

- Enter value for linedrop compensation.
- Default value is 000.
  Enter 000 for no compensation.
  Enter 001 for 1% compensation.
  Enter 002 for 2% compensation.
  Enter 003 for 3% compensation.
  Enter 004 for 4% compensation.
  Enter 005 for 5% compensation.
  Enter 016 for mains tracking.

DO NOT Change

STEP 75 SETUP FOR FORCED BATTERY OPERATION

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.
  Enter 001 for forced battery operation (for diagnostic use only).

STEP 76 SETUP IF BATTERY SYMETRY ERROR IS IN USE

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

STEP 77 SETUP OF TIME BETWEEN AUTOMATIC BATTERY MONITOR TEST

- Place unit in Standby.
- Enter the time between automatic battery monitor tests, in days.
- Default value is 090 for 90 days between tests.
  Minimum value is 000.
  Maximum value is 32,767.

STEP 78 CALIBRATION OF HALF BATTERY VOLTAGE (Only if "1" in Step 76)

- Set unit in Normal Operation.
- Measure the half battery voltage with (1) significant digit after the decimal point.
- Enter the whole value as (3) digits and the decimal value as (3) digits.
- Default value is actual measured half battery voltage.

STEP 79 SETUP IF SINGLE PHASE SYSTEM

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

STEP 80 SETUP IF CHARGER IS TO BE KEPT RUNNING IN ECONOMY OPERATION

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

STEP 81 SETUP TYPE OF BACKFEED PROTECTION RELAY

- Default value is 002.
  Enter 000 if no backfeed relay is installed.
  Enter 001 if backfeed relay is operated via External Connection Board.
  Enter 002 if backfeed relay is operated via Backfeed Relay Driver Board.

STEP 82 SETUP OF NOMINAL STATIC BYPASS VOLTAGE

- Place unit in Standby.
- Enter nominal bypass voltage (phase to phase) in volts.
- Default value is nominal bypass voltage.

  Enter 208 for 208Vac bypass voltage.
  Enter 220 for 220Vac bypass voltage.
  Enter 380 for 380Vac bypass voltage.
  Enter 400 for 400Vac bypass voltage.
  Enter 415 for 415Vac bypass voltage.
  Enter 450 for 450Vac bypass voltage.
  Enter 480 for 480Vac bypass voltage.

STEP 83 SETUP OF CHARGING VOLTAGE TEMPERATURE COMPENSATION

- Place unit in Standby.
- Enter temperature compensation of charging voltage in volts/° C.
- Value = Compensation factor (mV/°C/cell) * number of cells.
- Default value is 000 for no compensation.

  Enter 324 for 108 cells, -3mV/°C/cell for 10-60kVA.
  Enter 540 for 180 cells, -3mV/°C/cell for 80-100kVA.
  Enter 612 for 204 cells, -3mV/°C/cell for 120-220kVA.
  Minimum value is 000.
  Maximum value is 999.

STEP 84 VQ BYPASS DETECTOR ON/OFF

- Place unit in Standby.
- Enter correct value from table below to enable or disable VQ detectors.
- Default value is 000 for all detectors enabled.

  NOTE: All detectors must be ON during VQ calibration and can only be programmed OFF after final test.

SYNCRONIZATION	FREQUENCY	FAST	AVERAGE	
8	4	2	1	**OFF**
0	0	0	0	**ON**

Example:

Sync detector ON	= 0
Frequency detector ON	= 0
Fast detector OFF	= 2
Average detector ON	= 0
Value to Enter	= 2 (002)

STEP 85 VQ MAINS DETECTOR ON/OFF

- Place unit in Standby.
- Enter correct value from table below to enable or disable VQ detectors.
- Default value is 000 for all detectors enabled.
  NOTE: All detectors must be ON during VQ calibration and can only be programmed OFF after final test.

SYNCRONIZATION	FREQUENCY	FAST	AVERAGE	
8	4	2	1	**OFF**
0	0	0	0	**ON**

Example:

Sync detector OFF	= 8
Frequency detector OFF	= 4
Fast detector OFF	= 2
Average detector OFF	= 1
Value to Enter	= 15 (015)

STEP 86 VQ OUTPUT DETECTOR ON/OFF

- Place unit in Standby.
- Enter correct value from table below to enable or disable VQ detectors.
- Default value is 000 for all detectors enabled.
  NOTE: All detectors must be ON during VQ calibration and can only be programmed OFF after final test.

SYNCRONIZATION	FREQUENCY	FAST	AVERAGE	
8	4	2	1	**OFF**
0	0	0	0	**ON**

Example:

Sync detector ON	= 0
Frequency detector OFF	= 4
Fast detector OFF	= 2
Average detector ON	= 0
Value to Enter	= 6 (006)

STEP 87 SETTING OF DATE

- Enter new date, YYMMDD.
- Press "#" to store new date.

STEP 88 SETTING OF TIME

- Enter new time, HHMMSS.
- Press "#" to store new time.

STEP 89 PWM FREQUENCY

- Default value is 000.
- Enter 000 for 1050Hz at 50Hz or 1260Hz at 60Hz.
- Enter 001 for 1350Hz at 50Hz or 900 Hz at 60Hz.

STEP 90 SOFT START FOR GENERATOR OPERATION

- Default value is 001.

  Enter 000 for soft start OFF.
  Enter 001 for soft start ON.

STEP 91 SOFT START TIME FOR GENERATOR OPERATION

- Default value is 000.

  Enter 000 for 10 second ramp (0-100%) if generator option is ON.
  Enter 001 for 20 second ramp (0-100%) if generator option is OFF.

STEP 92 DELAY FOR COMMON FAULT RELAY

- Enter delay, in seconds, for common fault relay on Relay Option Board.
- Default value is 000 for no delay.

  Minimum value is 000.
  Maximum value is 327.

STEP 93 SETUP IF BATTERY TEMPERATURE SENSOR IS INSTALLED

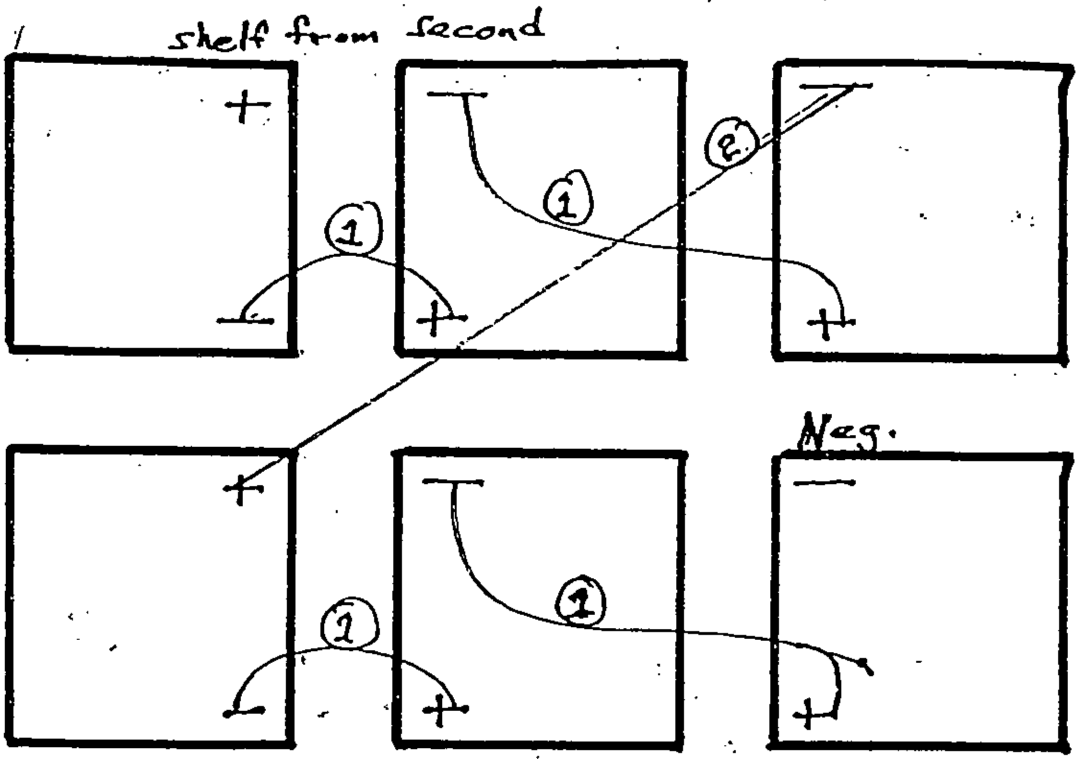
- Default value is 001.

  Enter 000 if battery temperature sensor is not installed.
  Enter 001 if battery temperature sensor is installed.

STEP 94 SETUP CHARGER OPTIONS

- Not used in Unity/I 3 Phase product line. Do not change.
- Default value is 000.

Single String 24 AH. UT-310-315



Unit front

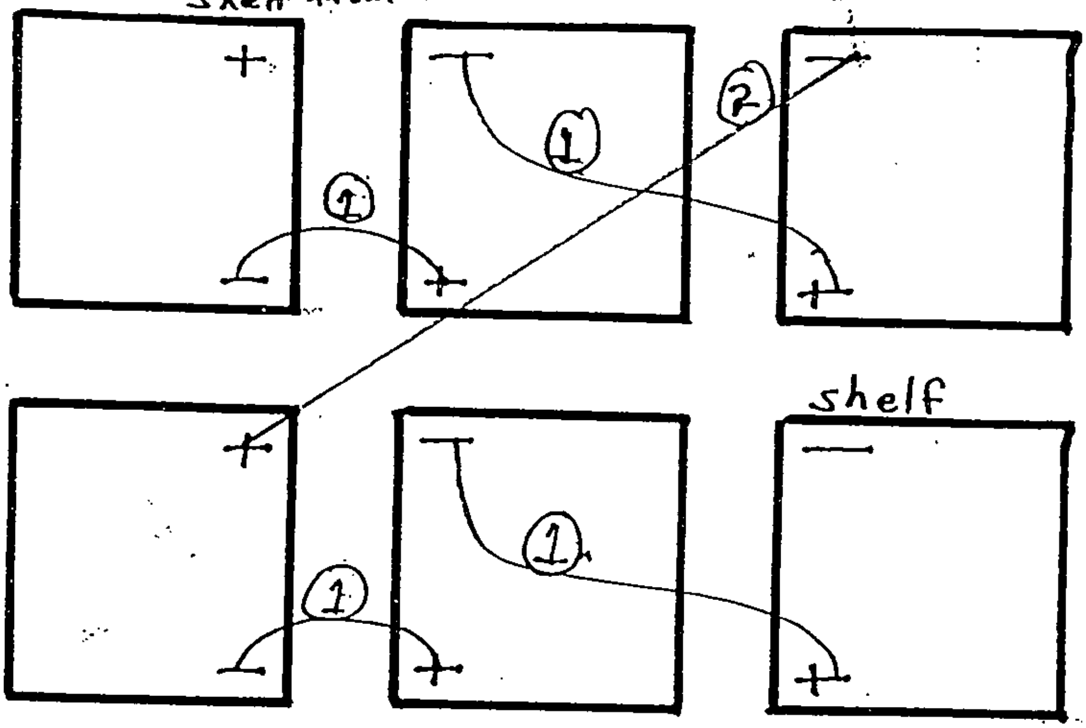
Top Shelf

1- Bat. Interconnect.

2- Tray Interconnect

Single String-24AH. UT-310-315

shelf from bottom



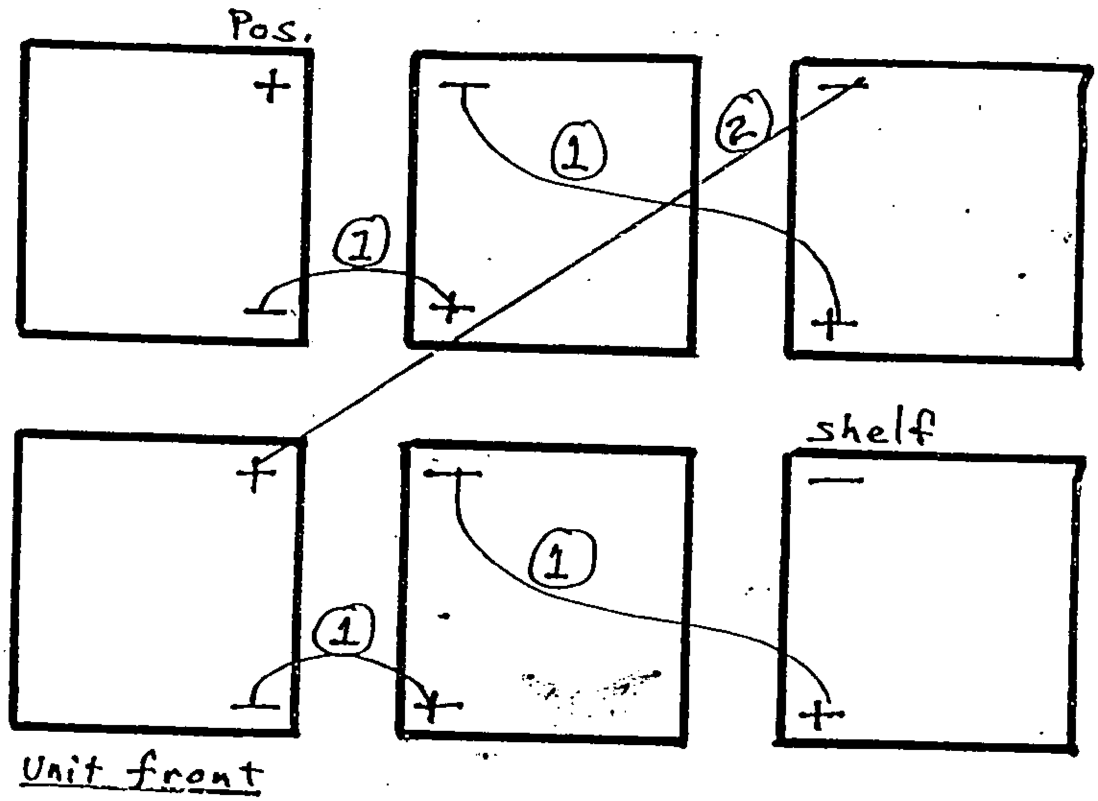
Unit front

Second shelf

1- Bat. Interconnect

2: ~~2~~ Tray Interconnect

Single String - 24 AH. UT-310-315



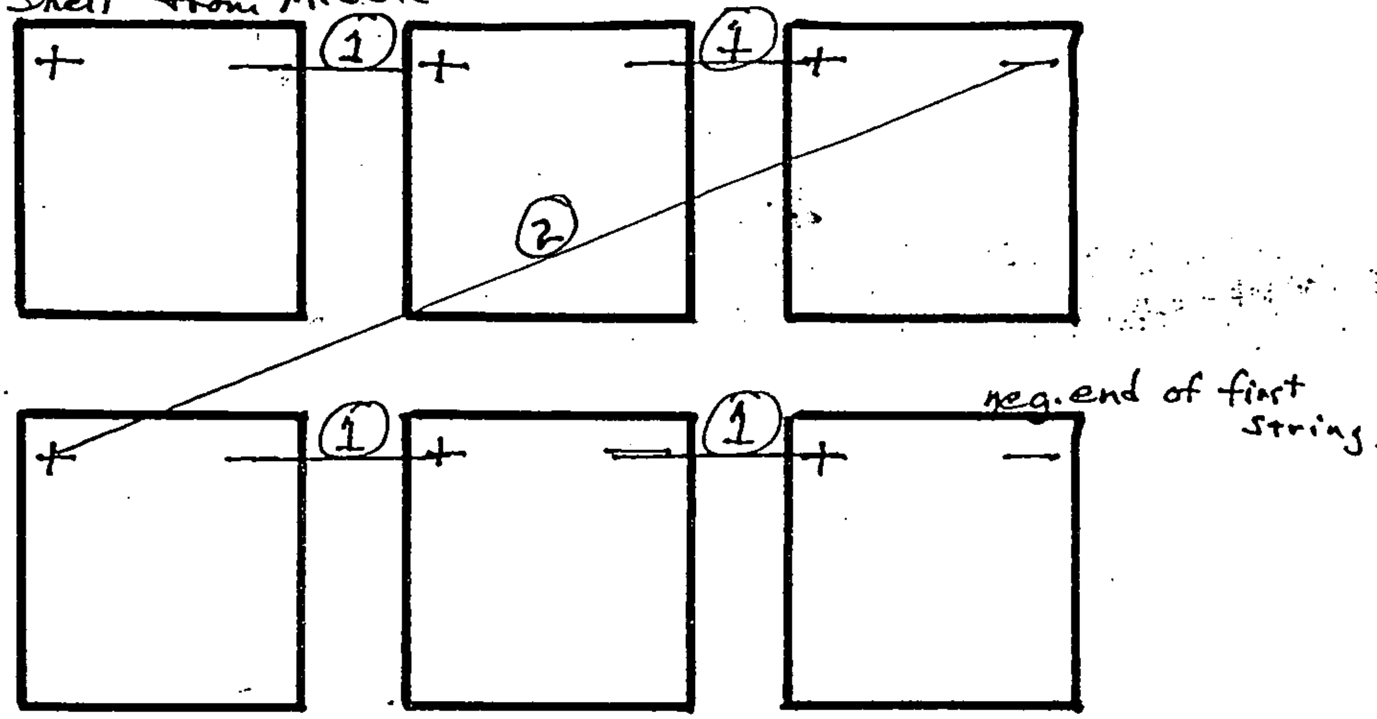
Bottom Shelf

1 Bat. Inter connect

2- Tray Interconnect

Single String - 38 A H.   UT. 310 - 315   Joe

shelf from Middle Shelf.



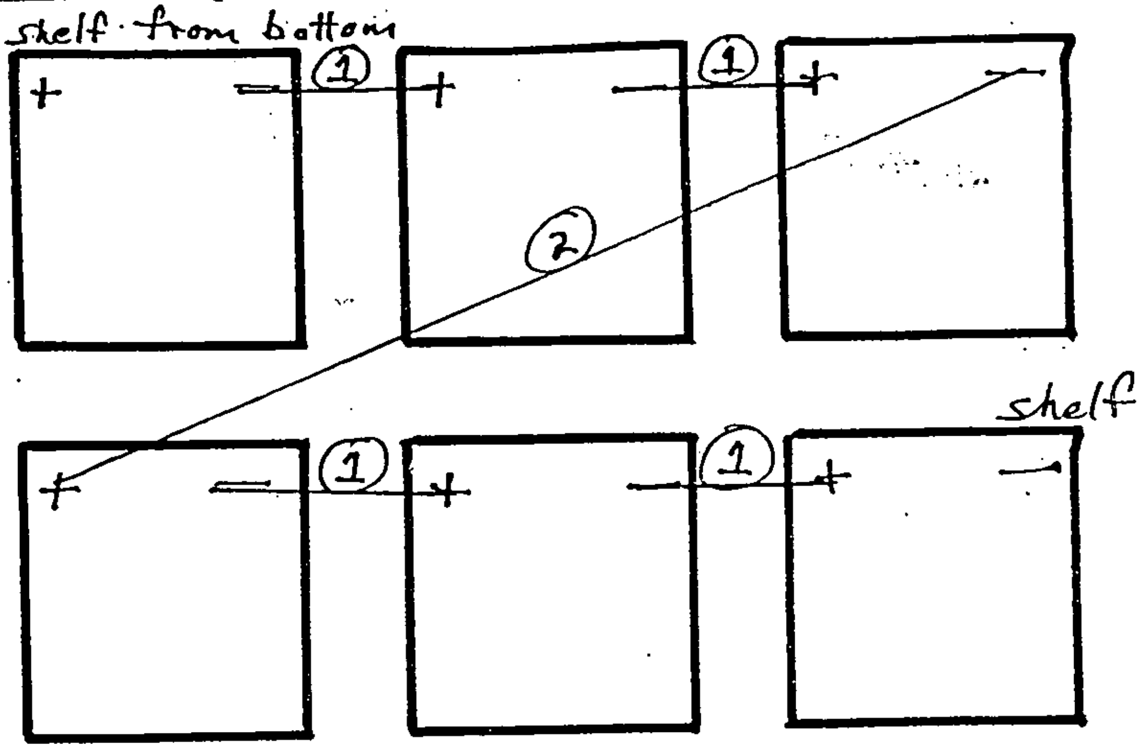
Unit front

Top Shelf

1 - Bat. Interconnect

2 - Tray Interconnect

String 38AH. UT-310-315



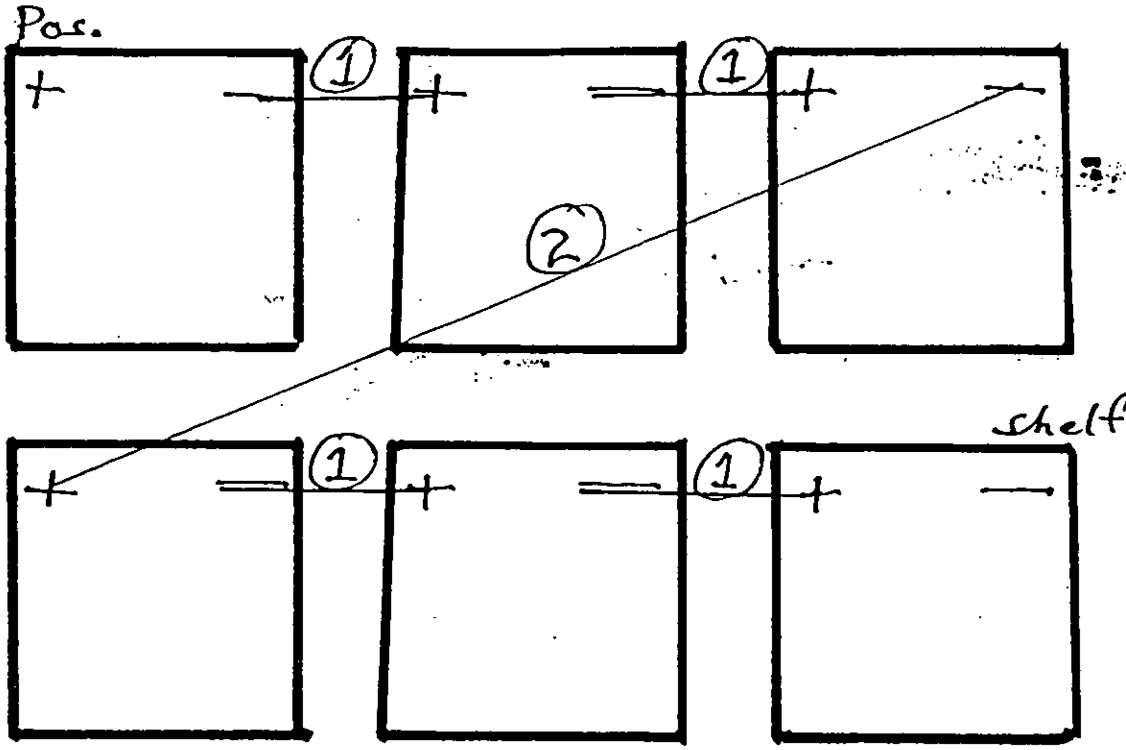
Unit front

Second Shelf

(1) Bat. Interconnect

(2) Tray Interconnect

e String 38 AH. UT-310-315



Unit front

Bottom Shelf

1 Bat. Interconnect

2 Tray Interconnect

Joe

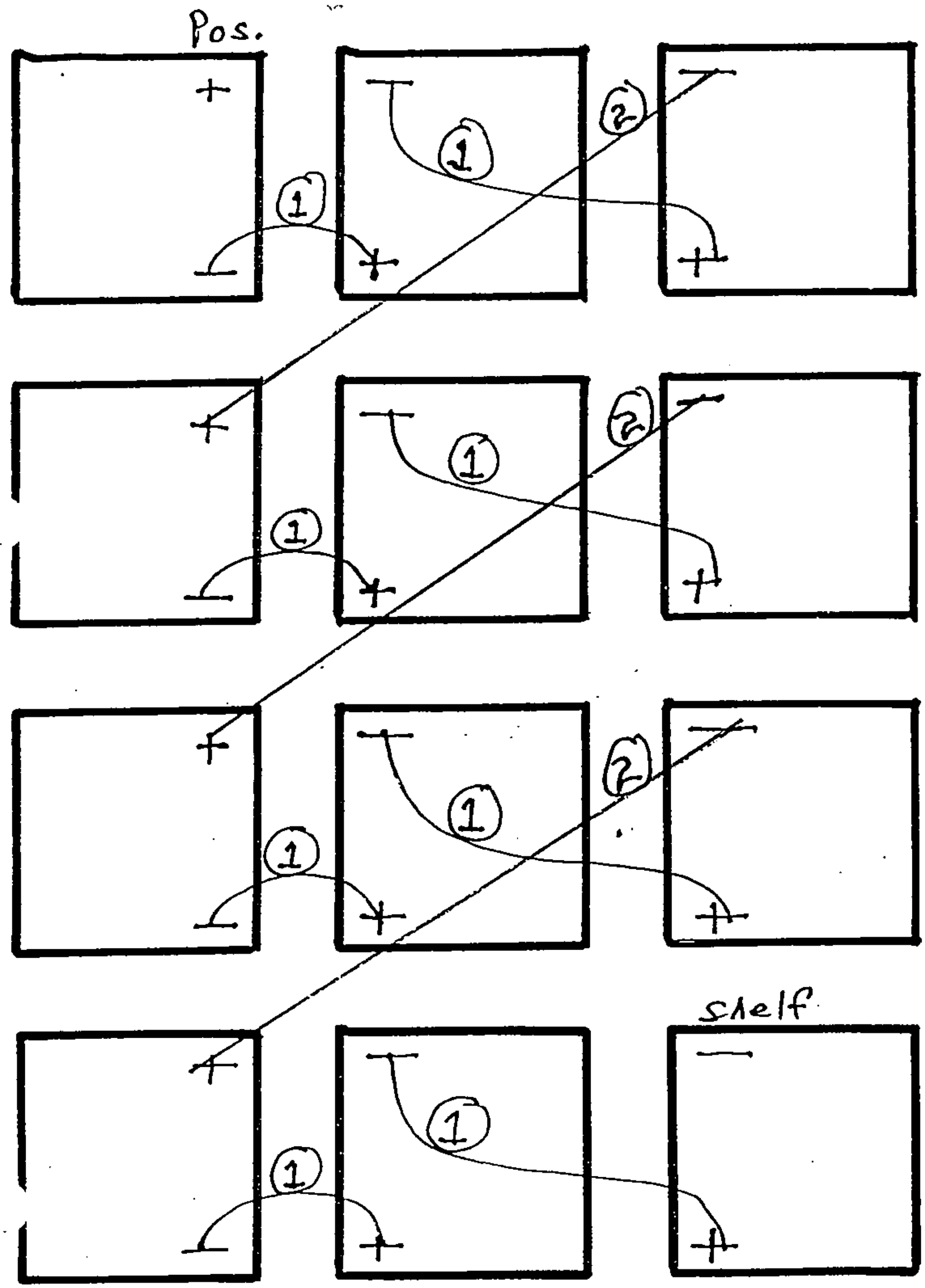
Double String - 24AH -

Bottom Layer.

(1) - Bat. Interconnect.

(2) - Tray Interconnect.

Unit Back



Unit front

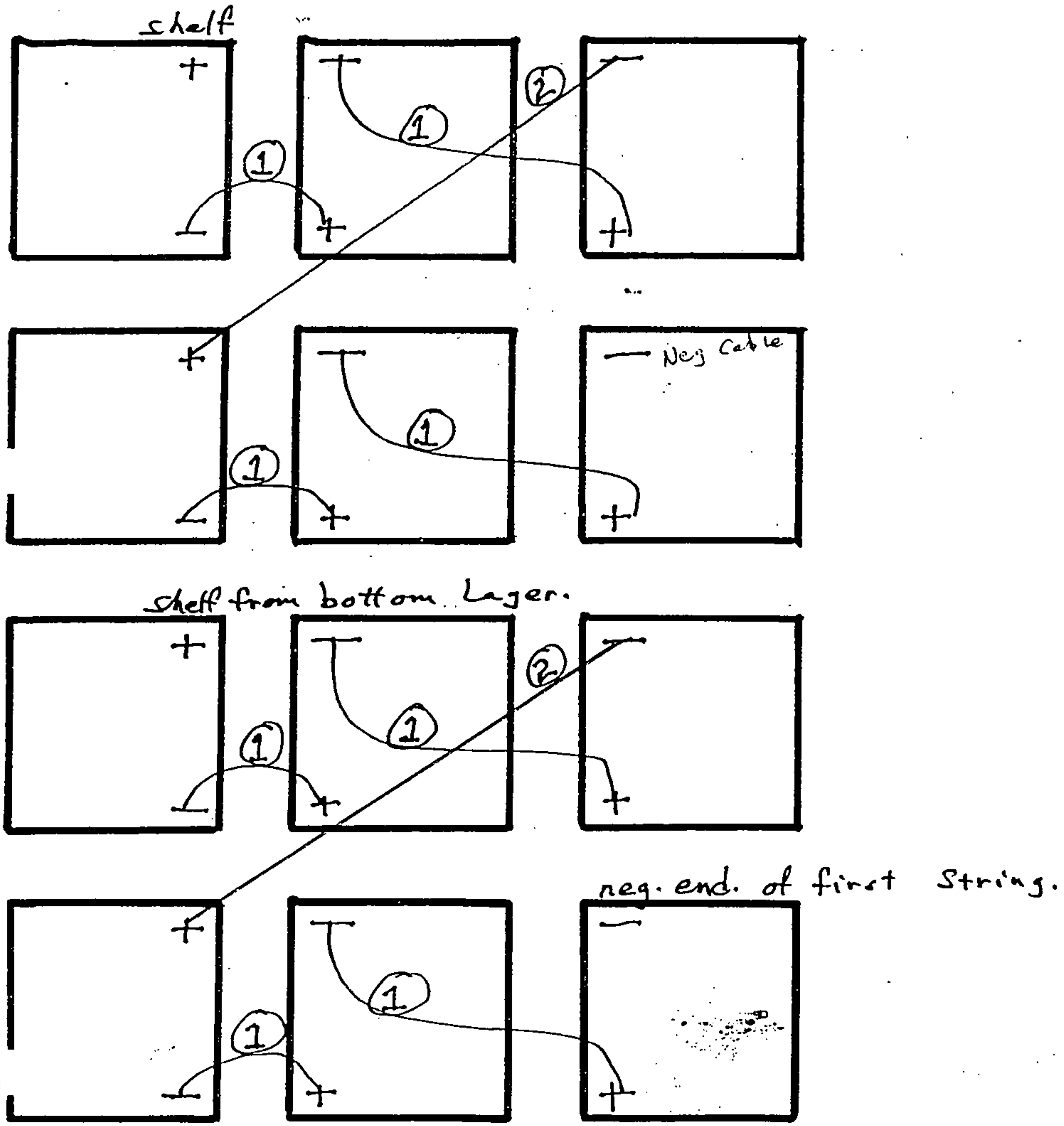
String-24-AH.

Second layer.

(1) Bat. Interconnect

(2) Tray Interconnect

Unit Back



Unit front.

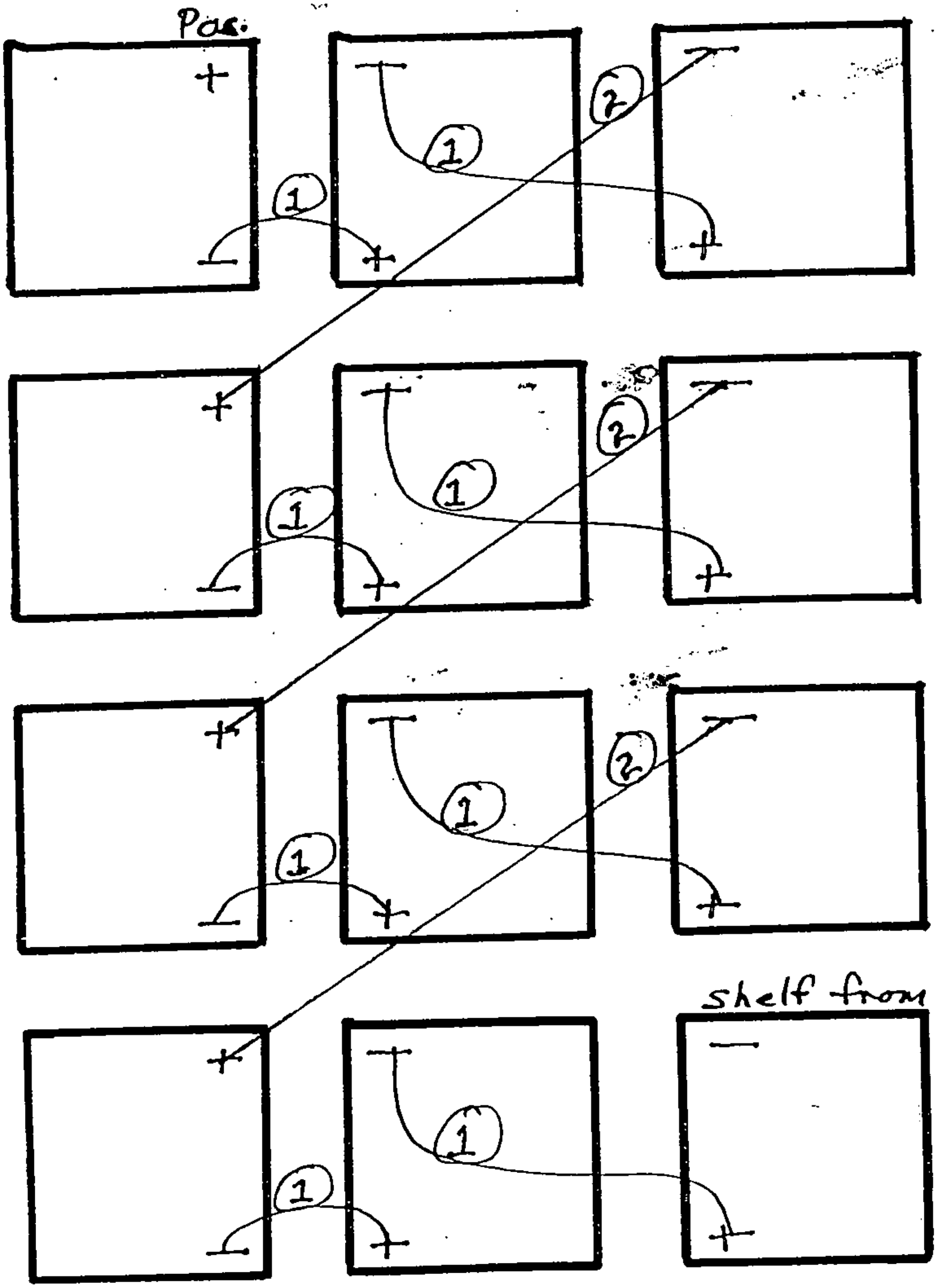
le String-24-AH.

Third layer

1 BAT. Interconnect

2 Tray Interconnect

Unit Back

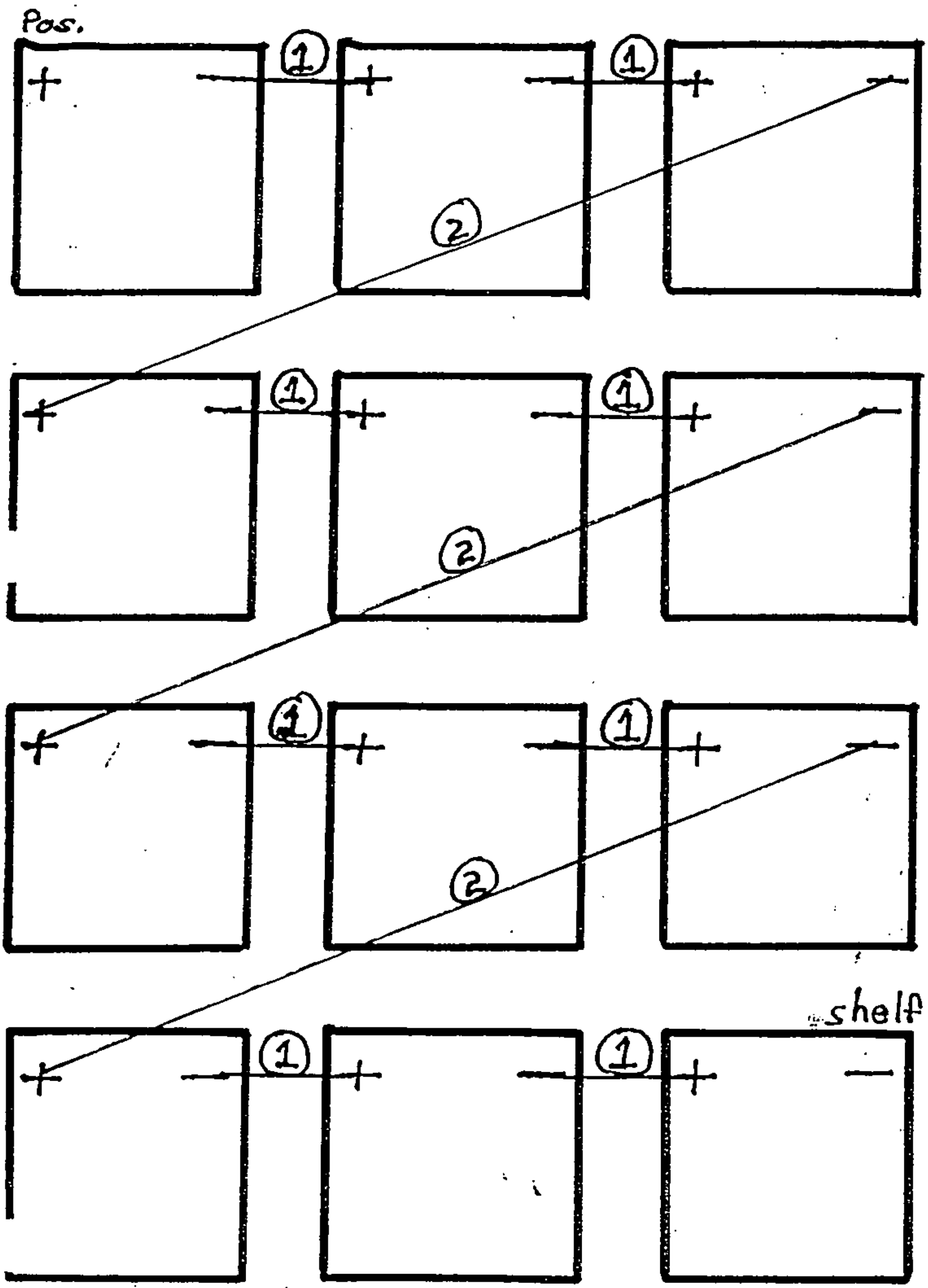


Unit front

Bottom Layer - 38 AH - Double String.

Joe

UNIT BACK

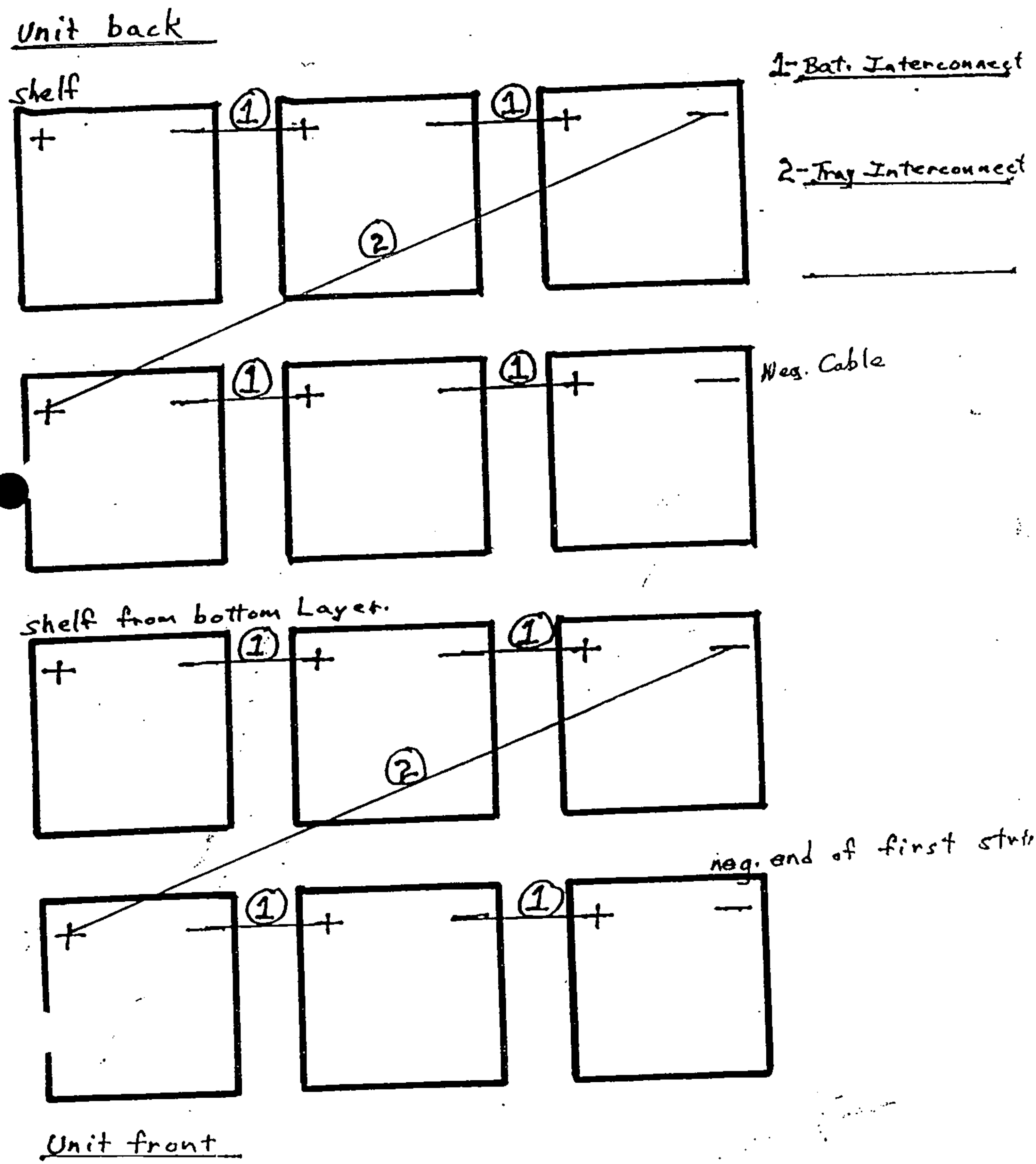


1- BAT. Interconnec

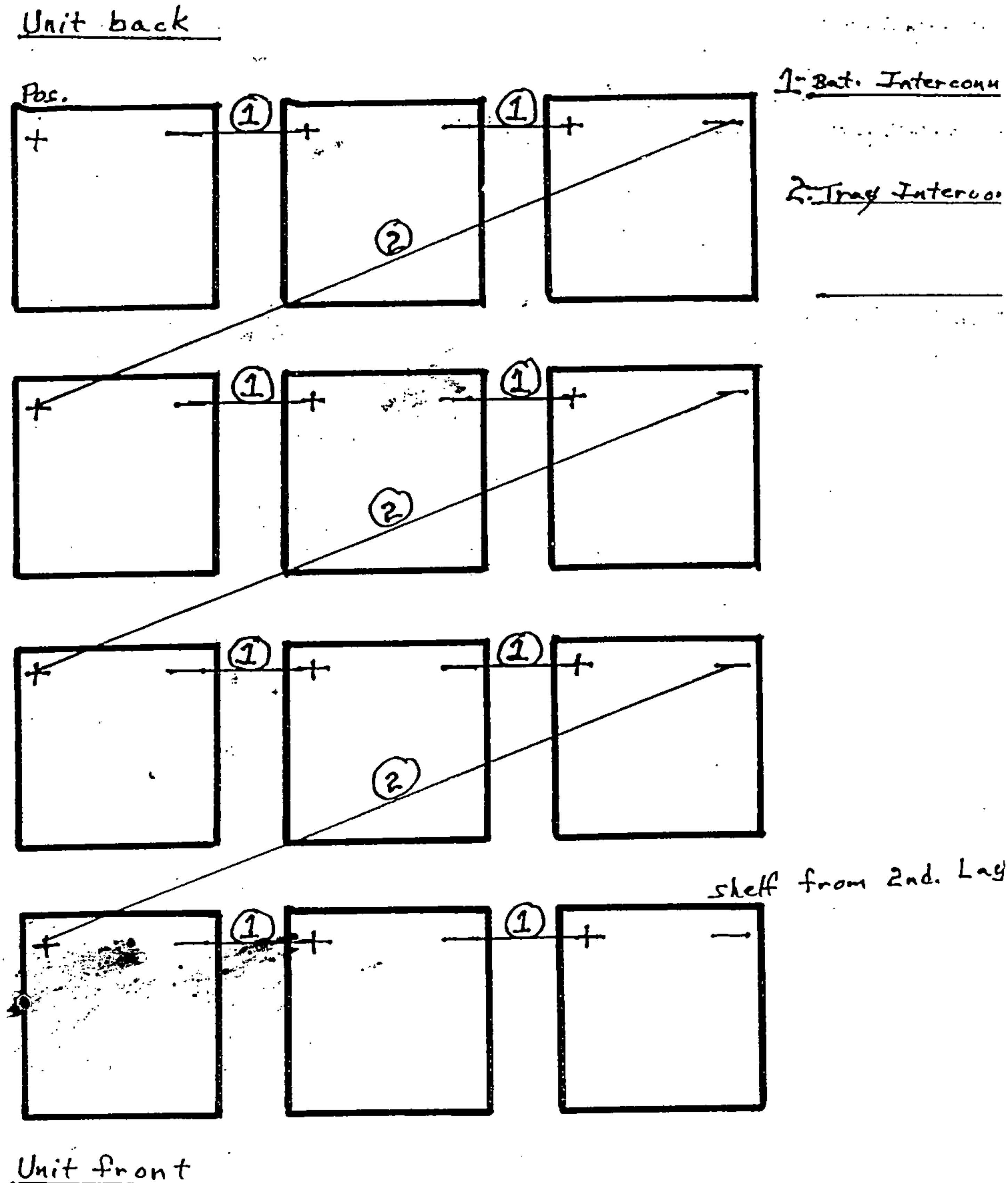
2- Tray Interconn

UNIT FRONT

Second Layer - 38 AH

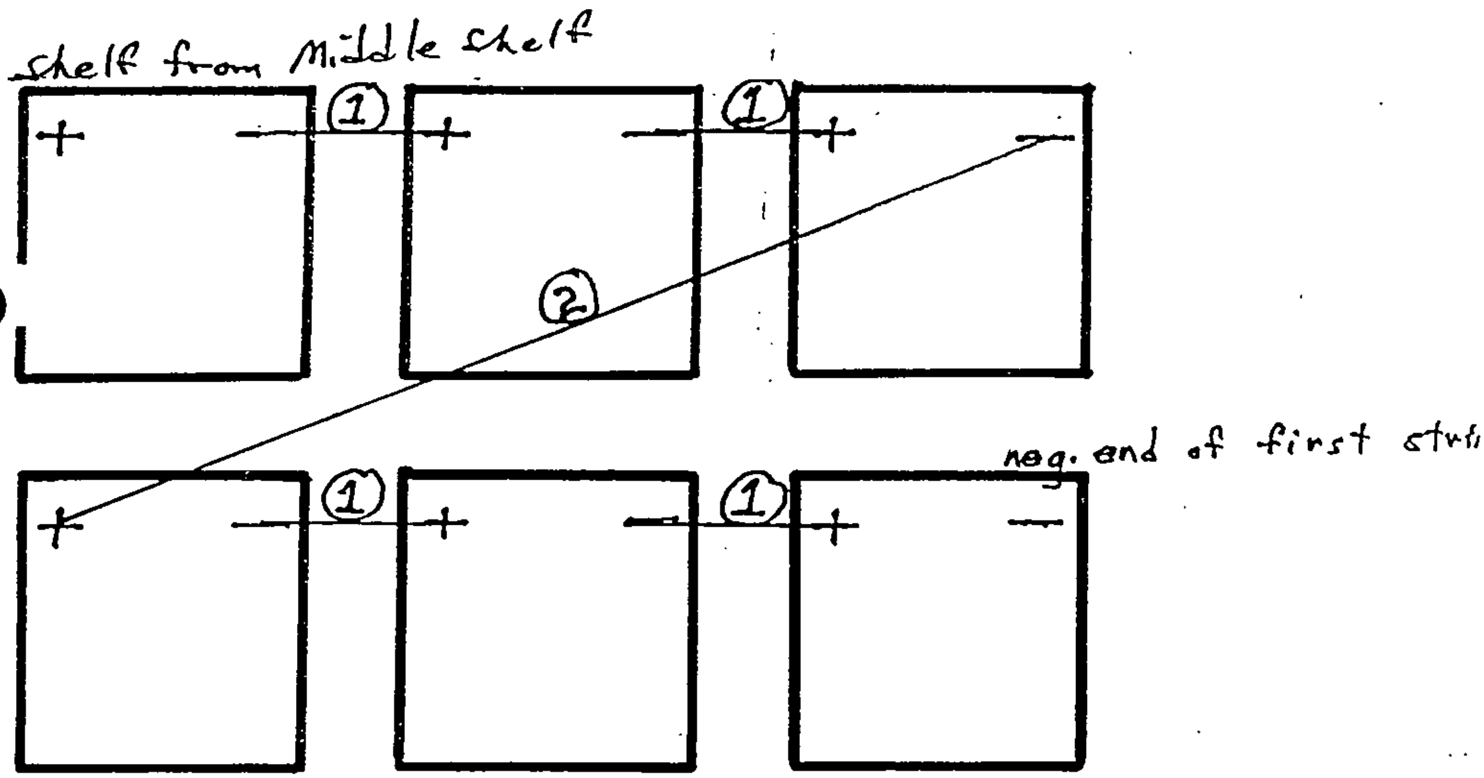


Third Layer - 30 AH



Joe

Top Shelf – Single String – 38-AH- UT-320 + 30K



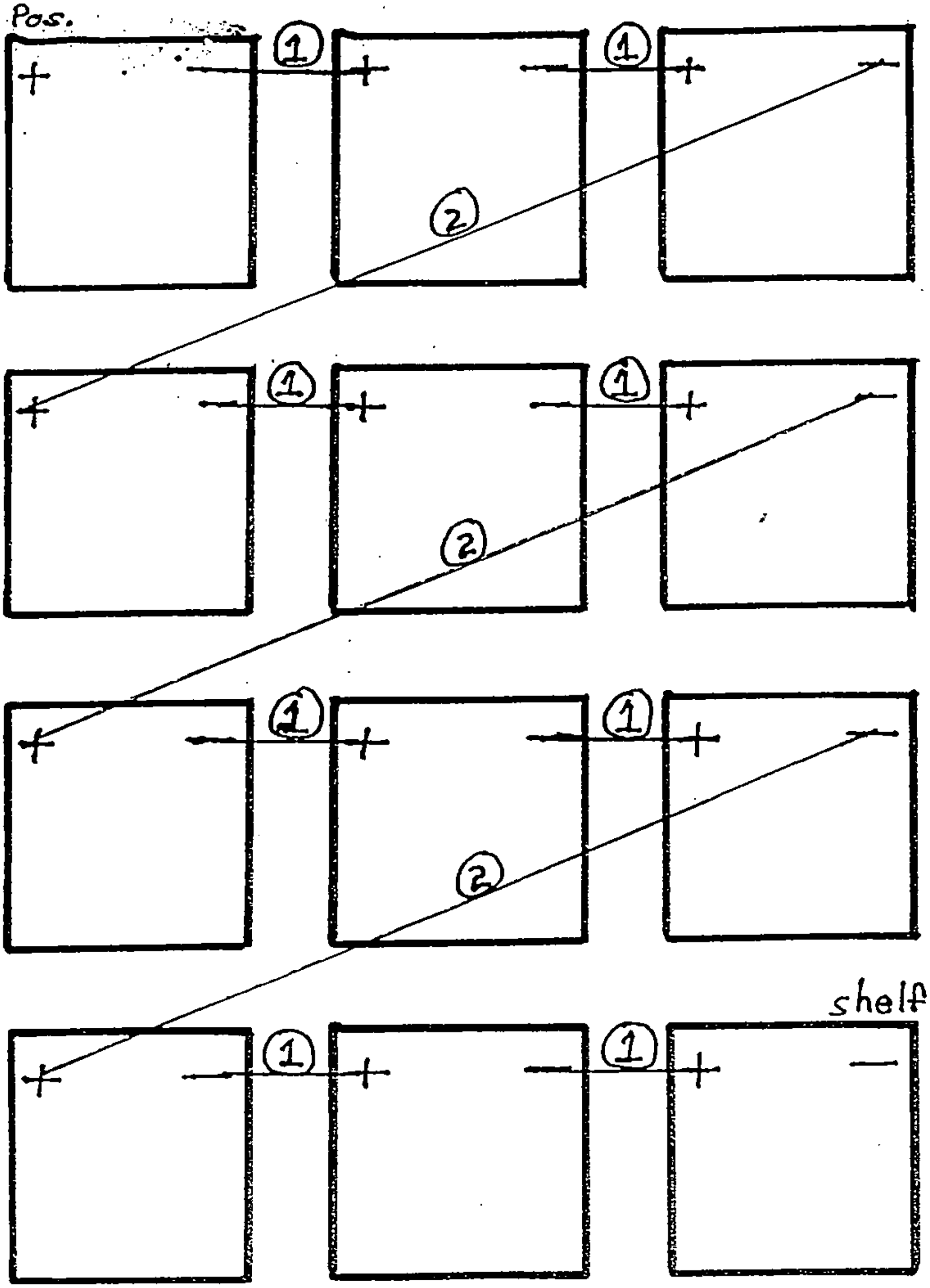
Unit front

Middle Shelf - Single String - 38-AH- UT-320+30K.

UNIT BACK

1-BAT. Intercon

2-Tray Interc



UNIT FRONT

UNITY/I™

Three-Phase Uninterruptible Power Systems
Parallel Configuration Procedure

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

This manual contains important instructions for your UNITY/I UPS

The installation and use of this product must comply with all national, federal, state, municipal, or local codes that apply. If you need help, please call Best Power's Worldwide Service at 1-800-356-5737 (U.S.A. or Canada) or 1-608-565-2100, or call your local Best Power office.

CAUTION!

UPS units contain hazardous AC and DC voltages. A qualified electrician must install the UPS, AC line service, and external batteries. The electrician must install AC line according to local and national codes and must be familiar with batteries and battery installation.

Before installing, maintaining, or servicing the UPS, shut off the UPS and disconnect all sources of AC and DC power.

Whenever AC and/or DC voltage is applied, there will be AC voltage at the UPS output; this is true because the UPS can supply output power from mains or from its batteries. To avoid equipment damage or personal injury, always assume that there may be voltage at the UPS output.

TEST BEFORE TOUCHING!

To reduce the risk of fire or electric shock, install the UPS and external batteries in a temperature and humidity controlled indoor area, free of conductive contaminants.

UPS batteries are high current sources. Shorting battery terminals or DC terminal strips can cause severe arcing, equipment damage and injury. A short circuit can cause a battery to explode. Always wear protective clothing and eye protection and use insulated tools when working near batteries.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, you may cause severe damage to electronic components.

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100 About this Manual

An uninterruptible power system (UPS) protects sensitive equipment against unacceptable disturbances from the main (AC line) supply. The UNITY/I three-phase UPS has the capacity to serve a wide variety of electrical equipment — from mainframe computers to enterprise-wide EDP installations to production lines. The UNITY/I three-phase UPS provides true on-line, single conversion technology and harmonics isolation.

IMPORTANT!

This three-phase parallel configuration procedure supplements the Planning and Installation manual that you received with your UPS. Refer to the Planning and Installation manual that came with your UPS for information on specifications, battery replacement procedures, wiring diagrams and additional safety information.

Because parallel systems can be configured in many ways, it is extremely important to plan for safety, location, and installation in advance. **The instructions in this procedure outline general installation instructions.**

If you are connecting an additional unit to an existing three-phase unit, with plans to create a parallel system, it is extremely important to contact Best Power to make sure all installation concerns are addressed.

This procedure does not cover changes that were made in the UNITY/I three-phase product after this manual was released.

101 Contacting Best Power

If you have any questions about your installation, **contact Best Power's Worldwide Service at 1-800-356-5737 (U.S.A. and Canada) or 1-608-565-2100.**

Best Power is committed to providing outstanding technical support. Please write or call if you have a question. Best Power's Worldwide Service provides telephone technical support 24 hours a day, 365 days a year. For UNITY/I three-phase products, Best Power provides priority telephone response time from 6:00 a.m. to 9:00 p.m. and guarantees 30-minute telephone response at all other times. When you contact Best Power's Worldwide Service, please have the following information available:

* UPS serial number and model number.
* brief description of problem or question pertaining to your system.

Mailing Address: Best Power Worldwide Service
P.O. Box 11
Necedah, Wisconsin 54646

For sales information or general inquiries, please call 1-800-356-5794 (U.S.A. and Canada) or 1-608-565-7200.

200 Safety First

Only qualified service personnel may service the UPS.

DANGER!

* Risk of electric shock. Hazardous live parts inside the UPS are energized from the battery supply even when the input AC power is disconnected. Disconnect all AC and DC sources to de-energize the unit before servicing.
* A battery can present a risk of electrical shock and high short circuit current. Observe the following precautions when working on batteries:
    1. Remove watches, rings, or other metal objects.
    2. Use tools with insulated handles.
    3. Wear rubber gloves and boots.
    4. Do not lay tools or metal parts on top of batteries.
    5. Disconnect the charging source prior to connecting or disconnecting battery terminals.
    6. Determine if the battery is inadvertently grounded. If so, remove the source of ground. Contact with any part of a grounded battery can result in electrical shock. A shock is less likely if you remove such grounds during installation and maintenance.

300 Parallel Configurations

IMPORTANT!

An Applications Engineer must be involved with all parallel system applications. You need to contact Best Power's Worldwide Service before you install a parallel system.

Best Power assumes no liability for use or misuse of these instructions and reserves the right to make changes without prior notice.

Units are connected in parallel for one of two reasons:

* To obtain increased security (N + 1 Redundancy).
* To obtain a higher total output power (Capacity).

If the units are paralleled for redundancy and one unit fails, the others have enough capacity to handle the load.

When units are paralleled for capacity, each units percentage of load will be the same, but the actual kW may vary. Chances are if one unit fails, the others will not have enough capacity to handle the load without overloading.

301 Priority Levels

All units in a parallel system must operate in the same mode or at the same priority level. The units in a parallel system operate on a transferrable master/slave principle. The first unit powered up is normally the master and the other unit or units connected in parallel are the slaves.

Listed below are the four priority levels for the units connected in parallel.

PRIORITY 1 = **Normal Operation:** During normal operation, mains (AC input) passes through the main static switch, through the input choke, into the main transformer and out to the loads. The output is regulated via the inverter and the battery bank is being charged. This is the only mode in which the batteries can be charged.

PRIORITY 2 = Battery Operation: When mains is out of tolerance, the unit switches into battery operation. The main static switch opens and the inverter draws power from the batteries. The power is sent through the main transformer and out to the loads. If battery capacity is exceeded, the unit will go into standby and wait for the return of mains. If autostart is programmed "On," the unit will automatically start after mains returns. If autostart is programmed "Off," the unit must be started manually.

PRIORITY 3 = Bypass operation: In bypass operation, the mains pass unregulated through the bypass static switch, through the main transformer and out to the loads. The inverter is in a standby mode and is synchronized to the mains. It is ready to handle the loads if bypass goes out of tolerance.

PRIORITY 4 = Standby operation: When the unit is in standby mode, both static switches are open and the unit is ready to be switched "on," but the unit does not have an output voltage.

Below are three examples of how a parallel system changes priority levels in different situations.

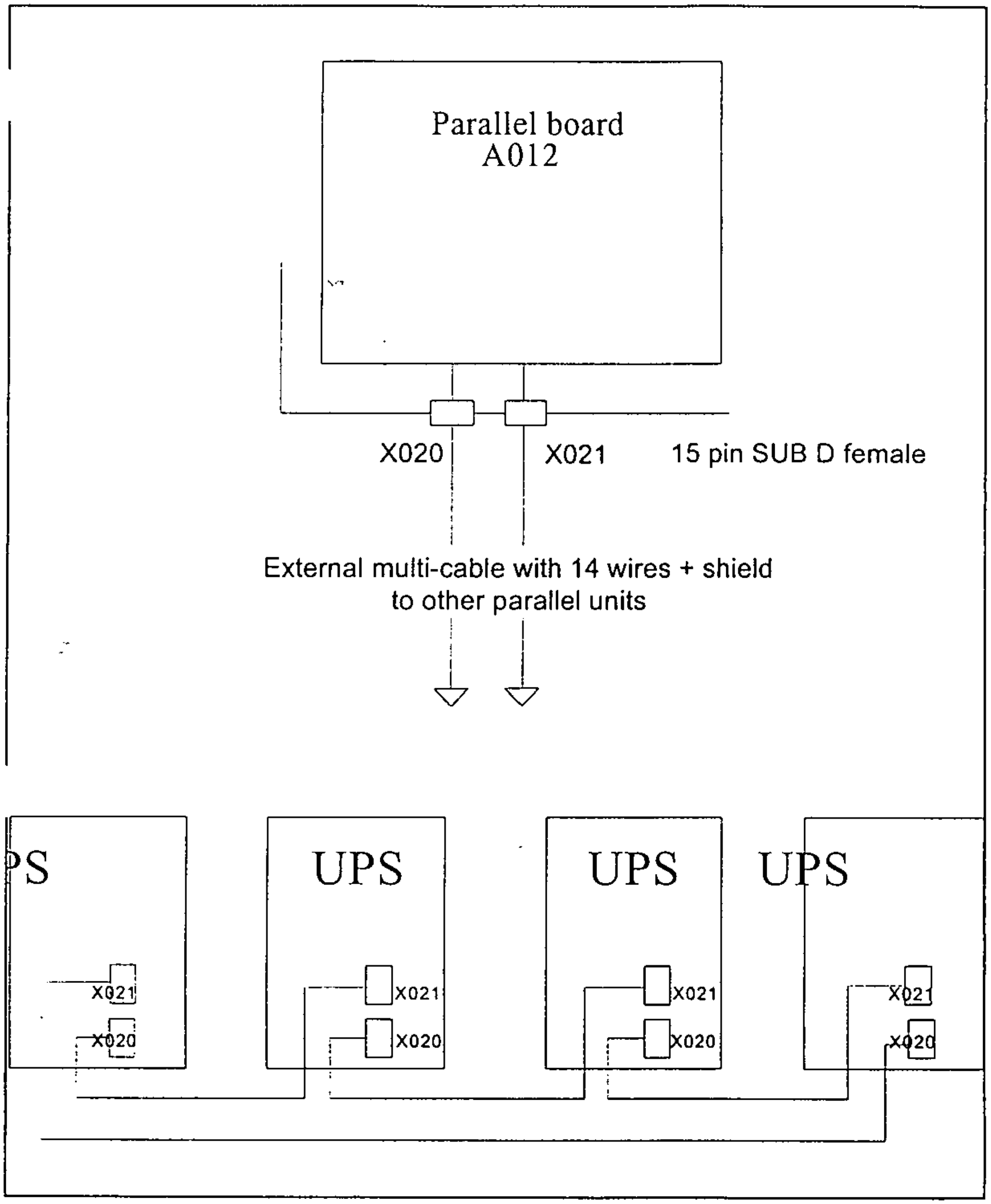
Example 1: Four units are paralleled together: A, B, C, and D. All four units are running in normal operation. Unit A encounters a problem and drops down a priority level. If units B, C, and D are able to handle the load without unit A, unit A will go into standby and units B, C, and D will remain in normal operation. This situation would be an N+1 redundancy parallel configuration.

Example 2: Units A, B, C, and D are paralleled together. Unit A input AC mains is lost and unit A drops down a priority level. In a capacity parallel system the other three units may not be able to handle the load and so would drop down to the next priority level: battery operation. All units would operate on battery until the problem with unit A was corrected. Once the problem was corrected and unit A came back up to normal operation, all units would then go back up into normal operation. However in a N+1 redundant system unit A would go to standby and the other units would stay in normal operation. When AC mains returns, unit A would return to normal operation.

Example 3: In example 2 above, if all units are operating at the battery operation priority level and unit A has an inverter over temperature alarm it will drop to standby and the other units will stay in battery operation until battery capacity is depleted. Units B, C, and D will then go into standby until AC Mains returns. Once the problem with unit A is corrected it may be necessary to restart the units, unless the units are programmed for "autostart." If autostart has been enabled units B, C, and D would autostart and unit A would stay in standby until the alarm condition clears itself or the problem has been cleared by service personnel.

302 Parallel Board

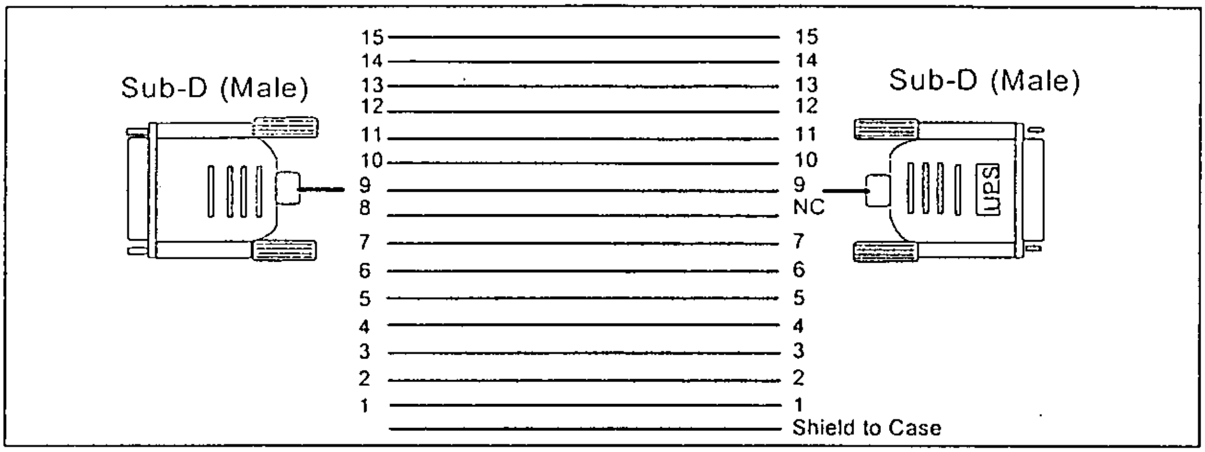
Units to be connected in parallel require an internal parallel board. Among other functions, the parallel board ensures correct load sharing between the units connected in parallel. Refer to Figure 1 for connections between the parallel boards.


Parallel board
A012
X020
X021
15 pin SUB D female
External multi-cable with 14 wires + shield
to other parallel units
PS
UPS
UPS
UPS
X021
X020
X021
X020
X021
X020
X021
X020

The parallel board allows you to connect up to four (4) units with a common DC bus voltage in parallel *without* an external static bypass switch.

With an external static bypass switch, you can connect up to nine units in parallel with a common DC bus voltage.

The external multi-conductor control cables are terminated with a 15-pin SUB-D male plug on both ends. All pins are connected straight through except pin 8, which is not connected. Refer to Figure 2. Shield is connected to the plug cover but only on one end — the other end is isolated.



One piece of 7 m cable is included with each parallel board. Other cabling is user supplied. Typical control cable construction is 14 x 26 AWG (14 mm²) + shield with 15 Pin-Sub-D Male connectors at both ends.

303 External Communication Interface (option)

The communication interface, having 3 ports, is used when an interaction between the UPS and (for example) a computer system must be established. The main purpose of such an interface is to ensure a controlled shutdown of the protected loads in the event of a failure in the mains power supply.

Normally the simple contact signals from port X005 is used, but serial communication can also be performed via the two serial ports X003 and X004. (Protocol is available on request.) Remote monitoring can also be established up to about a 500 m distance via the 20 mA current loop from X004.

It is important to consider establishing a communication interface with each unit in the parallel system. This will insure that you know the status of the entire system and not just that of a single unit.

400 Initial Startup and Phase Check

> **CAUTION!**
>
> At a customer's request, some units can be programmed at the factory for autostart. If programmed for autostart, the unit will turn on **any time** mains (AC line) is applied (after a 60-second delay). For more information, or to change this feature, see the User Manual that came with the UPS.
>
> Before continuing, read the warnings on the inside front cover of this manual.

Note: Many parallel configurations are possible. Because each system may have different types of switch gear, the terminology in this procedure must be generic. A glossary at the back of this manual defines terms that may not be familiar for your particular application.

401 Initial Startup and Phase Check for Units with a Rotary Switch Maintenance Bypass Cabinet (MBC)

Follow this Procedure Exactly! No Load Should Be Connected!

1. Make sure that all AC and DC power is off.

2. Put the maintenance bypass cabinet (MBC) into bypass operation by turning the UPS bypass switch to "BYPASS." Make sure that the main circuit breaker in the load panel is off so that the loads cannot receive power from the UPS.

3. Verify that a detailed inspection of each UPS was performed when it was installed. Verify that all connections within and between the units are secure. Verify that all installation procedures were performed correctly for your particular unit size.

Note: To optimize load sharing in parallel operation, all unit input cabling must be the same length/impedance as other unit input conductors. Likewise, all unit output cabling must be the same length/impedance as other output conductors.

4. At the mains AC service input panel, switch on the input power to the maintenance bypass cabinet (MBC).

5. Check the phase rotation at the service panel and the unit. The unit will not start if the phase rotation is incorrect. **The phase rotation must be A, B, C and clockwise.**

Note: If optional alternative mains are used, they must be in complete phase with the normal mains. Changes to phase rotation must be made at the maintenance bypass cabinet (MBC).

6. At the mains AC service input panel, switch off the input power to the maintenance bypass cabinet (MBC).

7. Turn the UPS output disconnect switch for each unit connected in parallel to "ON."

8. Apply DC power to the unit(s). Hold the pre-charge/discharge switch in the pre-charge position until the LED turns off, then turn the DC disconnect (DCD) "ON."

9. The display on the unit(s) should show System type xxkVA xxxV, and an audible alarm should sound.

10. Silence the audible alarm on the unit(s) by pressing the key. Within 20 seconds, the display should show **Stand-by**.

11. Push the green "on" button located inside the front door of the unit(s).

12. Silence the audible alarm on the unit(s) by pressing the key. Within 20 seconds, the display should show Battery Operation.

Note: If the unit(s) are not in battery operation, call Best Power's Worldwide Service.

13. At the mains AC service input panel, switch on the input power to the maintenance bypass cabinet (MBC).

14. Turn the UPS input disconnect switch for each unit connected in parallel to "ON." The display on each UPS should show Normal Operation load power xx%. With no load connected, the percentage should be < 5%.

Note: One or more alarms may occur. If the alarm(s) persists for more than 20 seconds, refer to the " Alarms" section of the user manual. If the unit activates a "battery monitor alarm," you should set the user parameter "battery monitor reset" to "ON."

Note: If the UPS is connected to a generator, verify that the unit operates properly on generator power before continuing. If the UPS operates properly on generator power, continue this procedure. If the UPS does not operate properly on generator power, phone Best Power's Worldwide Service for assistance.

CAUTION!

Before you switch the UPS bypass switch from "BYPASS" to "UPS", use the steps below to check for correct voltage, phasing, and system operating mode.

15. Program a unit into static bypass operation:

Note: When you program one unit into bypass operation the others will follow. However, the unit you program into bypass must be the same you program out of bypass in step 22.

a. Press [key] to access the user parameters.

b. Press the [up] or [down] key until the display shows Bypass operation: OFF.

c. Press [key] to turn static bypass operation on. The display should show Bypass operation.

16. At the maintenance bypass cabinet (MBC), make sure the UPS output voltage is approximately the same as the AC line input voltage (there may be slight differences). Use a true RMS voltmeter to measure the phase-to-neutral voltage at the MBC AC line input and the MBC output:

	MBC AC Line Input	**MBC Output**
a.	*L1* to *neutral*_______VAC	*L1* to *neutral*_______VAC
b.	*L2* to *neutral*_______VAC	*L2* to *neutral*_______VAC
c.	*L3* to *neutral*_______VAC	*L3* to *neutral*_______VAC

The voltages in the first column should be similar to the voltages in the second column. If the voltages are more than 10 volts apart for 208 V nominal or 25 volts apart for 480 V nominal, check the connections and correct any wiring problems before continuing.

17. At the maintenance bypass cabinet (MBC), make sure the UPS output voltage and the AC line input voltage are in phase. To do this, measure the AC voltages between the following points at the MBC AC line input and the MBC output:

	MBC AC Line Input		**MBC Output**	
a.	*L1 input*	to	*L1 output*	_______VAC
b.	*L2 input*	to	*L2 output*	_______VAC
c.	*L3 input*	to	*L3 output*	_______VAC

These readings must not be more than 10 VAC! If they are, call Best Power's Worldwide Service or your local Best Power office.

18. At the maintenance bypass cabinet (MBC), measure the following:

a. *N input* to *Ground* _______VAC
b. *N output* to *Ground* _______VAC
c. *N input* to *N output* _______VAC

"*N input* to *N output*" should not exceed "*N input* to *Ground*." If it does, call Best Power's Worldwide Service or your local Best Power office.

19. Check for proper voltages at the bypass switch load output terminals and the load distribution panel(s).

	Bypass Switch Load Output	**Load Panel Input**
a.	*L1* to *neutral*______VAC	*L1* to *neutral*______VAC

b. *L2* to *neutral*_______VAC *L2* to *neutral*_______VAC
c. *L3* to *neutral*_______VAC *L3* to *neutral*_______VAC

20. Switch the UPS bypass switch to "UPS."

21. Recheck for proper voltages at the bypass switch load output and the load distribution panel(s).

	Bypass Switch Load Output	Load Panel Input
a.	*L1* to *neutral*_______VAC	*L1* to *neutral*_______VAC
b.	*L2* to *neutral*_______VAC	*L2* to *neutral*_______VAC
c.	*L3* to *neutral*_______VAC	*L3* to *neutral*_______VAC

22. Return the UPS to normal operation mode:

a. Press [□] to access the user parameters.

b. Press the [↑] or [↓] key until the display shows Bypass operation: ON.

c. Press [✱] to turn static bypass operation off. The display should show Normal operation load power xx%.

You can now apply loads to the system. As the last step of the installation, Best Power recommends that you clear the events log. See Section 500, "Clearing the Events Log."

402 Initial Startup and Phase Check for Units with a Three-Breaker Maintenance Bypass Cabinet (MBC)

Follow this Procedure Exactly! No Load Should Be Connected!

1. Make sure that all AC and DC power is off.

2. Switch the maintenance bypass breaker (MBB) "OFF."

3. Switch the UPS output breaker(s) (UOB) "OFF." Set all input and output breakers to the "OFF" position. Your UPS should be completely off.

4. Verify that a detailed inspection of each UPS was performed when it was installed. Verify that all connections within and between the units are secure. Verify that all installation procedures were performed for your particular unit size.

Note: To optimize load sharing in parallel operation, all unit input cabling must be the same length/impedance as other unit input conductors. Likewise, all unit output cabling must be the same length/impedance as other unit output conductors.

5. Put the maintenance bypass cabinet (MBC) into the bypass position by turning the maintenance bypass breaker (MBB) "ON."

6. At the mains AC service input panel, turn the input power to the maintenance bypass cabinet (MBC) " ON."

7. Check the phase rotation at the maintenance bypass cabinet (MBC) input terminals. The unit will not

start if the phase rotation is incorrect. **The phase rotation must be A, B, C and clockwise.**

Note: If optional alternative mains are used, they must be in complete phase with the normal mains. Changes to phase rotation must be made at the maintenance bypass cabinet (MBC).

8. At the mains AC service input panel, turn the input power to the maintenance bypass cabinet (MBC) " OFF."

9. Turn the UPS output breaker(s) (UOB) on the unit(s) to "ON."

10. Apply DC power to the unit(s). Hold the precharge/discharge switch in the precharge position until the LED turns off, then turn the DC disconnect (DCD) "ON."

11. The display of the unit(s) should show System type xxkVA xxxV, and an audible alarm should sound.

12. Silence the audible alarm on the unit(s) by pressing the key. Within 20 seconds, the display should show **Stand-by**.

13. Push the green "on" button located inside the front door of the unit(s).

14. Silence the audible alarm on the unit(s) by pressing the key. Within 20 seconds, the display should show Battery Operation.

Note: If the unit(s) are not in battery operation, call Best Power's Worldwide Service.

15. At the mains AC service input panel, turn the input power to the maintenance bypass cabinet (MBC) " ON."

16. Turn the main UPS input breaker (MUIB) "ON."

17. Turn the UPS input breaker (UIB)for the unit(s) "ON." The display on each UPS should show Normal Operation load power xx%. With no load connected the percentage should be <5%.

Note: One or more alarms may occur. If the alarm(s) persists for more than 20 seconds, refer to the " Alarms" section of the User manual. If the units activates a "battery monitor alarm," you should set the user parameter "battery monitor reset" to "ON."

Note: If the UPS is connected to a generator, verify that the unit operates properly on generator power before continuing. If the UPS operates properly on generator power, continue this procedure. If the UPS does not operate properly on generator power, phone Best Power's Worldwide Service for assistance.

CAUTION!

Before you switch the maintenance bypass breaker (MBB) "ON," use the steps below to check for correct voltage, phasing, and system operating mode.

18. Program a unit into static bypass operation.

Note: When you program one unit into bypass operation the others will follow. However, the unit you program into bypass must be the same you program out of bypass in step 29.

a. Press to access the user parameters.

b. Press the or key until the display shows Bypass operation: OFF.

c. Press to turn static bypass operation on. The display should show Bypass operation.

d. **The green static bypass light should be on.** If the green static bypass light is not on, call Best Power before continuing.

19. Switch the UPS output breaker (UOB) "ON".

20. At the maintenance bypass cabinet (MBC), make sure that the UPS output voltage is approximately the same as the AC line input voltage (there may be slight differences). Use a true RMS voltmeter to measure the phase-to-neutral voltage at the MBC AC line input and the MBC output.

	MBC AC Line Input	**MBC Output**
a.	*L1* to *neutral*______VAC	*L1* to *neutral*______VAC
b.	*L2* to *neutral*______VAC	*L2* to *neutral*______VAC
c.	*L3* to *neutral*______VAC	*L3* to *neutral*______VAC

The voltages in the first column should be similar to the voltages in the second column. If the voltages are more than 10 volts apart for 208V nominal or 25 volts apart for 480V nominal, check the connections and correct any wiring problems before continuing.

21. At the maintenance bypass cabinet (MBC), make sure the UPS output voltage and AC line input voltage are in phase. To do this, measure the AC voltage between the following points at the MBC AC line input and the MBC output:

	MBC AC Line Input		**MBC Output**	
a.	*L1 input*	to	*L1 output*	______VAC
b.	*L2 input*	to	*L2 output*	______VAC
c.	*L3 input*	to	*L3 output*	______VAC

These readings must not be more than 10 VAC! If they are, call Best Power's Worldwide Service or your local Best Power office.

22. At the maintenance bypass cabinet (MBC), measure the following:

a. *N input* to *Ground* ______VAC
b. *N output* to *Ground* ______VAC
c. *N input* to *N output* ______VAC

"*N input* to *N output*" should not exceed "*N input* to *Ground*." If it does, call Best Power's Worldwide Service or your local Best Power office.

23. Check for proper voltages at the maintenance bypass cabinet (MBC) load output terminals and the load distribution panel(s).

	MBC Load Output	**Load Panel Input**
a.	*L1* to *neutral*______VAC	*L1* to *neutral*______VAC
b.	*L2* to *neutral*______VAC	*L2* to *neutral*______VAC
c.	*L3* to *neutral*______VAC	*L3* to *neutral*______VAC

24. Switch the maintenance bypass breaker (MBB) "ON."

25. Switch the UPS output breaker (UOB) "OFF."

26. Recheck for proper voltages at the MBC load output terminals and load distribution panel(s).

	MBC Load Output	Load Panel Input
a.	*L1* to *neutral*_____VAC	*L1* to *neutral*_____VAC
b.	*L2* to *neutral*_____VAC	*L2* to *neutral*_____VAC
c.	*L3* to *neutral*_____VAC	*L3* to *neutral*_____VAC

27. Switch the UPS output breaker (UOB) "ON."

28. Switch the maintenance bypass breaker (MBB) "OFF."

29. Return the UPS to normal operation:
   a. Press  to access the user parameters.
   b. Press the  or  key until the display shows Bypass operation: ON.
   c. Press  to turn static bypass operation off. The UPS display should show Normal operation load power xx%.

You can now apply loads to the system. As the last step of the installation, Best Power recommends that you clear the events log. See Section 500, "Clearing the Events Log."

403 Initial Startup and Phase Check for Units with a Kirk-Key Interlock Maintenance Bypass Cabinet (MBC)

This system has been supplied with kirk-key interlocks on the MIB1 and MIB2 and a kirk-key interlock with a solenoid key release unit (SKRU) on the MUOB and MBB circuit breakers. The kirk-key forces the operator to operate the circuit breakers in a pre-defined sequence. Do not attempt to defeat the kirk-key controls.

Follow this Procedure Exactly! No Load Should Be Connected!

1. Make sure that all AC and DC power is off. Set all input and output switches to the "OFF" position. Your UPS should be completely off. Do not apply power to the Maintenance Bypass Cabinet at this time.

2. MIB2 should be locked off with the kirk-key in the MIB1 lock, MIB1, UIB1, UIB2, UOB1, and UOB2 should be "OFF".

3. The MBB should be locked "ON"with the kirk-key retained in the lock.

4. The MUOB should be locked "OFF" with the kirk-key retained in the SKRU lock. and the MOB should be "OFF".

5. Verify that a detailed inspection of each UPS module was performed when it was installed. Verify that all connections within and between the units are secure. Verify that all installation procedures were performed according to the Installation and Planning manual for your particular unit size.

Note: To optimize load sharing in parallel operation, all unit input cabling must be the same length/impedance as other unit input conductors. Likewise, all unit output cabling must be the same length/impedance as other unit output conductors.

6. At the mains AC service input panel, turn both input power feeds to the maintenance bypass cabinet (MBC) "ON" (Source #1 & #2).

7. Check the phase rotation at the maintenance bypass cabinet (MBC) MIB1 & MIB2 input terminals. **The phase rotation must be A, B, C and clockwise.**

   Note: Alternative mains (Source #2) must be in complete phase with the normal mains (Source #1).

8. Turn the UPS output breaker (UOB1 & UOB2) *for each unit* connected in parallel to "ON."

9. Make sure that all DC Circuit Breakers in the DC Control Cabinet are "OFF"

10. Apply DC power to all the units connected in parallel as follows:.

    * Close the DC fuse holder with the fuses correctly installed **(use an open palm)** See Planning and Installation Manual (, pages 26 & 27 for more detail)

    * In the DC Control Cabinet. Turn DC circuit breakers DCB1 & DCB2 to "ON".

    * Hold the pre-charge/discharge switch for UPS #1 in the pre-charge position until the LED turns off, then close DC circuit breaker (DCD1). Repeat for UPS #2 pre-charge/discharge switch and DC circuit breaker (DCD2).

11. The display on each UPS should show `System type xxkVA xxxV`, and an audible alarm should sound. Silence the audible alarm on each unit (see Section 304 of the USER Manual). Within 20 seconds the display for each unit should read `**Stand-by**`.

12. Push the green "on" button located inside the UPS front door of each unit connected in parallel. Silence the audible alarm on each unit. Within 20 seconds, the display should show `Battery Operation`.

Note: If the units are not in battery operation, call Best Power's Worldwide Service.

13. At the maintenance bypass cabinet (MBC) turn the Source #1 (MIB1) input power to "ON."

14. Turn the UPS input breakers (UIB1 & UIB2) *for each unit* "ON." The display on each UPS should will show `Normal Operation load power xx%`. With no load connected the percentage should be
< 5%.

15. Program UPS unit #1 into static bypass operation. When you program one unit into bypass operation the other will follow. However, the unit you program into bypass must be the same one you program out of bypass in step 16.

   a. Press to access the user parameters.
   b. Press the or key until the display shows `Bypass operation: OFF`.
   c. Press to turn static bypass operation on. The display should show `Bypass operation`.
   d. **The green static bypass light on the Maintenance Bypass Cabinet (MBC) should be "on".**

   If the green static bypass light is not on, call Best Power before continuing.

16. At the maintenance bypass cabinet (MBC), make sure the MBC output voltage and AC line input voltages are in phase. To do this, measure the AC voltage between the following points at the AC line input and the MBC output for all units connected in parallel (input to UMOB). **The phase rotation must be A, B, C and clockwise.**

	AC Line Input		UMOB Input	
a.	*L1 input*	to	*L1 output*	______VAC
b.	*L2 input*	to	*L2 output*	______VAC
c.	*L3 input*	to	*L3 output*	______VAC

These readings must not be more than 10 VAC! If they are, call Best Power's Worldwide Service or your local Best Power office.

17. Following the instructions on the Parallel/Bypass Cabinet, transfer the system to UPS (Load on UPS power)

- The green static bypass light on the Maintenance Bypass Cabinet (MBC) should be "on". Press and hold the button on the SKRU and remove the kirk-key from the SKRU, release the button.

  If the green static bypass light is not on, call BEST before continuing.

- Insert the kirk-key into the MUOB lock and unlock the breaker, Turn the main UPS output breaker (MUOB) "ON." The kirk-key will be retained in the lock.

- Turn the maintenance bypass breaker (MBB) "OFF". Lock the MBB "OFF" by turning the kirk-key and removing the kirk-key from the MBB lock.

- Insert the kirk-key into the SKRU lock and turn it. The kirk-key will be retained in the lock.

18. Program the UPS to normal operation. This must be done at the same unit you programmed the unit into Bypass operation.

    a. Press to access the user parameters.
    b. Press the or key until the UPS display shows `Bypass operation: ON`.
    c. Press to turn static bypass operation off. The UPS display should show `Normal operation load power xx%`.

19. At the maintenance bypass cabinet (MBC) turn the Source #1 (MIB1) input power to "OFF" and remove the kirk-key from the lock. The MIB1 should now be locked "OFF". The UPS modules should show "`Battery Operation`".

20. At the maintenance bypass cabinet (MBC) turn the Source #2 (MIB2) input power to "ON" by inserting the kirk-key into the lock on MIB2 and unlocking it. Turn the MIB2 to "ON". After approximately 20 seconds the UPS modules should show "`Normal Operation`".

21. If Source #1 is the preferred source turn MIB2 "OFF". Lock it closed by turning and removing the kirk-key. The UPS modules should show "`Battery Operation`". Insert the kirk-key into the MIB1 lock and unlock MIB1. Turn MIB1 to "ON". The kirk-key will be retained in MIB1 lock. After approximately 20 seconds the UPS modules should show "`Normal Operation`".

22. This completes the maintenance bypass cabinet (MBC) check. The system is now ready to use. Power can be applied to the loads by closing the Main Output Circuit Breaker (MOB). As the last step of the installation, Best Power recommends that you clear the events log. See the section in your Installation and Planning Manual that describes how to clear the events log.

500 Complete System Shutdown Procedures

CAUTION!

After shutting down the unit, **wait at least five minutes** before removing any access panels or covers. Access panels should be removed by **qualified service personnel** only.

After shutting down the UPS, there may still be high voltage inside the unit.

TEST BEFORE TOUCHING!

Before continuing, read the warnings on the inside front cover of this manual.

This section tells how to shut down the UPS from normal operation mode.

* If you have a unit with a **rotary switch**, maintenance bypass cabinet see Section 601.
* If you have a unit with a **three-breaker**, maintenance bypass cabinet see Section 602.
* If you have a unit with a **kirk-key interlock** maintenance bypass cabinet, see Section 603,

501 Shutdown Procedure for Units with a Rotary Switch Maintenance Bypass Cabinet (MBC)

1. · **If you have shut the loads down:** Skip to step 3.
   · **If the loads are to remain powered:** Program the unit into static bypass operation:
   a. Press to access the user parameters.
   b. Press the or key until the display shows Bypass operation: OFF.
   c. Press to turn static bypass operation on. The display should show Bypass operation.
2. Switch the UPS bypass switch to "BYPASS."
3. Press the red "off" button located inside the UPS front door.
4. Switch the UPS AC disconnect switch "OFF."
5. Switch the DC disconnect (DCD) "OFF."
6. Turn the pre-charge/discharge switch to the discharge position and hold it until the LED turns off. The UPS display should now be blank.

To restart the unit, see Section 701, "Startup from Maintenance Bypass for Units with a Best Power-Supplied Rotary Switch Maintenance Bypass Cabinet."

7. **(Optional)** If the loads are **not** to be powered, turn off all AC power sources to the UPS and maintenance bypass cabinet (MBC).

502 Shutdown Procedure for Units with a Three-Breaker Maintenance Bypass Cabinet (MBC)

1. - **If you have shut the loads down:** Skip to step 4.
   - **If the loads are to remain powered:** Program the unit into static bypass operation:

     a. Press [key] to access the user parameters.

     b. Press the [up] or [down] key until the display shows Bypass operation: OFF.

     c. Press [key] to turn static bypass operation on. The display should show Bypass operation.

2. Switch the maintenance bypass breaker (MBB) "ON."
3. Switch the UPS output breaker (UOB) "OFF."
4. Press the red "off" button located inside the UPS front door.
5. Switch the UPS input breaker (UIB) "OFF."
6. Switch the DC disconnect (DCD) "OFF."
7. Turn the pre-charge/discharge switch to the discharge position and hold it until the LED turns off. The UPS display should now be blank.

To restart the unit, see Section 702, "Startup from Maintenance Bypass for Units with a Best Power-Supplied Three-Breaker Maintenance Bypass Cabinet (MBC)."

8. (Optional) If the loads are **not** to be powered, turn off all AC power sources to the UPS and maintenance bypass cabinet (MBC).

503 Shutdown Procedure for Units with a Kirk-Key Interlock Maintenance Bypass Cabinet (MBC)

This section tells how to shut down a parallel UPS system operating in the normal operation mode. For shutdown of an individual module in an N+[1] Redundant System see the next section.

1. - **If you have shut the loads down:** Skip to step 4.

- **If the loads are to remain powered:** Program a unit into static bypass operation. Remember, the unit you program into bypass must be the same one you program out of bypass.

  a. Press to access the user parameters.

  b. Press the or key until the display shows `Bypass operation: OFF`.

  c. Press to turn static bypass operation on. The display should show `Bypass operation`.

  d. **The green static bypass switch should be on.**

2. Following the instructions on the Maintenance Bypass Cabinet (MBC), transfer the system to Maintenance Bypass (Load on bypass power). The MBB should be "ON" with a kirk-key retained in the lock and The MUOB should be locked "OFF" with the kirk-key in the SKRU lock..

3. Press the red "OFF" button located inside the UPS front door of each unit.

4. Turn the UPS input breaker (UIB1 & UIB2) for each unit "OFF".

5. Disconnect DC power to all the units connected in parallel.

   * Hold the UPS #1 pre-charge/discharge switch in the discharge position until the LED turns off, then turn the DC circuit breaker (DCD1) "OFF". Repeat for UPS #2 precharge/discharge switch and DC circuit breaker (DCD2).

   * Turn "OFF" DC circuit breakers DCB1 and DCB2.

   * Open the DC fuse holder in each unit and remove the DC fuses. (see the "Planning and Installation Manual", page's 26 & 27 for more information as to the location)

6. Turn off both UPS output circuit breakers UOB1 and UOB2.

7. (Optional) If the loads are **not** to be powered, turn off MIB1, MIB2 and all AC power sources to the UPS and maintenance bypass cabinet (MBC).

8. To restart the system follow the procedure below.

600 System Restart After Complete System Shutdown

CAUTION!

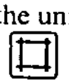
At a customer's request, some units can be programmed at the factory for autostart. If programmed for autostart, the unit will turn on **any time** mains (AC line) is applied (after a 60-second delay). For more information, or to change this feature, see the User Manual that came with the UPS.

Before continuing, read the warnings on the inside front cover of this manual.

This section tells how to start the UPS from maintenance bypass.

* If you have a unit with a **rotary switch** maintenance bypass cabinet, see Section 701.
* If you have a unit with a **three-breaker** maintenance bypass cabinet, see Section 702.
* If you have a unit with a **kirk-key interlock** maintenance bypass cabinet, see Section 703.

601 Startup from Maintenance Bypass for Units with a Rotary Switch Maintenance Bypass Cabinet (MBC)

1. Make sure that the following switches are in the following positions:
   * The UPS AC disconnect switch should be "OFF."
   * The UPS bypass switch should be on "LINE."
   * The DC disconnect (DCD) should be "OFF."
2. Switch the UPS AC disconnect switch "ON." The UPS display should show System type xxkVA xxxV and an audible alarm should sound.
3. Within 20 seconds, the UPS display should show **Stand-by**.
4. Turn the pre-charge/discharge switch to the pre-charge position and hold it until the LED turns off.
5. Switch the DC disconnect (DCD) "ON."
6. Press the green "on" button located inside the front door of the UPS. The UPS display should show Normal operation load power xx%.
7. Program the unit into static bypass operation:
   a. Press  to access the user parameters.
   b. Press the  or  key until the display shows Bypass operation: OFF.
   c. Press  to turn static bypass operation on. The display should show Bypass operation.
8. Switch the UPS bypass switch to "UPS."

9. Program the unit to normal operation:
   a. Press to access the user parameters.
   b. Press the or key until the display shows Bypass operation: ON.
   c. Press to switch the bypass operation off. The display should show Normal operation load power xx%.

602 Startup from Maintenance Bypass for Units with a Three-Breaker Maintenance Bypass Cabinet (MBC)

1. Make sure that the following switches are in the following positions:

   * The UPS input breaker (UIB) should be "OFF."
   * The UPS output breaker (UOB) should be "OFF."
   * The UPS maintenance bypass breaker (MBB) should be "ON."
   * The DC disconnect (DCD) should be "OFF."

2. Switch the UPS input breaker (UIB) "ON." The UPS display should show System type xxkVA xxxV, and an audible alarm should sound.

3. Within 20 seconds, the display should show **Stand-by**.

4. Turn the pre-charge/discharge switch to the pre-charge position and hold it until the LED turns off.

5. Switch the DC disconnect (DCD) "ON."

6. Press the green "on" button located inside the UPS front door. The UPS display should show Normal operation load power xx%.

7. Program the UPS into static bypass operation:
   a. Press to access the user parameters.
   b. Press the or key until the display shows Bypass operation: OFF.
   c. Press to turn bypass operation on. The display should show Bypass operation.

8. Switch the UPS output breaker (UOB) "ON."

9. Switch the maintenance bypass breaker (MBB) "OFF."

10. Program the unit to normal operation:
   a. Press [□] to access the user parameters.
   b. Press the [↑] or [↓] key until the display shows Bypass operation: ON.
   c. Press [*] to switch the bypass operation off. The display should show Normal operation load power xx%.

603 Startup From Maintenance Bypass for Units with a Kirk-Key Interlock Maintenance Bypass Cabinet (MBC)

Note: Many parallel configurations are possible. Because each system may have different types of switch gear, the terminology in this procedure must be generic. A glossary at the back of this manual defines terms that may not be familiar for your particular application.

Follow this Procedure Exactly! Load may Be Connected!

1. Make sure all UPS module input and output circuit breakers are set to the "OFF" position (UOB1, UOB2, MUOB, DCB1, DCB2, DCD1, and DCD2. The MBB and MOB should be "ON". Both UPS modules should be completely off.

2. If power to the Maintenance Bypass Cabinet (MBC) was turned "OFF". At the mains AC service input panel, turn both input power feeds to the maintenance bypass cabinet (MBC) "ON" (Source #1 & Source #2).

3. Turn the UPS output circuit breaker (UOB1 & UOB2) *for both unit's* connected in parallel to "ON."

4. Apply DC power to all the units connected in parallel as follows:.

   * Close the DC fuse holder with the fuses correctly installed **(use an open palm)**. (See Planning and Installation Manual, pages 26 & 27 for more detail)

   * In the DC Control Cabinet. Turn DC circuit breakers DCB1 & DCB2 to "ON".

   * Hold the pre-charge/discharge switch for UPS #1 in the pre-charge position until the LED turns off, then close DC circuit breaker (DCD1). Repeat for UPS #2 pre-charge/discharge switch and DC circuit breaker (DCD2).

5. The display on each UPS should show System type xxkVA xxxV, and an audible alarm should sound. Silence the audible alarm on each unit. Within 20 seconds the display for each unit should read **Stand-by**.

6. Push the green "on" button located inside the UPS front door of each unit connected in parallel. Silence the audible alarm on each unit. Within 20 seconds, the display should show Battery Operation.

Note: If the units are not in battery operation, call Best Power's Worldwide Service.

7. Turn "ON" either MIB1 or MIB2 as appropriate. Turn the UPS input breakers (UIB1 & UIB2) *for each unit* "ON." The display on each UPS should will show Normal Operation load power

xx%. With no load connected the percentage should be < 5%. If the MOB is "ON" the display for each module will show the actual module load percentage.

If the percentage displayed with both modules "on-line" exceeds 50% (7.5kVA per module) the system is overloaded and cannot operate in as N + 1 Redundant System.

Note: Failure to reduce the load level to less than 15kVA/15kW (50% per module) may result in loss of power to the loads, and/or damage to the MBC transformer.

8. Program UPS unit #1 into static bypass operation. When you program one unit into bypass operation the other will follow. However, the unit you program into bypass must be the same one you program out of bypass in step 10.

   a. Press to access the user parameters.
   b. Press the or key until the display shows Bypass operation: OFF.
   c. Press to turn static bypass operation on. The display should show Bypass operation.

   d. **The green static bypass light on the Maintenance Bypass Cabinet (MBC) should be "on".**

   Note: If the green static bypass light is not on, call Best Power's Worldwide Service before continuing.

9. Following the instructions on the Parallel/Bypass Cabinet, transfer the system to UPS (Load on UPS power)

   * The green static bypass light on the Maintenance Bypass Cabinet (MBC) should be "on". Press and hold the button on the SKRU and remove the kirk-key from the SKRU, release the button.

   * Insert the kirk-key into the MUOB lock and unlock the breaker, Turn the main UPS output breaker (MUOB) "ON." The kirk-key will be retained in the lock.

   * Turn the maintenance bypass breaker (MBB) "OFF". Lock the MBB "OFF" by turning the kirk-key and removing the kirk-key from the MBB lock.

   * Insert the kirk-key into the SKRU lock and turn it. The kirk-key will be retained in the lock.

10. Program the UPS to normal operation. This must be done at the same unit you programmed the unit into Bypass operation.

a. Press to access the user parameters.

b. Press the or key until the UPS display shows Bypass operation: ON.

c. Press to turn static bypass operation off. The UPS display should show Normal operation load power xx%.

11. The system is now ready to use and the loads should be on UPS power.

700 Shutdown Procedure

(for a Single Module of a N+[1] Redundant System)

A single module of an N+[1] Redundant System can be shutdown (i.e. taken off-line) without disruption to the load or using the maintenance bypass procedure.

1. Verify that the percent load on each module is 50% or less. If the percentage displayed with both modules "on-line" exceeds 50% (7.5kVA per module) the system is overloaded and cannot operate as a N+[1] Redundant System.

Note: Failure to reduce the load level to less than 15kVA/15kW (50% per module) may result in loss of power to the loads, and/or damage to the MBC transformer.

2. Verify that the other unit is in normal operation.

3. Press the red "off" button located inside the UPS front door of the unit to be shutdown.

4. Turn the UIB and UOB for the unit to be shutdown to the "OFF" position.

5. Disconnect DC power to the unit.

   * Hold the UPS #1 pre-charge/discharge switch in the discharge position until the LED turns off, then turn the DC circuit breaker (DCD1) "OFF". Repeat for UPS #2 precharge/discharge switch and DC circuit breaker (DCD2).

   * At the Unit: Open the DC fuse holder and removing the DC fuses.

6. The UPS module should now be in a safe mode for maintenance or parts replacement. However as noted below always test before touching any electrical termination or contact.

CAUTION!

After shutting down the unit, **wait at least five minutes** before removing any access panels or covers. Access panels should be removed by **qualified service personnel** only.

After shutting down the UPS, there may still be high voltage inside the unit.

TEST BEFORE TOUCHING!

Before continuing, read the warnings on the inside front cover of this manual.

800 Restart Procedure

(for a Single Module of a N + 1 Redundant System)

A single module of an N+[1] Redundant System can be restarted (i.e. placed on-line) without disruption to the load or using the maintenance bypass procedure.

1. If repairs to the unit were performed verify that the unit to be placed on-line is functioning normally as a single unit. If yoü have any doubts as to the operational status of the unit, contact Best Power's Worldwide Service before proceeding.

2. Verify that the other unit is in normal operation.

3. Apply DC power to the unit.

   * Close the DC fuse holder with the fuses correctly installed **(use an open palm)** (See Planning and Installation Manual, pages 26 & 27 for more detail)

   * Hold the UPS module pre-charge/discharge switch in the pre-charge position until the LED turns off, then turn the unit DC circuit breaker (DCD) "ON".

4. Turn the UIB for the unit to be restarted to the "ON" position.

5. Press the green "ON" button located inside the UPS front door of the unit to be restarted.

6. The UPS module should now be in a normal operation mode. The UPS display should show Normal operation load power xx%.

7. The system should now be back in a N + 1 Redundant operation.

8. Verify that the percent load on each module is 50% or less. If the percentage displayed with both modules "on-line" exceeds 50% (7.5kVA per module) the system is overloaded and cannot operate as a N + 1 Redundant System.

Note: Failure to reduce the load level to less than 15kVA/15kW (50% per module) may result in loss of power to the loads, and/or damage to the MBC transformer.

				QTY	PART#	COMPANY	DESCRIPTION	TOTALS
				1	MT80RXL Rote-A-Tote	R&K Supply Co.	Rot-A-Tote Tool Box -- Specify Black or Granite	$285.00
				2	FLUKE 87	Newark	Fluke 87 True RMS Digitial Multimeter	$335.00
				1	TLL-0050	In House	Fluke DMM Meter Leads	
				1	FLUKE 80I-410	Newark	Fluke 80I-410 Current Probe	$179.00
				1	FLUKE 80T-IR	Newark	Fluke 80T-IR Infarred Thermal Probe	$219.00
				1	TMT-P104A	Time-Motion	DMM Probes with Changable Tips	$69.95
				1	TMT-4T	Time-Motion	Extenable Pocket Magnetic Pick-up Tool	$7.95
				1	TMT-EX-1	Time-Motion	IC Extraction Tool	$2.95
				1	TMT-WS82	Time-Motion	Wrist Strap with Cord	$8.95
				1	TMT-855	Time-Motion	Portable Stactic Mat	$59.95
				1			Butaine Soldering Iron	
				1			Can of Butaine	
				1	SDR-0015	In House	Solder Wick	
				1	TMT-VB693	Time-Motion	Set of Hex Shank Screwdriver Bits	$35.95
				1	355TE300	Techni-Tool	Phase Rotation Meter	$59.00
				1	691SC553	Techni-Tool	Set High Voltage Screwdrivers	$42.65
				1	694ST126	Techni-Tool	Open Barrel Wire Crimpers	$24.50
				1	272SC800	Techni-Tool	Stubby Screwdriver Regular/Phillips	$5.50
				1	400SA024	Techni-Tool	Reamer	$11.90
				1	810IN013	Techni-Tool	Extractable Pocket Mirror	$5.25
				1	390PR010	Techni-Tool	Center Punch	$11.25
				1	650PR114	Techni-Tool	Barrel Pin Removal Tool - Size 16, Style B	$31.50
				1	103SC502	Techni-Tool	Power Driver with Charger and Battery	$115.00
				1	103SC020	Techni-Tool	Power Driver Battery	$28.75
				1	457ST004	Techni-Tool	Chip Pocket	$7.25
				1	25818	Sears	1/4"Dr to 1/4" Hex Adapter	$2.29
				1	25695	Sears	Set Hex Shank Drill Bits	$9.99
				1	4256	Sears	3/8"Dr to 1/4"Dr Adapter	$2.99
				1	43539	Sears	1/4"Dr x 3" Extension	$2.49
				1	43531	Sears	1/4"Dr x 6" Extension	$3.99
				1	44264	Sears	3/8"Dr x 3" Extension	$3.49
				1	44261	Sears	3/8"Dr x 6" Extension	$4.99
				1	4435	Sears	3/8"Dr U-joint	$8.99
				1	33556	Sears	Set Socket and Rachet	$49.99
				1	44311	Sears	3/8"Dr x 16mm Socket -Standard Depth	$1.99
				1	44308	Sears	3/8"Dr x 19mm Socket -Standard Depth	$1.99
				1	43580	Sears	3/8"Dr x 20mm Socket -Standard Depth	$1.99
				1	44405	Sears	1/4"Dr x 8mm Socket -Deepwell	$2.29
				1	44407	Sears	1/4"Dr x10mm Socket -Deepwell	$2.29
				1	44417	Sears	3/8"Dr x 13mm Socket -Deepwell	$2.69
				1	44419	Sears	3/8"Dr x 15mm Socket -Deepwell	$3.49
				1	44421	Sears	3/8"Dr x 16mm Socket -Deepwell	$3.49
				1	44422	Sears	3/8"Dr x 17mm Socket -Deepwell	$4.49

				1	TLL-0079	In House	Pair Ear Plugs	
				1	TLL-0070	In House	8" Flat File	
				1	TLL-0002	In House	Set Alligator Leads	
				1	TLL-0026	In House	Pot Tweeker	
				1	TLL-0161	In House	Handi-Hacksaw	
				1	TLL-0110	In House	Large/Medium Fuse Puller	
				1	TLL-0110	In House	Tape Measure	
				1	TLL-0045	In House	Multi-purpose Hand Driver	
				1		In House	120K-220KVA Unit Door Key	
				1		In House	Intrapak Cabinet Door Key	
				1		In House	Comm Opt Tester	
				1		In House	Jumper for 19 x 3 Calibration	
				1	QJR-217D	Snap-On	3/8"Dr Torque Wrench 30-200 Inch-Pounds	$163.00
				2	TLL-0077	In House	14-pin IC Test Clip	
				1			Set Ribbon cable Test Adpaters 2:10, 1:14, 1:16, 1:34, 1:40, 1:50	
				1			Micro Cassete Recorder	
				2			Micro Cassete Tapes	
				1		In House	Package of Black Unit Labels	
				2		In House	UPS Red Shipping Lablels	
				4		In House	UPS Blue Shipping Labels	
				2		In House	Return Address Tags	
				1			Misc Pens, Pencils, Markers	
				10		In House	Heatshrink and Rubber Bands For Battery Cables	
				1	BAT-0019	In House	9V Battery	
				2	BAT-0023	In House	AA Battery	
				2		In House	AAA Battery	
				1			Container of Misc Hardware	
				1			Various Sizes of Nylon Tyes	
				1			Pair of Saftey Glasses	
				1			Roll of Black Electrical Tape	
				1			Flashlight-- Plasic or Rubber Case	
				1			Tube of Solder	

Battery Sizing for the UNITY/I Three-Phase UPS

1. MAIN DATA:

Unit: UT__________ Load __________ kW Back-up Time ________ min.

Battery type ________ Battery design life time __________ years.

2. CHARGER DATA:

UNITY/I	310	315	320	330	340	360	380	3100	3120	3160	3220
Nominal Voltage	216	216	216	216	216	216	360	360	408	408	408
Nominal number of cells	108	108	108	108	108	108	180	180	204	204	204
Voltage window	216 - 270						360 - 450		410 - 500		
Factory set float charge voltage.	246	246	246	246	246	246	410	410	467	467	467
Battery charger current limit (amps)	6	8	10	15	20	30	25	30	30	40	55

3. INVERTER DATA:

UNITY/I	310	315	320	330	340	360	380	3100	3120	3160	3220
Voltage window	170 - 270[1]				170 - 270[1]		306 - 450[1]		348 - 480[1]		
% eff., 100% load	89	90	90	91	91	92	92	93	93	94	94
% eff., 75% load	89	90	90	91	91	92	92	93	93	94	94
% eff., 50% load	87	88	88	89	89	90	90	91	91	91	92
% eff., 25% load	84	85	85	86	86	87	87	88	89	90	90

1 If desired runtime is less than one hour, use voltage window minimum as shown with nominal number of cells. If runtime desired is one hour or greater, use 189, 189, 315, and 357 respectively as the voltage window minimum, with nominal number of cells.

4. OUTPUT LOAD POWER

If Load kVA is known for all phases:

Load L1 ______kVA x _____PF = ______$L1_{kW}$
Load L2 ______kVA x _____PF = ______$L2_{kW}$
Load L3 ______kVA x _____PF = ______$L3_{kW}$

$Load_{kW} = L1_{kW}+L2_{kW}+L3_{kW}=$ ______$Load_{kW}$

If Load current is known for all phases:

Load L1 ______kA x _____PF = ______$L1_{AkW}$
Load L2 ______kA x _____PF = ______$L2_{AkW}$
Load L3 ______kA x _____PF = ______$L3_{AkW}$

Total $A_{kW} = L1_{AkW}+ L2_{AkW}+ L3_{AkW} =$ ______ $_{AkW}$

$Load_{kW}$ = Total A_{kW} x phase-neutral voltage (V_{P-N})

$Load_{kW}$ = _____ A_{kW} x _____ V_{P-N} = _____ $Load_{kW}$

$$\text{Battery Load}_{kWB} = \frac{\text{Load}_{kW}}{\text{Inv. eff.}} = \frac{\quad\quad kW}{\quad\quad} = \underline{\quad\quad\quad}\ kWB$$

$$\text{Cell load}_{kW/cell} = \frac{\text{Battery Load}_{kWB}}{\text{Number of cells}} = \frac{\quad\quad kWB}{\quad\quad} = \underline{\quad\quad\quad}\ kW/cell$$

$$\text{Min. cell voltage} = \frac{\text{Min. inv. voltage window}}{\text{Number of cells}} = \frac{\quad\quad}{\quad\quad} = \underline{\quad\quad\quad}\ v/cell$$

5. BATTERY SPECIFICATION:

Given data:

Number of cells ________________

Cell load ____________________kW/cell

Min. voltage __________________ v/cell

Back-up time _________________ minutes

Fullfilled by:

Make ________________________

Type ________________________

Number of blocks ______________

Block dimensions ________________
(H x W x D)

Example

If the prospective customers' loads are: 30kVA @ .9 PF   35kVA @ .8 PF   31 kVA @ .8 PF
and the runtime desired is 30 minutes.

OUTPUT LOAD POWER

If Load kVA is known for all phases:

Load L1 __30__ kVA x __.9__ PF = __27__ $L1_{kW}$
Load L2 __35__ kVA x __.8__ PF = __28__ $L2_{kW}$
Load L3 __35__ kVA x __.8__ PF = __28__ $L3_{kW}$

$\text{Load}_{kW} = \underline{27}_{\,kW} + \underline{28}_{\,kW} + \underline{28}_{\,kW} = \underline{83}\ \text{Load}_{kW}$

$$\text{Battery Load}_{kWB} = \frac{\text{Load}_{kW}}{\text{Inv. eff.}} = \frac{83\ _{kW}}{93} = \underline{89.2}\ _{kWB}$$

$$\text{Cell load}_{kW/cell} = \frac{\text{Battery Load}_{kWB}}{\text{Number of cells}} = \frac{89.2\ _{kWB}}{180} = \underline{0.4955}\ _{kW/cell}$$

$$\text{Min. cell voltage} = \frac{\text{Min. inv. voltage window}}{\text{Number of cells}} = \frac{306}{180} = \underline{1.7}\ \text{v/cell}$$

5. BATTERY SPECIFICATION:

Given data:	Fullfilled by:
Number of cells ___180___	Make ______
Cell load ___0.4955___ kW/cell	Type ______
Min. voltage ___1.7___ v/cell	Number of blocks ______
Back-up time ___30___ minutes	Block dimensions ______ (H x W x D)

USER MANUAL

UNITY/I Three-phase UT310-UT3220

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

This manual contains important instructions for your UNITY/I™ UPS.

IF THE UPS IS SOUNDING AN ALARM, go to Section 206. To silence the audible alarm, press the silence alarm key shown at the right. If you do not silence the alarm, it will automatically silence itself after 30 seconds. *Silencing the audible alarm does not correct the problem that caused the alarm.*

The installation and use of this product must comply with all national, federal, state, municipal or local codes that apply. If you need assistance, please *have your UPS model and serial number available* and call BEST's Worldwide Service at 1-800-356-5737 (U.S.A. or Canada; elsewhere, call your local BEST office).

You can find additional product information on the Best Power World Wide Web site at http://www.bestpower.com.

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Borri Elettronica Industriale Srl
Via dei Lavoratori, 124
20092 CINISELLO BALSAMO (Mi)
Milan, ITALY
Telephone: (39) 2-6600661-2
FAX: (39) 2-6122481

Sola Electric AG
Postfach, CH-5412 Gebenstorf
SWITZERLAND
Telephone: 41/56/4019595
FAX: 41/56/2019555

Best Power Standard Warranty Registration For U.S.A./Canada Users Only

U.S.A. and Canada Users Only

Best Power Model Number Best Power Serial Number

(SpikeFree™, - no serial number required.)

I agree that all products have been properly installed and grounded in accordance with the instructions received from Best Power.

Signature ______________________ Installation Date (Month Day Year)

Contact Person

Company Type of Business

Street Address

City State Zip

Telephone (Area Code) (Telephone Number & Extension) EXT E-mail ______________

Free Additional Warranty Option (Not available for UNITY/I™ Three-Phase models) **Limited Double Lifetime Warranty Registration** Please see Limited Warranty-Transient Voltage Surge Suppression Circuitry in manual. To register for the "Limited Double Lifetime Warranty," list the equipment *connected to* your Best Power unit. The serial number of the equipment being protected by a Best Power UPS and/or SpikeFree product is required! Failure to provide this information will make you ineligible for this added warranty.

Make	Model	Serial Number

Complete and fax or mail this form to activate your warranty.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

Best Power
P.O. Box 11
Necedah, WI 54646
USA
Fax: 608-565-2509

Warranty Registration Fax
1-608-565-2509

For Assistance Completing The Warranty Form Call:
1-800-356-5737

Best Power Standard Warranty Registration For International Users Only

Outside U.S.A. and Canada

Best Power Model Number Best Power Serial Number

(SpikeFree™, - no serial number required.)

I agree that all products have been properly installed and grounded in accordance with the instructions received from Best Power.

Date of Purchase (Month Day Year)

Contact Person

Purchasing Company/Organization

Address

State/Country

Country Code/Telephone FAX

Location of Unit Company/Organization

Address

State/Country

Country Code/Telephone FAX

E-mail ______________________

Mail or Fax to the location nearest to you.

Best Power Technology Pte. Ltd
50 Tagore Lane
Siang How Warehouse
#03-03/06
Singapore 787494
Fax: 65-452-0288

Best Power Technology Limited
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Moorside Road
Winchester, Hampshire
England SO23 7RX
Fax: 44(0)1962 841846

SOLA Australia Ltd
13 Healey Road
Dandenong VIC 3175
Australia

Best Power Technology GmbH
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Fax: (49) 9131-7770-123

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Fax: (41) 56-418-30-33

Best Power Technology sarl
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B.P. 10673/Tremblay en France
95725 ROISSY CDG CEDEX, FRANCE
Fax: 33-1-48-62-49-96

Borri Elettronica Industriale Srl
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20092 CINISELLO BALSAMO (MI)
Milan, Italy
Fax: 39-2-6122481

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ATTN: WORLDWIDE SERVICE
BEST POWER
PO BOX 11
NECEDAH WI 54646-9901

PLEASE
PLACE
POSTAGE
HERE

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INTRODUCTION

An uninterruptible power system (UPS) protects sensitive equipment against unacceptable disturbances from the mains (AC line) supply. The UNITY/I™ Three-Phase UPS has the capacity to serve a wide variety of electrical equipment — from mainframe computers to enterprise-wide EDP installations to production lines. The UNITY/I Three-Phase UPS provides true on-line, single-conversion technology and harmonics isolation.

This user manual explains how to use these models: UT310, UT315, UT320, UT330, UT340, UT360, UT380, UT3100, UT3120, UT3160, and UT3220.

001 Storing the UNITY/I and Batteries

You can store the UNITY/I between –4°and 104°F (–20°and 40°C). However, BEST recommends that you store the unit and batteries between 59° and 77°F (15°and 25°C). *Recharge stored batteries every 90 to 120 days.*

002 If You Have a Question

Best Power is committed to outstanding customer service. Our Worldwide Service center is happy to help you with any problems or answer any questions you may have. A service technician is available 24 hours a day, 365 days a year. Just call the telephone number below or your nearest BEST office. (See the addresses at the beginning of this manual; you can also send a fax to the BEST office nearest you.) Please have your unit's model and serial number available when you call. You can find both numbers inside the unit's front door on the ID label.

Worldwide Service	1-800-356-5737 (U.S.A. and Canada) or 1-608-565-2100
Bulletin Board Service:	1-608-565-7424
CompuServ:	Type "Go BEST" at any ! prompt

For more product information, you can also visit the Best Power World Wide Web site at http://www.bestpower.com.

SECTION 100: STARTUP AND SHUTDOWN

⚠ CAUTION!

To avoid possible personal injury or equipment damage, assume that there may be AC voltage at the UPS's output terminals / receptacles any time AC input power or DC battery voltage is applied. The UPS can provide output voltage from the batteries even when there is no AC input line voltage. When AC voltage is present, the UPS can provide output voltage even when the batteries are disconnected. If you want to be certain that there is no UPS output voltage, always disconnect the AC input source, switch off the UPS, AND switch off the DC. **TEST BEFORE TOUCHING!**

Some units have been programmed at the factory for autostart. When this parameter is programmed to be on, the unit will automatically switch on **whenever** mains (AC line) is applied. To switch this parameter off, see Section 205.

For safety reasons, only qualified service personnel should do a complete startup or shutdown of the UPS whenever this is necessary. The qualified service person should follow the instructions in the Planning and Installation Manual. The UPS must be completely shut down before service or before the UPS is taken out of operation for more than 24 hours.

Although users cannot completely start or shut down the unit, they can switch the UPS into standby mode and return it to normal operation by following the instructions below. (In standby mode, the UPS does not provide output voltage.)

To put the unit into standby mode, press the red control button inside the unit's front door.

To take the unit out of standby and switch it back to normal operation, press the green control button inside the unit's front door.

NOTE: Make sure the UPS operates in the normal mode for at least 12 hours every three months to recharge the batteries.

SECTION 200: OPERATION

201 The Display Unit

The display unit on the front of the UPS includes a display, an alarm LED, and a keypad to help you communicate with the UPS and to help the UPS notify users of operating conditions.

Figure 1 below shows the display unit for the UT310 through UT3100. Figure 2 on the next page shows the display unit for the UT3120 through UT3220. Figure 3 on page 5 shows the optional LED panel that is available for the UT3120 through UT3220.

Figures 1, 2, and 3 all point out the display, Alarm LED, and keypad. Using the **keypad**, you can show parameters, alarm messages, measured values, and the events log on the **display**. You can also use the **keypad** to program UPS parameters.

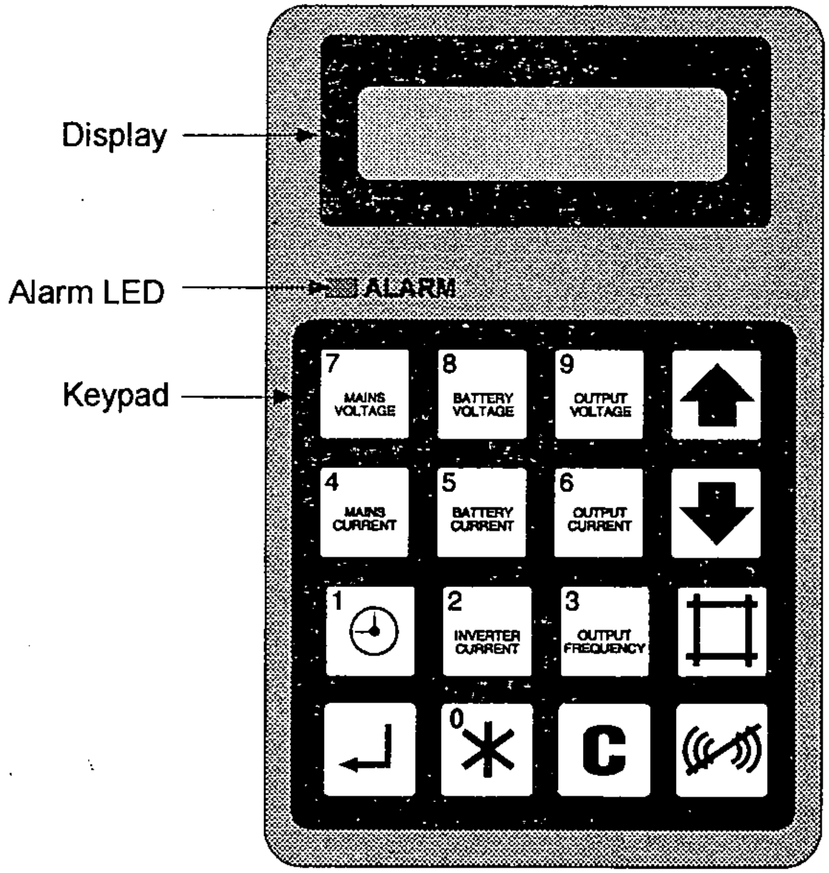


Figure 1: Display Unit for the UT310, UT315, UT330, UT340, UT360, UT380, and UT3100

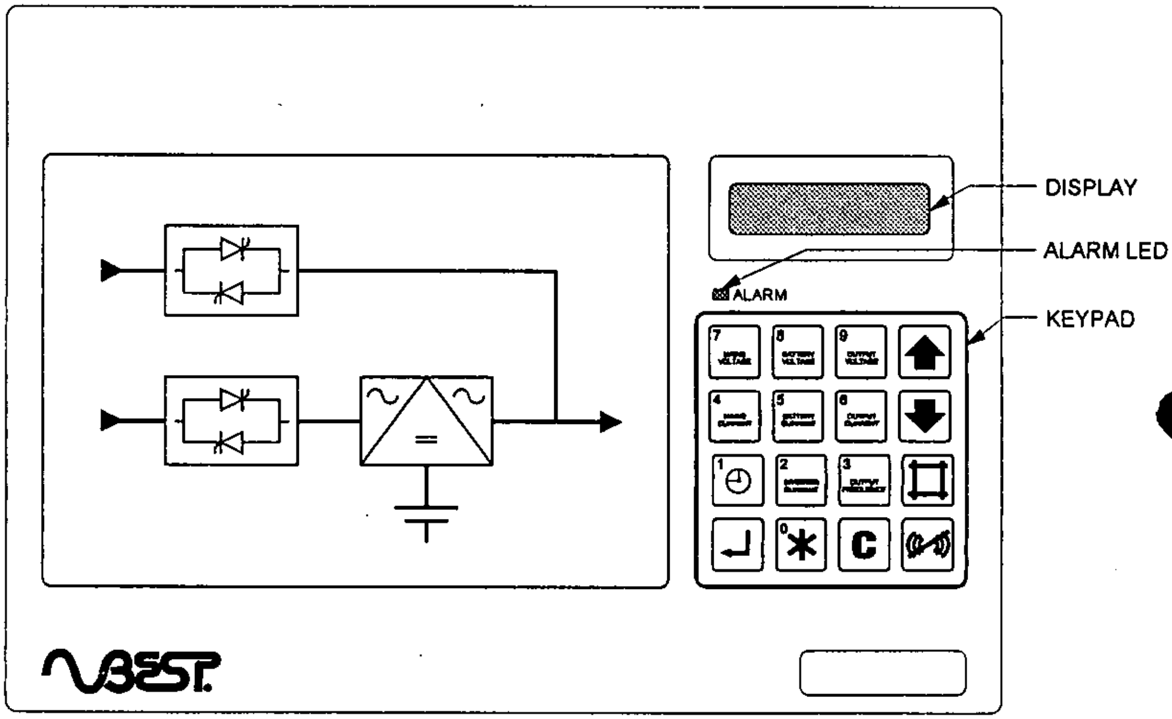


Figure 2: Standard Display Unit for the UT3120, UT3160, and UT3220

An optional LED panel (shown below) is available for the UT3120, UT3160, and UT3220. This panel gives you information about the unit's operation modes and about the cause of alarms. The drawing below shows the panel and points out each LED (light) on the panel. Table 1 explains what each LED means when it is green and what it means when it is red.

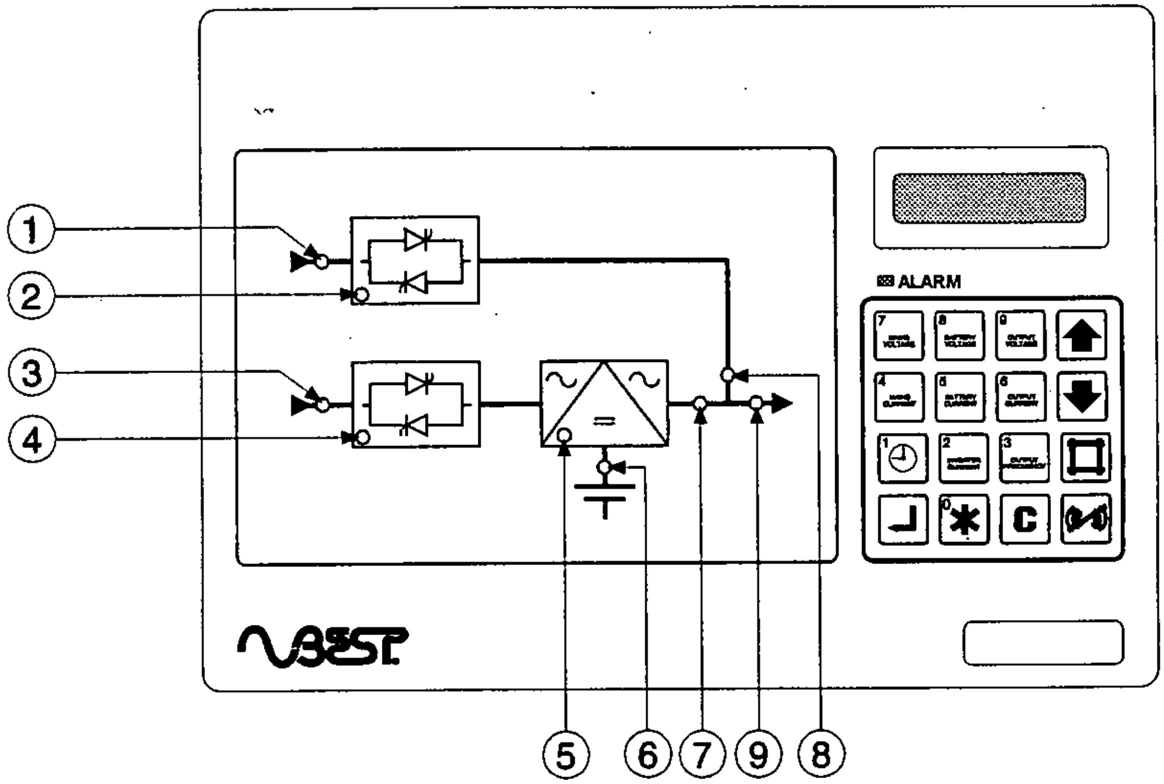


Figure 3: Display Unit with Optional LED Panel for the UT3120, UT3160, and UT3220

TABLE 1 - Optional LEDs

LED	What It Means When It's Green	What It Means When It's Red
1	The bypass mains (voltage) is acceptable.	The bypass mains (voltage) has failed.
2	This LED is never green.	There is a bypass static switch alarm.
3	Mains (AC input) is acceptable.	Mains (AC input) has failed.
4	This LED is never green.	There is a mains static switch alarm or charge regulation error alarm.
5	This LED is never green.	There is an inverter alarm.
6	The battery is connected and working.	The battery is disconnected or there is a battery alarm.
7	The inverter is on.	This LED is never red.
8	The bypass is on.	This LED is never red.
9	Output voltage is acceptable.	Output voltage is outside tolerance: it is outside of the unit's programmed limits.

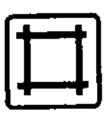
202 Operating Modes

The UNITY/I display automatically shows the mode the unit is operating in. Table 2 below shows sample displays and explains what they mean.

TABLE 2 - Operating Modes

Mode Displayed (Sample Display)	What It Means
Normal operation load power ##%	The UPS is in the normal operation mode. During normal operation, mains (AC line) passes through the UPS and out to the load. The unit's inverter regulates the output and charges the batteries. The second line of the display shows the % load on the phase (leg) that is most fully loaded.
Battery operation time ## minutes	The UNITY/I has switched to battery operation. This happens when AC input (mains) is out of tolerance (when it is outside of the unit's programmed limits). The main static switch opens, and the inverter draws power from the batteries. The power is then sent out to the loads. If the batteries are depleted, the unit will switch to standby mode (see below) and wait for mains to return in tolerance. Then, if autostart is programmed to "On," the unit will automatically start about 30 seconds after mains returns. If autostart is programmed to "Off," you must start the unit manually by pressing the green button inside the front door. (See Section 205 to program the autostart parameter.)
Bypass operation	In this mode, the AC input (mains) passes unregulated through the bypass static switch, through the main transformer, and out to the loads. The UPS inverter is in the standby mode and is synchronized to the mains, ready to transfer the unit to battery operation if mains voltage goes out of tolerance (see the Glossary). *For 50 Hz units, this display may mean that the internal bypass switch is in the "Bypass" position; see Section 304.*
Economy mode	The unit has been programmed to operate in economy mode. The AC power flow is the same as in bypass operation, except that the unit will periodically transfer into normal operation to charge the batteries (default is every 7 days). The inverter is in standby and is synchronized to the mains, ready to transfer to battery operation if mains voltage goes out of tolerance (see the Glossary). The output voltage is not regulated in this mode, but efficiency increases. If you would like to program your unit for economy mode, phone BEST's Worldwide Service or the nearest BEST office for more information.
** Stand-by **	Both static switches are open. The unit is not supplying output voltage. You can switch the unit on by pressing the green button inside the front door.

203 Using the Keys

Key	What It Does
	Scrolls up through lists such as the parameters, the alarm log, or the events log. See Sections 205, 207, and 208.
	Scrolls down through lists such as the parameters, the alarm log, or the events log. See Sections 205, 207, and 208.
	Enters a value or exits a mode. See Sections 205, 207, and 208.
	Displays the alarm log. If the unit is in parameter mode, this key changes the setting of a parameter from "ON" to "OFF." See Sections 205 and 207.
	Displays user parameters. See Section 205.
	Silences audible alarms. See Section 206.
	Not used.

Key	What It Does
1	Displays the time and date. If the unit is in parameter mode, this key changes the setting of a parameter from "OFF" to "ON." See Section 205.
2 INVERTER CURRENT	Displays inverter current. See Section 204.
3 OUTPUT FREQUENCY	Displays output frequency. See Section 204.
4 MAINS CURRENT	Displays mains (AC input) current. See Section 204.
5 BATTERY CURRENT	Displays battery current. See Section 204.
6 OUTPUT CURRENT	Displays output current. See Section 204.
7 MAINS VOLTAGE	Displays mains (AC input) voltage. See Section 204.
8 BATTERY VOLTAGE	Displays battery voltage. See Section 204.
9 OUTPUT VOLTAGE	Displays output voltage. See Section 204.

204 Displaying Measurements

As it operates, the UNITY/I measures several values that you can display by pressing one or two keys. This section shows you what keys to press to display the measurements, what a sample display of each measurement looks like, and what the displays mean. If two keys are shown, press them at the same time. **The display values shown below are samples that are typical for some 60 Hz models. Actual values vary depending on the unit's size, frequency, and voltage.**

Key	Sample Display	What the Display Means
7 MAINS VOLTAGE	Mains 1. voltage 210 210 210 Vac	Mains (AC line) voltage is 3 x 210 VAC ($L_{1\text{-}2}$, $L_{2\text{-}3}$, $L_{3\text{-}1}$).
4 MAINS CURRENT	Mains 1. current 21 21 21 Aac	Mains (AC line) current is 3 x 21 AAC (I_1, I_2, I_3).
8 BATTERY VOLTAGE	Battery voltage 216 Vdc	Battery voltage is 216 VDC.
5 BATTERY CURRENT	Battery current 2 Adc (-30Adc)	Charging current is (+) 2 ADC. Discharging current is (–) 30 ADC.
2 INVERTER CURRENT	Inverter current 12 12 12 Aac	Inverter current is 3 x 12 AAC.
9 OUTPUT VOLTAGE	Output voltage 208 208 208 Vac	Output voltage is 3 x 208 V ($L_{1\text{-}2}$, $L_{2\text{-}3}$, $L_{3\text{-}1}$).
6 OUTPUT CURRENT	Output current 15 15 15 Aac	Output current is 3 x 15 AAC (I_1, I_2, I_3).
3 OUTPUT FREQUENCY	Output frequency 60 Hz	Output frequency is 60 Hz.

When two keys are shown, press them at the same time.

Keys	**Sample Display**	**What the Display Means**
[7 MAINS VOLTAGE] [▲]	*50 Hz Models Only:* Mains 2. voltage 385 385 385	*50 Hz Models Only.* Bypass mains voltage is 3 x 385 VAC (if the bypass mains option is installed).
[8 BATTERY VOLTAGE] [5 BATTERY CURRENT]	Battery temp. 25 C°	Battery temperature is 25 C (77°F) (This display is only for units with battery temperature compensation. Battery temperature compensation is standard for UT310-UT330 models with internal batteries and is optional for all units with external batteries.)
[6 OUTPUT CURRENT] [△]	Output peak curr 19 19 19 Aac	Output peak current is 3 x 19 AAC.
[↵]	Normal operation load power xx%	Returns to "Normal operation" display and indicates the % load of the most fully loaded phase (leg).
[1 🕘]	95.12.16 10.22.13 UTC	Year, month, day. Hour, minute, second. UTC = Universal Time Coordination. (This may be programmed to your time.)

205 User Parameters

User parameters allow you to define some of the information the UPS uses to operate. You can view and program the parameters listed in Table 3 on the next page. The parameters are easy to access and program; simply follow the five steps below. **Make sure that you fully understand a parameter before attempting to change it.** If you need help, phone BEST's Worldwide Service or the nearest BEST office. (See the beginning of this manual for addresses and telephone numbers.)

1. Press [⌑] to display the user parameter list.
2. Press [▲] or [▼] to scroll through the list.
3. To switch a parameter "ON," press [1 🕘].
4. To switch a parameter "OFF," press [0 ✱].
5. To exit the parameter list, press [↵].

TABLE 3 - User Parameters

PARAMETERS	FACTORY SETTING	COMMENTS
Second Language	OFF	If you select ON, the UNITY/I displays all messages in its second language. (For 60 Hz systems, this language is Spanish.) The following languages are available, but they must be ordered from the factory: Danish, Dutch, Finnish, French, German, Italian, Polish, and Portuguese.
Adaptive slewrate	ON	OFF is used when mains frequency (AC input frequency) is unstable. **Phone BEST before changing this parameter.**
Battery monitor reset	—	ON will reset the battery monitor alarm and remove battery monitor alarm messages from the alarm log. **ON also resets all battery information (such as runtime); run a battery monitor test again (see Section 302) to set battery information to the correct levels.** (This parameter is only active on units with a battery monitor. This is standard for UT310-UT330 models with internal batteries and optional for UT310-UT3220 models with external batteries.)
Battery monitor test	—	This test calculates the condition of the batteries. See Section 302 for more information. (This parameter is only active on units with a battery monitor test option; the monitor is standard for UT310-UT330 models with internal batteries and optional for UT310-UT3220 models with external batteries.)
Battery capacity test	—	This test determines how much backup time (runtime) is available. See Section 303 for more information.
M3 startup	—	Not applicable.
Boost charge	OFF	ON sets the unit for 8 hours (programmable) of continuous boost (equalize) charge. If you would like to change the time to more or less than 8 hours, call BEST's Worldwide Service.
Bypass operation	OFF	ON switches the system into static bypass operation. **The unit must be programmed for static bypass operation before an external bypass switch is activated.** If this is not done, power to the loads may be disturbed. **When you operate the UPS in bypass, it will not charge the batteries.**
Autostart	OFF	If this is set to ON, the unit will automatically start whenever mains (AC line) is applied after 30 seconds. (Some units have been programmed for autostart at the factory.) **⚠ CAUTION: When this parameter is on, the unit automatically switches on and provides power to the loads whenever mains is available. When you are servicing the unit or loads, make sure this is set to OFF.**

The UNITY/I is designed to alert you to certain UPS conditions. If the unit detects an alarm condition, it:

- lights the red alarm light in the upper left corner of the display unit, and
- sounds a 30-second audible alarm.

To silence the audible alarm, press this key:

If you do not silence the alarm, it will silence itself after 30 seconds. *Silencing the audible alarm does not correct the condition that caused the alarm.*

To find out why the UPS sounds an alarm, display the alarm log by following steps 1-4 below. This log shows all alarms that are active now. Note each alarm!

1. Press * to access the alarm log.

2. Press ↑ or ↓ to move through the alarm log.

3. If you press ↓ after displaying the last active alarm, the display shows this:

   "No further alarm."

4. To exit the alarm log press ↵.

Once you have identified the active alarms, find each alarm message in Table 4 on the next few pages. The table will tell you what each alarm message means and what you should do in response to the alarm. In some cases, the table will tell you to phone BEST's Worldwide Service or the nearest BEST office. Before you call BEST, make sure you do the following:

- Have the unit's model and serial number ready.
- Display the alarm log as described above; note all alarms.
- Display the events log (see Section 208) and note the ten most recent events.

Because the UPS can operate in many modes, Table 4 may not describe your unit's exact circumstances. If you have any questions or if you need more information, call BEST's Worldwide Service or the nearest BEST office.

MAIN DC Breaker closed, monitoring contacts are closed

TABLE 4 - Alarm List

Alarm Message	What It Means	What to Do
Battery MCB is off *(This alarm is normally for units with external batteries. It can be caused by incorrect installation.)*	The DC disconnect circuit breaker is open. If bypass voltage is within tolerance (see Glossary), the unit transfers to static bypass operation. If not, the unit transfers to standby and **does not supply output voltage.**	At the DC disconnect, **you must first turn the precharge/discharge switch to the precharge position and hold it until the LED turns off.** Precharge is very important to prevent damage to your equipment. After precharge, switch the DC disconnect circuit breaker on.
Battery Monitor Alarm	The battery monitor test has found that the battery pack is near low runtime capacity or that the battery pack may have a problem. The unit's status does not change, but when the unit operates on battery, runtime will be seriously reduced.	Phone BEST's Worldwide Service to schedule battery maintenance.
Battery Monitor Warning	The battery monitor test has found that battery capacity is reduced (typically below 80%). The unit's status does not change, but the unit will not be able to operate as long on battery (it will have reduced runtime).	See Section 205 to display the parameters. Then, change the "Battery monitor reset" parameter to "ON." This will clear the Battery Monitor Warning . Next, do a battery monitor test (see Section 302). If the alarm starts again, phone BEST's Worldwide Service to schedule battery maintenance.
Bypass freq. is out of tolerance	The bypass frequency is out of tolerance (too high, low, or unstable). The unit may transfer to battery or standby operation; it cannot operate in static bypass.	Ask an electrician to make sure that the correct input frequency is being supplied to the UPS. If so, phone BEST's Worldwide Service.
Bypass is moment. out of tolerance *(This alarm is normal when there is a power outage.)*	The bypass voltage was momentarily out of tolerance (see the Glossary). The unit may transfer to battery or standby operation; it cannot operate in static bypass.	Ask an electrician to make sure that the correct input voltage is being supplied to the UPS. If so, and if this voltage is within the range accepted by the UPS, phone BEST's Worldwide Service.
Bypass is out of tolerance *(This alarm is normal when there is a power outage.)*	The bypass voltage is out of tolerance (too high or low). The unit may transfer to battery or standby operation; it cannot operate in static bypass.	Ask an electrician to make sure that the correct input voltage is being supplied to the UPS. If so, phone BEST's Worldwide Service.
Charge reg. error *(reg. = regulator)*	Failure in charge regulation. The unit transfers to battery until the "Low DC shutdown" alarm; then, it transfers to standby and **does not supply output voltage.**	Phone BEST's Worldwide Service.
External service switch activated	The external service bypass switch is in the line position. The unit is in standby and **does not supply output voltage.** However, the loads may be receiving power from the external manual bypass.	Phone BEST's Worldwide Service.

Alarm Message	What It Means	What to Do
Fan fault Needs fan monitoring option installed	If the fan monitoring option is installed, this alarm sounds if one or more of the fans are slowing down. The unit's status does not change, but the problem may cause other high-temperature alarms that could change the unit's status.	Phone BEST's Worldwide Service.
Fatal Error RAM1 data error	Components on the main controller board have failed.	Phone BEST's Worldwide Service.
Fault in int. power supply	There is a fault in the internal power supply unit (PSU). UT3120-UT3220 models do not change status because they have a redundant power supply. Standard UT310-UT3100 models transfer to standby and **do not supply output voltage**; these models come with one power supply, but you can order multiple power supplies as an option.	Phone BEST's Worldwide Service.
High Battery Temperature	The ambient battery temperature is higher than the set alarm level. The unit's status does not change, but battery life could be affected. This alarm is often caused by high room temperature.	Make sure the room temperature is below 80° F (27° C). If not, cool the room. If the temperature was below 80° F (27° C) when the alarm sounded, find the exhaust vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service.
High DC Warning	The monitored battery voltage is higher than the unit's shutdown setpoint.	Phone BEST's Worldwide Service.
High DC Shutdown	The monitored battery voltage is higher than the unit's shutdown setpoint. The unit will switch to battery power to reduce DC bus voltage.	Phone BEST's Worldwide Service.
High output voltage *(This alarm is usually only listed in the events log.)*	The output voltage is higher than the alarm setpoint. The unit stays in the normal operation mode. If the alarm is not cleared, the unit will transfer to static bypass operation if bypass is within tolerance (see the Glossary). If bypass is not within tolerance, the unit will transfer to standby and **will not supply output voltage.**	If the alarm is still active, put the UPS into bypass by displaying the user parameters and changing "Bypass Operation" to "ON." (See Section 205.) Then, call BEST's Worldwide Service.
High temp. choke	The temperature in the main choke is too high. If the problem is not corrected soon, the unit will transfer to battery operation.	Find the exhaust vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service.

Alarm Message	What It Means	What to Do
High temp. transformer	The temperature in the main transformer is too high. If the problem is not corrected soon, the unit will transfer to standby and **will not supply output voltage.**	Find the exhaust vents for the UPS fan check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service.
Inverter fuse blown	One or more of the fuses at the output of the inverter are blown (F004, F005, F006). If bypass is within tolerance (see the Glossary), the unit transfers to static bypass operation. If not, the unit transfers to standby and **does not supply output voltage.**	Phone BEST's Worldwide Service.
Inverter voltage error	The output voltage is too high or too low. If the alarm was caused by high output voltage, the unit transfers to static bypass operation if bypass is within tolerance (see the Glossary). If bypass is not within tolerance, the unit transfers to standby and **does not supply output voltage.** If the alarm was caused by low output voltage, the unit transfers to static bypass operation if bypass is within tolerance. If bypass is not within tolerance, the unit transfers to battery for five seconds and then transfers to standby and **stops supplying output voltage.**	If the UPS is in standby, restart the UPS by pressing the green button inside the door. If the UPS will not restart, a user may have started an emergency power off (EPO) shutdown. Find out if the EPO shut down the UPS; if it did, **find out why and make sure the emergency has passed**. Then, you can reset the EPO and restart the unit by pressing the green button inside the door. If the unit still will not restart, call BEST's Worldwide Service.
Low DC shutdown *(This alarm is normal when the UPS has run on battery for a long time.)*	The UPS has been running on battery power because of a power outage or problems in the AC input. Battery voltage has dropped below the shutdown setpoint, and the UPS has shut down. If bypass is within tolerance (see the Glossary), the unit will transfer to static bypass operation. If not, the unit will transfer to standby and **will not supply output voltage.**	If the UPS is programmed for autostart, it will automatically restart when the power outage ends and AC input is again available. If the UPS is not programmed for autostart, you can restart the UPS when the power outage ends by pressing the green button inside the door.
Low DC warning *(This alarm is normal when the UPS has run on battery for a while.)*	The UPS has been running on battery power for a while because of a power outage or problems in the AC input. Battery voltage has fallen to the warning alarm setpoint. If the UNITY/I is operating on battery, the unit's status will not change, but battery voltage will eventually drop to the shutdown setpoint. At this point, the unit will shut down and sound a "Low DC shutdown" alarm. If the "Low DC warning" alarm happens during a battery capacity test, the unit transfers back to normal operation. *If the unit has not been running on battery power, call BEST.*	If possible, restore AC input power to the UPS. If you cannot do this, prepare for a possible Low DC shutdown by shutting down the loads (protected equipment) connected to the UPS.

Alarm Message	What It Means	What to Do
Mains freq. is out of tolerance	The mains (AC input) frequency is out of tolerance (see the Glossary). The unit transfers to battery operation. If mains frequency comes back within tolerance, the unit transfers back to normal operation. If not, the unit continues to run on battery until "Low DC shutdown." Then, if bypass is within tolerance, the unit transfers to bypass. If not, the unit transfers to standby and **does not supply output voltage.**	Ask an electrician to make sure that the correct input frequency is available to the UPS. The electrician must correct any problems in input frequency. If input frequency is correct, phone BEST's Worldwide Service.
Mains is moment. out of tolerance *(This alarm is normal during a power outage.)*	The mains (AC line voltage) was momentarily too high or too low. The unit transfers to battery; if mains returns within tolerance, the unit transfers back to normal operation.	If possible, restore AC input power to the UPS. If AC input is available to the UPS, ask an electrician to make sure that 1) the correct input voltage is available to the UPS, and 2) this voltage is within a range the UPS will accept.
Mains is out of tolerance *(This alarm is normal during a power outage.*	The mains (AC input) voltage is too high or too low, so the unit transfers to battery operation..If AC input returns to normal, the unit transfers back to normal operation. If not, the unit continues to run on battery until the "Low DC shutdown" alarm. Then, if bypass voltage is within the range programmed into the UPS, the unit transfers to bypass. If not, the unit transfers to standby and **does not supply output voltage.**	If possible, restore AC input power to the UPS. If AC input is available to the UPS, ask an electrician to make sure that 1) the correct input voltage is available to the UPS, and 2) this voltage is within a range the UPS will accept.
OFF Button Pushed *(If the alarm was caused by the Off button, it will only appear in the events log.)*	A user pushed the red "Off" button or activated an emergency power off shutdown. The unit switches to standby mode and **does not supply output voltage.**	Restart the unit by pressing the green button inside the door. If the unit will not restart, the alarm was caused by an emergency power off (EPO) shutdown. **Find out why this shutdown was activated and make sure the emergency no longer exists;** then, you can restart the unit by deactivating the emergency power off shutdown.
Output freq. is out of tolerance	The output frequency is too high, low, or unstable (out of tolerance). The unit transfers to battery operation and runs on battery until the "Low DC shutdown" alarm. Then, the unit transfers to bypass if bypass is within tolerance. If not, the unit transfers to standby and **does not supply output voltage.**	Ask an electrician to make sure that the correct input frequency is being supplied to the UPS. Then, phone BEST's Worldwide Service.
Output is moment. out of tolerance	The output voltage was momentarily too high or too low (out of tolerance). If bypass is within tolerance, the unit transfers to static bypass operation. If not, the unit transfers to standby and **does not supply output voltage.**	If other alarms are also active, troubleshoot these alarms first. If this is the only alarm, phone BEST's Worldwide Service.

Alarm Message	What It Means	What to Do
TSM 1 temp. shutdown	Inverter module 1 has shut down because the temperature on the heatsink is higher than the shutdown level. If bypass is within tolerance, the unit transfers to static bypass operation. If not, the unit transfers to standby mode and **does not supply output voltage.**	Find the vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service. If the fans are operating, make sure the room temperature is below 80° F (27° C). If not, cool the room. If the room was below this temperature, call BEST's Worldwide Service.
TSM 1 temp. warning	The temperature on the heatsink for inverter module 1 has exceeded the warning setpoint. The unit's status does not change. However, if the temperature continues to rise, the unit will sound a "TSM 1 temp. shutdown" alarm.	Find the vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service. If the fans are operating, make sure the room temperature is below 80° F (27° C). If not, cool the room. If the room was below this temperature, call BEST's Worldwide Service.
TSM 2 temp. shutdown	Inverter module 2 has shut down because the temperature on the heatsink is higher than the shutdown level. If bypass is within tolerance, the unit transfers to static bypass operation. If not, the unit transfers to standby and **does not supply output voltage.**	Find the vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service. If the fans are operating, make sure the room temperature is below 80° F (27° C). If not, cool the room. If the room was below this temperature, call BEST's Worldwide Service.
TSM 2 temp. warning	The temperature on the heatsink for inverter module 2 is higher than the warning setpoint. The unit's status does not change. However, if the temperature continues to rise, the unit will sound a "TSM 2 temp. shutdown" alarm.	Find the vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service. If the fans are operating, make sure the room temperature is below 80° F (27° C). If not, cool the room. If the room was below this temperature, call BEST's Worldwide Service.

Alarm Message	What It Means	What to Do
TSM 3 temp. shutdown	Inverter module 3 has shut down because the temperature on the heatsink is higher than the shutdown level. If bypass is within tolerance, the unit transfers to static bypass operation. If not, the unit transfers to standby and **does not supply output voltage.**	Find the vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service. If the fans are operating, make sure the room temperature is below 80° F (27° C). If not, cool the room. If the room was below this temperature, call BEST's Worldwide Service.
TSM 3 temp. warning	The temperature on the heatsink for inverter module 3 is higher than the warning setpoint. The unit's status does not change. However, if the temperature continues to rise, the unit will sound a "TSM 3 temp. shutdown" alarm.	Find the vents for the UPS fans and check to see if the fans are operating. **Do not try to open the unit, and do not insert anything into a fan vent.** If the fans are not operating, call BEST's Worldwide Service. If the fans are operating, make sure the room temperature is below 80° F (27° C). If not, cool the room. If the room was below this temperature, call BEST's Worldwide Service.

207 Displaying the Alarm Log

The UNITY/I lists all **active** alarms in an alarm log, with the most recent alarm first. When the alarm is cleared, the unit removes it from the alarm log; however, the alarm will be displayed in the events log. (See Section 208.)

To display the alarm log, follow these steps:

1. Press  to display the alarm log.

2. Press  or  to move through the alarm log.

3. If you press  after you have displayed the last alarm, the display shows "No further alarm."

4. To exit the alarm log press .

208 Displaying the Events Log

The events log is a list of the last 250 alarms and operational modes. This log includes the time and date of each event. **Most entries in this log will be alarms; see Section 206 for explanations of the alarms.** Other entries describe operating modes; the table below lists these mode messages and explains what they mean.

TABLE 5 - Log Messages

Mode	What It Means
Main processor unit (MPU) is reset	The UPS was completely switched off.
Stand-by	The UPS was in standby mode. (See Section 202.)
Normal operation	The UPS was in normal operation. (See Section 202.)
Bypass operation	The UPS was in bypass operation. (See Section 202.)
Battery operation	The UPS was in battery operation. (See Section 202.)
Economy operation	The UPS was programmed to operate in Economy mode. (See Section 202.)

1. To access the events log, press both [0 *] and [↑] at the same time.

2. Use the [↑] and [↓] keys to scroll through the log.

3. To display the time and date the alarm or other event happened, press [1 ⏱].

Sample display: 95.12.16 (Year, month, date)
10.22.13 UTC (Hour, minute, second. UTC = Universal Time Coordination.)

4. If you press [↓] after displaying the last event in the log, the display shows "No further event."

5. To exit the events log, press [↵].

SECTION 300: PREVENTATIVE MAINTENANCE

BEST recommends a periodic preventative maintenance check every six months. BEST also recommends that the cooling fans and batteries be replaced every three years.

301 Preventative Maintenance Check

At the preventative maintenance check, a qualified service technician should:

- Check all wiring connections.
- Inspect and clean the unit.
- Check the batteries.
- Check the AC and DC meter functions.
- Perform a battery capacity or battery monitor test. (See Sections 302 and 303.)
- Check all modes of operation.
- Perform a power outage test.

Safety precautions must be observed while performing maintenance checks. For more information on preventative maintenance checks, or to schedule a maintenance check with a BEST authorized field service representative, call BEST's Worldwide Service or the nearest BEST office.

302 Battery Monitor Test

IMPORTANT: **If you are using UPS contacts for a communication link, take the necessary precautions so this test will not cause a premature shutdown. See your software documentation for more information.**

The battery monitor is standard for UT310-UT330 models with internal batteries and optional for UT310-UT3220 models with external batteries. The steps on the next page tell you how to start a battery monitor test. This test calculates the condition of the batteries and compares it to data programmed in the unit. The test discharges the batteries to about 75% of their capacity. During this test, the unit checks the applied load and the ambient temperature of the batteries. The unit then compares the results of the test with its programmed data. If the unit determines that the condition of the batteries is acceptable, it returns to normal operation. If the test determines that the condition of the batteries is unacceptable, the unit starts either a "Battery monitor warning" alarm or a "Battery monitor alarm." See Table 4 (page 12) for more information on these alarms. If you would like the unit to automatically perform a battery monitor test on a regular basis (default = every 90 days), phone the nearest BEST office for more information.

Note: The information programmed into the unit is based on the size and type of batteries that were installed when the unit was sold. If the battery configuration changes, this test will not be accurate for the new configuration. Phone the nearest BEST office for more information.

To perform a battery monitor test:

1. Press [□] to display the user parameters.
2. Press [▲] or [▼] to scroll through parameters until the display shows "Battery monitor test."
3. Press [🕒] to start the battery monitor test. The display shows "Batt. operation time > xxx min."

   ("xxx" = the minutes of runtime remaining. This number will fluctuate during the test.)
4. When the test is complete, the display shows "Normal operation load power xx%" if the batteries are in acceptable condition. If the test has determined that the batteries are unacceptable, the unit starts either a "Battery monitor warning" or "Battery monitor alarm." See Table 4 (page 12) for a detailed description of these alarms.

303 Battery Capacity Test

IMPORTANT: **If you are using UPS contacts for a communication link, take the necessary precautions so this test will not cause a premature shutdown. See your software documentation for more information.**

The battery capacity test discharges the batteries to the "Low DC warning" and displays estimated runtime. This estimate is only correct for the unit's condition at the time of the battery capacity test. If the load changes and you would like to display estimated runtime, you must perform this test again. **After a battery capacity test, the unit must charge the batteries for at least eight hours before it has full battery capacity and full runtime.**

To perform a battery capacity test, follow these steps:

1. Press [□] to display the user parameters.
2. Press [▲] or [▼] to scroll through the parameters until the display shows this:

   Battery capacity test: xxx

   ("xxx" = the backup time from the last test). If the test has never been performed before or if the test has been aborted, the display will show "???."
3. Press [↵] to abort the test or [🕒] to continue. The display shows

   "Batt. operation time xxx min."

4. If you wish to abort the test while it is underway, follow these steps:

   a. Display the user parameter list by pressing .

   b. Use the arrow keys to scroll through the parameters until the display shows "Battery capacity test: xxx."

   c. Switch the battery capacity test "OFF" by pressing .

5. Wait until the display shows "Normal operation load power xx%" and a short alarm sounds.

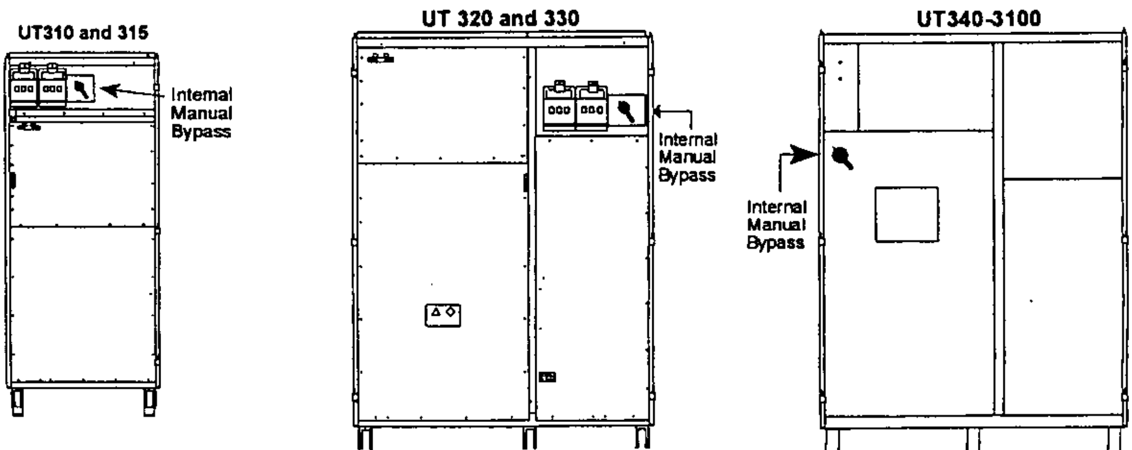
6. Press . The display will show "Battery capacity test: xxx." ("xxx" = the estimated backup time in minutes)

7. Press to exit the user parameter list.

304 Internal Bypass Switch (50 Hz Models Only)

50 Hz UT310-UT3100 models include an internal bypass switch inside the front door. This switch is **not the recommended method of bypassing the UPS if the unit is being serviced.** Use an external maintenance bypass switch for 100% isolation of the UPS. If the UPS is not being serviced, you may change the internal bypass switch position to "By-pass" to operate your load equipment directly from mains AC line power. The display will show "Bypass operation," and the "System in man. bypass" alarm will be active. (See Section 206.) Use the "normal" position when you want your load equipment to receive power from the UPS.

> **⚠ CAUTION**
>
> **If the unit is being serviced, use an external maintenance bypass switch. Hazardous voltages are present inside the unit even when the internal bypass switch is in the "By-pass" position.**



SECTION 400: SPECIFICATIONS

For a complete list of specifications, see the Planning and Installation Manual for your model.

TABLE 6 - General specifications for all models (unless otherwise noted)

Mains tolerance		+10%, -15% (programmable)
Bypass tolerance		±10% (programmable)
Input frequency ±6% (programmable)		60 Hz or 50 Hz.
Output frequency	mains synchronized: free running:	60 Hz ±6% or 50 Hz ±6%. 60 Hz ±0.1% or 50 Hz ±0.1%.
Current distortion		0-5%
Tolerance	symmetrical load asymmetrical load load step 0-100	±1%, static. ±3%, static. (100% imbalance, provided output current rating is not exceeded.) ±5%.
Distortion (linear load)		0-3%
Overload capacity	normal operation, 1 minute normal operation, 10 minutes battery operation, 1 minute battery operation, 10 minutes	250% 150% 150% 125%
Audible noise (dBa)		55 (UT310-UT315) 65 (UT320-UT3100) 73 (UT 3120-UT3220)
Maximum Humidity (noncondensing)		95%
Efficiency	economy mode normal operation	97% (UT360-3220) 96% (UT320-UT340) 95% (UT310-UT315) 93% (UT310-UT315) 94% (UT320-UT330) 95% (UT340-UT360) 96% (UT380-UT3220)

SECTION 500: OPTIONS

BEST offers many options for UNITY/I units. For more information, contact your local BEST office (see the inside front cover) or your dealer. Note that some options only apply to certain models.

Battery Temperature Compensation: Enables the UPS to adapt the charging voltage to the battery temperature. This is standard in units with internal batteries but optional for units with external batteries. For units with external batteries, this option monitors the temperature in one battery cabinet.

Communication Interface Board: If you would like to use shutdown software or remote monitoring, your UPS must have this internal circuit board. The board offers three methods of communicating with the UPS:

1. Normally open or normally closed contacts that indicate UPS ON, bypass operation, battery operation, and low battery. (You can choose this method for an AS/400 monitoring system.)
2. RS232 Serial Communications port.
3. Zero to 20 mA current loop.

Fan Monitor: If the unit's fans are not functioning properly, this option starts a "Fan fault" alarm.

LED Panel: *This option is for the UT3120, the UT3160, and the UT3220.* The panel includes LEDs that give you quick information on UPS operating modes and alarms.

Maintenance Bypass Cabinet: An external bypass switch lets you conveniently transfer your protected load equipment to direct AC input power when it is time to service the UPS. The cabinet includes an AC disconnect.

Parallel Board: This option allows your qualified installer to connect two or more units in parallel. The parallel board ensures proper control of parallel units and proper load sharing between the units. Each unit that will be connected in parallel requires one of these boards. Each board includes 23 feet (7 meters) of interconnection cable. *A BEST Application Engineer should be involved in all parallel unit installations. Phone BEST's Worldwide Service or the nearest BEST office for details.*

Relay Board: This option provides 16 additional relays. In UT320 and UT330 models, this option must be installed at the factory. In UT340-UT3220 models, the relay board can be installed in the field by qualified service personnel. *This option is not available for UT 310 and UT 315 models.*

Warranties:

In addition to the standard warranty on page 27, BEST offers a large array of service plans and extended warranties to fit your needs. Whether you choose a basic level or one that makes power protection virtually effortless, you can be sure Best Power will honor its commitment to provide you with true peace of mind.

Contact your local Best Power representative for availability in your country. By calling us toll-free at 1-800-356-5737 (U.S. and Canada) and referencing this page, you will automatically receive a 10% discount on any plan purchase.

Level 6 — Customized Service Agreement:
Designed by you to match service delivery to your unique needs. Includes any features of Levels 1-5 plus any additional services and terms that you may require.

Level 5 — On-Site Comprehensive Agreement:
A factory-trained technician will perform Preventative Maintenance yearly to reduce the likelihood of unit failure. If failure should occur, you will receive priority scheduling to repair the unit at your location. All labor and parts (including internal batteries) are covered.

Level 4 — On-Site Repair Agreement:
You will receive priority scheduling for a Best Power factory-trained technician to perform the unit repair at your location and ensure that everything is working properly. All labor and parts (including internal batteries) are covered.

Level 3 — External Battery Preventative Maintenance:
Two types of battery preventative maintenance service are available: *Standard* and *Premium*. The *Standard* Preventative Maintenance Agreement can be performed during normal working hours and is designed to prevent minor problems from becoming major battery integrity issues. The *Premium* Preventative Maintenance Agreement is designed to meet the manufacturer's requirements to maintain battery warranty; it will generally be performed outside normal working hours because it requires a full DC power-down.

Level 2 — Standard Warranty Extension:
This plan extends the Best Power Standard Warranty for an additional year.

Level 1 — Standard Warranty Protection (2 Years Free):
See page 27. Best Power warrants the product to be free from defect in material and workmanship. Best Power will factory repair the product upon failure at no charge to you. You will be responsible for the freight in and out. On-site repair is available — parts are covered at no charge, labor and shipping are extra. See page 27 for details.

SECTION 600: WARRANTY

LIMITED TWO YEAR WARRANTY
Standard Warranty For All Purchases

BEST POWER, a division of General Signal Power Systems, Inc. (hereinafter called BEST POWER) warrants that each product sold by BEST POWER is compatible with existing commercially available computer equipment with enclosed power supplies and is free from defects in materials and workmanship under normal use and service. This warranty is applicable only to the initial retail purchaser (PURCHASER), and is not transferable. The duration of this warranty is two (2) years from the date of the first retail sale or the date of delivery to the PURCHASER, whichever occurs first, subject to the following conditions.

If the PURCHASER discovers within the duration of this warranty a failure of the product to perform compatibly with presently existing computer equipment or a defect in material or workmanship, the PURCHASER must promptly notify BEST POWER in writing within the duration of the warranty or not later than one month after expiration of the warranty. BEST POWER's obligation under this warranty is limited to the replacement or repair, subject to the conditions specified below, of such product returned intact to BEST POWER which shall appear to BEST POWER, upon inspection, to have been either incompatible or defective. Replacement or repair will be made at BEST POWER's Worldwide Service, Highway 80, Necedah, Wisconsin 54646, U.S.A. Such repair or replacement shall be at BEST POWER's expense. This warranty does not cover any taxes which may be due in connection with replacement or repair, nor any installation, removal, transportation or postage costs. These expenses will be paid by PURCHASER. If BEST POWER is unable to repair or replace the product to conform to this warranty after a reasonable number of attempts, BEST POWER will refund the purchase price. Remedies under this warranty are expressly limited to those specified above.

TO THE EXTENT ALLOWED BY LAW, BEST POWER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY. TO THE EXTENT ALLOWED BY LAW, BEST POWER SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, INJURIES TO PROPERTY, LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT.

Some states do not allow limitations on how long an implied warranty lasts, so that the above limitation on duration of implied warranties may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. You are advised to consult applicable state laws.

No warranty is made with respect to other products sold by BEST POWER which do not bear the name BEST POWER and no recommendation of such other product shall imply or constitute any warranty with respect to them. This warranty does not cover repair or replacement because of damage from unreasonable use (for example only, damage from road hazard, accident, fire or other casualty, misuse, negligence, or incorrect wiring) and any use or installation not in conformance with instructions furnished by BEST POWER, or repairs or replacements needed because of modifications or parts not authorized or supplied by BEST POWER.

SECTION 700: GLOSSARY

Ampere (Amp): A unit of electric current. One amp = a steady current produced by one volt applied across a resistance of one ohm.

British thermal unit (BTU): A unit of heat energy. One BTU = the heat needed to raise the temperature of one pound of air-free water from 60° F (15.5° C) to 61° F (16.1° C) at a constant pressure of one standard atmosphere.

Decibel adjusted (dBa): A unit used to show the relationship between an acoustic noise source and a reference sound power level of –85 dBm.

Ground (Earth): A conducting connection, whether intentional or accidental, by which an electric circuit or electric equipment is connected to earth, or to some conducting body that serves in place of earth.

Load tolerance - symmetrical: Equally balanced loads on a three-phase system.

Load tolerance - asymmetrical: Unbalanced loads on a three-phase system.

Mains (AC Line): The input power source. It includes the conductors extending from the service switch, the generator bus, or the converter bus to the main distribution center in interior wiring.

Maintenance bypass cabinet (MBC): Contains the external bypass switch and the AC disconnect switch.

Noise attenuation - differential mode: The ability to attenuate (reduce) noise, line to line.

Noise attenuation - common mode: The ability to attenuate (reduce) noise, line to ground and neutral to ground.

Nominal voltage: The voltage at which a device operates under ideal conditions.

Out of Tolerance: Outside of the unit's programmed limits. If you would like these limits reprogrammed, call BEST's Worldwide Service.

Power factor (PF): The ratio of the true (real) power to the apparent power of an alternating current (AC) circuit.

Protective earth (PE): Same as the equipment grounding conductor. See Ground (Earth).

Static bypass: An internal bypass mode inside the unit. The unit must be programmed into static bypass operation before an external bypass switch is used.

Static switch: An electronic switch that has no moving parts.

Best Power Standard Warranty

LIMITED TWO-YEAR WARRANTY

Standard Warranty For All Purchases

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If the PURCHASER discovers within the duration of this warranty a failure of the product to perform compatibly with presently existing computer equipment or a defect in material or workmanship, the PURCHASER must promptly notify BEST POWER in writing within the duration of the warranty or not later than one month after expiration of the warranty. BEST POWER's obligation under this warranty is limited to the replacement or repair, subject to the conditions specified below, of such product returned intact to BEST POWER which shall appear to BEST POWER, upon inspection, to have been either incompatible or defective. Replacement or repair will be made at BEST POWER's Worldwide Service, Highway 80, Necedah, Wisconsin 54646, U.S.A. Such repair or replacement shall be at BEST POWER's expense. This warranty does not cover any taxes which may be due in connection with replacement or repair, nor any installation, removal, transportation or postage costs. These expenses will be paid by PURCHASER. If BEST POWER is unable to repair or replace the product to conform to this warranty after a reasonable number of attempts, BEST POWER will refund the purchase price. Remedies under this warranty are expressly limited to those specified above.

TO THE EXTENT ALLOWED BY LAW, BEST POWER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY. TO THE EXTENT ALLOWED BY LAW, BEST POWER SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, INJURIES TO PROPERTY, LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT.

Some states do not allow limitations on how long an implied warranty lasts, so that the above limitation on duration of implied warranties may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. You are advised to consult applicable state laws.

No warranty is made with respect to other products sold by BEST POWER which do not bear the name BEST POWER, and no recommendation of such other product shall imply or constitute any warranty with respect to them. This warranty does not cover repair or replacement because of damage from unreasonable use (for example only, damage from road hazard, accident, fire or other casualty, misuse, negligence, or incorrect wiring) and any use or installation not in conformance with instructions furnished by BEST POWER, or repairs or replacements needed because of modifications or parts not authorized or supplied by BEST POWER.

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Best Power Limited "Double Lifetime" Warranty

LIMITED WARRANTY

Transient Voltage Surge Suppression Circuitry (For U.S. and Canadian Purchasers Only)

Best Power, a division of General Signal Power Systems, Inc. ("BEST POWER") hereby warrants the transient voltage surge suppression circuitry in each FERRUPS®, FORTRESS®, PATRIOT®, UNITY/I®, or SPIKEFREE™ product (hereinafter called "Product"), sold by it for installation in the United States of America and Canada to be free from defects in material and workmanship under normal use and service for the lifetime of the Product, beginning with the date of the sale to the initial retail purchaser, subject to the following conditions. This warranty is applicable only to the initial retail purchaser (hereinafter called "PURCHASER"), is not transferable, and is limited to the following remedies:

1. The replacement or repair of the transient voltage surge suppression circuitry in each Product that is returned intact to BEST POWER and which shall appear to BEST POWER upon inspection to have been defective in material or workmanship or to have been damaged through normal use;

2. The reimbursement to the PURCHASER of up to $25,000 per occurrence of documented physical damage to specified computer equipment connected to a Product where such damage could have been prevented by transient voltage surge suppression circuitry as detailed in BEST POWER's specification for the Product sold.

This warranty is made in addition to BEST POWER's Limited Two Year Warranty.

This warranty does not include any taxes which may be due in connection with replacement or repair nor any installation, transportation or postage costs. These expenses will be paid by PURCHASER. Replacement or repair will be made at BEST POWER's Worldwide Service, Highway 80, Necedah, Wisconsin 54646, U.S.A.

This warranty does not cover repair or replacement because of damage from unreasonable use (damage from road hazards, accident, fire or other casualty, misuse, negligence, incorrect wiring) and any use or installation not in conformance with instructions furnished by BEST POWER, or repairs or replacements needed because of modifications or parts not authorized or supplied by BEST POWER.

This warranty is operable only upon the written acceptance by BEST POWER of an application by the PURCHASER on BEST POWER's standard form for the above warranty coverage for the Product sold. In such application, the PURCHASER shall represent that the Product sold has been properly installed and grounded in accordance with instructions received from BEST POWER, and the PURCHASER shall also specify the computer equipment to which the Product sold has been connected and the location of the computer equipment. This warranty will not apply to any equipment not specified in the application by the PURCHASER as protected equipment.

EXCEPT AS EXPRESSLY SET FORTH IN THIS WARRANTY AND BEST POWER'S LIMITED TWO-YEAR WARRANTY, BEST POWER MAKES NO OTHER WARRANTIES, AND TO THE EXTENT ALLOWED BY LAW, BEST POWER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

REMEDIES UNDER THIS WARRANTY ARE EXPRESSLY LIMITED TO THE REPAIR OR REPLACEMENT OF PRODUCTS AND THE REIMBURSEMENT SPECIFIED ABOVE, AND TO THE EXTENT ALLOWED BY LAW ANY CLAIMS FOR LOSS ARISING OUT OF THE FAILURE OF PRODUCTS TO PERFORM FOR ANY PERIOD OF TIME, OR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR OTHER ECONOMIC LOSS ARE EXPRESSLY EXCLUDED.

Some states do not allow limitations on how long an implied warranty lasts, so that the above limitation on duration of implied warranties may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so that the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. You are advised to consult applicable state laws.

Additional Information

The Best Power device purchased and all connected equipment must be specified in writing on the registration form. Any changes to the connected equipment must be sent in writing to Best Power or the agreement is void.

All connected equipment must pass through a Best Power product and conform with installation instructions furnished by Best Power. Also, the installation must comply with all applicable electrical and safety codes set forth by the National Electrical Code (NEC). Power protection products must be plugged into or directly connected to properly wired and grounded outlets of panels. Only Best Power bypass switches may be used. No extension cords, adapters, other ground wires, or other electrical connections may be used. The warranty does not cover damage from improperly installed equipment.

Users who suspect surge-related damage should call Best Power's Worldwide Service at 1-800-356-5737 for specific instructions. A report explaining the nature of the damage must be compiled by a qualified technician and sent to Best Power in a timely fashion. Best Power reserves the right to have its technicians evaluate the damage, evaluate any parts, circuitry and examine the customer's facility. Damaged parts must remain available for inspection until the claim is settle[illegible] surge circuitry has failed to protect the connected equipment, Best Power will repair or reimburse as specified in the w[illegible] ,ocument.

The warranty does not include taxes that may be due as a result of replacing or repairing equipment[illegible]stomer is also responsible for any installation, transportation, or postage costs.

For Users in the United States Only

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

For Users in Canada

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

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