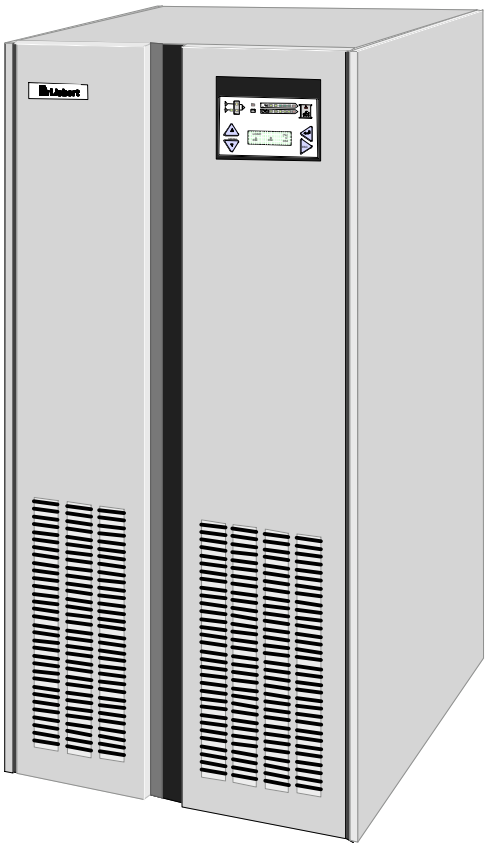
Liebert

7200 Series UPS

Single Module
Parallel 1+1



User Manual

This manual contains information concerning the installation, operation and maintenance of the Liebert Series 7200 Uninterruptible Power System (UPS) for Single Module and 1+1 Installations.

All relevant parts of the manual should be read prior to commencing installation.

The UPS must be commissioned by an engineer approved by the manufacturer (or his agent) before being put into to service. Failure to observe this condition will invalidate any implied warranty.

The Series 7200 UPS has been designed for Commercial/Industrial use only.

The Series 7200 UPS has not been designed for use in any life support applications.

If you encounter any problems with the procedures contained in this manual you should seek immediate assistance from the Liebert Sales Office from whom the equipment was purchased. Alternatively, contact the Liebert's Customer Service & Support department at the address shown below:

Liebert Europe
Customer Service and Support Department,
Globe Park, Marlow, SL7 1YG, U.K.

Telephone +44 (0) 1628 403200
Fax +44 (0) 1628 403203

Liebert Corporation pursues a policy of continual product development and reserves the right to change the equipment design without notice.

This manual describes the following equipment:

EQUIPMENT	*PART NUMBER*
30 kVA UPS Module	5410305 R
40 kVA UPS Module	5410307 T
60 kVA UPS Module	5410310 W
Battery Cabinet Type `B' 38 Ah • with battery circuit breaker (BCB) 100 A • without BCB and side panels	 5320031 P 5320034 S
Battery Cabinet Type `C' 50 Ah • with battery circuit breaker (BCB) 100 A • with battery circuit breaker (BCB) 160 A • without BCB and side panels	 5320032 Q 5320037 V 5320035 T
Battery Cabinet Type `D' 85 Ah • with battery circuit breaker (BCB) 160 A • with battery circuit breaker (BCB) 250 A	 5320038 W 5320039 X
Battery Circuit Breaker Box 100 A (for UPS 30 to 40 kVA)	4641027 B
Battery Circuit Breaker Box 160 A (for UPS 60 kVA)	4641028 C
Battery circuit breaker control board	4520067 T
Temperature sensor board	4532029 V
Input harmonic filter 30 kVA	4641015 P
Input harmonic filter 40 kVA	4641016 Q
Input harmonic filter 60 kVA	4641017 R
AS400 alarm interface board	4590055 P
Additional 3 x AS400 interface board	4590057 R
External alarm interface board	4590056 Q
Remote Alarm Monitor (RAM)	4305001 Z
Remote/Local Communications kits.	4645102 U
Parallel kit	4645004 A
Auxiliary Battery Distribution Box 125A	4641031 F
Auxiliary Battery Distribution Box 250A	4641032 G

Safety Precautions

ELECTROMAGNETIC COMPATIBILITY

This equipment complies with the requirements of the EMC Directive 89/336/EEC and the published technical standards.
Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.

WARNING

This is a class A UPS product. In a domestic environment this product may cause radio interference in which case the user may be required to take additional measures.

WARNING

HIGH EARTH LEAKAGE CURRENT: EARTH CONNECTION IS ESSENTIAL BEFORE CONNECTING THE INPUT SUPPLY.

This equipment must be earthed in accordance with local electrical codes.

Caution

This equipment is fitted with RFI suppression filters.
Earth leakage exceeds 3.5 mA but is less than 500 mA.
Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous RCCB or RCD devices.

Note also that the earth leakage currents of the load will be carried by this RCCB or RCD.

WARNING

THIS UPS DOES NOT INCORPORATE AUTOMATIC BACKFEED PROTECTION. A WARNING LABEL MUST BE FITTED TO ALL EXTERNAL PRIMARY POWER ISOLATORS STATING:

INSULATE THE UNINTERRUPTIBLE POWER SYSTEM BEFORE WORKING ON THIS CIRCUIT.

General

As with other types of high power equipment, dangerous voltages are present within the UPS and battery enclosure. The risk of contact with these voltages is minimised as the live component parts are housed behind a hinged, lockable door. Further internal safety screens make the equipment protected to IP20 standards.
No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures.
All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel.

Batteries

Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times.
Particular attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.

Test Equipment

When the battery is under charge it is earth-referenced about its mid-point -e.g. if the battery is being charged at 460V the battery extremities will be at +230V and -230V with respect to neutral (earth). When using mains-powered test equipment such as oscilloscopes in the UPS high voltage area, always use a differential mode of operation to avoid the need to disconnect the oscilloscope frame earth.

Personnel

When working inside the UPS (trained personnel only) it is recommended that protection be worn to prevent eye damage, should an electrical arc be struck by mishandling or severe electrical fault.
Some of the power components are very heavy. If their removal is necessary ensure that sufficient manpower is available, otherwise use adequate mechanical handling equipment.
When working in the general area of the UPS where high voltages are present, a second person should be standing-by to assist and summon help in case of accident.

Table of Contents

1. Chapter 1 - General Description

1.1 Introduction

The 7200 Series uninterruptible power supply (UPS) system is connected between a critical load, such as a computer, and its three phase mains power supply. Being designed to furnish a well regulated 3 phase output power supply under all rated load and input supply conditions, the system offers the user the following advantages:

Increased power quality:

The UPS has its own internal voltage and frequency regulators which ensure that its output is maintained within close tolerances independent of voltage and frequency variations on the mains power lines.

Increased noise rejection:

By rectifying the input a.c. power to d.c. power, and then converting it back to a.c., any electrical noise present on the input mains supply line is effectively isolated from the UPS output, therefore the critical load sees only clean power.

Power blackout protection:

If the mains power fails, the UPS continues to power the critical load from its battery source, leaving the load immune from power disturbances.

1.2 Design Concept

1.2.1 7200 Module Design

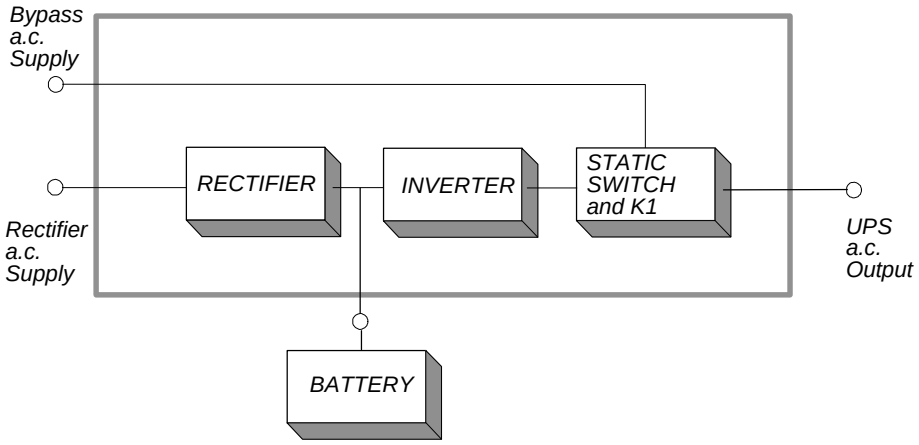


Figure 1-A . Single Module block diagram

This section describes an individual module's operating principles. The UPS basically operates as an a.c.-d.c.-a.c. converter (see figure 1-1). The first conversion stage (from a.c. to d.c.) uses a 3 phase, fully-controlled SCR bridge rectifier to convert the incoming mains supply into a regulated d.c. bus-bar.

The d.c. bus-bar produced by the rectifier provides both battery charging power - which uses a temperature compensated battery charging system, to prolong battery life - and power to the inverter section – which utilizes the latest IGBT switching pulse width modulation (PWM) design - and provides the second conversion phase, i.e. reconverting the d.c. bus-bar voltage back into an a.c. voltage waveform.

During normal operation both the rectifier and inverter sections are active and provide regulated load power whilst simultaneously float charging the battery. In the event of a mains power failure, the rectifier becomes inoperative and the inverter is powered solely from the battery. Critical load power is maintained under these conditions until the battery is fully discharged, whereupon the UPS shuts down. The end of battery discharge is assumed when the battery voltage falls below a preset value (i.e. 330V d.c. for a 400V a.c. system).
The period for which the load can be maintained following a mains power failure is known as the system's 'Autonomy Time' and is dependent upon both the battery A/Hr capacity and the applied percentage load.

1.2.2 Bypass supplies

The circuit block annotated 'Static Switch' in figure 1-2 contains an electronically controlled switching circuit which enables the critical load to be connected either to the inverter output or to a bypass power source via the `static bypass line'. Normally, the load is connected to the inverter via a contactor K1 (

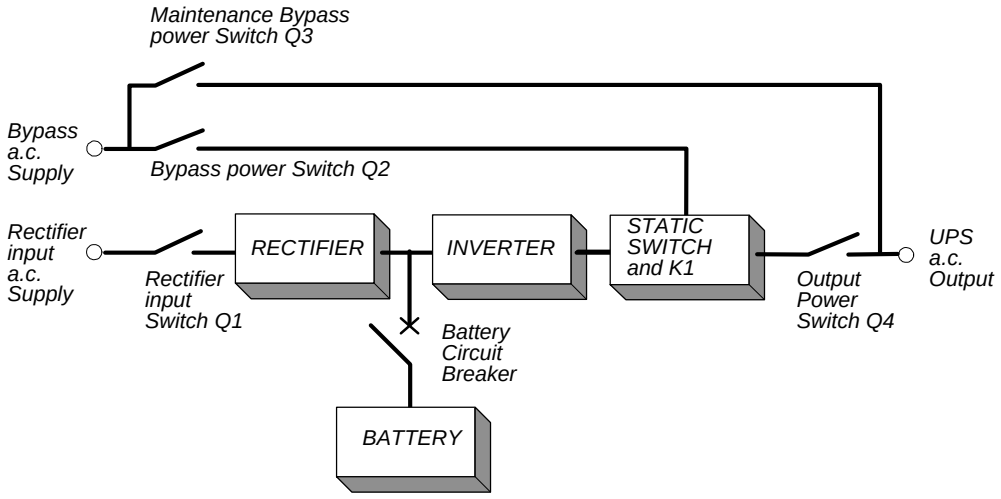


Figure 1-B . UPS power switches configuration

controlled by the static switch circuits); but in the event of a UPS overload, or inverter failure, it is automatically transferred to the static bypass line.

To provide a clean (no-break) load transfer between the inverter output and static bypass line, the static switch activates connecting the load to the bypass supplies followed by the K1 contactor opening. When switching from the bypass supplies back to the inverter the K1 contactor closes first followed by the static switch turning off. To achieve this the inverter output and bypass supply must be fully synchronized during normal operating conditions. This is achieved through the inverter control electronics which make the inverter frequency track that of the static bypass supply provided that the bypass remains within an acceptable frequency window. The synchronizing window is pre-selected to 2% of nominal frequency, giving an acceptable frequency window ±1 Hz.

An [INV: UNSYNCHRONIZED] warning message is displayed on the operator control panel when the inverter and bypass supplies are not synchronized; a second, manually controlled, `maintenance bypass' supply is also incorporated into the UPS design. Its purpose is to enable the critical load to be powered from the mains (bypass) supply while the UPS is shut down for maintenance or troubleshooting.

***Note**: The load is unprotected against mains power supply aberrations or failure when it is connected to either the static bypass or maintenance bypass supply.*

1.2.3 UPS Power Switch Configuration

The power switch locations in the various 7200 models are shown in figure 1-3 figure 1-2 illustrates the 7200 series UPS module in what is known as the *"Split Bypass"* configuration. In the *"Split Bypass"* configuration the static bypass line is connected by a separate power switch to a dedicated `bypass' power source which also feeds the maintenance bypass line. Where a separate power source is not available the Bypass (Q2) and Rectifier input supply connections would be linked together.

With the exception of the maintenance bypass isolator, all the isolators shown must be closed during normal UPS operation.

1.2.4 Battery circuit breaker

The battery is connected to the d.c. Busbar through a circuit breaker fitted inside the battery cabinet –or located adjacent to the batteries where a battery cabinet is not used. This circuit breaker is closed manually, but it contains an undervoltage release coil which enables it to be tripped from the UPS control electronics following certain detected faults. It also has a magnetic trip facility for overload protection.

1.2.5 Battery Cabinet

The batteries associated with the UPS are generally housed in a purpose-built cabinet located along-side the main UPS equipment.

It is possible to install batteries of various types and capacity in the cabinet to obtain the required autonomy characteristics.

The battery cabinet can be purchased in one of the following forms:

1. Complete installation comprising the battery cabinet, batteries and circuit breaker.

2. Battery cabinet and circuit breaker only –with no batteries.

3. Battery cabinet only –with no batteries or circuit breaker.

1.2.6 Battery circuit breaker box

As an alternative to the battery cabinet, a battery circuit breaker can be provided in a custom built box. This Battery Circuit Breaker Box is designed to be wall or rack mounted and is connected between the UPS and Battery.

1.2.7 Battery temperature compensation

For systems with batteries installed in non-optimized temperature conditions, the 7200 UPS offers a battery temperature compensation circuit. As the temperature inside the battery cabinet/area rises the d.c. bus bar voltage reduces in order to sustain the battery at its optimum charge voltage. This will assist in prolonging the life of the battery.

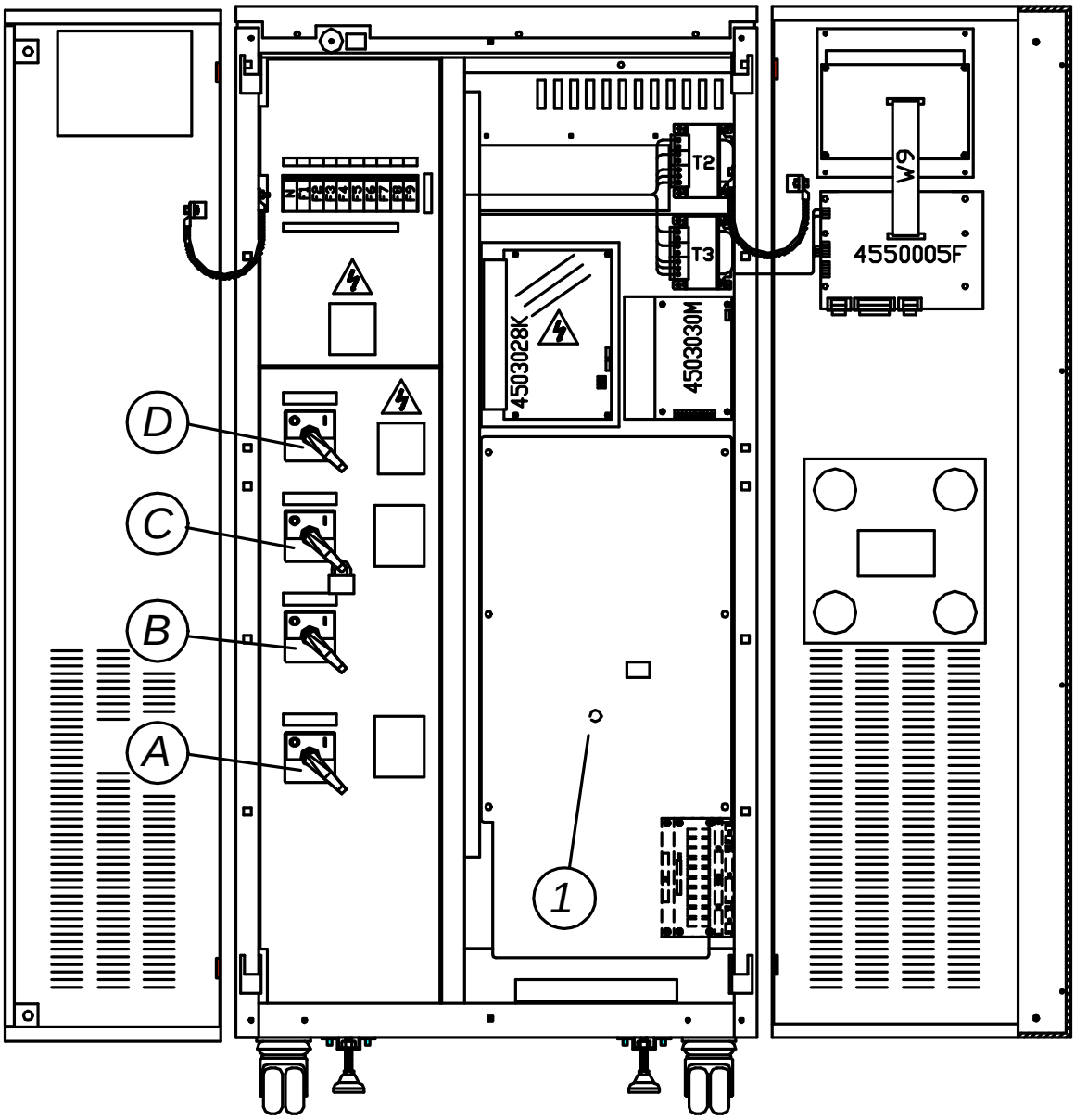


Figure 1-C . Power Switch Location

A = (Q1) Rectifier input power switch
B = (Q2) Static Bypass input power switch
C = (Q3) Maintenance Bypass power switch
D = (Q4) UPS output power switch

1 = Reset push-button

1.3 Operator Control and Display Panel

The operator control and display panel can be divided into two functional sections; `*LED indications*' and ` *control and display*'. As can be seen the upper section consists of LEDs which indicate the operational and alarm status of the system by turning ON or OFF or by flashing ON/OFF. This section can be further split into five separate areas as identified in figure 1-4.

The lower section of the operator control and display panel consists of a LCD (Liquid Crystal Display) and its associated switches.

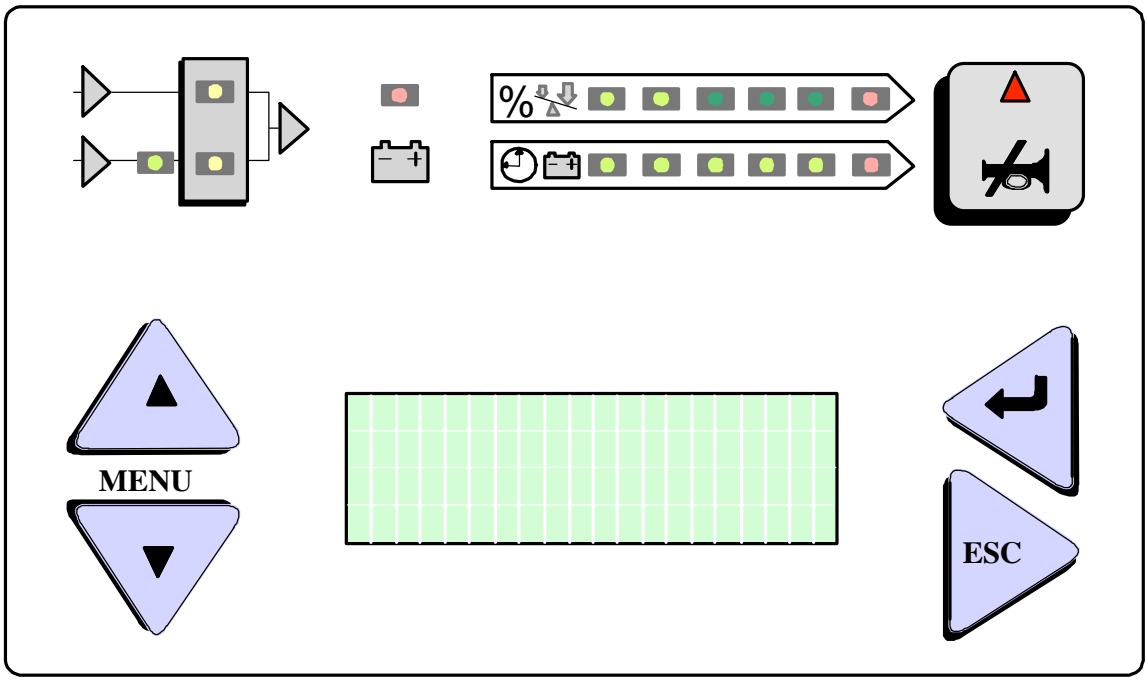


Figure 1-D. operator control/display panel

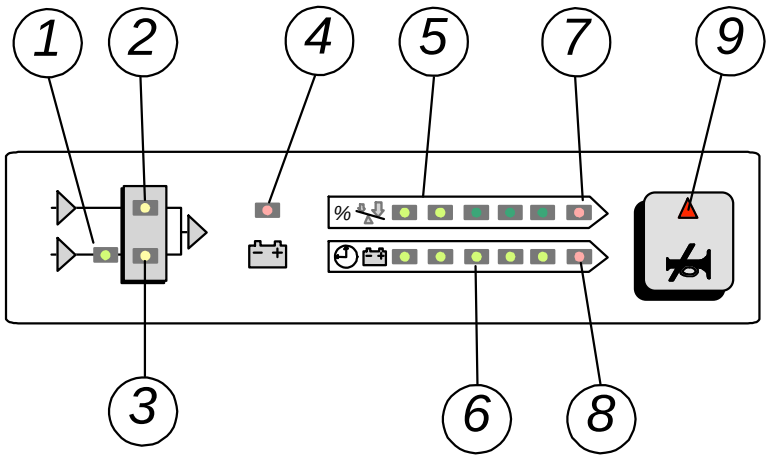


Figure 1-E. LED indications

1.3.1 LED indications

The control and display panel LED indications are illustrated in figure 1-5 and described in the following text:

1. *Bypass a.c. input supply present:*
   This led illuminates when the bypass a.c. input power switch is closed and the input supply is within of set value nominal voltage (default ±10%).

2. *Load on inverter:*
   This led illuminates when the output power switch is closed and the load is connected to the inverter via the K1 contactor.

3. *Load on bypass:*
   This led illuminates when the output power switch is closed and the load is connected to the bypass a.c. supply via the static switch.

4. *Battery Status:*
   This LED illuminates when the battery is discharging and flashes when the battery circuit breaker is open.

5. *5 LED bargraph indicating % load:*
   These LED's illuminate progressively from the left to indicate the applied load as a percentage of the maximum current load, increasing in 20% steps to 100% of full load when all five LEDs are illuminated. The applied load reading is taken from the phase supplying the highest load.

6. *5 LED bargraph indicating % battery charge state or battery time remaining:*
   These LED's illuminate progressively from the left to indicate the state of charge of the battery as a percentage of full charge, increasing in 20% steps to 100% when all five LEDs are illuminated.
   When the mains a.c. input supply fails and the UPS is operating on the battery, this bargraph changes to give the battery time remaining. With a fully charged battery all five LEDs will illuminate showing ten minutes or more autonomy, as time elapses the LEDs will extinguish in steps starting from the right hand side.

7. *Overload indication:*
   This amber LED is situated at the end of the % load bargraph and illuminates to indicate that the applied load has exceeded 100%. This indication will be accompanied by audible and visual LCD warnings.

8. *Low Battery:*
   This amber LED is situated at the end of the % battery charge bargraph and illuminates when operating on battery to indicate that the battery voltage is low at 1.8 volts per cell and that the UPS will shortly shut down.

9. *Alarm warning indication/alarm silence switch:*
   This red LED will flash whenever the UPS detects certain fault conditions and will normally be accompanied by an audible warning. Pressing the button will silence the audible warning but will not cancel the visual indication if the fault condition is still present.

Switch - Emergency Power Off (EPO):

The optional EPO switch is located remote to the UPS cabinet in a position agreed with the user. When the EPO switch is pressed it disables the static switch block entirely (so removing load power). It also disables the rectifier and inverter, and trips the battery circuit breaker. Under normal circumstances it does not remove UPS input power since this is applied through a manually controlled external isolator; however, if the UPS input supply is connected via a circuit breaker having an electrical trip facility,

emergency power off another (insulated) section of can be used to drive the external circuit breaker's trip circuit.

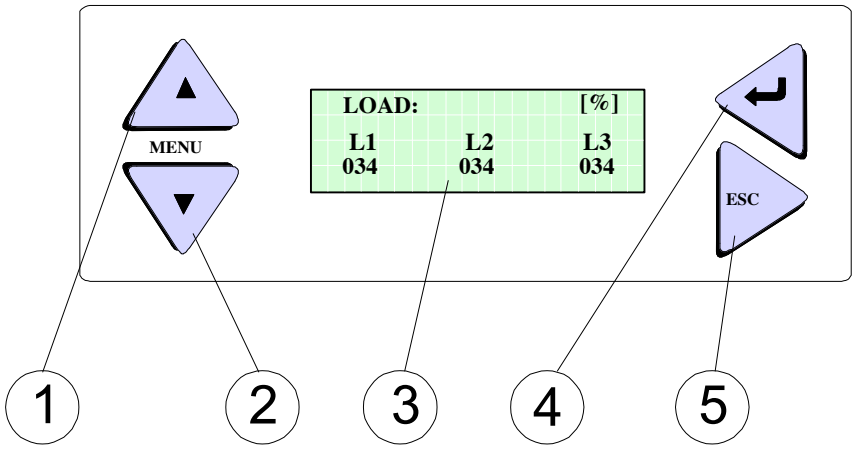


Figure 1-F . LCD (Liquid Crystal Display)

1.3.2 LCD Display

The LCD consists of a window and four push buttons. The display is capable of showing 4 rows of 20 characters and is used to indicate the UPS operating parameters, warnings and alarms. The push buttons permit the operator either to select options from a menu for display on the window, or else to change the value of certain parameters.

ENTER **(4)** Pressing ENTER, when selecting options, displays the next window. The next window is determined by the option which has beenelected in the present window. When selecting new parameters its saves the new parameters.

ESCAPE **(5)** Pressing the ESCAPE cancels the most recent actions; i.e. when selecting options it returns the previous window to the LCD; when setting parameters, it exits the window without saving the new settings

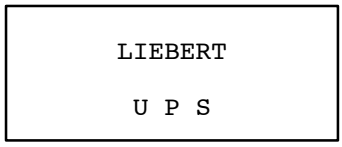
UP **(1)** The UP push-button moves a cursor up the LCD over the options offered on certain windows, and moves a rectangular cursor to the next digit on the right when changing parameter values in others.

DOWN **(2)** The DOWN push-button moves a cursor down the LCD over the options offered on certain windows, and changes the highlighted parameter values in others.

The Menu Options

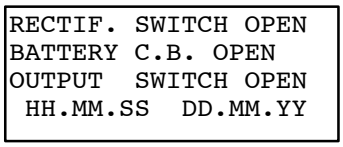
A map of the routes to the options offered by the menu is provided in figure 1-7. Options include windows which show status information and windows which permit data to be entered, or parameters for equipment control to be set. The menu map shows that the routes pass from the main menu through different intermediate windows to reach the option targeted. The diagram shows each of the windows in the format in which it appears on the LCD screen. The initializing, default & main menu windows are described below.

LCD Display Panel Messages



- **Initializing Window.**

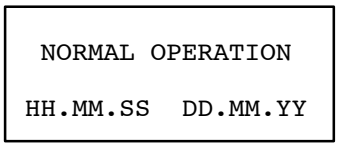
After first connecting power to the UPS and closing the bypass a.c. input power switch, the INITIALIZATION message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded and the unit performs a self test. It is followed by a window showing various messages with the time and date on the bottom line.



When the power switches and battery circuit breaker have been closed and the inverter has stabilised the window will change to the default window.

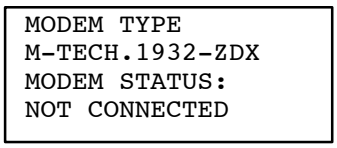
- **Default Window.**

The message shown below, will be seen on the default window whenever the UPS is operating normally:

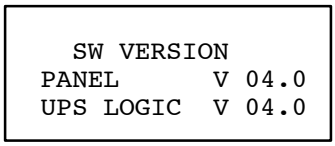


The top lines display the UPS operational status and indicates alarm conditions when they occur; and line four normally shows the time and date. Refer to Chapter 6 - Troubleshooting, for more details.

- **Info Window.**



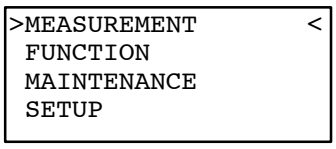
From Default Window, pressing the ESC key, information about the modem programmed in memory (see communication handbook) and its connection are shown on display.



Pressing again the ESC key, software release are shown, both on UPS board and on Panel board: this feature is useful upgrading SW for next versions and to know exactly features of present release.

Pressing again ESC key it goes back to Default Window.

- **Main Menu Window.**



The main menu is selected from the Default Window by pressing the ENTER key:

The four windows accessed from the Main Menu offer further options which are described in the relevant chapters of this manual.

The MEASUREMENT option gives access to windows which show the present values of parameters such as input & output voltages and current, load etc. These parameters are useful when determining the state of the UPS or the causes of alarms, and are described in more detail in Chapter 5 - Maintenance.

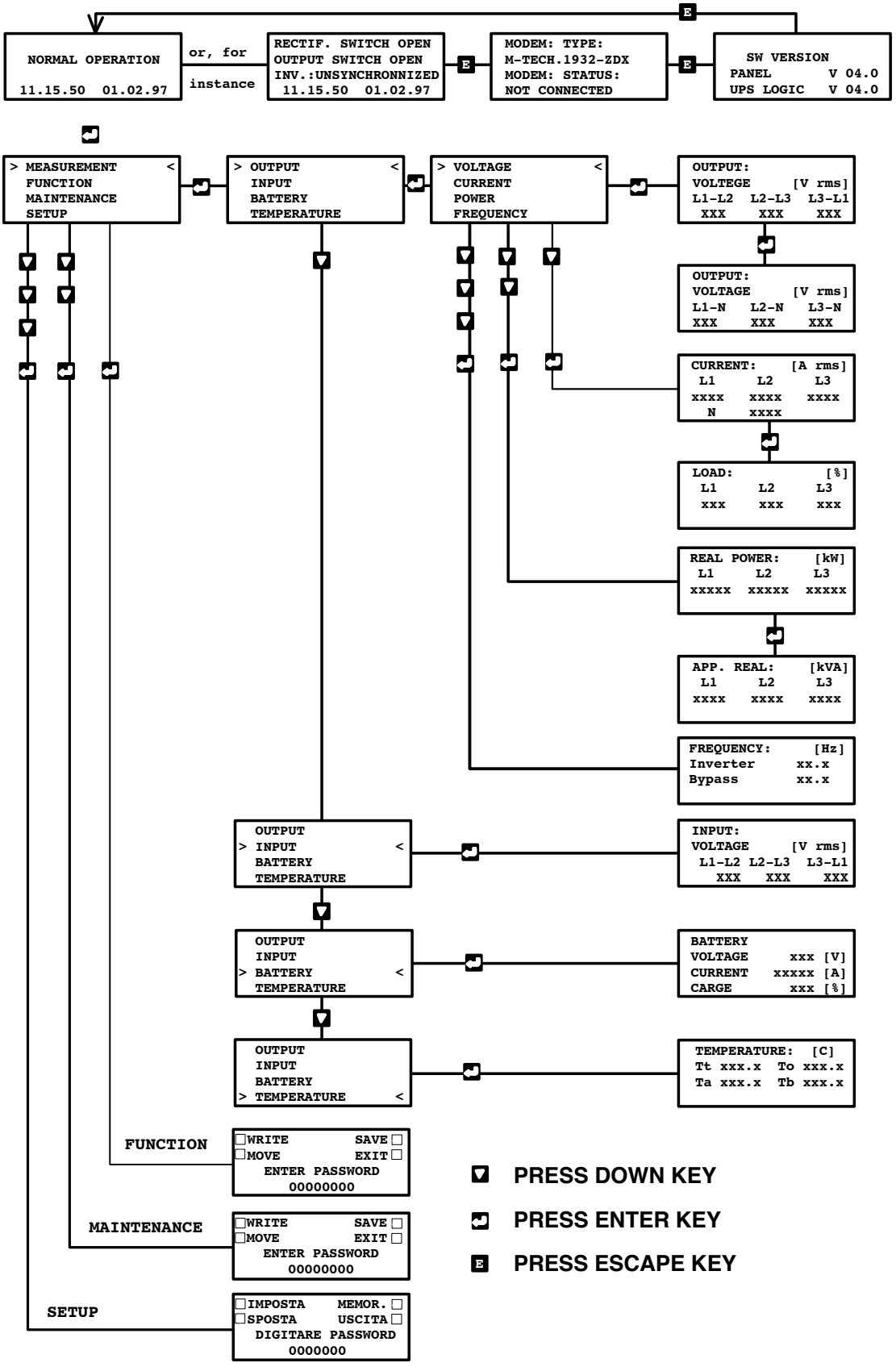


Figure 1-G. Map of screen display available to operator

The FUNCTION, MAINTENANCE and SETUP options all require a password which is set by the commissioning engineer. This manual does not provide servicing instructions and the options accessed from these windows are therefore not shown on the menu map in figure 1-7. Only trained service engineers should be authorized with a password.

In any case FUNCTION, MAINTENANCE and SETUP options can be read but is not possible to change them without password.

- **Option Selection Mode**

If a window from which options can be selected is displayed, a pair of indicator arrows appear at the extremities of the line.

The UP/DOWN push buttons move these up and down the screen over the options. When the arrows point at a chosen option, press ENTER to display the next window. Press ESCAPE to return the previous window to the screen.

Alarm/Warning messages

The Alarm and Warning messages are shown on the three upper lines of the display. The ALARM indicator (red) and audible warning accompany all Alarm messages.

There is a default selection for every message and corresponding mode of red indicator (OFF, ON, FLASHING) and buzzer sound (OFF, ON, INTERMITTENT, SINGLE SOUND).

The default mode can be changed according to particular needs of the plant, a PC and communication program are needed (see Communication Handbook).

The Alarm and Warning messages are detailed in Chapter 6 - Troubleshooting of this manual.

2. Chapter 2 - Operating Instructions

2.1 Introduction

The UPS can be considered to be in one of three operating conditions:

- **Normal operation** - All relevant power switches and circuit breakers closed, the load is powered by the UPS.
- **On Maintenance Bypass** - UPS shut down but the load connected to the unprotected mains via the Maintenance Bypass Supply line.
- **Shutdown** - All power switches and circuit breakers open - no load power.

This chapter contains instructions which enable you to switch between the three above conditions, to carry out a RESET after a fault transfer and how to switch OFF the inverter.

2.1.1 General notes

Note 1: All the user controls and indicators mentioned in these procedures are identified in chapter 1. Some of the diagrams are repeated here to assist in understanding the procedures.

Note 2: The audible alarm may annunciate at various points in these procedures. It can be canceled at any time by pressing the `Alarm Reset' push-button.

Note 3: The 7200 series UPS incorporates an optional automatic boost charge facility which can be used in systems containing conventional flooded lead-acid batteries. If this type of battery is used in your installation you may notice that the battery charger voltage may be greater than its nominal (432V d.c. for 380V a.c.,

446V d.c. for 400V a.c. and 459V d.c. for a 415V a.c. system) when the mains supply returns from a prolonged outage. This is the normal response of the boost charge facility: the charger voltage should return to normal after a few hours.

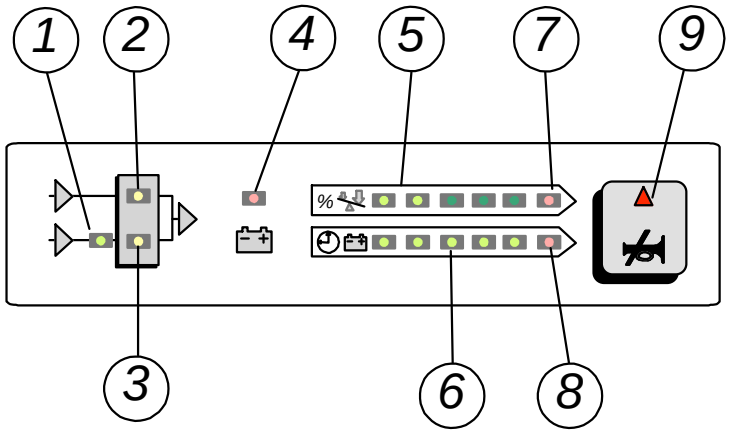


Figure 2-A . LED indications

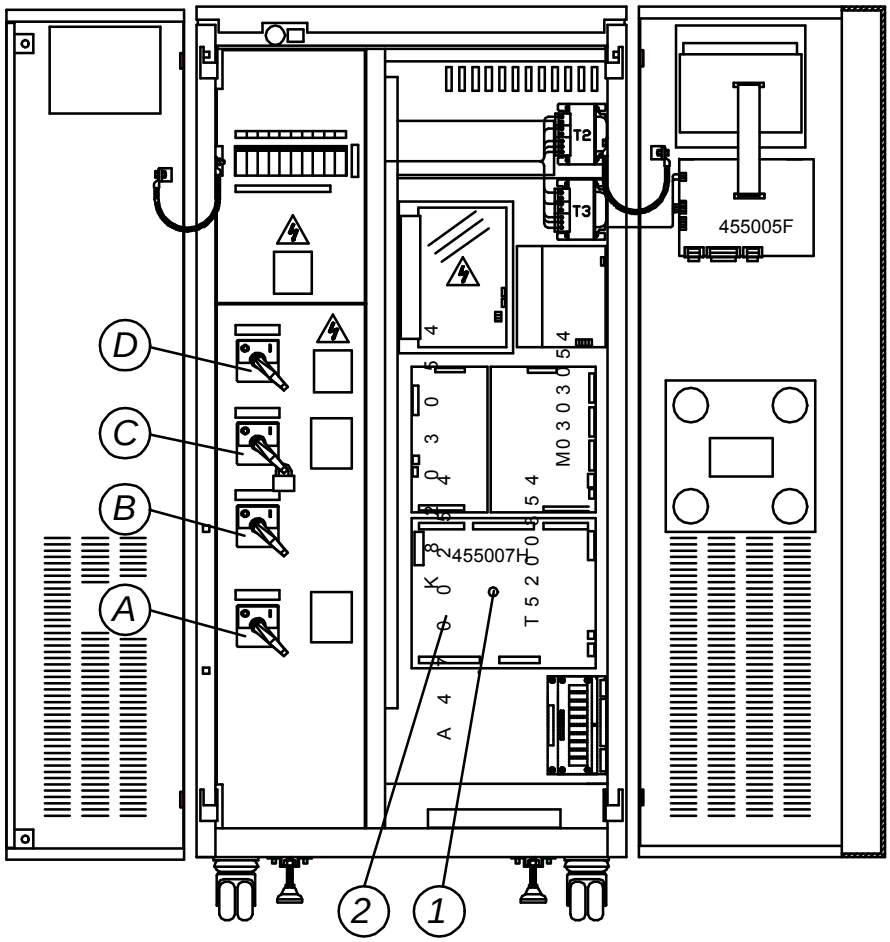


Figure 2-B . Power Switch identification

A = (Q1) Rectifier input power switch
B = (Q2) Static Bypass input power switch
C = (Q3) Maintenance Bypass power switch
D = (Q4) UPS output power switch
1 = Reset push-button
2 = UPS Logic Board

2.2 Procedure for switching the UPS to power the load from a power off condition

This procedure should be followed when turning on the UPS from a fully powered down condition - i.e. where the load is not being initially supplied at all. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed

1. Open the UPS doors to gain access to the main power switches.

WARNING

THE FOLLOWING ACTION WILL APPLY POWER TO THE LOAD EQUIPMENT - ENSURE THAT IT IS SAFE TO DO SO.

2. Close the bypass power switch Q2.
   The *Module Mimic* LED's will indicate *Bypass a.c. input supply present* (1 - steady green) and the *Load on bypass* (3 - flashing amber).
   The Display screen will show the following:

```
      LIEBERT

       U P S
```

```
RECTIF. SWITCH OPEN
BATTERY C.B. OPEN
OUTPUT  SWITCH OPEN
 HH.MM.SS  DD.MM.YY
```

Initializing Window: after first connecting power to the UPS and closing the Q2 isolator, this message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded. It is followed by a screen showing various messages with the time and date on the bottom line.

Note: If input power is present but the display remains blank, locate the UPS Logic Board and observe that the indication on the board is a flashing 88. If this is not the case then the Micro Controller is not working, anyway contact your dealer for advice.

3. Close the Rectifier input power switch Q1 the and UPS output power switch Q4
   After approximately 20 seconds the *Module Mimic* LED's will change so that the *Load on inverter* will light (2 - steady green) and the *Load on bypass* (3) will extinguish.
   The display window will show:

```
BATTERY C.B. OPEN


 HH.MM.S  DD.MM.YY
```

4. Before closing the battery circuit breaker check the d.c. bus-bar voltage. From the above window press the ENTER key:
   The Main Menu Window will display:

```
> MEASUREMENT          <
  FUNCTION
  MAINTENANCE
  SETUP
```

Select MEASUREMENT and press ENTER key:

```
  OUTPUT
  INPUT
> BATTERY              <
  TEMPERATURE
```

Select BATTERY and the d.c. bus bar voltage will be displayed:

```
BATTERY:
VOLTAGE      446 [V]
CURRENT      001 [A]
CHARGE       000 [%]
```

If the voltage indicated is satisfactory (432V d.c. for 380V a.c. system 446V d.c. for 400V a.c. system and 459V d.c for a 415V a.c. system) press the escape key repeatedly until the display returns to the original window.

5. Manually close the battery circuit breaker. This is located inside the battery cabinet (if used) or is otherwise located adjacent to the battery racks.
   The *Module Mimic* indicator (4) *Battery unavailable* should extinguish. Several LED's on the *Battery state of charge bar graph* will illuminate showing the battery state of charge.
   When the battery circuit breaker has been closed and the inverter has stabilized the screen will change to the default window.

   Default Window.
   The message shown below, will be seen on the default screen whenever the UPS is operating normally:

```
  NORMAL OPERATION

13.45.32    29.04.97
```

The top lines display the UPS operational status and indicates alarm conditions when they occur; and line four normally shows the time and date.

The UPS is operating normally with its inverter supplying the load.

2.3 Procedure for Switching the UPS into a Maintenance Bypass condition from normal operation.

This procedure should be followed to transfer the load from the UPS inverter output to the maintenance bypass system. This may be required during UPS maintenance procedures.
The first part of this procedure details how to select the Inverter OFF and power the load from the bypass mains via the Static Switch.

1. From the Default window press the ENTER key: the Main Menu Window will display:

```
  MEASUREMENT
> FUNCTION             <
  MAINTENANCE
  SETUP
```

2. Select FUNCTION and press ENTER key.

```
↑WRITE          SAVE ↵
↓MOVE           EXIT C
     ENTER PASSWORD
        00000000
```

   Before being allowed into the FUNCTION windows you are requested to enter a password. This is achieved by pressing the UP arrow key repeatedly until the first digit displays the character required, you then press the DOWN arrow key once to move on to the second digit. This action is repeated for all eight digits. When the PASSWORD has been completed press the ENTER key:

```
  BATTERY TEST
  GENERATOR
  PANEL SETUP
> NEXT PAGE            <
```

3. You now have access to all function windows. Press the DOWN arrow key until the cursors have selected NEXT PAGE - press the ENTER key.

```
  MODEM CONNECTION
> ON/OFF UPS CONTROL <
  RELOAD UPS DATA
  RESET  BUFFERS
```

4. Press the DOWN arrow key until the cursors have selected ON/OFF UPS CONTROL - press the ENTER key:

Caution

The following window allows the operator to select the UPS inverter ON or OFF, select the rectifier ON or OFF, select the rectifier to manual or float voltage and to switch OFF the Line voltage to the load.
Before making this operation, read messages on display to be sure that bypass supply is regular and the inverter is synchronous with it, not to risk a short interruption in powering the load.

*IF YOU ARE NOT **SURE** OF WHAT YOU ARE DOING - THEN **DO NOT DO IT**.*

```
> INVERTER      ON   <
  LINE          ON
  RECTIFIER     ON
  RECTIFIER    FLO
```

5. Ensure INVERTER is selected by the cursors and press the ENTER key:

```
↑ROTATION      START ⏎
                EXIT  C
 INVERTER         ON
```

The ON selection should be highlighted, using the UP arrow key, rotate between the selections offered (in this case it will be ON or OFF) select OFF. Press the ENTER key to execute your command.

The UPS inverter will now shut down and the load will transfer to the Bypass supply.
The Display window can be returned to normal by operation of the ESCAPE key back through the various windows.
The *Module Mimic* indicator *Load on bypass* (3) will flash amber and the *Load on Inverter* indicator will extinguish.

Your load is now powered via the Static Bypass system.

6. Unfasten the lock, release the internal safety bar and close the maintenance bypass power switch Q3. Open the Rectifier input power switch Q1, the Output power switch Q4, the bypass power switch Q2 and the Battery circuit breaker.
The unit will power down but the load will continue to be supplied by the manual bypass.

WARNING

The following points will be live within the UPS:
- *Bypass a.c. input supply terminals*
- *Maintenance Bypass power switch*
- *Static Bypass power Switch*
- *UPS output terminals*

Input and output terminals remain protected by an insulating transparent cover.

Your load is now powered from the maintenance bypass system and the UPS is completely shut down.

2.4 Procedure for Switching the UPS ON from a Maintenance Power down condition

This procedure will describe how to start the UPS and the how to transfer the load from the maintenance bypass to the UPS inverter.

1. Close the output power switch Q4 and the Bypass power switch Q2.
   The *Module Mimic* indicators (1) *Bypass supply present* and (3) *Load on bypass* will illuminate.

2. Close the Rectifier input power switch Q1.
   The rectifier will `walk-in' and stabilize at float the voltage. Check the battery voltage on the measurement screen.

3. Wait for 20 seconds then close the battery circuit breaker. This is located inside the battery cabinet (if used) or is otherwise located adjacent to the battery racks.
   The *Module Mimic* indicator (4) *Battery unavailable* should extinguish. Several LED's on the *Battery state of charge bar graph* will illuminate showing the battery state of charge.

4. Open the Maintenance Bypass power switch Q3 and fit lock.
   The *Module mimic* indicator *Load on bypass* (3) will Flash amber.
   The Display window will show the present status of the UPS:

```
LOAD ON BYPASS
INV.: OFF

HH.MM.SS    DD.MM.YY
```

5. From the above window press the ENTER key:
   The Main Menu Window will display:

```
  MEASUREMENT
> FUNCTION           <
  MAINTENANCE
  SETUP
```

6. Select FUNCTION and press ENTER key:

```
↑WRITE          SAVE ↵
↓MOVE           EXIT C
    ENTER PASSWORD
      00000000
```

FUNCTION windows you are requested to enter a password. This is achieved by pressing the UP arrow key repeatedly until the first digit displays the character required, you then press the DOWN arrow key once to move on to the second digit. This action is repeated for all eight digits. When the PASSWORD has been completed press the ENTER key.

Caution

This operation gives the operator access to modify UPS's operating mode, it is advised that only trained qualified personnel should attempt to do that.

7. You now have access to all function windows.

```
  BATTERY TEST
  GENERATOR
  PANEL SETUP
> NEXT PAGE
↵
```

Press the DOWN arrow key until the cursors have selected NEXT PAGE - press the ENTER key.

8. Press the DOWN arrow key until the cursors have selected ON/OFF UPS BLOCK.

```
  MODEM CONNECTION
> ON/OFF UPS CONTROL <
  RELOAD UPS DATA
  RESET  BUFFERS
```

Press the ENTER key.

Caution

*The following window allows the operator to select the UPS inverter ON or OFF, select the rectifier ON or OFF, select the rectifier to manual or float voltage and to switch OFF the Line (bypass) voltage to the load IF YOU ARE NOT **SURE** OF WHAT YOU ARE DOING - THEN **DO NOT DO IT**.*

```
> INVERTER     OFF  <
  BYPASS        ON
  RECTIFIER     ON
  RECTIFIER    MAN
```

9. Ensure INVERTER is selected by the cursors and press the ENTER key:

```
↑ROTATE          START ⏎
                 EXIT C
 INVERTER          ON
```

ighted, using the UP arrow key, rotate between the selections offered (in this case it will be ON or OFF) select ON. Press the ENTER key to execute your order.
After approximately 20 seconds the *Module Mimic* LED's will change so that the *Load on inverter* (2) will light steady green and the *Load on bypass* (3) will extinguish.

10. Return the Display window to normal by repeatedly pressing the ESCAPE key back through the various windows until the default screen is displayed.

The UPS is operating normally with its inverter supplying the load.

2.5 Procedure for completely powering down the UPS

This procedure should be followed to completely power down the UPS and **LOAD**. All power switches, isolators and circuit breakers will be opened and there will be ***no load power***.

Caution

The following procedure will switch off all power to the load equipment.

1. Open the Battery circuit breaker and the Rectifier input power switch Q1.
   The *Module Mimic* indicator (2) *Load on Inverter* will extinguish and the *Load on Bypass* indicator
   (3) will flash amber. The *battery not available* indicator (4) will light amber and the battery bar graph LED's will all extinguish.
   The display window will show messages reflecting the actions taken (i.e. Load on Bypass: Battery Breaker open: Rect. breaker open: etc.).

2. Open the Output power switch Q4 and the bypass power switch Q2.
   All operator LED indications and messages will extinguish as the mains driven internal power supplies decay.

3. To completely isolate the UPS from the a.c. supplies, the main external power input isolator (both isolators, where separate supplies are provided for rectifier and bypass) should be opened.

   Wait 5 minutes for the internal d.c. bus bar capacitors to discharge.

The UPS is now completely powered down.

IMPORTANT

The Maintenance Bypass Power switch may be operated at any time when the UPS is powered down to connect the load to the maintenance bypass supply if required.
The load equipment is not protected from normal supply aberrations when operating in the maintenance bypass mode.

2.6 Procedure for carrying out a RESET after a recognised controlled transfer to bypass or EPO action.

When the necessary action to correct the problem has been taken, this procedure should be followed to restore the UPS back to its normal operating condition following, a controlled transfer to bypass or when the Remote Emergency Power Off switch has been activated.

A recognized controlled transfer to bypass is activated by the following problems: Inverter Overtemperature, Cut-off Overload, Battery Over voltage, when configured for a manual return from bypass operation (only for system test).

1. Gain access to the UPS logic board - Open the UPS right hand door (see figure 2-2).

2. Press the RESET push switch, labeled S1 on the UPS Logic board (part number 4550004E.
   This operation can be easily done trough the hole on the screening panel using, for instance, a plastic pencil or similar.
   Operation of this push button resets the logic circuitry to enable the rectifier, inverter and static switch to operate normally.

   Note: When the remote EPO switch has been activated it is necessary to manually close the battery circuit breaker.
   When the EPO system incorporates a trip facility of the external input a.c. power supply circuit breaker, the RESET switch would have no affect on it. First close the external input a.c. supply circuit breaker, the UPS can be started in the normal manner, as the logic circuits will automatically reset on return of the power supplies.

3. On completion close the UPS doors.

3. Chapter 3 - Installation Procedure

3.1 Introduction

WARNING

Do not apply electrical power to the UPS equipment before the arrival of the commissioning engineer.

WARNING

The UPS equipment should be installed by a qualified engineer in accordance with the information contained in this chapter and the drawing package shipped inside the UPS cabinet

WARNING

Battery hazards

Special care should be taken when working with the batteries associated with this equipment. When connected together, the battery terminal voltage will exceed 400 Vdc and is potentially lethal.

Eye protection should be worn to prevent injury from accidental electrical arcs.
Remove rings , watches and all metal objects.
Only use tools with insulated handles.
Wear rubber gloves.

If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.

If electrolyte comes into contact with the skin the affected area should be washed immediately

This chapter contains information regarding the positioning and cabling of the UPS equipment and batteries.

Because every site has its peculiarities, it is not the aim of this chapter to provide step-by-step installation instructions, but to act as a guide as to the general procedures and practices that should be observed by the installing engineer.

3.1.1 Equipment positioning and environmental considerations

The UPS cabinets are fitted with castors on the base to allow ease of movement and positioning. When the equipment has been finally positioned ensure the adjustable feet are set so that the UPS will remain stationary and stable (see figure 3-2).

The UPS can be lifted using either a fork lift, or a cradle. Take care when using either method not to damage the UPS castors or jacking feet located on the bottom of the unit.

WARNING

Ensure that the UPS weight is within the designated S.W.L. of any handling equipment. See the UPS specification for weight details.

Do not move battery cabinets with the batteries fitted.

The UPS module should be located in a cool, dry, clean-air environment with adequate ventilation to keep the ambient temperature within the specified operating range. Where ventilation is poor and ambient temperature is high, a system of extractor fans should be installed to aid cooling-air flow, and a suitable air filtration system used where the UPS is to operate in a dirty environment.

Cables

All control cables should be screened and run separate from the power cables, in metal conduits or metal ducts which are electrically bonded to the metalwork of the cabinets to which they are connected.

Cooling air flow

All the models in the 7200 range are force-cooled with the aid of internal fans. Cooling air enters the module through ventilation grills located at the bottom of the front doors and is exhausted through the fan grills located on the rear panel; you must therefore allow for a minimum gap of 250 mm behind the unit to allow adequate air flow (see figure 3-1).

Clearances

Clearance around the front of the equipment should be sufficient to enable free passage of personnel with the doors fully opened.

3.1.2 Raised floor installation

If the equipment is to be located on a raised floor it should be mounted on a pedestal suitably designed to accept the equipment point loading. The installation diagrams accompanying the system identify the location and equipment through which the cabinet can be secured to the floor.

3.1.3 Battery Location

Temperature is a major factor in determining the battery life and capacity. Battery manufacturers quote figures for an operating temperature of 20°C. Operating above this temperature will reduce the battery life, operation below this temperature will reduce the battery capacity. On a normal installation the battery temperature is maintained between 15°C and 25°C. Batteries should be mounted in an environment where the temperature is consistent and even over the whole battery. Keep batteries away from main heat sources or main air inlets etc.

Pedestals are required for the battery cabinets when they are located on raised floors, in the same way as for the UPS cabinets.

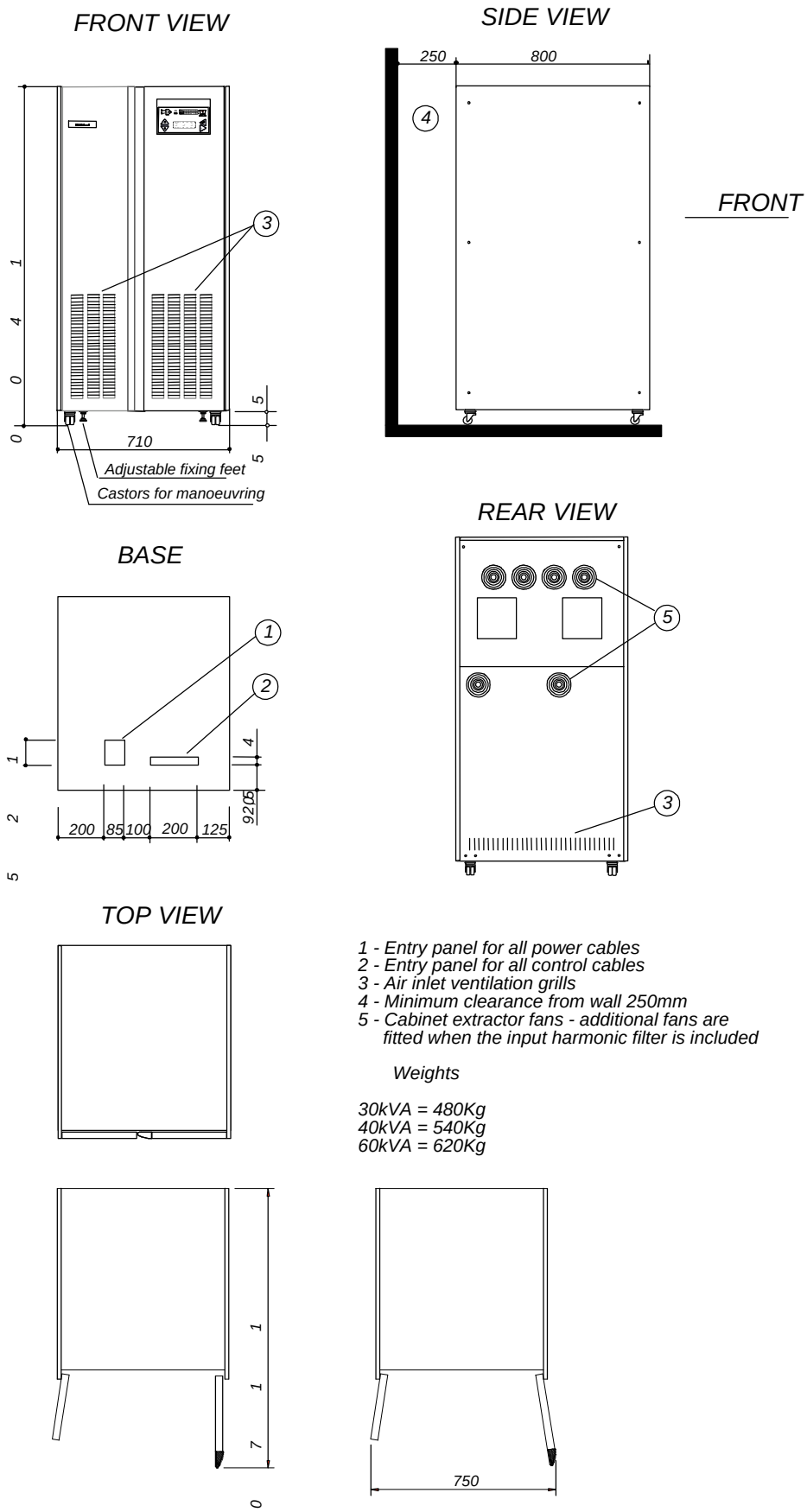


Figure 3-A . Installation Diagram

3.2 Preliminary Checks

Before you install the UPS hardware you should carry out the following preliminary checks:

1. Verify that the UPS room satisfies the environmental conditions stipulated in the equipment specification, paying particular attention to the ambient temperature and air exchange system.

2. Remove any packaging debris, then visually examine the UPS and battery equipment for transit damage, both internally and externally. Report any such damage to the shipper immediately.

3. Verify that the shipment is complete –e.g. that the battery contains the correct number of cells etc. Report any discrepancy immediately.

4. When you are satisfied that the equipment is complete and in good condition move it to its proposed final position.

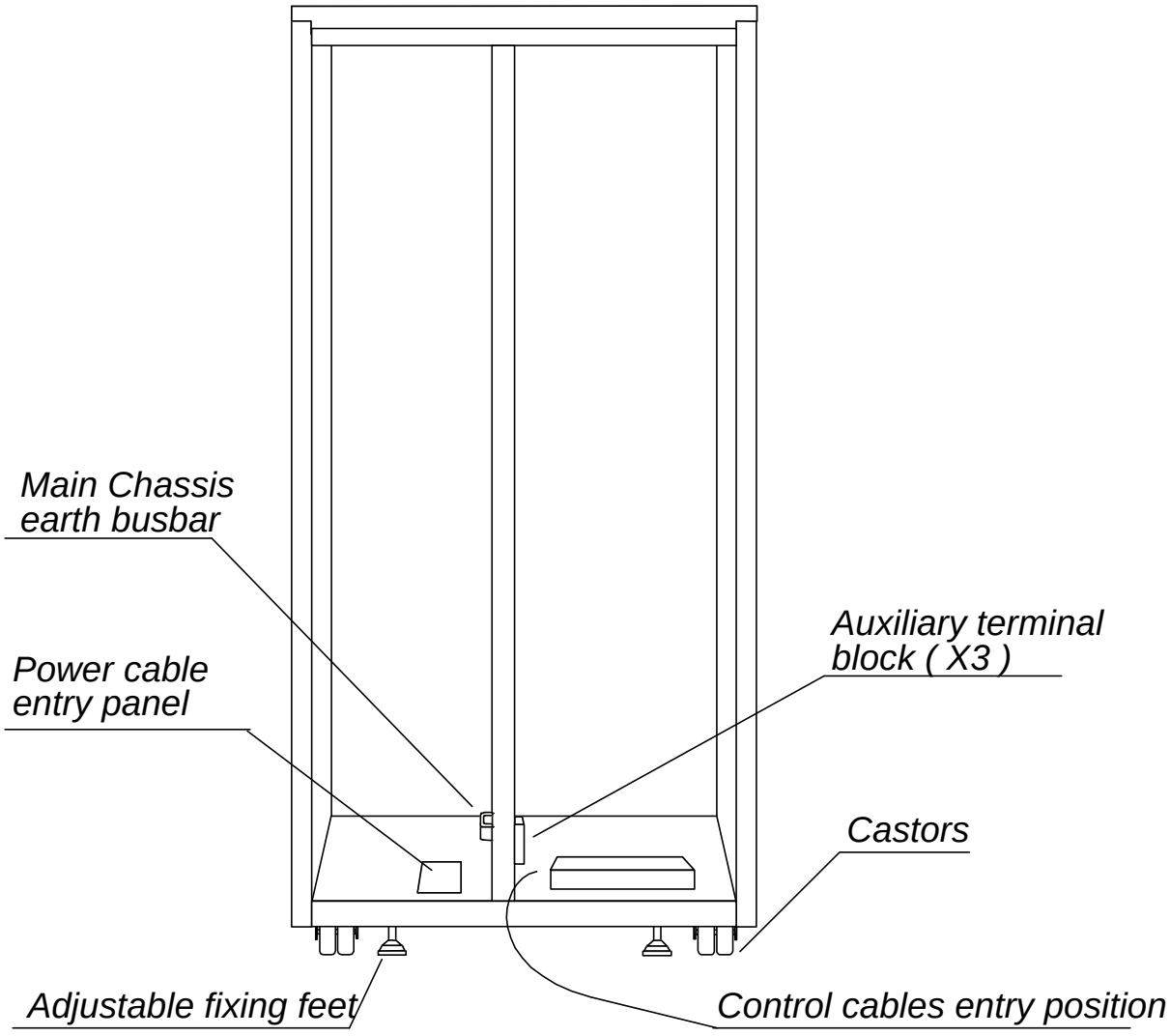


Figure 3-B . Cable entry locations

3.3 Connecting the UPS power cables

WARNING

BEFORE CABLING-UP THE UPS, ENSURE THAT YOU ARE AWARE OF THE LOCATION AND OPERATION OF THE EXTERNAL ISOLATORS THAT CONNECT THE UPS INPUT/BYPASS SUPPLY TO THE MAINS DISTRIBUTION PANEL.
CHECK THAT THESE SUPPLIES ARE ELECTRICALLY ISOLATED, AND POST ANY NECESSARY WARNING SIGNS TO PREVENT THEIR INADVERTENT OPERATION.

3.3.1 Cable entry

Cables enter the UPS modules via entry panels in the base of the cabinet. As shown in figure 3-2 separate entry positions are provided for power cables (which include input, output and battery supplies) and control cables (which includes battery control, remote stop and communication wiring). All control cables should be screened and run in a separate trunking to the power cables.

3.3.2 Cable rating

The input/output cables can be sized to suit the modules' rating according to the table below.

UPS RATING (kVA)	NOMINAL CURRENT: Amps Recommended Cable Size (mm^2)							BUSBAR CONNECTION STUD SIZE	
	Input Mains with full battery recharge			Bypass/output at full load			Battery at min. battery voltage	Input/output Cable Terminations U - V - W - N	Battery Terminations +ve & -ve
	380V	400V	415V	380V	400V	415V			
30	64 *(16)*	59 *(16)*	56 *(16)*	46 *(10)*	44 *(10)*	42 *(10)*	82 *(25)*	M6 Bolt max. 50 mm^2	M8 Bolt max. 95 mm^2
40	85 *(25)*	78 *(25)*	73 *(25)*	61 *(16)*	58 *(16)*	56 *(16)*	110 *(35)*	M6 Bolt max. 50 mm^2	M8 Bolt max. 95 mm^2
60	128 *(35)*	117 *(35)*	109 *(35)*	91 *(25)*	87 *(25)*	84 *(25)*	163 *(50)*	M6 Bolt max. 50 mm^2	M8 Bolt max. 95 mm^2

(NN) mm^2 is the recommended minimum size according to BS7671 Table 4D1A (IEEE regs. 16th Edition).

Notes:

1. The neutral conductor should be sized for 1,5 times the output/bypass phase current.

2. The earth conductor should be sized at 2 times the output/bypass conductor (this is dependent on the fault rating, cable lengths, type of protection etc.).

3. Table 4D1A applies to single core PVC-insulated, non armored cable in a ambient temperature of 30°C, according to fixing method 1, samples shown in figure 3-3.

4. **These recommendations are for guideline purposes only and may be superseded by local regulations and codes of practice.**

Sheathed cables clipped direct to or lying on a non-metallic surface.

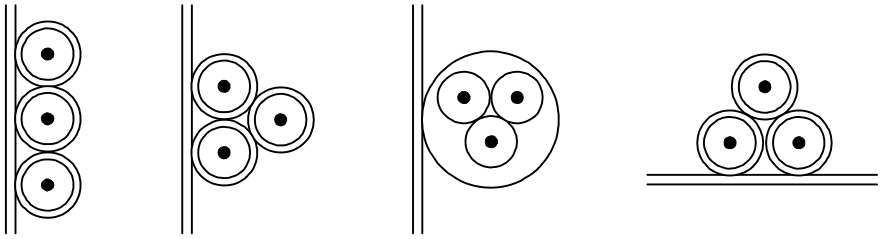


Figure 3-C . Cable fixing samples from method 1

3.3.3 Cable connections

The input mains/bypass cables, UPS output cables and battery cables (all require lug type terminations) are connected to busbars situated between the power isolator switches - as shown in figure 3-5. A terminal block X3 is used for connecting the control cables to the battery circuit breaker and the external emergency stop facility, these are female spade type connections (Fast-on 6,3x0,8).

3.3.4 Safety earth

The safety earth bus-bar is located near the input and output power supply connections as shown in the following diagram. The safety earth cable must be connected to the earth bus-bar and bonded to each cabinet in the system.

All cabinets and cable trunking should be earthed in accordance with local regulations.

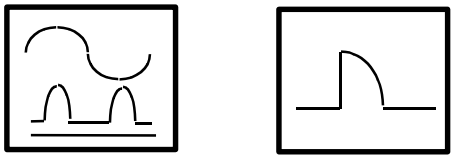
WARNING
FAILURE TO FOLLOW ADEQUATE EARTHING PROCEDURES CAN RESULT IN ELECTRIC SHOCK HAZARD TO PERSONNEL, OR THE RISK OF FIRE, SHOULD AN EARTH FAULT OCCUR.

3.3.5 Protective devices

Bypass input of UPS is not self-protected against overloads or shorts circuits: it's necessary to install in distribution panel a circuit breaker or fuses to protect bypass line.

Rectifier input: it's the same, in case of separate rectifier input, it's necessary to install in distribution panel another circuit breaker or fuses to protect input wires.

The UPS is fitted with RFI suppression filters, earth leakage current exceeds 3.5 mA and is less than 500 mA.
Earth leakage current of loads will add when UPS is operating from bypass supply.
Residual Current Circuit Breakers (RCCBs) must be selected insensitive to DC unidirectional pulses (class A) and transient current pulses.
They are identified by the symbols



Output of UPS: an insulator switch may be inserted in distribution panel for maintenance purpose; be sure don't use a protective device for the whole output power of UPS, in particular don't use RCCB.
Protective devices may be used for distribution lines to loads, be sure that they are selective with protecting devices in input of UPS.

3.3.6 Cabling procedure

Once the equipment has been finally positioned and secured, connect the power cables as described in the following procedure.

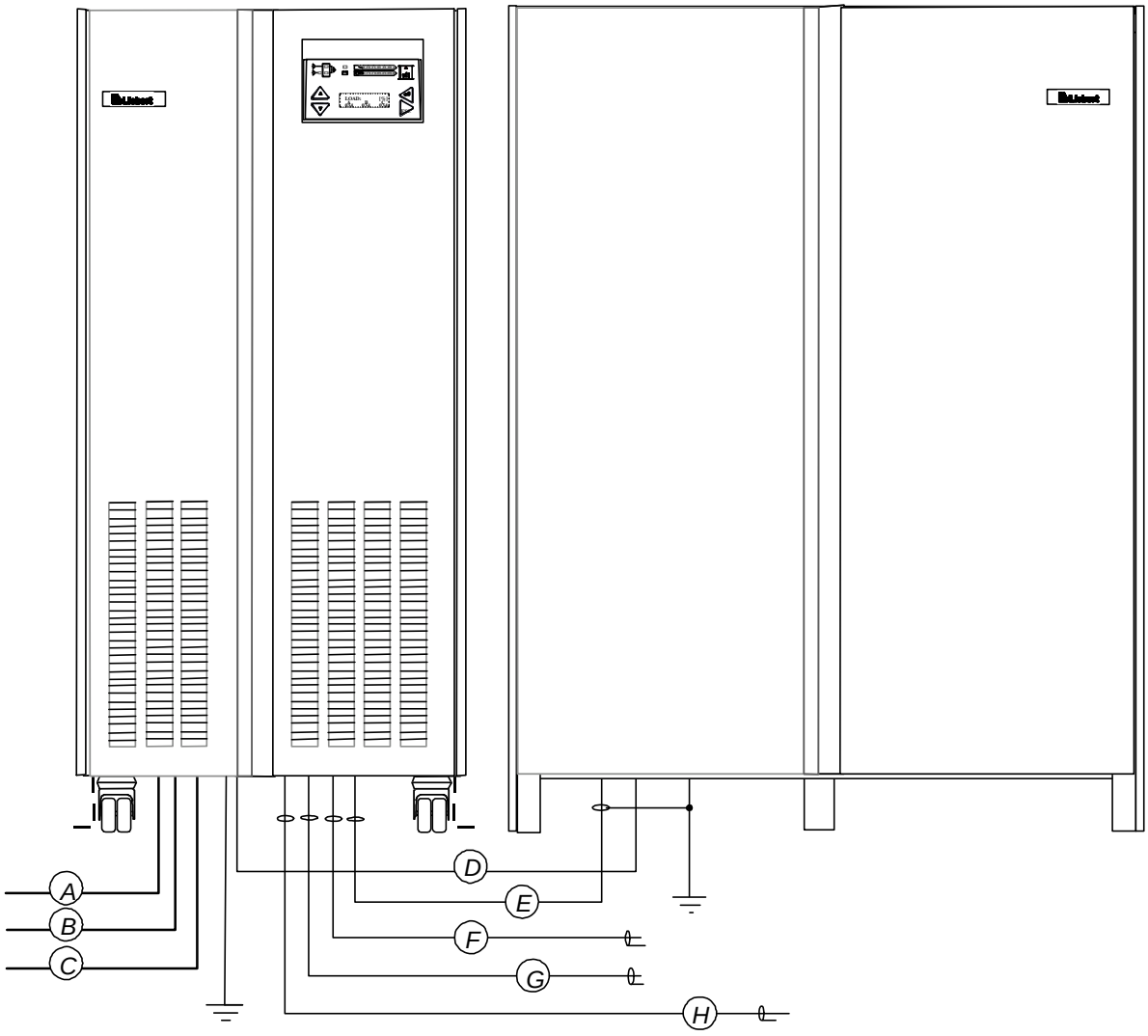
Study the connection diagram in figure 3-5.

1. Verify that the UPS equipment is totally isolated from its external power source and all the UPS power switches are open.

2. Connect the a.c. input supply cables between the mains distribution panel and the UPS rectifier input supply busbars and tighten the connections to 10 Nm. If a separate bypass supply is not provided ensure the links are fitted between the rectifier input supply busbars and the bypass input supply busbars (see figure 3-5).
   ENSURE CORRECT PHASE ROTATION.

3. If a separate bypass supply is provided, connect the UPS bypass input supply cables between the bypass distribution panel and the UPS bypass input supply busbars and tighten the connections to 10 Nm. Ensure that any links fitted between rectifier input and bypass busbars are removed (see figure 3-5).
   ENSURE CORRECT PHASE ROTATION.

4. Connect the UPS output cables between the UPS output busbars and the load distribution panel and tighten the connections to 10 Nm.



A - Rectifier a.c. input supply.
B - Bypass a.c. input supply
C - UPS a.c. output
D - Battery Power
E - Battery Control/Temp. compensation
F - Communications to P.C. or Modem
G - Communications to AS400/External alarm monitor
H - Remote Emergency Power Off (EPO).

Figure 3-D . UPS External cables

Distance from floor to connection point

Cable	UPS minimum distance (mm)	Battery cabinet minimum distance (mm)
A	600	
B	800	
C	1000	
D	1000	400
E	400	600
F	400	
G	400	
H	400	
Ground	300	400

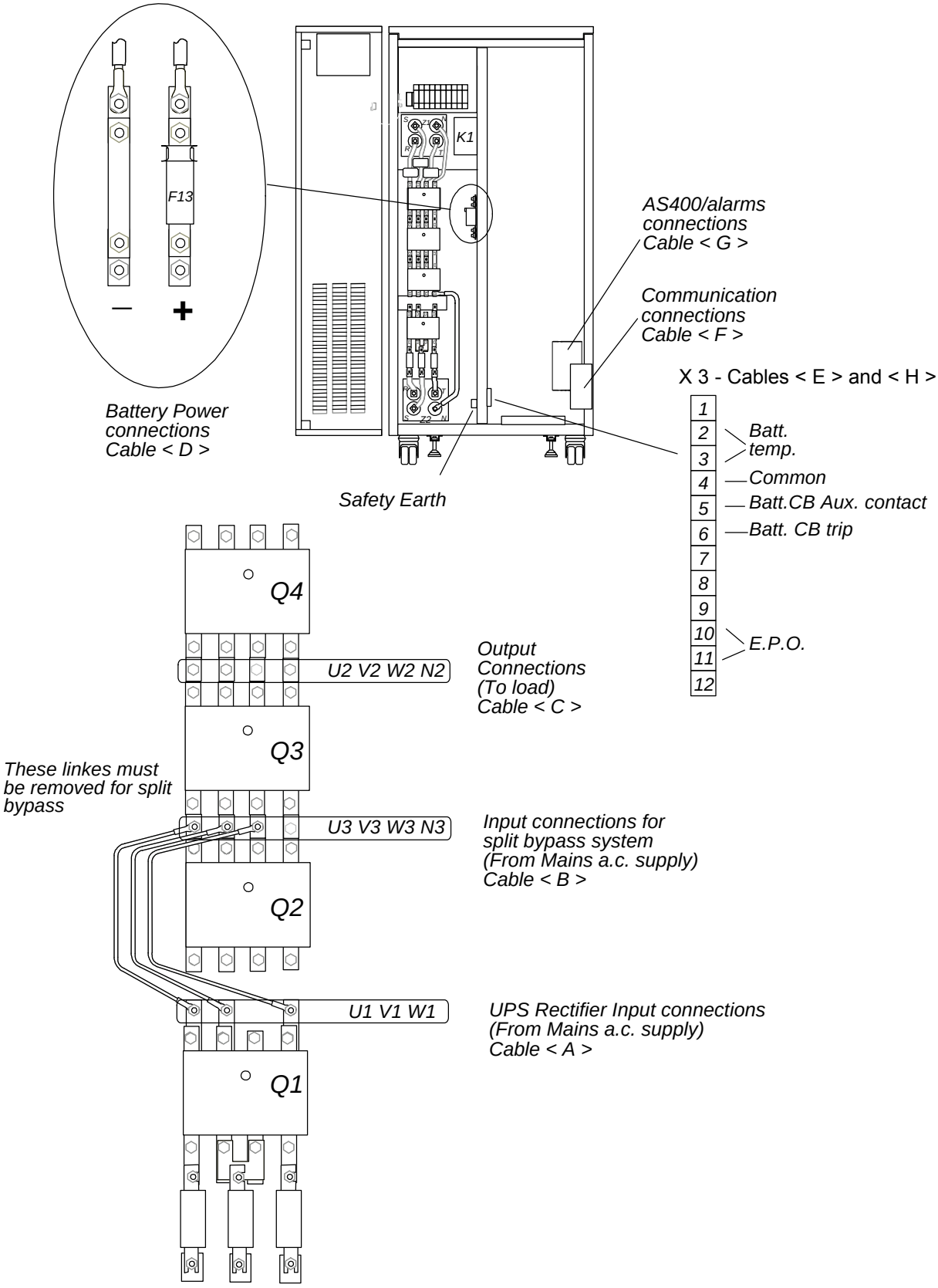


Figure 3-E . Power and control cable connections

5. Connect the battery power cables between the UPS battery terminals and its associated battery circuit breaker –see figures 3-5 and 3-6. As a safety precaution remove the battery fuse in the module until the arrival of the commissioning engineer.
   OBSERVE THE BATTERY CABLE POLARITY.

WARNING

Do not try to close the battery circuit breaker before the equipment has been commissioned

6. Connect the safety earth and any necessary bonding earth cables to the copper earth bus-bar located below the battery power connections.

   Note: The earthing and neutral bonding arrangement must be in accordance with local and national codes of practice.

7. Connect the battery circuit breaker control and temperature compensation cables between the UPS auxiliary terminal block and battery circuit breaker controller board as shown in figures 3-5 and 3-6. These cable must be shielded, shield should be connected at protective earth of battery cabinet or battery breaker, not of UPS .

Caution

If battery temperature compensation is not used the system must be de-activated by the commissioning engineer.

8. If the remote emergency power off (EPO) facility is to be used then remove the link between terminals 10 and 11 of the auxiliary terminal block and connect the `normally closed' remote stop switch between these two terminals using shielded cable.

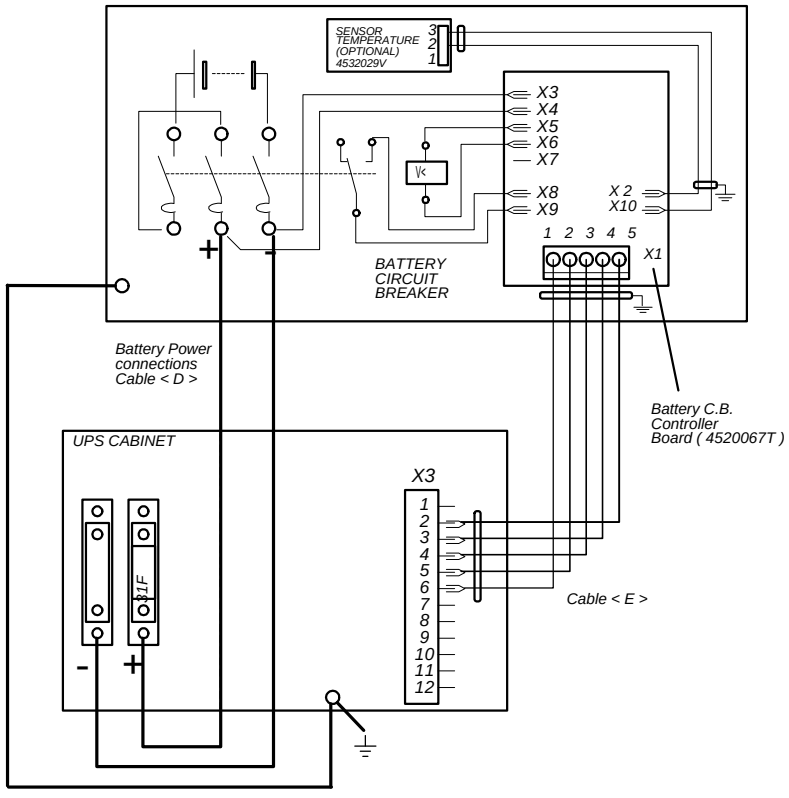


Figure 3-F .

4. Chapter 4 – Optional equipment

Several items of optional equipment are available for fitting to the 7200 series UPS for use by the customer as required.

These options are:

- AS400 alarm Interface Board (part no. 4590055 P)
  Additional 3 x AS400 Interface Board (part no. 4590057 R)
- Remote Alarms Interface Board (part no. 4590056 Q)
- Remote Alarms Monitor (part no. 4305001Z)
- Battery Cabinets (part no. 5320031 P - 38 Ah 100 A)
  (part no. 5320032 Q - 50 Ah 100 A)
  (part no. 5320037 V - 50 Ah 160 A)
  (part no. 5320038 W - 85 Ah 160 A)
  (part no. 5320039 X - 85 Ah 250 A)
- Battery Circuit Breaker Box's (part no. 4641027 B - 100 A)
  (part no. 4641028 C - 160A)
- Temperature sensor board (part no. 4532029 V)
- Input filters (part no. 4641015 P - 30 kVA)
  (part no. 4641016 Q - 40 kVA)
  (part no. 4641017 R - 60 kVA)
- Remote communications kit (part no. 4645102 U)

4.1 AS400 Alarm Interface Board (4590055 P)

The Alarm Interface board is fitted in the right hand side of the unit, on the front lower face (see figure 4-2) near the auxiliary terminal block (X3) and is connected to the UPS control electronics (UPS Logic board) by a ribbon cable (W10), which is normally stowed in the cable loom when not in use. The board has several functions as described below.

4.1.1 Remote control inputs

The Interface Board has facilities to accept three remote control inputs, as shown in figure 4-1. One remote input allows the inverter to be shut down (transferring the load to the bypass supply). The second remote input can be configured to reduce the input current limit, reduce battery current limit, inhibit inverter synchronization. This feature is most often used when the input mains supply fails, and the UPS is powered from a standby generator, which may not be large enough to maintain power supplies within the normal parameters. The third remote input is not used at this time (spare).

The external control signals (12V d.c. or a.c.) should be connected to terminal block X5 as shown in figure 4-1. The voltage applied to these terminals must be generated by an external power source and not taken from the UPS internal low voltage supplies.

4.1.2 AS400 Interface

The AS400 Interface connects the five most operationally critical UPS alarms to an IBM AS400 computer, which is designed to monitor such alarms and respond to their appearance.

The alarms in question are:

- Mains failure
- Load on UPS
- Low battery and/or battery circuit breaker open
- Load on mains (bypass)
- Load on maintenance bypass

Connection to the AS400 is provided on the Interface Board via a terminal block X3. These alarm signals are provided by volt-free relay contacts, Maximum contact rating is 50 Vcc @ 1 Amp.

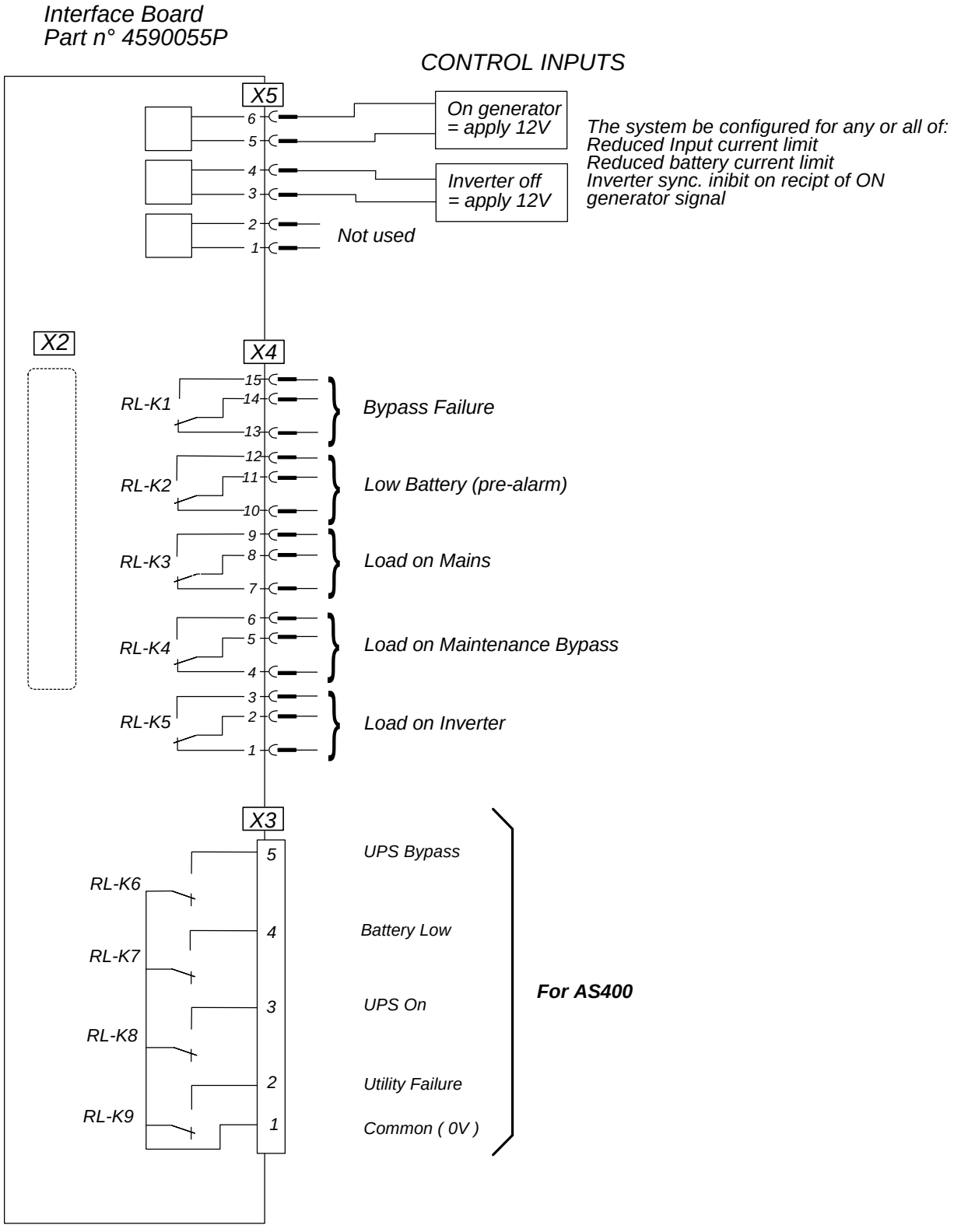
4.1.3 Alarm outputs

In addition to the AS400 alarm outputs the Interface Board also contains a number of relays whose contacts provide a set of volt-free alarm outputs that are connected to terminal block X4 as shown in figure 4-1. These outputs can be used to drive an external alarms monitoring device. Maximum contact rating on M1 terminals = 50 Vcc @ 1 Amp.

Note: When using the above contacts for remote alarm annunciation, the power supply for the remote indicators must be provided from an external power source. Under no circumstances should the UPS internal low voltage supplies be used for this purpose.

4.1.4 X2 Extension

The X2 connection on the board is provided to interface the UPS systems with the remote alarms board part number 4590056Q which contains additional alarms.



Maximum contact rating = 50 Vcc @1 ampere

Figure 4-A . Interface Board inputs/outputs

4.2 Remote Alarms Interface Board (4590056 Q)

4.2.1 Alarm outputs

The Remote Alarms Interface board is fitted in the right hand side of the unit as shown in figure 4-2 and is connected (piggy back style) directly via connector X1 onto the Interface Board connector X2. This board therefore can only be used in conjunction with the Interface Board (4590055P).

The Remote Alarms Interface board contains a number of relays driven by alarm signals generated within the UPS, whose contacts provide a set of volt-free alarm outputs that are connected to terminal blocks X2 and X3 as shown in figure 4-3. These outputs can be used to drive an external alarms monitoring device.

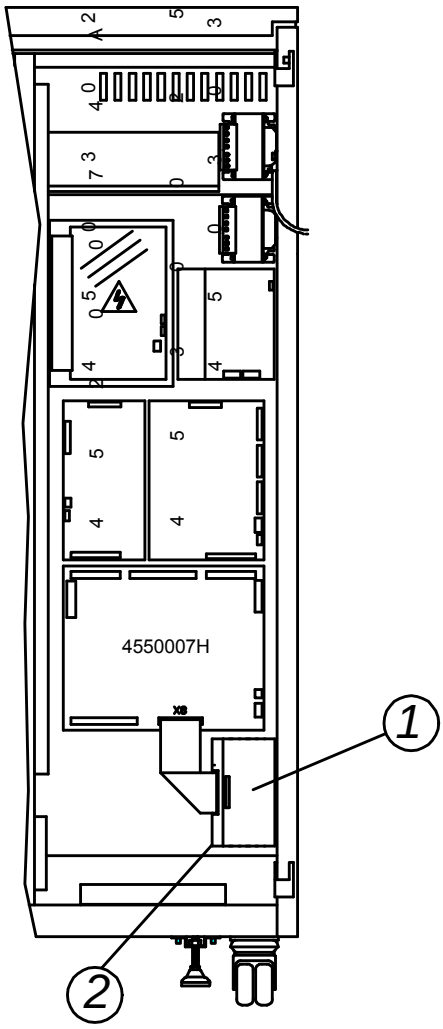


Figure 4-B . Location of Alarm Interface boards

1 - Remote Alarms Interface Board Pt. n° 4590056Q

2 - Alarm Interface Board Pt. n° 4590055P

Maximum contact rating on M1 terminals
50 Vcc @ 1 Amp.

Note: When using the above contacts for remote alarm annunciation, the power supply for the remote indicators must be provided from an external power source. Under no circumstances should the UPS internal low voltage supplies be used for this purpose.

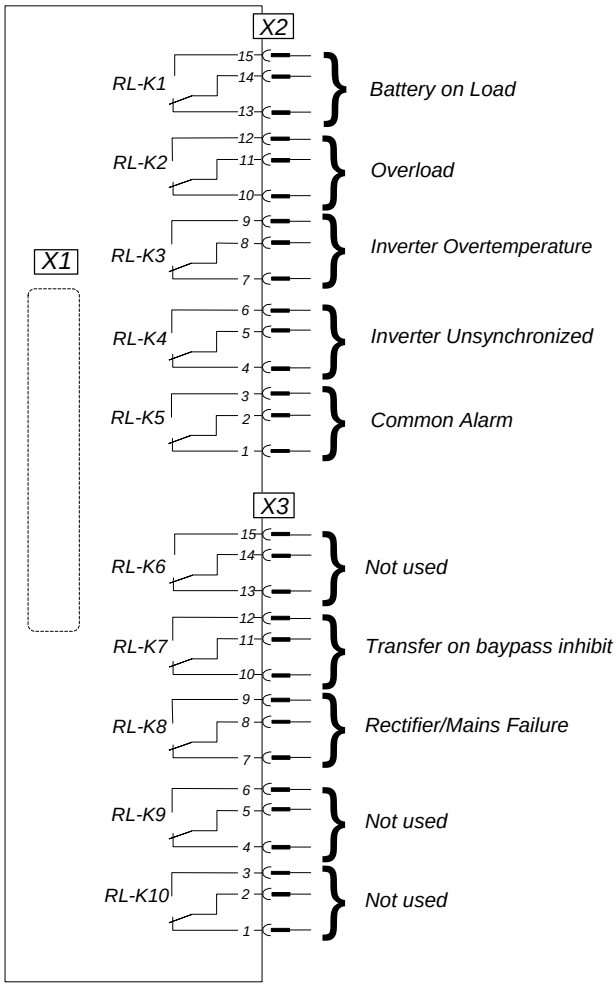


Figure 4-C. Remote Alarms Interface Board Part n° 4590056Q

4.3 Additional 3 x AS400 Interface (4590057 R)

This board is connected (piggy back style) directly via connector X1 onto the Interface Board connector X2 of 4590055 P, in the same place of 4590056 Q. This board can only be used in conjunction with the Interface Board (4590055 P).

It is not possible to fit both 4590056 Q and 4590057 R boards.

The Additional 3 x AS400 Interface connects the UPS up to three IBM AS400 computers, all they are totally insulated (ground and signals).
Alarms logic and contact rating are the same as the section AS400 of 4590055 P board: this circuit is repeated three times on 4590057 R, so it is possible to connect up to 4 AS400 to the UPS.

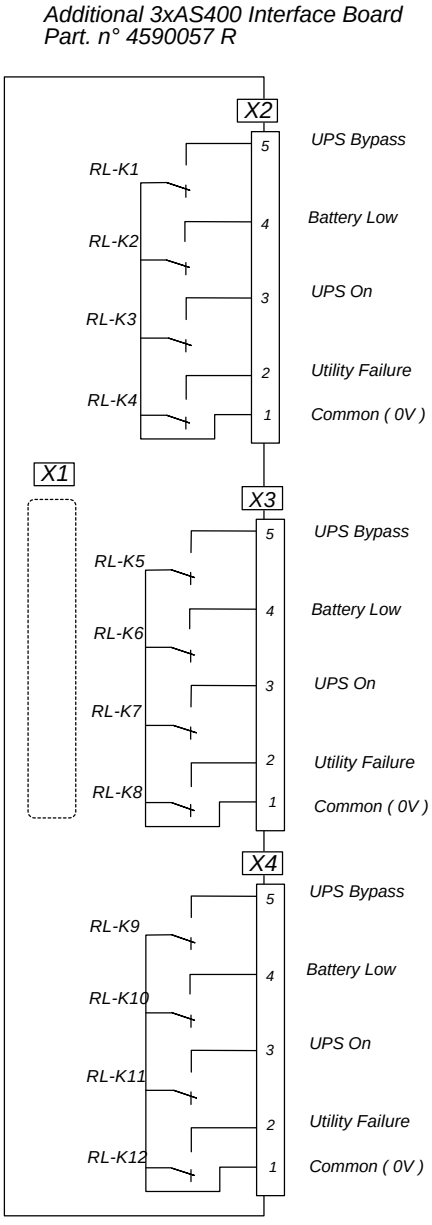


Figure 4-D. Additional 3 x AS400 Inteface Board

4.4 Remote Alarm Monitor (4305001 Z)

When used in conjunction with the Interface board described previously, the Remote Alarm Monitor enables the auxiliary alarm signals to be displayed at a remote station up to 100 meters from the main equipment.

The RAM, which can be mounted either horizontally or vertically, contains a mains-driven power supply for alarm LED annunciation and displays the following warnings:

Panel	*Colour*	*Normal state*	*Interpretation*
INVERTER ON	green	ON	Normal operating condition indicating that the load is being supplied by the inverter. This is not an `alarm' indicator.
UTILITY FAILURE	red	OFF	When lit, it indicates that the input bypass is out of tolerance or missing.
BATTERY LOW	red	OFF	When lit, it indicates that the battery voltage is below minimum or that the battery circuit breaker is open.
BYPASS ON	red	OFF	When lit, it indicates that the load is being fed from the bypass supply, possibly due to a UPS failure.
BYPASS MAINTENANCE	red	OFF	When lit, it indicates that the UPS has been selected to operate on the maintenance bypass and the load is unprotected
ALARM	red	OFF	This is a `common alarm' and is lit when any of the red leds described above are lit.

Table 4-A

An audible warning accompanies any of the above alarm conditions. This is, however, subject to a short time delay when activated in conjunction with the `Utility Failure' and `Bypass ON' alarms, to prevent the warning being activated by transient conditions. Pressing the `reset' push-button cancels the audible warning but the alarm indications remain until the condition is rectified.

4.4.1 Connections

Power supply

The RAM contains a single phase 220-240 V a.c. mains-driven power supply. Power is applied through a standard three-pin mains connector located in the RAM back panel (plug provided) use 3-core 0.5 mm^2 cable (minimum). The supply is rated at approximately 4 Watts and fused at 1A.
It is advised that the power supply is taken from the UPS output, otherwise in the event of a mains failure the RAM may be inoperative.

Alarm connections

A 9 pin D-type connector with solder points is provided with the RAM. This connector fits into the 9 pin socket on the back of the RAM and should be cabled to the Interface Board (4590055 P), fitted to the UPS, using 9 core, 0.22 mm. (minimum) shielded cable as shown. The maximum recommended distance is 100 meters.

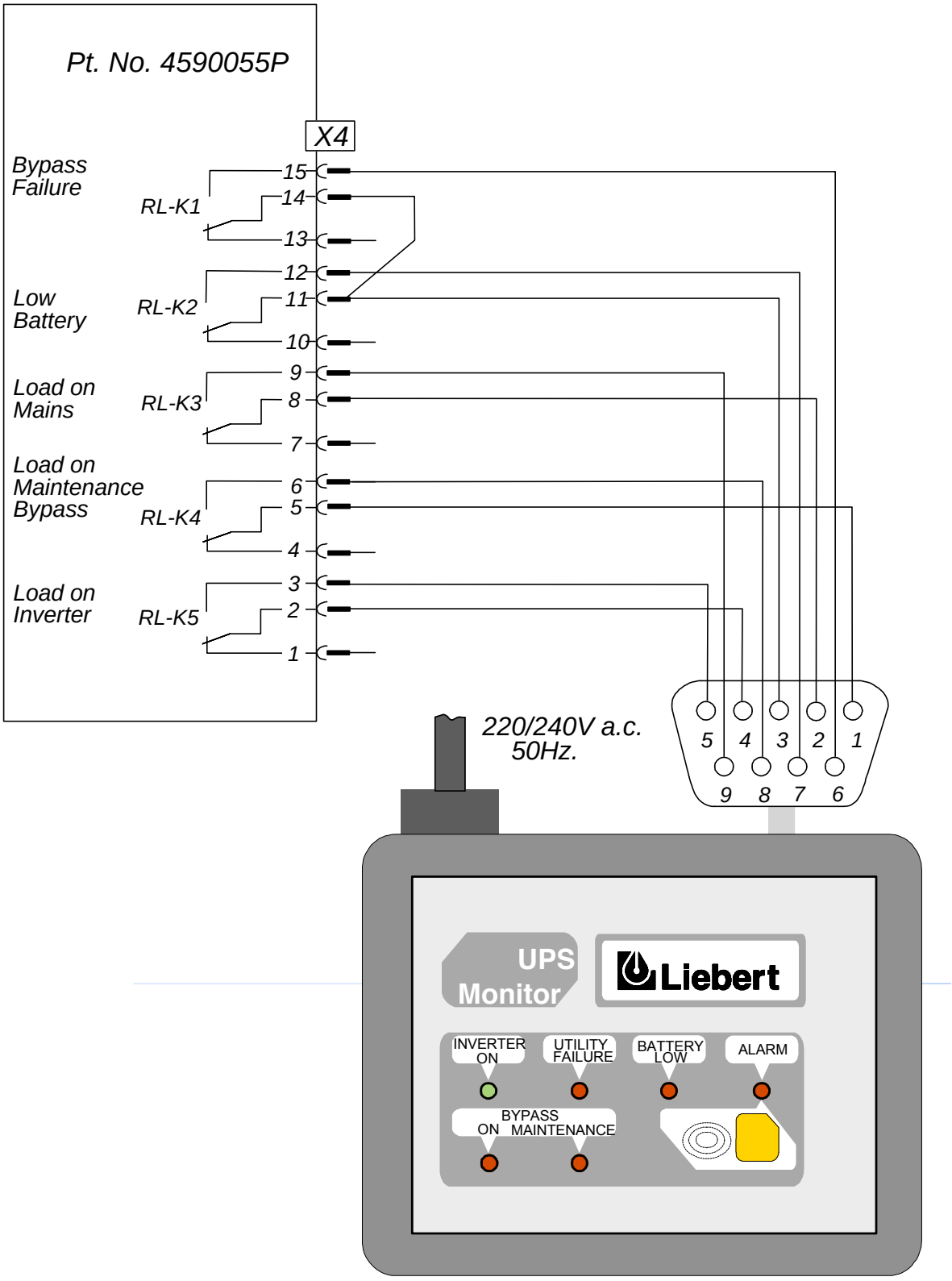


Figure 4-E . Remote Alarm Monitor connection details

4.5 Battery cabinets

WARNING

Only qualified personnel should install or service batteries.
A battery can present a risk of electric shock or burns from high short circuit currents.
Eye protection should be worn to prevent injury from accidental electrical arcs.
Remove rings, watches and all metal objects.
Only use tools with insulated handles.
Wear rubber gloves.
If a battery leaks electrolyte, or is otherwise physically damaged, it should be replaced and stored in a container resistant to sulphuric acid and disposed of in accordance with local regulations.
If electrolyte comes into contact with the skin the affected area should be washed immediately.
Batteries MUST be disposed of in accordance with local environmental laws.

Three types of cabinets are available for 38 Ah, 50 Ah and 85 Ah batteries. The cabinets have the same height, width and design as the UPS and can be installed on either side of the UPS.

The cabinets are equipped with an automatic circuit-breaker, with magnetic overcurrent protection and undervoltage tripping, controlled from a special board (part no. 4520067T) mounted inside the battery cabinet.

This circuit-breaker has the following features:

- cabinet insulated for safety
- short-circuit protection
- circuit-breaker automatic opening when the Inverter is locked out due to battery undervoltage, thus avoiding damaging discharges to the battery
- circuit-breaker remote breaking action using the emergency stop button, if installed
- protection against operating errors (closing the circuit-breaker with the rectifier disabled)
- protection against battery cabinet and UPS connection errors (polarity reversal +/-)

The cabinets have the following part numbers:

- part no. 5320031 P for 12V/38 Ah batteries with 100 A circuit-breaker
- part no. 5320032 Q for 12V/50 Ah batteries with 100 A circuit-breaker
- part no. 5320038 W for 12V/85 Ah batteries with 160 A circuit-breaker

The cabinets can be supplied with batteries already installed or empty.

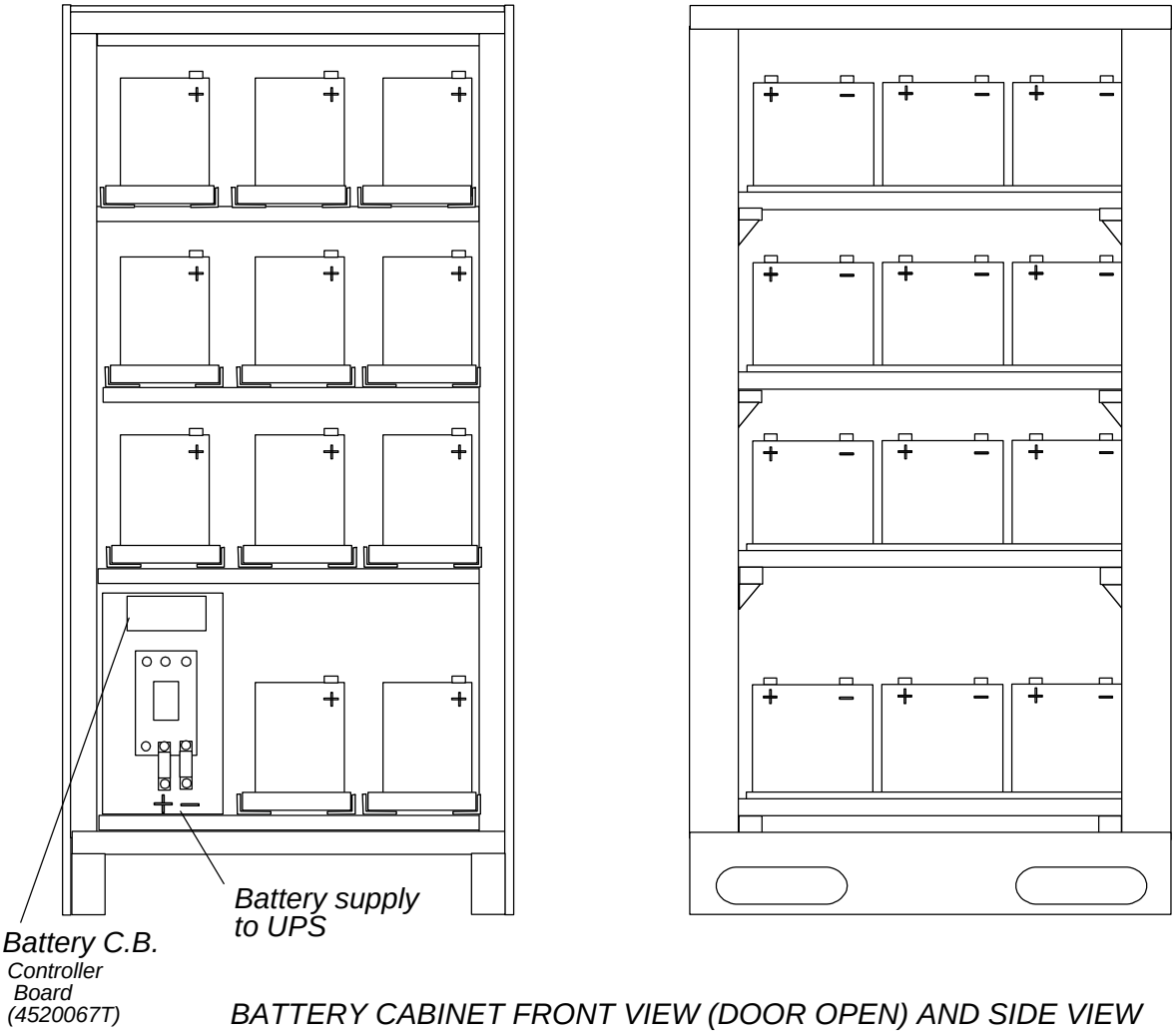
Cabinets with batteries already installed.
These cabinets are shipped with open connections between the shelves. Since it may be necessary to remove the rear panel, these connections **must be** made **prior to positioning**. These are indicated in figures 4-7, 4-9, 4-11 and 4-12.

Note The continuous voltage value, and therefore the number of battery blocks, depends on the value of the mains input and output voltages (see Electrical data - Chapter 8). Figures 4-7, 4-9, 4-11 and 4-12 indicate the maximum equipment layout (34 single 12 V blocks for 415V input/output voltage); they also indicate the single blocks positions which are not installed for mains voltage of 400V (33 single blocks) or 380V (32 single blocks).

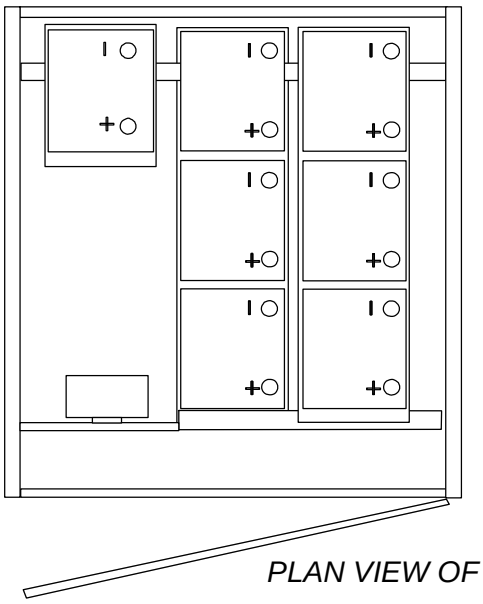
Empty cabinets.
In this case, the installation must be performed by qualified personnel.
Figures 4-6, 4-8 and 4-10 provide examples of the layout for the three types of cabinets. Due to the different dimensions of the single blocks, type and position of the terminals, these examples should be used as a general guide.

Battery manufacturer or supplier instructions must be referred to.

Auxiliary connections
The auxiliary connections between UPS and battery circuit-breaker control board are illustrated in figure 4-13.



BATTERY CABINET FRONT VIEW (DOOR OPEN) AND SIDE VIEW



PLAN VIEW OF BATTERY CABINET BOTTOM ROW

Figure 4-F . 38 Ah Battery cabinet

Battery Assembly and Layout

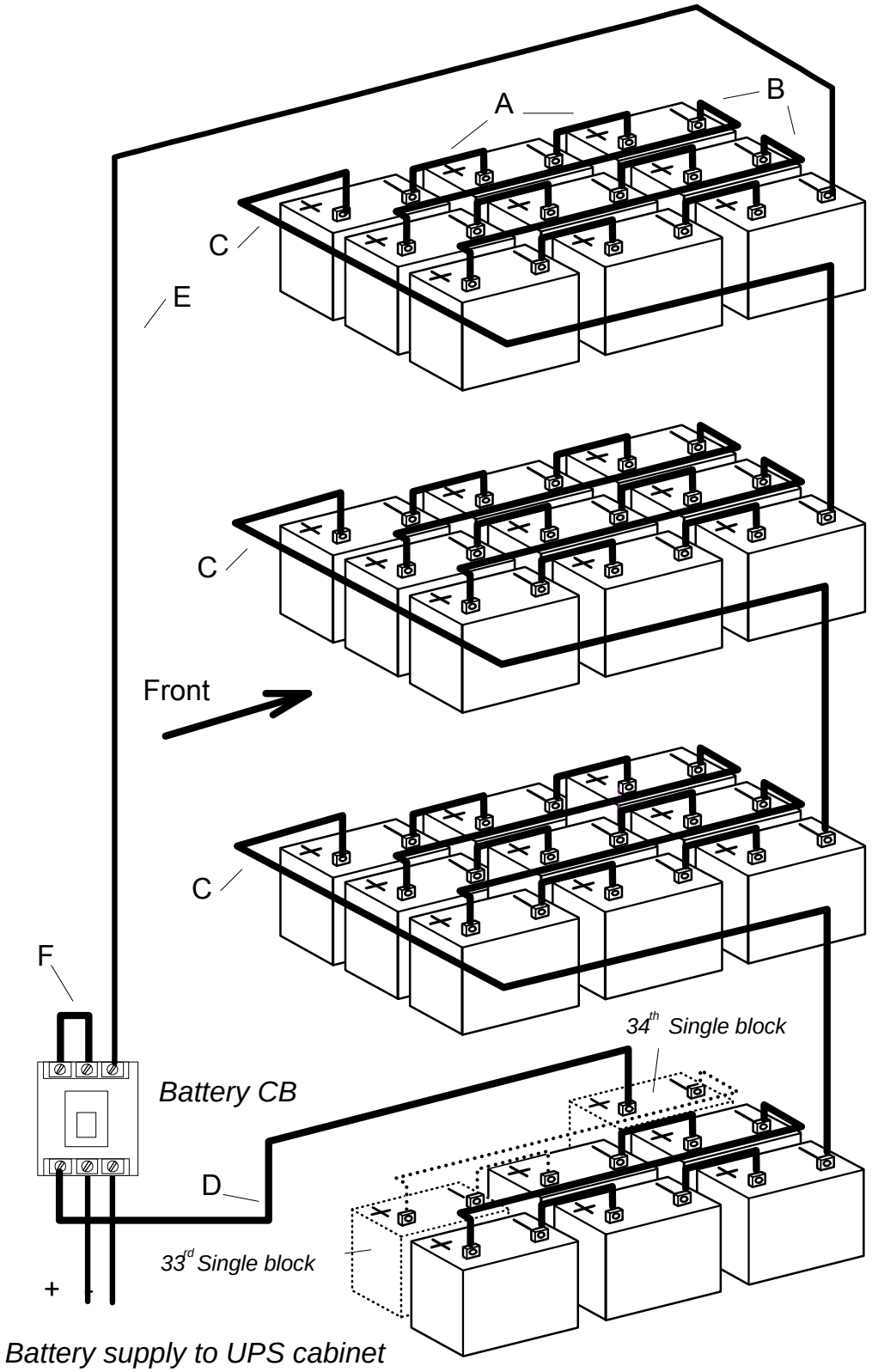
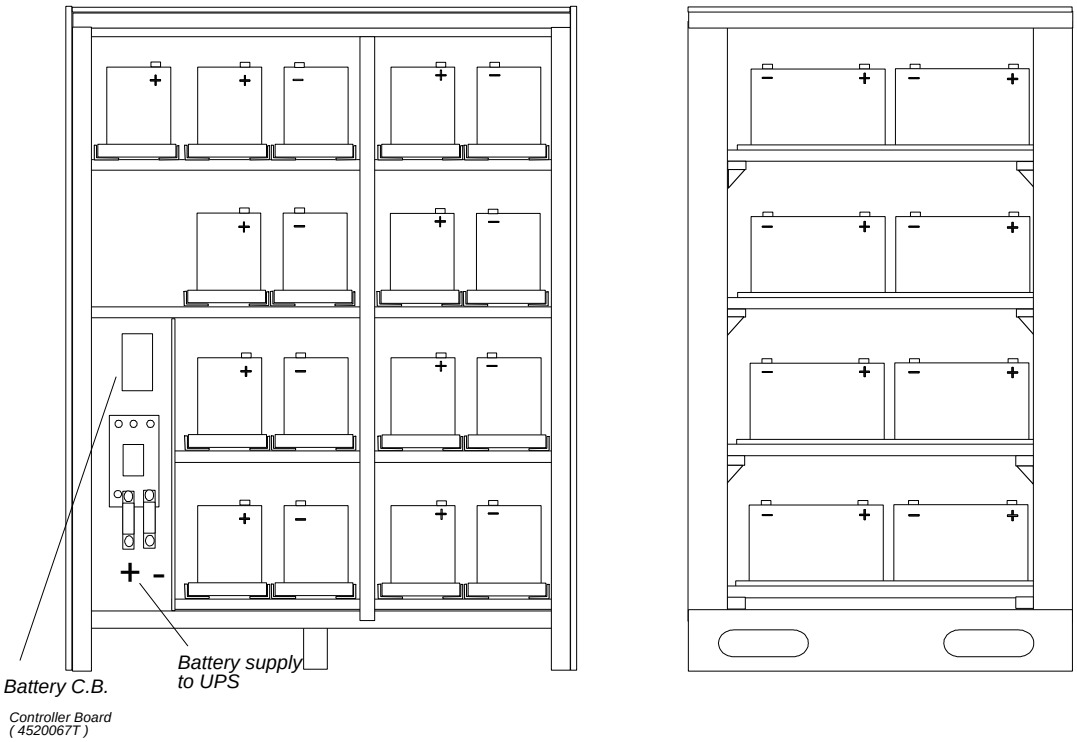
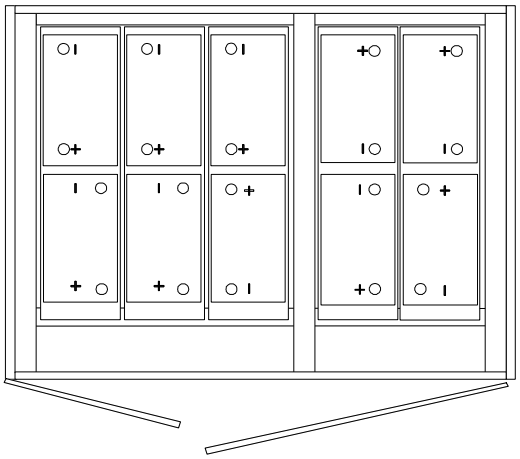


Figure 4-G . 38 Ah Battery cabinet

(C) = connections to be made during installation



BATTERY CABINET FRONT VIEW (DOORS OPEN) AND SIDE VIEW



PLANT VIEW OF BATTERY CABINET TOP ROW

Figure 4-H . 50 Ah Battery cabinet

Battery Assembly and Layout

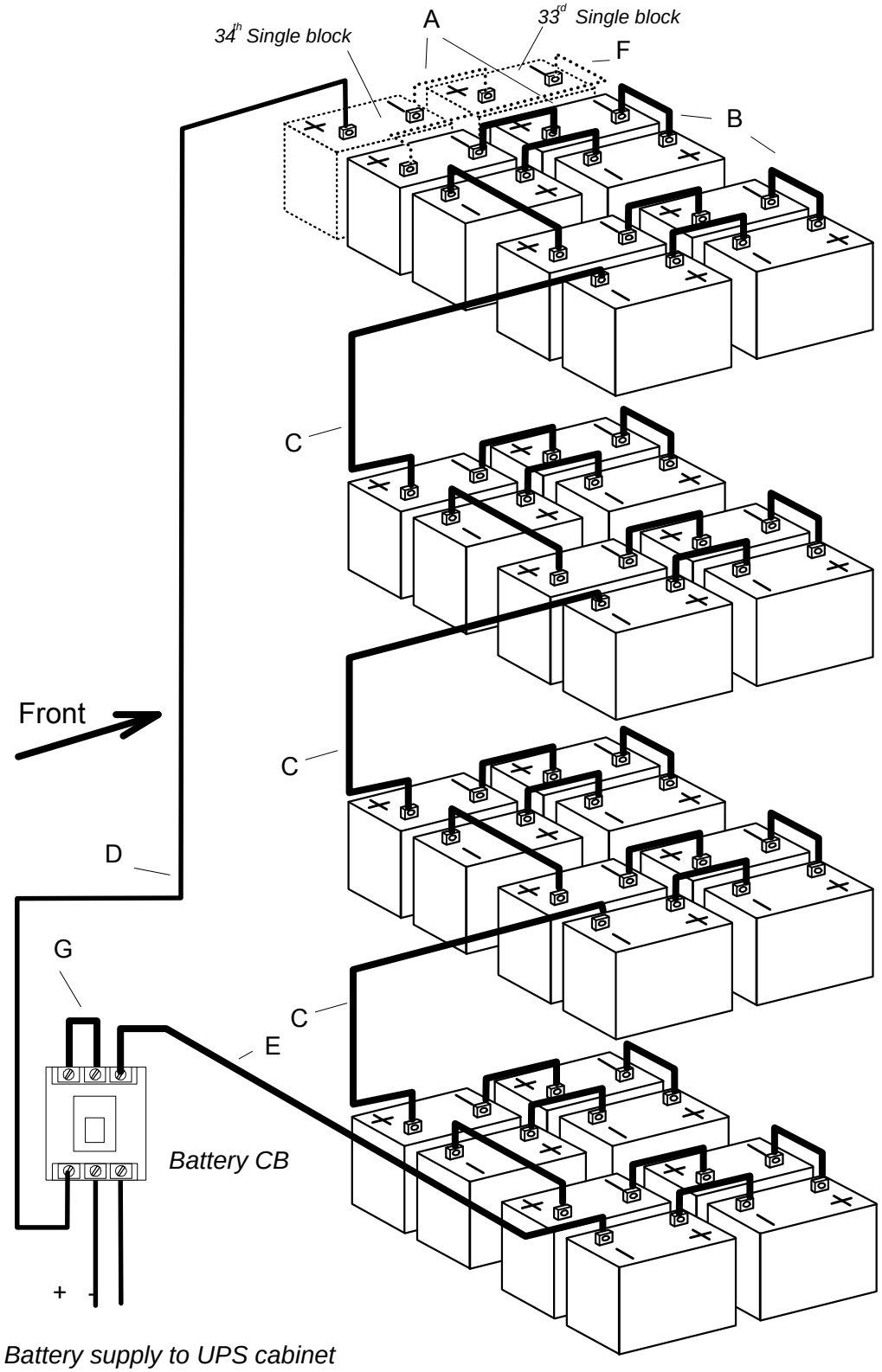
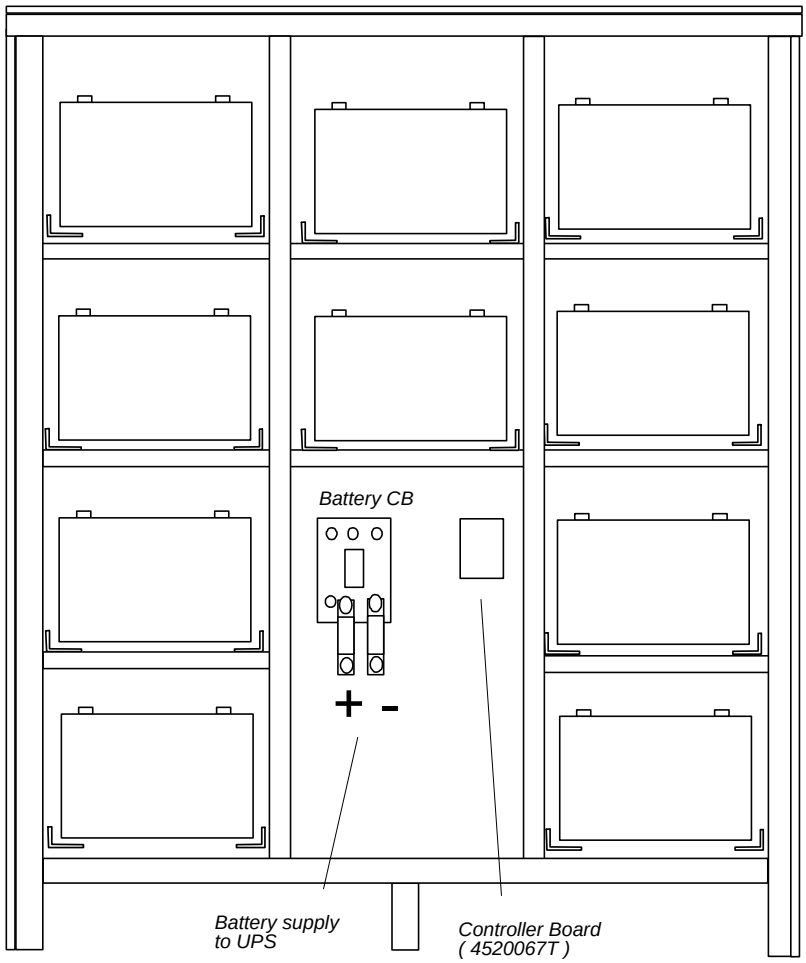
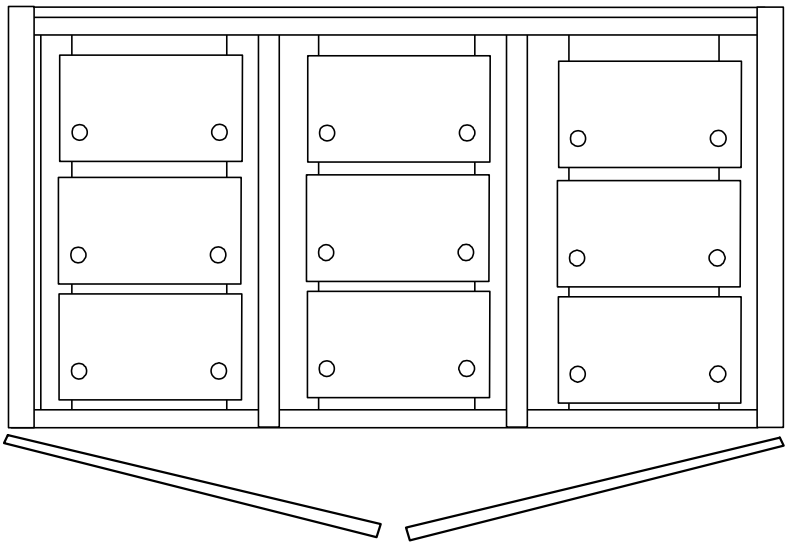


Figure 4-I . 50 Ah Battery cabinet

(C) = connections to be made during installation.



BATTERY CABINET FRONT VIEW (DOORS OPEN) AND SIDE VIEW



PLANT VIEW OF BATTERY CABINET TOP ROW

Figure 4-J . 85 Ah Battery cabinet

Battery Assembly and Layout

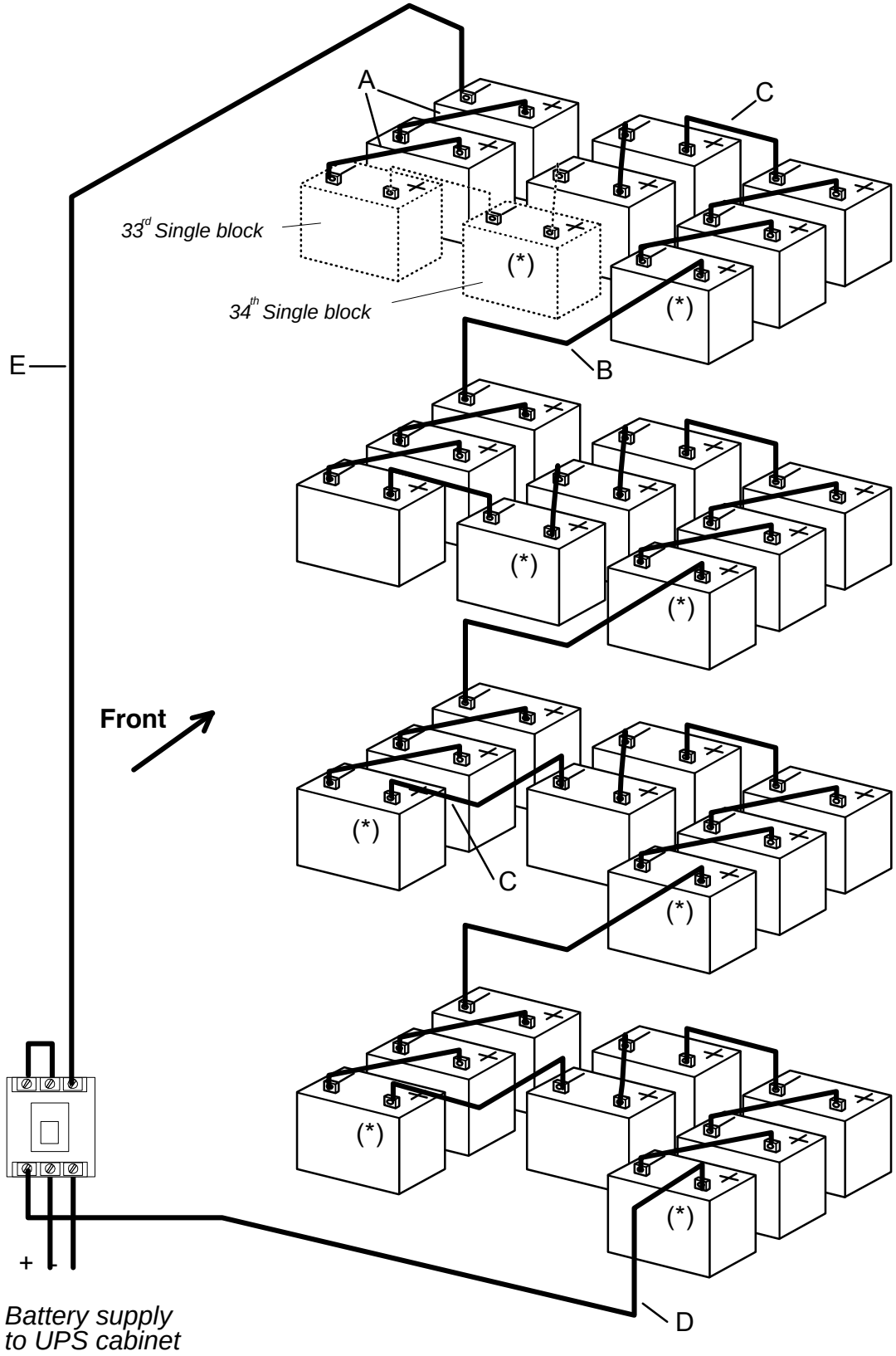


Figure 4-K . 85 Ah Battery cabinet

*(*) = connections to be made during installation.*

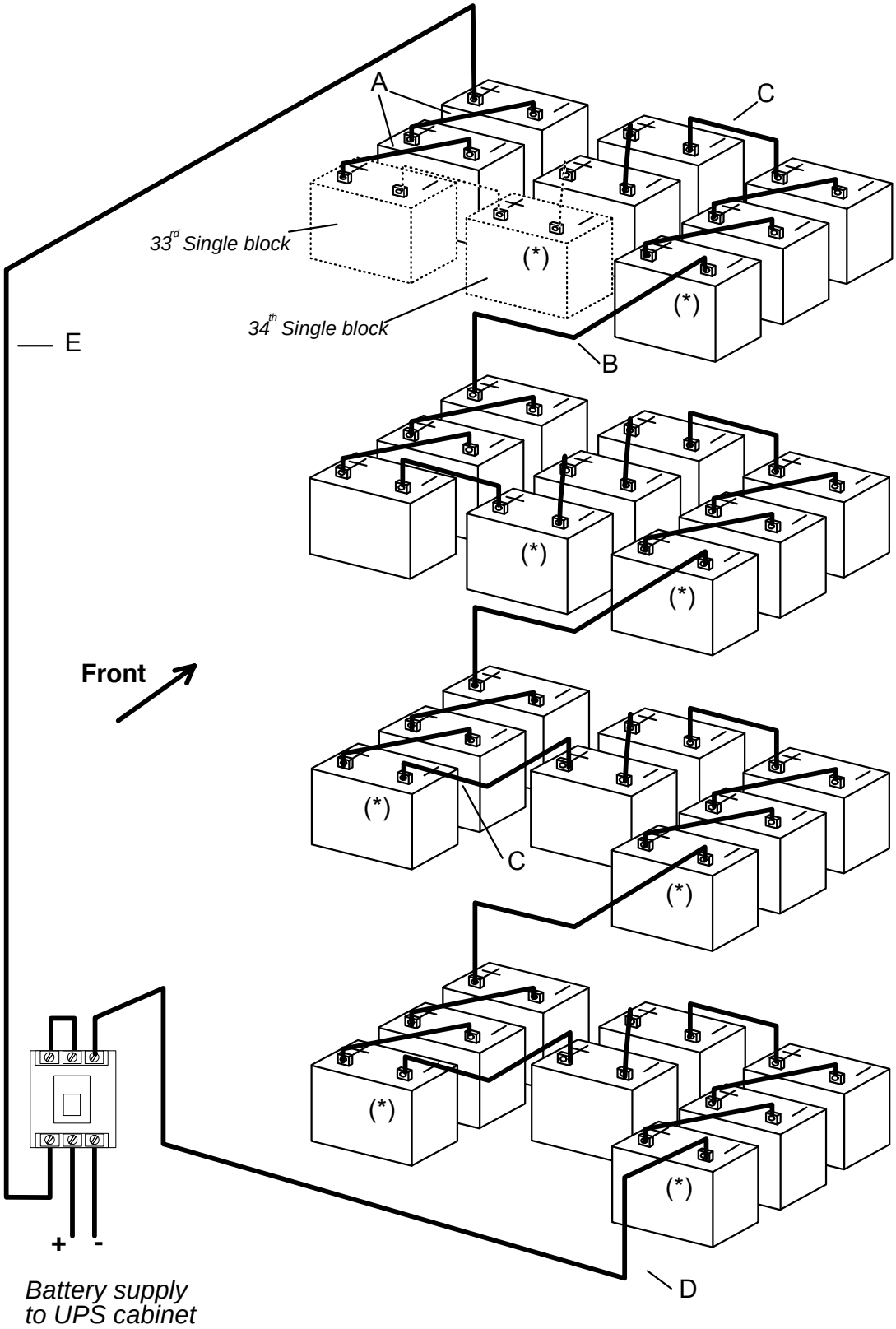


Figure 4-L. 85 Ah Battery cabinet

*(*) = connections to be made during installation.*

4.6 Battery circuit breaker boxes

The boxes contain a battery isolating circuit-breaker and the Control board part no. 4520067 T as also mounted in the Battery Cabinets.

The circuit-breaker boxes are designed for wall mounting, when the circuit-breaker is not installed in special cabinets, and must be located near the battery.

An earth connection must be provided.

Two boxes are available depending on the UPS power rating:

- part no. 4641027 B with 100 A Circuit-breaker for 30 - 40 kVA UPS.
- part no. 4641028 C with 160 A Circuit-breaker for 60 kVA UPS.

The circuit-breaker includes magnetic overcurrent protection and an undervoltage tripping release. It offers the following features:

- battery isolation for safety
- short-circuit protection
- circuit-breaker automatic opening when the Inverter is locked out due to battery undervoltage, thus avoiding damaging discharges to the battery
- circuit-breaker remote breaking action using the emergency stop button, if installed
- protection against operating errors (closing the circuit-breaker with the Rectifier disabled)
- protection against Battery cabinet and UPS connection errors (polarity reversal +/-)
- Figure 4-13 indicates the connections between the UPS and the Battery circuit-breaker Box.

4.6.1 Temperature Sensor Board (4532029 V)

With this feature fitted and enable the nominal float voltage supplied to the battery is adjusted so as to be inversely proportional to the ambient battery cabinet/room temperature (as monotored by a remote temperature sensor). This prevents the battery being over charged at high ambient temperatures.

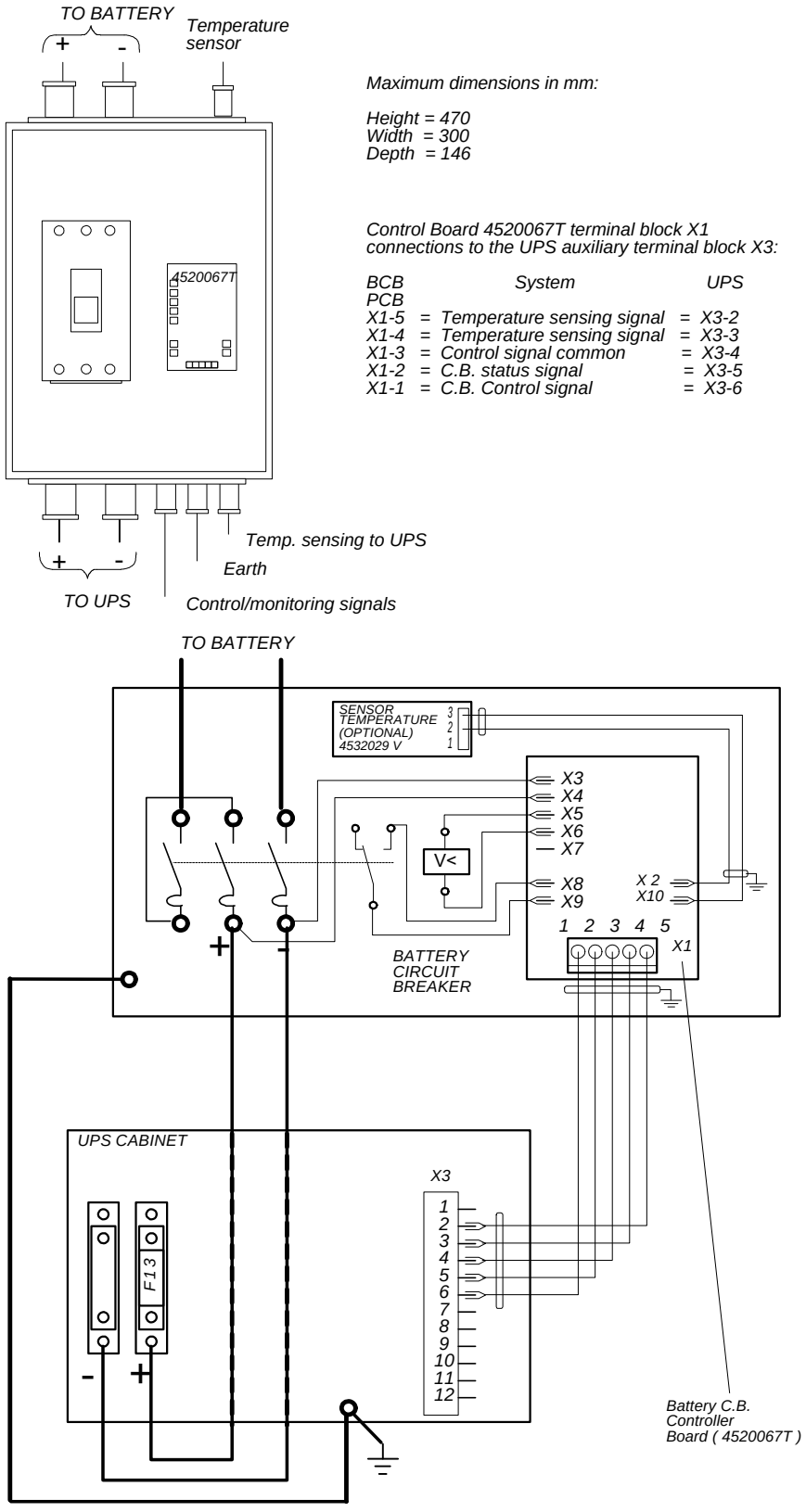


Figure 4-M . Connections and layout of the battery circuit-breaker box

4.7 Input Harmonic filter

4.7.1 Introduction

An optional input harmonic filter can be added to the 7200 series UPS to improve the UPS input power factor and reduce the amount of electrical noise reflected into the input three phase supply.

The filter components are contained within the UPS cabinet therefore extra cooling is required (see figure 4-15). The filters are matched to the UPS capacity, resulting in different part numbers for each system as follows:

30 kVA filter	4641015 P
40 kVA filter	4641016 Q
60 kVA filter	4641017 R

4.7.2 Specification

Input voltage	380-400-415, three phase
Input voltage tolerance	±10%
Nominal frequency	50 Hz
Input frequency tolerance	± 5%
UPS input current distortion	10% max.
UPS input power factor	>0.9

4.7.3 Notes on connection

This option is normally factory fitted with the harmonic filter becoming an integral part of the UPS as shown in the block diagram figure 4-14 and the component location diagram figure 4-15. Therefore, connection of the input power supplies does not change from that given in chapter 3.

Note: The input Neutral connection must always be connected to the bypass input `N3' on the UPS.

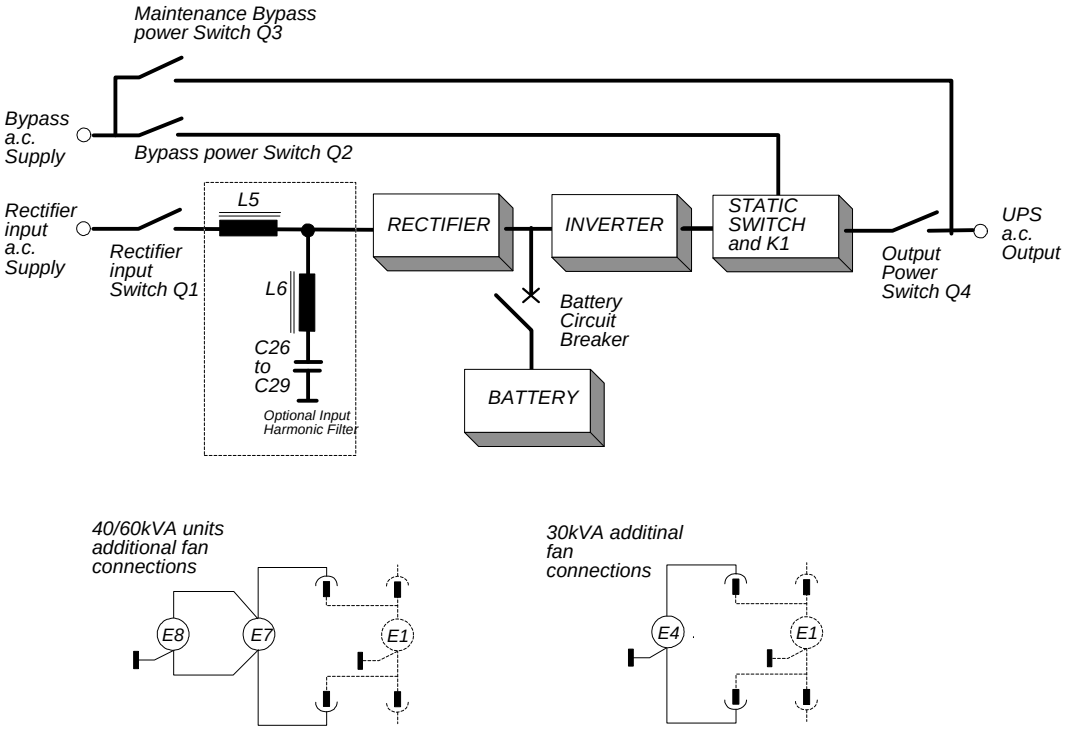
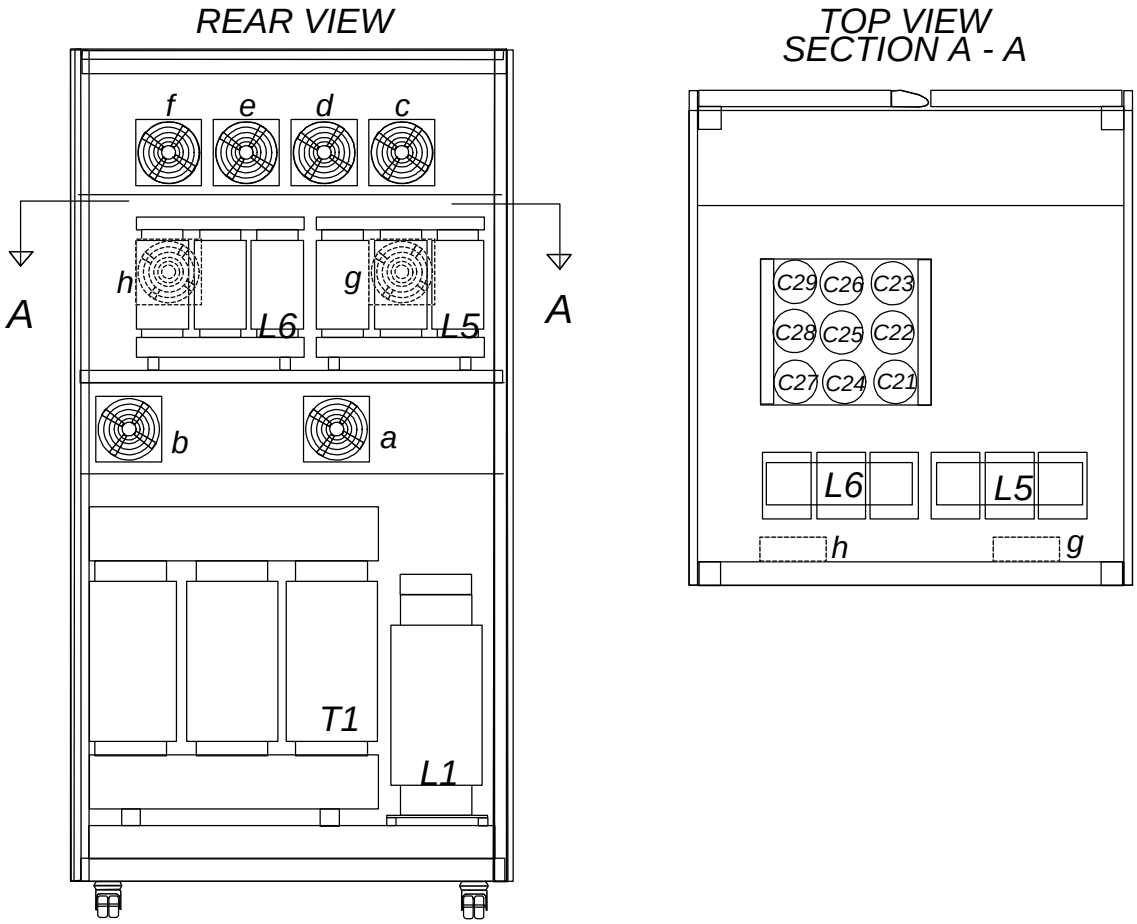


Figure 4-N . Block diagram of Input Filter and UPS



Fans (g) and (h) are additional when the input harmonic filter is fitted.

Figure 4-O . Harmonic filter component part locations

The two couples of fuse-holders F6-F7 and F8-F9 must be replaced by the two automatic switches included in the kit. Replace also label on fuse-holders.

Model	Fan Ident from Diagram							
	a	b	c	d	e	f	g	h
30 kVA	E1	-	-	-	E2	E3	E4	-
40 kVA	E1	E2	E3	E4	E5	E6	E7	E8
60 kVA	E1	E2	E3	E4	E5	E6	E7	E8

4.8 Communications Kits (4645102 U)

The Communications kits offer the necessary cable assembly and fixings for connection into the communications socket (X8) on the operator logic board (part no. 4550005F) to a DB25 male connector (X4), located adjacent to the cable access panel as shown in figure 4-1.

Using the wiring configurations shown in figure 4-17 the UPS can be connected to either a personal computer or a modem.

See manual included in the kit.

Caution

Note: *The communications wiring for this option must be kept separate from the power wiring. This is to maintain the integrity of `Safety Extra Low Voltage' (S.E.L.V.) circuits*

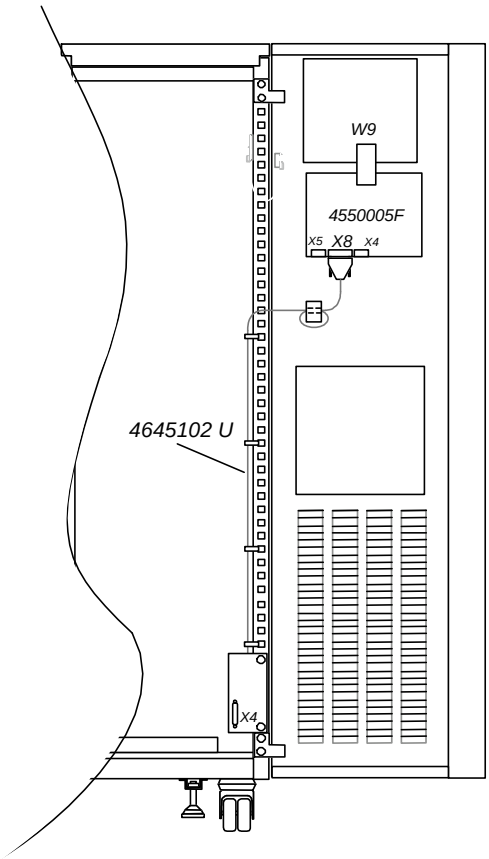
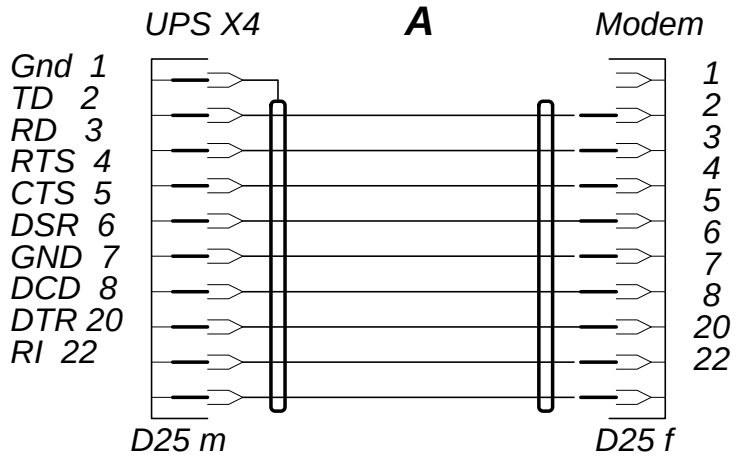
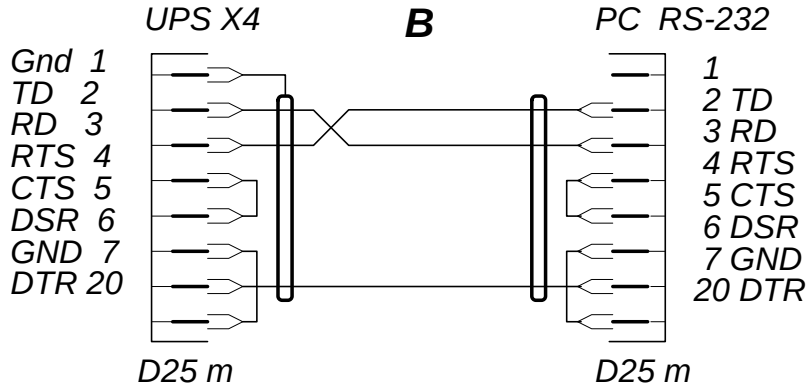


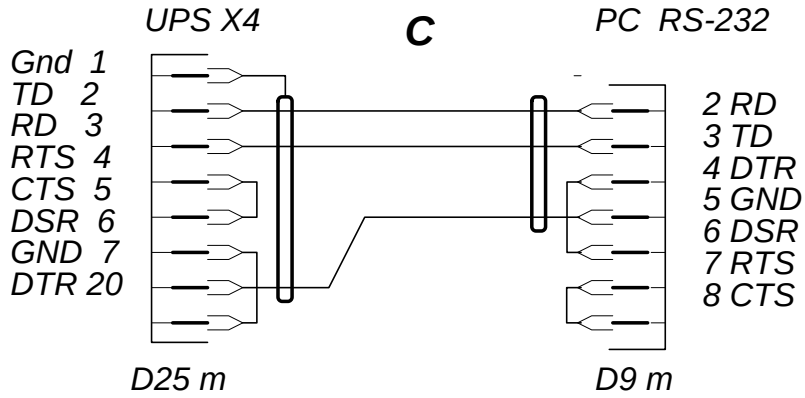
Figure 4-P . Installing the RS232 communication cable



Wiring details for connections of UPS to Modem via DB25 socket



Wiring details for connections of UPS to Personal Computer via DB25 socket



Wiring details for connections of UPS to Personal Computer via DB9 socket

Figure 4-Q . RS232 connections to PC or Modem

5. Chapter 5 - Maintenance

5.1 Introduction

This chapter contains the procedures necessary to effect general maintenance of the UPS module and battery. Certain procedures entail gaining internal access to the UPS, and should only be undertaken by a competent engineer who is familiar with the operation and layout of the equipment and understands the areas of potential hazard. If you have any doubts concerning safety or the method of carrying out any procedure then contact an approved service agent for assistance or advice. If the locally approved agent is not known to you, then you should contact the Customer Services & Support department at the address shown at the front of this manual.

The manufacturer offers customer training, at a nominal fee, if required. Such training can range from a one-day operator course to in-depth training on maintenance and troubleshooting lasting several days, and can be carried out at the manufacturer's plant or at the customer premises.

5.2 Safety Precautions

When working on the UPS remember that the equipment contains live voltages at ***ALL TIMES*** unless it is *externally* isolated from the mains supply, bypass supply and batteries. It is essential that the safety and precautionary notes contained throughout this manual are read and ***FULLY UNDERSTOOD*** before touching any UPS internal component part.

5.3 Scheduled Maintenance

The UPS utilizes solid-state components which are not subject to wear, with the only moving parts being the cooling fans. Scheduled maintenance requirements, beyond ensuring that the environmental conditions remain suitably cool and clean, are therefore minimal. However, a well documented periodic program of inspection and preventive maintenance, as suggested below, will help to ensure optimum equipment performance and may serve to detect certain minor malfunctions prior to them developing into a major fault. To monitor the various parameters follow the instructions shown in paragraph 5.4.

5.3.1 Daily checks

Carry out a daily walk-by inspection of the UPS, checking the following points:

1. Carry out a spot check of the operator control panel; ensuring that all mimic LED indications are normal, all metered parameters are normal and no warning or alarm messages are present on the display panel.

2. Check for obvious signs of overheating.

3. Listen for any noticeable change in audible noise.

4. Ensure that the ventilation grills around the UPS are unobstructed.

5. If possible, log the results of the inspection, noting any discrepancies from the norm.

5.3.2 Weekly checks

Carry out the following checks from the mimic panel and log the results:

1. Measure and record the battery charge voltage.

2. Measure and record the battery charge current.

3. Measure and record the UPS output voltage on all three phases.

4. Measure and record the UPS output line currents. If these are significantly different from the values previously logged then, if possible, record the size, type and location of any additional load connected to the UPS supply since the previous inspection. This type of information could prove useful to the troubleshooting engineer should a problem occur.

If any of the above indications differ greatly from the previously logged values for no apparent reason then you should contact the Customer Service & Support Department at the address given at the front of this manual for advice.

5.3.3 Annual Service

The equipment should be thoroughly cleaned and the following checks carried out annually. This entails working inside the equipment in regions containing hazardous voltages.

A manufacturer-trained engineer is fully aware of the hazards concerned and will carry out this procedure with the load connected to the maintenance bypass supply; however if the customer decides to carry out this service procedure himself it is imperative that the UPS be totally shut down and isolated from the input mains and bypass supplies and batteries using the procedure given below. We therefore strongly recommend that the annual service is carried out by trained personnel.

1. Carry out the weekly checks detailed above.

2. Shut down the UPS following the recommended operating procedure.

3. Isolate the UPS input mains supply externally (also the bypass supply if a split bypass system is in use) and isolate the battery.

4. Ensure that the UPS is totally powered down by checking for voltage at the rectifier input connections (U1, V1 & W1), the battery connection terminals, the output connections (U2, V2 & W2) and the bypass input connections (U3, V3 & W3).

5. Gain full access to the UPS interior by opening its internal hinged safety panel.

6. Carry out a thorough examination of the UPS power components and sub-assemblies, paying particular attention to the following:-

   Electrolytic capacitors - Check for signs of leakage, buckling etc.

   Magnetic components - Check for signs of overheating, security of fixture and signs of delamination.

   Cables and connections - Check cables for chaffing, fraying or signs of overheating. Check that all printed circuit board connectors are secure.

   Printed circuit boards - check the cleanliness and integrity of the circuit boards and replace if any signs of deterioration are found.

7. Thoroughly clean inside the equipment enclosure using a vacuum cleaner and low pressure air to remove any foreign debris.

8. Reconnect the UPS input mains power.

9. Start the UPS and transfer the load to the inverter following the appropriate operating procedure.

10. If possible, check the battery autonomy time by opening the rectifier input power switch (Q1) with the UPS on-load. Close the rectifier input power switch (Q1) immediately the dc busbar voltage falls within 5 volts of the battery end of discharge voltage. (note the end of battery discharge is assumed when the battery voltage falls to 320V d.c. for a 380V a.c. system; 340V d.c. for a 400V a.c. system; 340V d.c. for a 415V a.c. system). At this voltage the battery circuit breaker will trip and the load will transfer to bypass. Ensure that the available battery autonomy time meets the installation specifications.

5.3.4 Extended service

We recommend that ALL the input/output power cables and their connections are checked periodically. As this requires the UPS to be *completely* shut down such a check should be carried out on an `opportunity' basis but at an interval not exceeding 2 years.

5.3.5 Battery maintenance

The batteries used with the UPS are generally sealed, valve-regulated type, and the only maintenance requirement is to ensure that the cells are kept clean and dry. Maintenance procedures appropriate to both valve-regulated and non-sealed batteries vary, and should be obtained from the battery manufacturer.

5.4 UPS status parameters

The value of the status parameters are displayed on the LCD screen by selecting options from the windows reached via the measurement option on the main screen (see figure 5-1 menu map). Under normal circumstances the default window will be displayed:-

```
   NORMAL OPERATION

11.16.10    01.05.97
```

From the default window press ENTER to display the main access screen:

```
> MEASUREMENT       <
  FUNCTION
  MAINTENANCE
  SETUP
```

The cursor will be aligned with the MEASUREMENT option, once again press ENTER.

Note: The menu options FUNCTION, MAINTENANCE and SETUP are only accessible with a password, but for general maintenance procedures these options are not required.

```
  OUTPUT
  INPUT
  BATTERY
> TEMPERATURE       <
```

With reference to figure 5-1 and by using the DOWN and ENTER keys all the parameters monitored from the operator control and display panel can be viewed. For example to view the system temperatures use the DOWN key until the cursors are opposite TEMPERATURE; now press the ENTER key.

```
   TEMPERATURE   [C]
Tt + 27,4  To  +25,4
Ta + 22,6  Tb  +20,7
```

The TEMPERATURE screen is displayed where:-

Tt is transformer temperature
To is UPS cabinet outgoing temperature;
Ta is ambient temperature;
Tb s battery cabinet temperature.

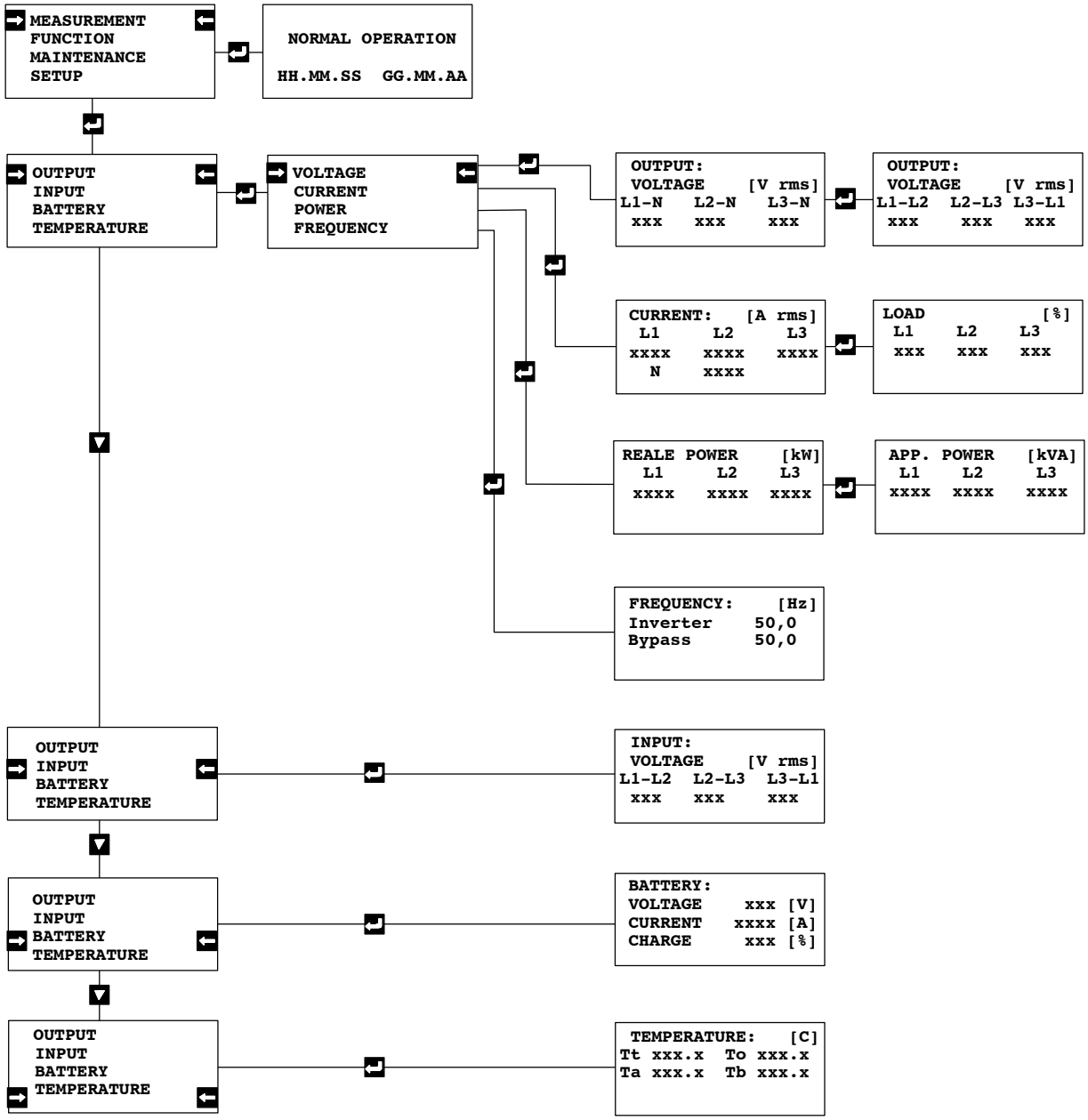


Figure 5-A . Parameter access menu map

6. Chapter 6 - Trouble shooting

6.1 Trouble shooting UPS Systems

The UPS contains complex electronic control circuits that require a firm understanding in order to carry out comprehensive fault diagnosis and repair of the equipment. The following information aims to provide a trained user with sufficient knowledge to understand the nature of a fault through the correct interpretation of the accompanying alarms and indications, and to carry out any necessary first aid repair action.

WARNING

Some of the instructions in the charts at the end of this chapter involve checking internal fuses. This should be undertaken (after the equipment has been shut down) only by a trained electrician who is familiar with the layout and operation of the equipment and fully conversant with the areas of potential hazard.

6.1.1 Operating parameters and limitations

Most UPS problems do not emerge as a gradual performance degradation; generally the UPS either works correctly or it will shut down - and transfer the load to the bypass supply if applicable. However, it is important to maintain a regular record of the UPS meter indications, as suggested in the maintenance instructions, in order that any change in the system or load characteristics are readily identified.

In general, the output voltage should be within 2% of nominal. If the UPS has not operated on battery power within the previous ten hours the battery charge current should be typically less than 6A.

If any indication differs significantly from the typical figures given above the cause should be investigated.

Information concerning prevailing load conditions can prove useful when discussing problems with the service agent - for example, details of any particular load being started or shed at the time that the fault occurred.

6.1.2 General Trouble shooting Procedure

Trouble shooting should be carried out methodically using the following guidelines:-

Fault Identification

When first summoned to the scene of a UPS fault, your immediate action should be to observe and record the displayed messages, mimic indications and the position of the UPS power isolator switches. This should be completed before you touch any switch.

Corrective Action

When all the indications have been noted, you should refer to the following fault interpretation charts and carry out the actions detailed against any led whose status is abnormal. If you are unsure as to how to undertake the actions detailed - or if several led indications are abnormal and you are unable to distinguish between the likely cause and affects - then seek immediate assistance from an approved service agent.

Fault Reporting

Irrespective of whether fault rectification is successful or not, report the fault occurrence to the nearest service agent who will then forward the details to the manufacturer. This type of customer feedback is an important factor in maintaining high product reliability, and also provides important data concerning the equipment field performance.

Caution

The following diagnostic charts are designed for 'first aid' trouble shooting only. If a problem cannot be resolved by taking the actions given then fully trained assistance should be sought immediately.

Do not under any circumstances make internal circuit adjustments or interfere with the circuit boards in any other way.

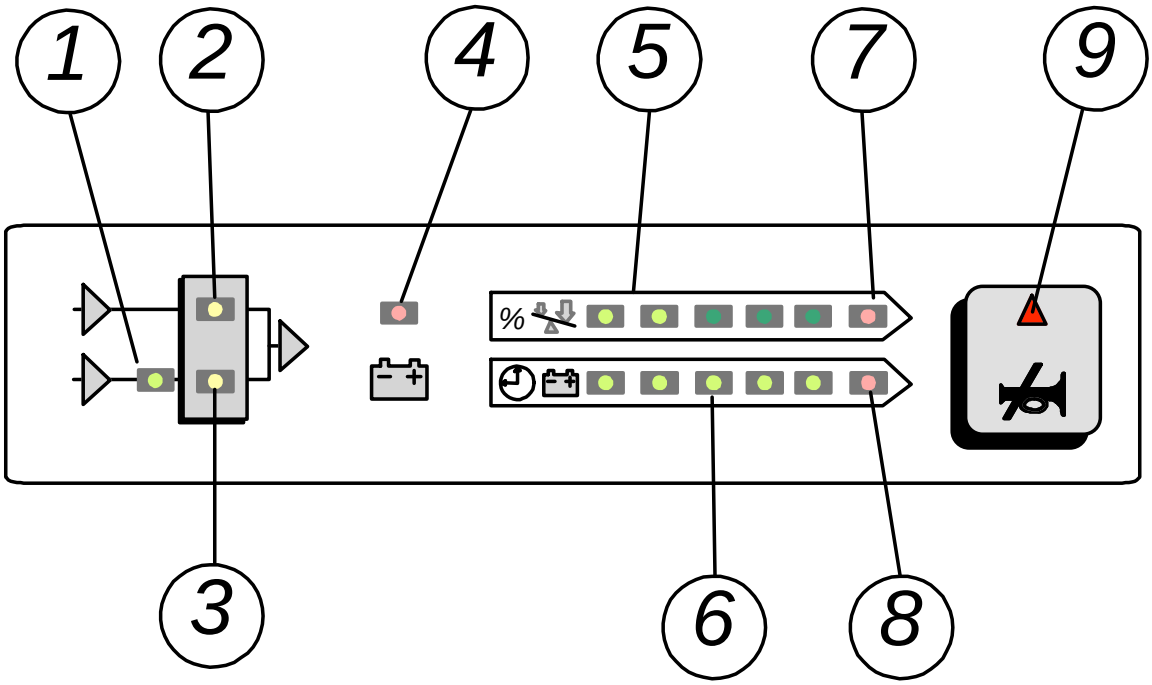


Figure 6-A . Details

6.2 LED interpretation

The Item number refers to the details shown in figure 6-1.

ITEM NUMBER	NORMAL STATE	INTERPRETATION - ACTION
1	ON	If this green led is OFF it signifies a problem with the bypass input a.c. Check the following: a) Bypass input power switch Q2 is closed. b) Input supply voltage is within 10% of nominal. c) Power supply fuses are OK - LS1, LS2 on the a.c. Power Supply board will extinguish if either fuse is ruptured. If the above checks prove unsatisfactory then seek qualified assistance.
2	ON	If this green led is OFF it signifies that the inverter is not producing its correct output voltage. Check the following: a) If [OVERTEMPERATURE] or [OVERLOAD] alarm messages are active then (after allowing the UPS to cool / checking that the load current on the bypass line is not excessive) press the reset switch (S1) on the UPS Logic Board. b) If the d.c. busbar is below 320V d.c. for 380 V a.c. system, 330V d.c. for 400 V a.c.. system or 340 V d.c. for a 415 V a.c. system then do the checks as per `Rectifier Block'- input failure items 15,16,17 & 18 in the following table c) If the inverter works OK when mains is available but not when mains is unavailable then check the battery power fuse F13. If the above checks prove unsatisfactory then seek qualified assistance.
3	OFF	If this yellow led is ON (flashing) then it signifies that the load has been transferred to the static bypass supply. If this is an automatic change over it will be accompanied by a fault warning on the display panel: take the appropriate actions for the display indication (see Display alarm message table).
4	OFF	If this yellow led is ON it signifies that the battery is not available. This could be due either to the battery circuit breaker being open or that the d.c. busbar voltage is below the figures stated in (2) above. The battery circuit breaker will open automatically if the d.c. voltage falls below these levels. Check the following: a) Battery circuit breaker is closed. b) DC busbar voltage — if not above 320V then carry out checks as per 1 (mains failure) above. If the d.c. busbar voltage is greater than 320V but you are unable to close the battery circuit breaker then seek qualified assistance. c) If the battery circuit breaker trips as soon as mains power is disconnected then check the battery power fuse (F13).
5	N/A	This is a bar graph indicating the % of the total load that is being applied to the system under normal running conditions several of these LEDs would be ON.
6	N/A	This is a bar graph indicating the battery charge state and would normally have four or five of the LEDs ON. When the unit runs on battery, this bargraph changes to give an indication of the time remaining on battery as 2 minutes per led.
7	OFF	If this yellow led is ON it signifies that the applied load has exceeded the maximum. It will be accompanied by all five load bargraph LEDs being ON (item 5), the Alarm warning indication flashing RED(item 9) and an OVERLOAD message on the visual display. This will be accompanied by an audible warning. Reduce the load immediately.
8	OFF	If this yellow led is ON it signifies that the battery voltage is low and that the end of battery discharge is near (normally two minutes). This will be accompanied by an audible warning
9	OFF	This red LED will flash on and off and indicates that the UPS has detected a fault, it will be accompanied by a message on the display panel, take the required actions for the display panel message (see Display alarm message table). This will be accompanied by an audible warning.

6.3 Display panel message interpretation

The messages displayed on the 7200 can be categorized into two types; (a) ALARM messages these are messages which need urgent attention and warn of a UPS shutdown or imminent shutdown the load would normally transfer to the bypass supply if it is available. All alarm messages are accompanied by an audible warning. (b) WARNING messages these are messages generated to warn or confirm to the operator of actions taken (i.e. if the rectifier a.c. input supply power switch was opened the Warning message would read RECTIF. SWITCH OPEN).

The following table lists the various messages displayed on the operator panel together with a description of their interpretation.

	DISPLAY ALARM MESSAGES	INTERPRETATION
1	EMERGENCY STOP	This alarm indicates that the UPS was shut down by means of the local or remote (if fitted) Emergency Power Off push button (EPO) which is normally due to operator action - investigate why the emergency power off push button was pressed. If the emergency power off push button was not pressed then check the continuity of the circuit to the remote switch. Customer connections; auxiliary terminal block X3; pins 10 and 11; normally closed.
2	INV.: OFF	The INV.: OFF alarm is active whenever the inverter is not producing its correct output voltage; either because it has been switched OFF or due to an internal fault, it will normally be accompanied by one or more of the other inverter fault conditions.
3	INV.: OVERVOLTAGE INV.: UNDERVOLTAGE OUTPUT: NO VOLTAGE OUTPUT: WAVEFORM ERR	Most of the inverter fault messages are self explanatory however the WAVEFORM ERR. informs the operator that the output voltage peak has flattened caused by an internal inverter problem and therefore the output will be out of limits.
4	INV.: OVERTEMPER.	Over temperature is sensed by a normally-close thermostat (90^{o} C operating) fitted to each inverter heat sink. If an over temperature condition arises, the audible alarm will accompany this message: the inverter stops and load transfers to bypass after 3 minutes.
5	OVERTEMP. SHUTDOWN	This message informs the operator that the inverter has been switched off and that the load has been transferred to bypass due to an inverter over temperature.
6	OVERLOAD PRESENT	The inverter overload has an inverse load/time characteristic – i.e. it will accept 125% overload for 10 minutes and 150% for 60 seconds. If this characteristic is exceeded then the load transfers to the bypass supply, the inverter stops and the overload alarm annunciates. The [OVERLOAD PRESENT] alarm will annunciate as soon as the load exceeds 100% of the UPS rating,, and the load will transfer to bypass some time later –depending on the degree of overload present.
7	OVERLOAD SHUTDOWN	This message informs the operator that the load has transferred to bypass due to an inverter overload.
8	OUTPUT SWITCH OPEN	This is a status alarm. The output switch must be selected `CLOSED' at all times except when operating on the maintenance bypass supply
9	BYPASS SWITCH OPEN	This is a status alarm. The bypass input switch must be closed at all times.
10	BATTERY C.B. OPEN	This is a status indication only. Note that if the UPS is operating with the battery circuit breaker open and the mains power fails then the UPS output will also fail together with load power, since the inverter has no battery back-up.
11	BATTERY: FUSE FAIL	This problem should be rectified as soon as possible. If the mains power fails then the UPS output will also fail together with load power, since the inverter has no battery back-up.
12	BATTERY: TEST FAILED	The system has carried out a test of the battery. If this alarm is not accompanied by a [BATTERY C.B. OPEN] or [BATTERY: FUSE FAIL] message then a full check of the battery bank is required
13	DC BUS: UNDERVOLTAGE	When the inverter is operating on the battery this message is displayed when the battery voltage has fallen below a preset value. If the input a.c. power cannot be restored you should shut down your loads.
14	BATTERY: E.O.D.	Battery discharge has continued beyond a preset value. The inverter will have shut down, the system will attempt a transfer to bypass: if there is no bypass supply

	DISPLAY ALARM MESSAGES	INTERPRETATION
		available, any loads still connected will be without power.
15	RECT.: OFF	The RECT.: OFF alarm is active whenever the battery charger (rectifier) is not producing its correct output voltage; this can be caused by, an operator selection to off, an input supply failure, an open rectifier a.c. input power switch or an internal fault which may be accompanied by one of the fault conditions.
16	RECT.: SWITCH OPEN RECT.: CURRENT LIMIT BATTERY: FUSE FAIL DC BUS: FAST OVERVOL	Most of the rectifier fault messages are self explanatory however, the DC BUS: FAST OVERVOLTAGE message informs the operator the d.c. bus bar voltage is too high.
17	BYP: ABSENT BYP: OVERVOLTAGE BYP: UNDERVOLTAGE BYP: FREQUENCY ERROR	INPUT FAILURE: input a.c. supply failed or out of specified acceptable range. Do not switch OFF the inverter while this indication is active or the load will lose its power.
18	BYP: SCR FAILURE	One or more of the static switch SCR's has developed a fault. The bypass would not support the load in the event of a UPS failure, immediate action is required. Seek qualified assistance.
19	BYP: PHASE ROT.ERROR	This message informs the operator that the input power lines have been cross-connected and the phases sequence is incorrect.
20	CONTACTOR FAILURE	The contactor has not closed on load at the correct time: probably the load is on bypass, if allowable. Seek qualified assistance.
21	INV.: PARALLEL ERROR	This message has meaning only on paralleled 1+1 system: the parallel board has detected a wrong sharing of the load and has blocked its inverter. Seek qualified assistance..
22	MANUAL BYPASS CLOSED	This is a status warning that the load is being powered through the maintenance bypass line and is unprotected from mains supply aberrations.
23	INV.: UNSYNCHRONIZED	This warns that the inverter is not synchronized with the bypass supply, which is normally due to a problem with the bypass supply being outside an acceptable frequency window. Do not switch OFF the inverter when this alarm is active or the load will experience a 200 msec power break.
24	BATTERY: ON LOAD	This is a status warning that the battery is discharging. It normally accompanies a [BYP: ABSENT] or [RECT: OFF] message.
25	AUTONOMY XXXX min	The micro monitors the battery percentage capacity while on charge and the battery time remaining while on discharge. It calculates the time remaining as function of the discharge current against the programmed ampere hour capacity of the battery. It will update the time remaining as the load is changed
26	BATTERY: UNDER TEST	This message informs the operator that the system is carrying out a periodic battery test.
27	BOOST TIME EXPIRED	This message is only applicable to systems which include the boost charge option, boost time charge elapsed set value, battery should be controlled by service personnel.
28	LOAD ON BYPASS	This is a status warning that the load is being powered through the static bypass line and is unprotected from mains supply aberrations. This action is either selected by the operator or a fault condition, check for other fault messages.
29	RECT.: OFF RECT.: OFF VIA DISPLAY	This is a status message confirming that the rectifier has been selected off by the operator from either the front panel display or an external PC or by a switch on UPS µP PCB.
30	BYP.: OFF BYP.: OFF VIA DISPLAY	This is a status message confirming that the bypass has been inhibited by the operator from either an external PC or by a switch on UPS µP PCB.
31	INV.: OFF INV.: OFF VIA DISPLAY	This is a status message confirming that the inverter has been selected off by the operator from either the front panel display or an external PC or by a switch on UPS µP PCB.
32	BYP:XFER COUNT BLOCK	This message informs the operator that the load has been transferred to the bypass more than eight times in one minute. After eight transfers the load will remain on bypass. This message could be initiated by a load causing the UPS to overload, it requires investigation.

In addition to the above messages there are a number of software alarms (i.e. BAD EEPROM , BACK-UP BATTERY LOW etc.) that will require attention from a qualified service engineer.

7. Chapter 7 - 1+1 Parallel System

7.1 Generality

The system consist of two single UPS 7200 modules with the same power rating. Each UPS is equipped with the optional parallel Kit (part no. 4645004A), and the outputs to the load are connected in parallel.
The system can be configured on site as follows:

- redundant parallel
- power parallel (available with software revision V4.1 and subsequent revisions and High-Voltage Interface board part no. 4590058S)

Redundant parallel
A system is defined a being in a redundant parallel configuration when the load power rating is less than or equal to the rated power of are UPS module. In this case, only one UPS is needed to supply the load.

◊ **Normal operation**
Both the UPS units supply the load. They automatically share current and are synchronised with to the mains. They remain synchronised to each other during a power outage and are synchronised again with the mains when power is restored.

◊ **Fault or manual inverter shutdown**
The load continues to be supplied by the inverter of the second UPS.

◊ **Overload**
The system has a very high overload capacity, equal to the sum of the power ratings of the two UPS units plus the relative overload (minimum three times the supplied load). If the power demanded by the load temporarily exceeds this value, the load switches to the mains bypass through both UPS modules.

◊ **Maintenance**
Maintenance can be performed on a UPS by opening the relative switches **without using the internal manual By-pass**, since the second UPS can supply the load.

Power parallel
A system is defined a being in a power parallel configuration when the power requested by the load is greater than the rated power of one UPS module. In this case, both UPS modules are needed to supply the load.

◊ **Normal operation**
Similar to the redundant parallel configuration.

◊ **Fault or manual Inverter shutdown**
The load is switched to the mains bypass through the Static Switches of both UPS modules, even if the power requested at that time by the load is less than the power rating of one UPS.

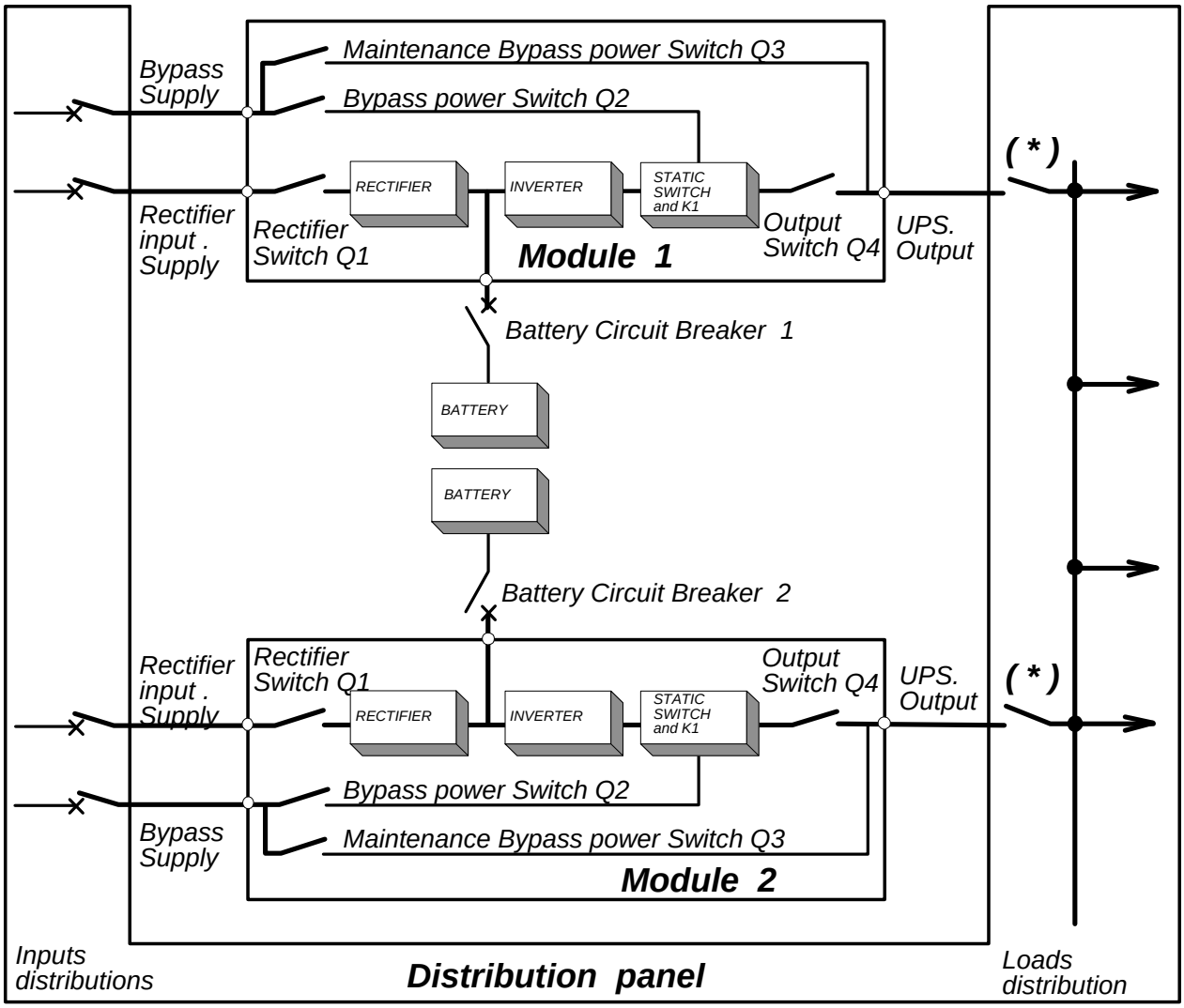
◊ **Overload**
The overload capacity is equal to 1.5 times the system power rating.

◊ **Maintenance**
To carry out maintenance operations, **both** UPS modules must be switched to manual bypass.

Battery configuration
The system is designed to operate with two different battery configurations:

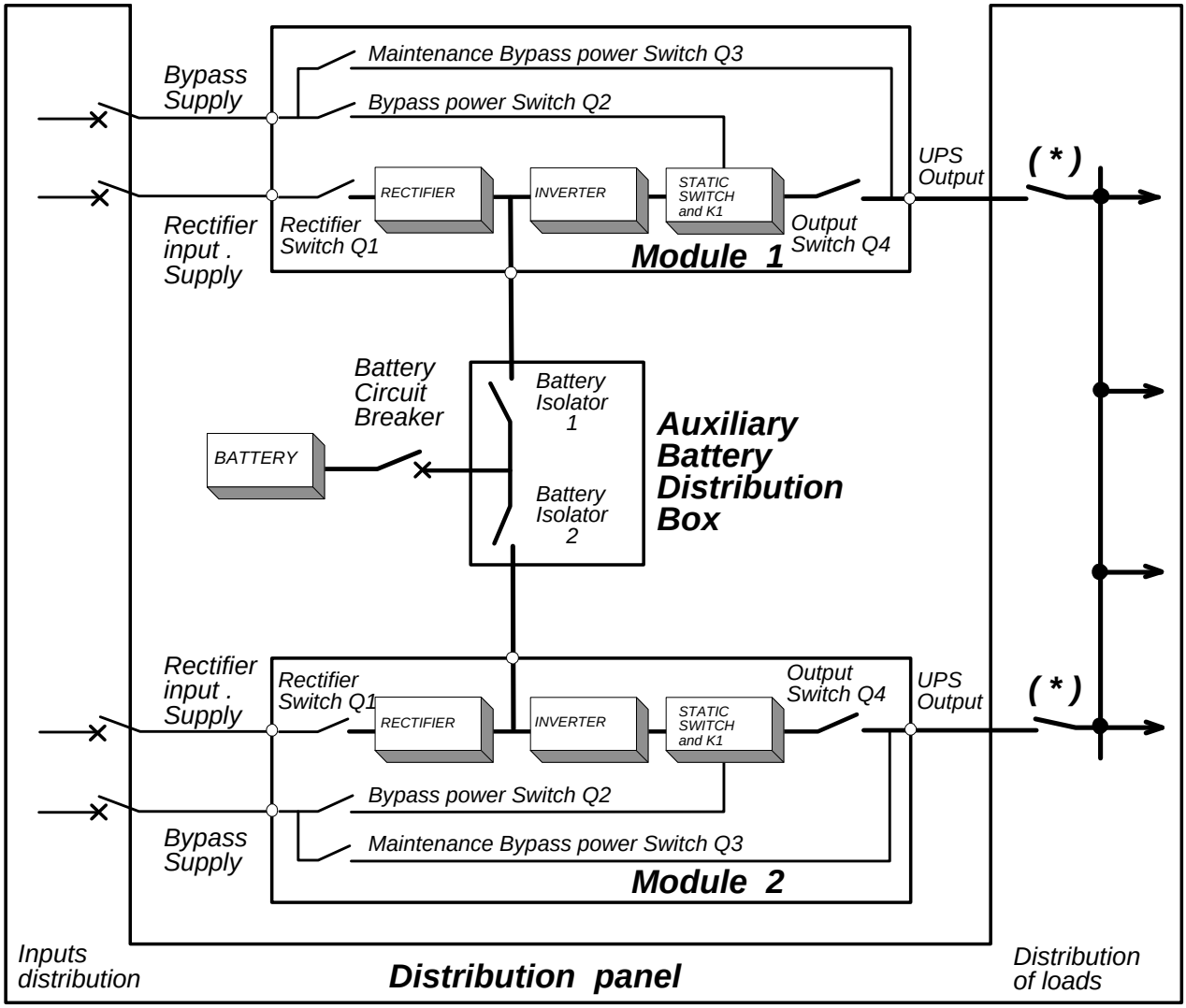
◊ **With separate batteries**
Each UPS is connected to its own battery (see figure 7-1).
This is the most common configuration.

◊ **With common battery**
The two UPS units are connected to a single battery (see figure 7-2).
The option "Battery auxiliary distribution box" (see paragraph 7.4) is required for common battery.



(*) Note: Before opening one of the distribution isolator, open the corresponding output isolator of UPS (Q4)

Figure 7-A . System with separate batteries



(*) Note: Before opening one of the distribution isolator, open the corresponding output isolator of UPS (Q4)

Figure 7-B . System with common battery

7.2 Installation procedure (Separete batteries)

Installation procedure is basically the same as for single module, so read and apply instructions of Chapter 3 - Installation Procedure of this User Manual.
Differences are shown below.

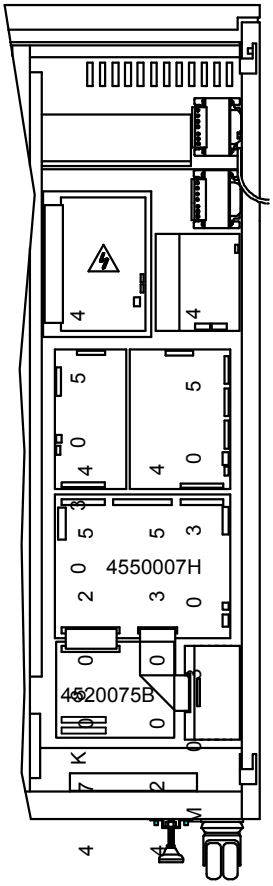


Figure 7-C Position of parallel option

7.2.1 Preliminary Checks

Be sure that the option parallel kit is present and connected for both modules, that they are the same size and with the same SW and HW release.

WARNING

Operation of fitting the parallel kits and setting of boards and UPS to convert it from Single Module to 1+1 must be made by Liebert Service & Support trained personnel.
This operation involves also setting of system with:
separate batteries or common battery, 1+1 redundant or full power

7.2.2 Power cables

Input Bypass and Rectifier, outputs of modules

As shown in fig. 7-1 and 7-2, to achieve maximum flexibility, is suggested to use separate isolators and protections for each module: in this case rating of cables is the same as for single module.

As for single module, it's suggested to use a power isolators at the output of each module: this power isolators connected at the output of UPS is only for plant maintenance:

it must not be used for protection of UPS output or cabling

this protection is deemed to input bypass line breaker and current limit of inverter.

The cross section and lenght of the cables on the bypass line and on the output of the two UPS modules should de equal, to ensure the balance of the currents when the load is supplied by the bypass mains.

Battery

For separate batteries (fig. 7-1) rating of cables is the same as for the single module.

7.2.3 Control cables

Parallel bus

Each module has its Parallel Board (s. n. 4520075B) connected with the other via two shielded 34-poles flat-cables.
The connection is redundant, disconnecting one cable lits a red LED on Parallel boards, disconnecting both cables inverters are blocked (this last function may be disabled during servicing of the system).

Cables length is fit for connection of two modules side by side; cables enter in cabinets passing trough the slot right in the base of cabinet (see Fig. 3-2).

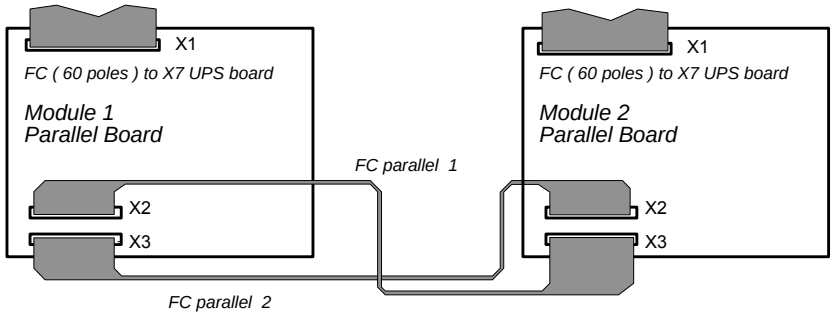


Figure 7-D. Connection of parallel signal bus cables

Emergency Power Off (EPO)

It's suggested to use an emergency power off push button with two separate and insulated ways, so it's possible to power off both modules at the same time.
A third insulated way may be used to trip input breakers of distribution panel if it's needed to power off also inputs of modules.
For EMI reasons cabling must be shielded and shield must be grounded at EPO side.

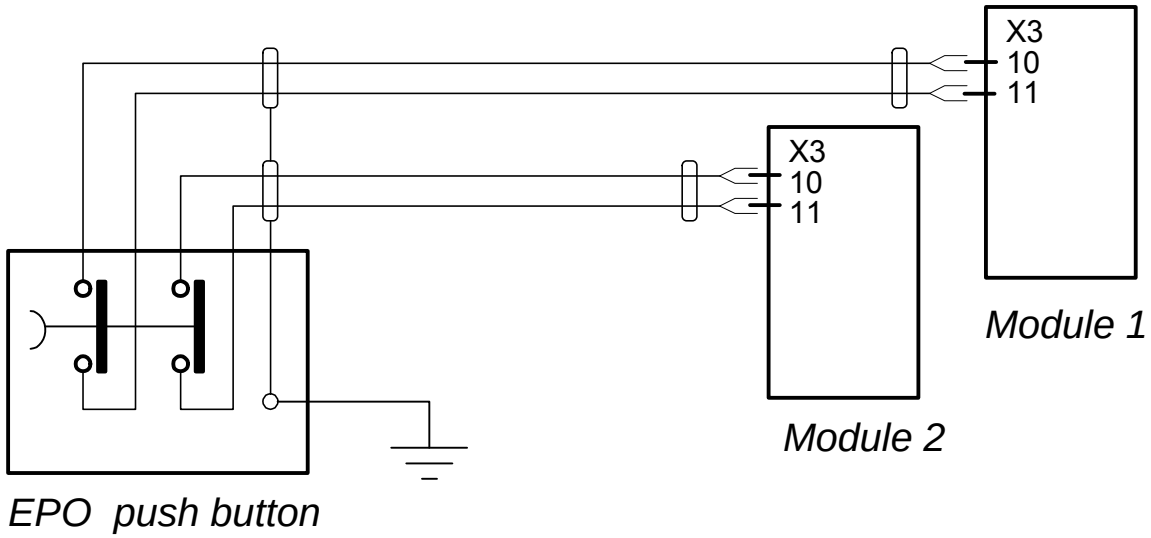


Figure 7-E . Connection of EPO push button

7.3 System start-up and shutdown procedures (Separate batteries)

These operations must be performed one at a time, progressing to the next step only after having completed the previous step on both UPS modules.

7.3.1 System start-up

Follow the procedure for the single UPS by referring to paragraph 2.2.
For a system configured in the “redundant parallel” mode, the first of the two UPS modules available will change its state from “load on bypass” to “load on inverter” (turning on and off the relative mimic leds) and will inhibit the “load on bypass” message on the second module. When the second module becomes available, it will enter the “load on inverter” state and this led on the mimic panel will turn on.
For a system configured in the “power parallel” mode, the two UPS modules will simultaneously change from “load on bypass” to “load on inverter” when both will become active.

7.3.2 Switching the system to maintenance bypass from normal operation.

Follow the procedure for the single UPS by referring to paragraph 2.3.
For a system configured in the “redundant parallel” mode, the changeover from “load on inverter” to “load on bypass” will occur only when the operation described in point 4 has been completed on both UPS modules.

7.3.3 Switching the system ON from a maintenance power down condition.

Follow the procedure for the single UPS, referring to paragraph 2.4.

7.3.4 Switching OFF and isolating one UPS while the other remains in service.

This operation is permitted only for a system configured in the “redundant parallel mode”.

1. In sequence, open the UPS switches Q4 (output), Q1 (rectifier input), Q2 (bypass input).

2. Open the battery circuit-breaker.

To completely isolate the UPS, open the a.c. power supply circuit-breaker (both circuit-breakers if separate supplies are provided for the rectifier and the bypass supply) and the output circuit-breaker on the power distribution switchboard.
If individual UPS output isolation circuit-breaker are not installed on the power distribution switchboard, remember that voltage supplied by the UPS which remains in service will still be present on the output terminals of the shutdown UPS.

Wait approximately 5 minutes before accessing the interior of the equipment to allow all the internal capacitors to discharge.

7.3.5 Switching ON a UPS that was previously switched OFF and isolated from the system.

1. Close the circuit-breakers relative to the shutdown UPS that were previously opened on the power distribution switchboard.

2. Close the switches Q1 (rectifier input) and Q2 (bypass input) of the UPS.

3. Select the MEASUREMENT function from the display on the main menu, then press ENTER and select BATTERY. Press ENTER and check that the voltage level has reached the rated value (432V or 446V or 459V in accordance with the number of battery blocks).

4. Close the battery circuit-breaker.

5. Close UPS switch Q4 (output), wait about 20 seconds and check that the message NORMAL OPERATION appears on the message page display.

7.3.6 Complete system shutdown.

Follow the procedure described in paragraph 2.5 by working on both UPS modules.

7.4 Installation procedure (Common battery)

WARNING

If residual current circuit-breakers are used on the incoming side of the UPS modules, make sure to use a common sensor for both rectifier incoming lines. At the instant of electrical connection, the current may not be split instantaneously and this may cause the residual current circuit-breakers to trip separately.

Refer to the general diagram shown in figure 7-2.

In addition to the information described in paragraph 7.2, the 1+1 system with common batteries also uses the ”battery auxiliary distribution box”. This box uses two isolators to connect the battery to the two UPS modules, and thus individually isolate the two modules from the system.
The box is also designed to supply the two UPS modules with a battery current measurement (charge or discharge).
Follow the instructions provided below to connect this option.

Use part no. 4641031 F (125 A) with the 30 kVA UPS.
Use part no. 4641032 G (250 A) with the 40 and 60 kVA UPS.

7.4.1 Connection between UPS and “battery auxiliary distribution box”

Refer to the diagram shown in figure 7-6 and the attached table.

1. POWER CABLES:
   For the connection between the UPS modules and the auxiliary box use cables with the section indicated in paragraph 3.3.2.
   For the connection between the auxiliary box and the battery use 2 cables in parallel (for each of the 2 polarities) which have the section indicated in paragraph 3.3.2.

2. AUXILIARY CABLES:
   Use multiple-core shielded cables with a section of 0.5 mm^2. Connect the cables with the Fast-on 6.3x0.6 mm terminals contained in a bag inside the “auxiliary battery distribution box”.

The battery current transformer “T11”, mounted next to the battery fuse, inside the two UPS modules, must be disconnected and removed. The cables, disconnected from the UPS wiring, must be re-connected to cable “D1” or “D2” as illustrated in figure 7-6.

The temperature sensor, contained in a bag inside the battery auxiliary distributio box, must be mounted in the battery cabinet next to the sensor which was previously installed, and connected to the auxiliary box through cable “B” as illustrated in figure 7-6.

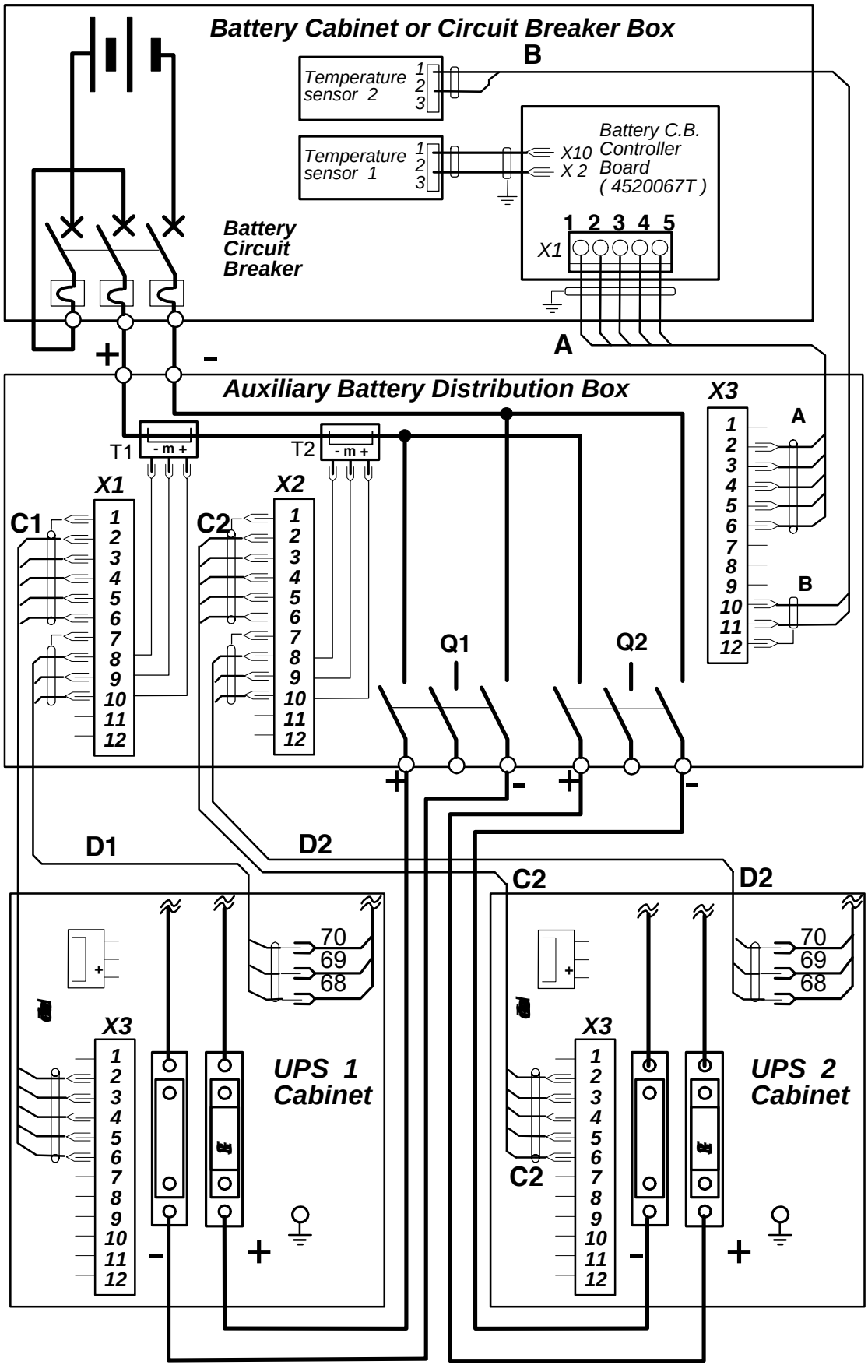


Figure 7-F .Connections of Auxiliary Battery Distribution Box

Cable A: 5 wires + screen	
Aux. Batt. Distribution box	*Battery Cabinet or Batt. Switch Box*
Connector X3 (F)	*Connector X1 on 4520067T PCB (screws)*
Pin 1 not connected	Screen
Pin 2	Pin 5
Pin 3	Pin 4
Pin 4	Pin 3
Pin 5	Pin 2
Pin 6	Pin 1

Cable B: 2 wires + screen	
Connector X1 (F)	*2nd Temperature Sensor in Battery (screws)*
Pin 12 Screen	Pin 3 not connected
Pin 11	Pin 2
Pin 10	Pin 1

Cables C: 5 wires + screen	
Connector X3 on UPS cabinet	*Connector X2 or X3 on Aux. Batt. Distrib. Box*
Pin 1 not connected	Pin 1 screen
Pin 2	Pin 2
Pin 3	Pin 3
Pin 4	Pin 4
Pin 5	Pin 5
Pin 6	Pin 6

Cables D: 3 wires + screen	
Cables of removed T11 in UPS cabinets	*Connector X2 or X3 on Aux Batt. Distrib. Box*
Wire 68	Pin 10
Wire 69	Pin 9
Wire 70	Pin 8
Not connected	Pin 7 screen

How to build cables of fig. 7-6

7.5 System start-up and shutdown procedures (Common battery)

WARNING

The isolators Q1 and Q2, located in the "Auxiliary Battery Distribution Box", must be operated following the procedures described below. Incorrect operation of these isolators might cause the circuit-breaker located in the battery cabinet to open or blow the battery fuse located in the UPS.

In the system start-up and maintenance by-pass configuration procedures, the operations must be performed one at a time, going to the next one only after having completed the previous one on both UPS modules.

7.5.1 System start-up

Follow the procedure for the single UPS by referring to paragraph 2.2.
After completing the operations described in point 4, and before going to point 5, close isolators Q1 and Q2 located inside the "auxiliary battery distribution box".

For a system configured in the "redundant parallel" mode, the first of the two UPS modules available will change its state from "load on bypass" to "load on inverter" (turning on and off the relative leds on the mimic panel) and will inhibit the "load on bypass" state on the second one. When the second one becomes available, it will enter the "load on inverter" state and the relative led on its mimic panel will turn on.
For a system configured in the "power parallel" mode, the two UPS modules will simultaneously change the state from "load on bypass" to "load on inverter" when both will become available.

7.5.2 System maintenance by-pass configuration procedure

Follow the procedure for the single UPS by referring to paragraph 2.3.
After completing the operation, open isolators Q1 and Q2 located inside the auxiliary box for common battery.
For a system configured in the "redundant parallel" mode, the changeover from "load on inverter" to "load on bypass" will take place only when the operation described in point 4 has been completed on both UPS modules.

7.5.3 Procedure to switch the system from the maintenance by-pass mode to the normal operating condition

Follow the procedure for the single UPS by referring to paragraph 2.4.
After completing the operations described in point 2, and before going to point 3, close the isolators Q1 and Q2 located inside the "auxiliary battery distribution box".

7.5.4 Switching OFF and isolating isolation one UPS while the other remains in service.

This operation is permitted only for a system configured in the "redundant parallel mode".

1. In sequence, open the UPS switches Q4 (output), Q1 (rectifier input), Q2 (bypass input).

2. Open the isolator located inside the battery auxiliary distribution box, relative to the UPS that is being excluded.

To completely isolate the UPS, open the a.c. power supply circuit-breaker (both circuit-breakers if separate supplies are provided for the rectifier and the bypass input) and the output circuit-breaker on the power distribution switchboard.
If the output circuit-breaker of the single UPS is not installed on the power distribution switchboard, remember that voltage supplied by the UPS which has remained in service will still be present on the output terminals of the shutdown UPS.

Wait about 5 minutes before accessing the interior of the equipment to allow all the internal capacitors to discharge.

7.5.5 Switching ON a UPS that was previously switched OFF and isolated from the system.

1. Close the circuit-breakers relative to the shutdown UPS that were previously opened on the power distribution switchboard.

2. Close the switches Q1 (rectifier input) and Q2 (bypass input) of the UPS.

3. Select the MEASUREMENT function from the display on the main menu, then press ENTER and select BATTERY. Press ENTER and check that the voltage level has reached the rated value (432V or 446V or 459V in accordance with the number of battery blocks).
   If this occurs, proced the next step.
   If this does not occur and a voltage close to 0V is measured, this means that the active UPS is operating under the battery charge current limiting condition.
   In this case, open Q1 (rectifier input) then open the circuit-breaker located inside the battery cabinet, close Q1 again and check the voltage level on the display. The battery circuit-breaker must be closed again after completing the operation described in point 4.

4. Close the isolator located inside the battery auxiliary distribution box, for to the UPS which has been switched ON.

5. Close UPS switch Q4 (output), wait about 20 seconds and check that the message NORMAL OPERATION appears on the message page display.

7.5.6 Complete system shutdown.

Follow the procedure described in paragraph 2.5 by working on both UPS modules.

After completing the operation, open isolator Q1 and Q2 located in the battery auxiliary distribution box.

8. Chapter 8 - Specification Single Module

MECHANICAL CHARACTERISTICS	UNITS	Model kVA Rating		
		30	**40**	**60**
Height	mm	1400		
Width	mm	710		
Depth	mm	800		
Weight	Kg	480	540	620
Colour (two tone)	—	RAL 7001		
Protection grade	—	With enclosure - IP 20 With front door open - IP 20		
Ventilation	—	by internal intake fans		
Airflow	m^3/h	480	960	
Cable entry	—	Bottom		

ENVIRONMENTAL	UNITS	Model kVA Rating		
		30	**40**	**60**
Operating temperature	°C	0- +40		
Maximum temperature for 8 hr day	—	40°C derate by 1,5% per °C between +40°C + 50°C		
Mean temperature for 24 hr day	°C	35 max.		
Relative humidity	—	≤ 90% at 20°C		
Altitude		≤1000m asl(derate by 1% per 100m between 1000 and 2000)		
Storage temperature	°C	-25 to +70		
Acoustic noise at rated load. (1 meter from the apparatus according to ISO3746)	dBA	56		
EMC standard	—	Designed to meet EN 50091-2, class A.		
Safety Standard	—	Designed to meet EN 50091-1.		

INPUT RATINGS	UNITS	Model kVA Rating		
		30	**40**	**60**
Power consumption at rated load while float charging the battery	kVA	32,8	43,5	64,9
Power consumption at rated load while boost charging the battery	kVA	41,0	54,3	81,1
Input current level normal running (Vin 400V)	A	47,0	63,0	94,0
Input current level full battery recharge (Vin 400V)	A	59,0	78,0	117,0
Line voltage	V a.c.	380 - 400 - 415 3 Ph + N		
Current rating of neutral cable	A	1,4 times rated current		
Permissible input voltage variation	%	+10 –15		
Frequency	Hz	50 or 60		
Permissible input frequency variation	%	± 5		
Power walk-in	—	Progressive over 2 seconds		
Power factor at 380/400/415V	cos Φ	0,8		
With optional input filter fitted	cos Φ	> 0,9		

SYSTEM DATA	UNITS	Model kVA Rating		
		30	**40**	**60**
Efficiency at 50% load,	%	92,0	92,6	93,1
Efficiency at 100% load	%	91,5	92,0	92,5
Losses at rated load	kW	2,3	2,8	3,9
Losses with battery on boost charge	kW	2,8	3,4	4,5
Losses with no load	kW	0,8	1,1	1,3

OUTPUT RATINGS	UNITS	Model kVA Rating		
		30	**40**	**60**
Voltage	V a.c.	380/400/415 (preset on commissioning) 3 Ph N		
Frequency	Hz	50 or 60 (presettable)		
Power at 0,8 pf	kVA	30	40	60
Power at 1,0 pf	kW	24	32	48
Normal current at 0.8 pf	A	43	57	87
Overload ability at 0,8 pf 3 Φ 1 Φ	—	110% for 60 minutes 125% for 10 minutes 150% for 1 minute 200% for 30 seconds		
Current limiting short circuit (inverter) 150% rated current (3 phase) for 220% rated current (1 phase) for	—	 5 Seconds 5 Seconds		
Maximum permissible non linear load	%	100 with 3 : 1 crest factor		
Voltage stability — steady state	%	± 1		
Voltage stability — transient state	%	± 5		
Reset time to within ± 1%	ms	20		
Frequency stability — synchronized	—	The output will synchronize with the input supply within ± 0.5 Hz of nominal frequency (adjustable to ± 2 Hz)		
Frequency stability - not synchronized	—	± 0,1% when the input supply frequency is outside the synchronizing range		
Phase voltage asymmetry — balanced load	—	± 1%		
Phase voltage dissymmetry — 100% unbalanced load	—	± 2%		
Voltage phase shift — with balanced load	Angle ^{o}	120 ± 1		
Voltage phase shift — with unbalanced load	Angle ^{o}	120 ± 1		
Output voltage distortion — linear load	—	1% typical 2% max.		
Output voltage distortion — non–linear load (3:1 crest factor)	—	≤ 5% max.		
Maximum frequency slew rate	Hz/sec	0,1 to 1,0		
Synchronized transfer to bypass	ms	0 approximately		
Not synchronized transfer to bypass	ms	100 approximately		
Overload on bypass (without fuses)	—	10 x rated current for 100 ms		

INTERMEDIATE DC CIRCUIT	UNITS	Model kVA Rating		
		30	40	60
Voltage limits of inverter operation for 380V min.	V d.c.	320		
Voltage limits of inverter operation for 380V max.		460		
Voltage limits of inverter operation for 400V min.	V d.c.	330		
Voltage limits of inverter operation for 400V max.		475		
Voltage limits of inverter operation for 415V min.	V d.c.	340		
Voltage limits of inverter operation for 415V max.		490		
Number of lead-acid cells UPS 380 V	Nº	192		
Number of lead-acid cells UPS 400 V		198		
Number of lead-acid cells UPS 415 V		204		
Float charge voltage UPS 380 V	V d.c.	432		
Float charge voltage UPS 400 V		446		
Float charge voltage UPS 415 V		459		
Boost charge voltage UPS 380 V	V d.c.	460		
Boost charge voltage UPS 400 V		475		
Boost charge voltage UPS 415 V		490		
End of discharge voltage UPS 380 V	V d.c.	320		
End of discharge voltage UPS 400 V		330		
End of discharge voltage UPS 415 V		340		
Absolute maximum voltage (manual charge) UPS 380 V	V d.c.	480		
Absolute maximum voltage (manual charge) UPS 400 V		495		
Absolute maximum voltage (manual charge) UPS 415 V		510		
Rectifier output current rating	A	75	100	150
Voltage stability with rectifier	—	± 1%		
Residual alternating voltage	—	≤ 1%		
Battery charging cycle	—	Characteristics to DIN 41772 I-U, boost-to-floating charge switching,, with current measuring criterion plus control of charging time		
Maximum boost charge duration	hours	1 - 15 hours (selectable)		
Charging current	A	3 - 15	5 - 20	6 - 30
Inverter power at rated load	kW	25,7	34,1	50,8
Input current to inverter at minimum voltage	A	78	103	154
Efficiency of inverter @ 50% load	%	93,8	94,4	94,8
Efficiency of inverter @ 100% load	%	93,3	93,8	94,4

STATIC SWITCH CIRCUIT	UNITS	Model kVA Rating		
		30	40	60
Overload from standby supply	A	10 times the rated current for 100 ms		
Current rating of neutral cable	A	1,4 time the rated current.		

BATTERY CABINETS

MECHANICAL CHARACTERISTICS	UNITS	38 Ah	50 Ah	85 Ah
Dimensions (W X H X D)	mm	690 x 1400 x 800	1050 x 1400 x 800	1350 x 1400 x 800
Weight (without batteries)	Kg	130	150	
For use with units	—	30 - 40 kVA		30 - 40 - 60 kVA
Battery circuit breaker size	A	100	100 or 160	160 or 250
Ventilation	—	Natural		
Lifting	—	Trans-pallet entry		

BATTERY CIRCUIT BREAKER BOX	N° of Poles	Suitable for UPS size (kVA)	Part N°	Magnetic overload setting (adjustable)
100 A	3	30 - 40	4641027 B	250 – 400
160 A	3	60	4641028 C	500 – 800
Undervoltage trip coil rating all units	—	110 Vdc (6,7 — 9,2 kOhm)		
Auxiliary contacts (for signaling) all units	—	1 set changeover		