

**FIRSTLINE P
65-80kVA
Maintenance Bypass Switch Cabinet
With SKRU
USER MANUAL**

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Table of Contents

1.1 Protective Equipment.....	3
1.2 General Precautions	3
1. Safety Warnings.....	4
2. Introduction	5
2.1 Overview.....	5
3. Cabinet Setup	6
3.1 Inspecting the Equipment	6
3.2 Floor Loading.....	6
3.3 Clearances	6
3.4 Unloading the Cabinet(s)	6
4. Electrical Installation	8
4.1 Overview.....	8
4.2 Wiring Preparation	8
4.3 Wiring Installation	8
4.4 Control Connections	9
Connections Between the Maintenance Bypass Switch and the UPS	9
Terminal Strip Torque Requirements.....	10
Switch Settings	10
5. Operation	12
5.1 Maintenance Bypass Switch (MBS).....	12
5.2 To place load on maintenance bypass:	13
5.3 To place load on ups:	13
6. Maintenance	15
7. Technical Specifications.....	16
Table 1 - Model Floor Loadings.....	6
Table 2 - Wire Size Requirements and Maximum Current Ratings	16
Table 3 –Terminal Tightening Torques.....	16
Table 4 - Environmental Specifications	16
Figure 1 - The FirstLine P Maintenance Bypass Switch Cabinet.....	5
Figure 2 - Pallet Mounting Hardware.....	6
Figure 3 - Inside Front View of Transformer Cabinet.....	7
Figure 4 - Customer Low Voltage Connection Terminal Block.....	11
Figure 5 - Circuit Breaker Sequence Label	14
Figure 6 – Optional Utility Input Breaker Sequence Label.....	Error! Bookmark not defined.

Symbols Used In the Manual

In this manual, some operations are shown by graphic symbols to alert the reader to the dangerous nature of the operations:

	Danger / Risk of Electric Shock <i>This symbol indicates the possibility of serious injury or substantial damage to the unit unless adequate precautions are taken.</i>
	Warning <i>This symbol indicates important information which must be understood, and any stated precautions taken</i>
	Note

1.1 Protective Equipment

No maintenance operations shall be carried out on the unit without wearing the Personal Protective Equipment (PPE) described below. Personnel involved in the installation or maintenance of the unit must be properly clothed.

The following signs show the protective equipment that should be worn. The various items of PPE must be selected and sized according to the nature of the hazard (particularly electrical) posed by the unit.

	Accident prevention footwear		Protective eyewear
	Protective clothing		Helmet
	Work gloves		

1.2 General Precautions

This manual contains detailed instructions for the use, installation, and start-up of the unit. Read the manual carefully before installation. For information on using the unit, the manual should be kept close at hand and consulted before carrying out any operation on the unit.

This Bypass Cabinet has been designed and manufactured in accordance with the standards for the product, for normal use and for all uses that may reasonably be expected. It may under no circumstances be used for any purposes other than those envisaged, or in any other ways than those described in this manual. Any interventions should be carried out in accordance with the criteria and the timeframes described in this manual.

1. SAFETY WARNINGS



IMPORTANT SAFETY INSTRUCTIONS SAVE THESE INSTRUCTIONS

READ AND FOLLOW ALL SAFETY INSTRUCTIONS

- Do not use outdoors.
- Do not route wiring across or near hot surfaces.
- Do not install near gas or electric heaters.
- Equipment should be installed where it will not readily be subjected to tampering by unauthorized personnel.
- The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition.
- Do not use this equipment for other than intended use.
- This equipment connects to the output of an uninterruptible power supply. Hazardous voltages may be present even when the electrical supply to this equipment is turned off.
- If equipped with a maintenance bypass switch, control connections between this equipment and the ups must be present to prevent the possibility of backfeed.
- Read and follow the instructions that came with the associated UPS or emergency lighting system before operating this equipment.
- WARRANTY IS VOID IF SYSTEM IS ENERGIZED WITHOUT APPROVED STARTUP/COMMISSIONING BY A FACTORY AUTHORIZED SERVICE PROVIDER. (U.S. & CANADA ONLY)



This equipment contains lethal voltages. All repairs and service should only be performed by authorized service personnel. There are no user serviceable parts inside this equipment. Operation of switches and breakers require access to the cabinet interior and should only be performed by qualified personnel exercising appropriate caution.



This equipment connects to the output of a UPS which contains its own energy source (batteries). The UPS output may carry live voltage even when the UPS is not connected to an AC supply.



To reduce the risk of fire and electric shock, install this equipment in a humidity controlled, indoor environment, free of conductive contaminants. Do not operate near water or excessive humidity (95% maximum). If condensation is present, the equipment must be allowed to completely dry before operation.



The UPS associated with this equipment contains batteries. Batteries can present a risk of electrical shock or burn from high short circuit current. Read, understand, and follow all instructions in the UPS manual before attempting any operations involving the battery.



Input and output circuit breakers must be provided by others. This circuit protection must meet the input and output protection requirements as shown in **Table 2** of this manual.

2. INTRODUCTION

2.1 Overview

The FirstLine P Transformer Cabinet for 80 kVA is a steel cabinet that can either attach to the left side of the UPS cabinet or remain free standing. The purpose of the Transformer Cabinet is to allow operation of a FirstLine P UPS 480 V 3W+G with 480 V 4W+G output to provide an output neutral when an input neutral is not available. The enclosure is styled to match the UPS. See **Figure 1** for the outline drawing of the Transformer Cabinet.

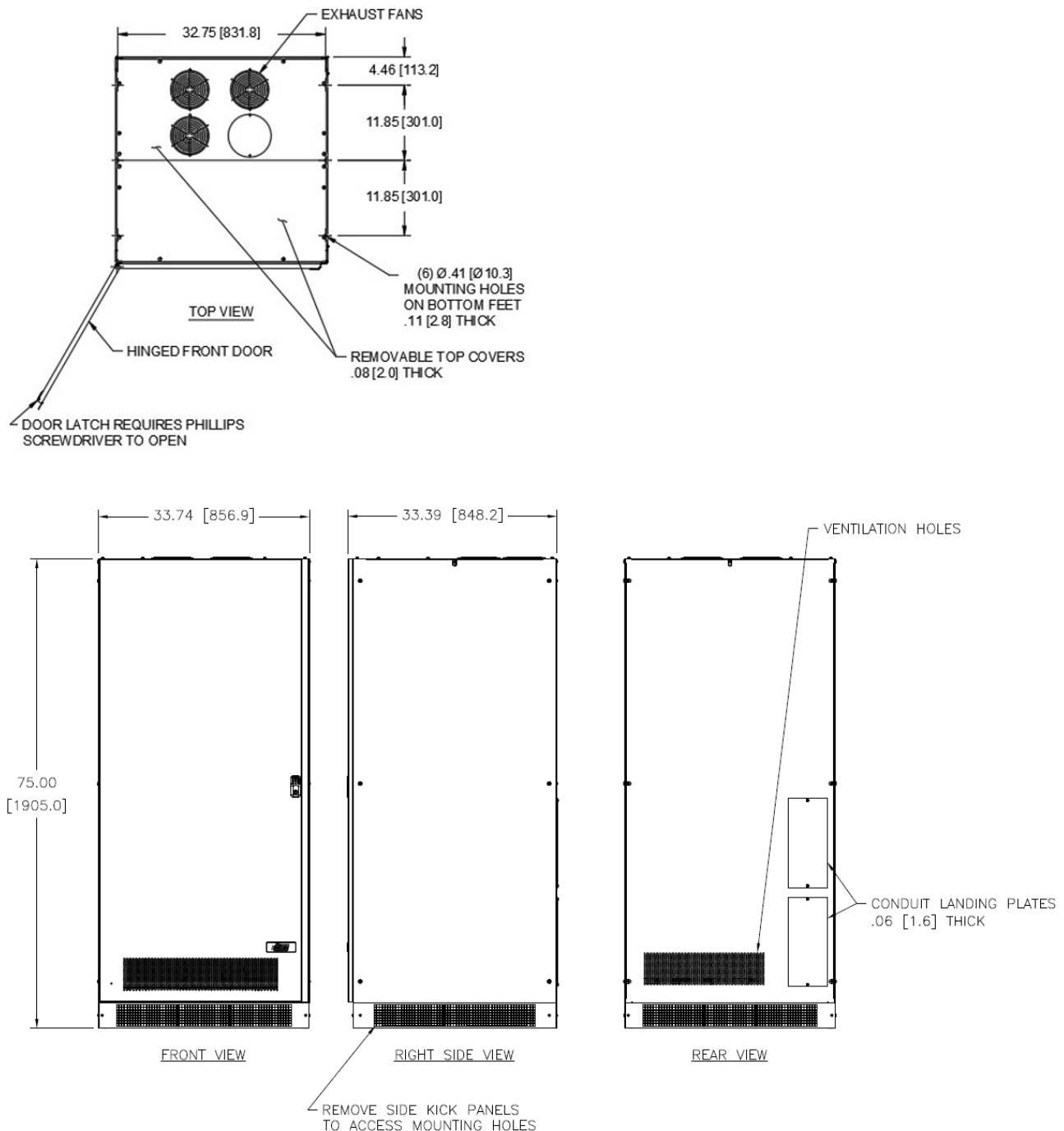


Figure 1 - The FirstLine P Maintenance Bypass Switch Cabinet

3. CABINET SETUP

3.1 Inspecting the Equipment

If any equipment has been damaged during shipment, keep the shipping and packing materials for the carrier or place of purchase and file a claim for shipping damage.

3.2 Floor Loading

When planning the installation, consider the battery cabinet weight for floor loading. The strength of the installation surface must be adequate for point and distributed loading. The approximate weights are shown in **Table 1**.

Table 1 - Model Floor Loadings

MAXIMUM WEIGHT	POINT LOADING
1470 lbs (667 kg)	11.2 lb/in ² (0.8 kg/cm ²)

3.3 Clearances

The following clearances are recommended for the FirstLine P Maintenance Bypass Switch Cabinet. Other clearances may be needed based on site conditions.

From Front of Cabinet	36" (91.4 cm) working space
Other surfaces	No Clearance requirements

3.4 Unloading the Cabinet(s)

The following tools are required for unloading the cabinet(s):

- Wrenches for 3/8" lag bolts.
- Forklift or pallet jack



The cabinets are heavy (see **Table 1**). Unloading the cabinets requires at least two people to safely remove the cabinets from the pallet.

To remove the Maintenance Bypass Switch cabinet from the ship pallet:

1. Make sure the forklift is rated for the cabinet weight.
2. Make sure the path traveled has sufficient support for the combined weight of the forklift and the cabinet.
3. Make sure forks are at maximum separation.
4. Use a very strong ratchet strap (or similar device) of sufficient strength to tie the upper part of the cabinet to the forklift tower before moving.
5. Keep people out of the fall zone. If the cabinet topples over, stand clear
6. With a Phillip's screwdriver, remove the two kick panels. These will be remounted when the cabinet is in place.
7. Remove all banding, wrapping and foam protection.
8. Remove the six 3/8" lag bolts securing the cabinet to the pallet. See
9. **Figure 2**



Figure 2 - Pallet Mounting Hardware

10. Lift the cabinet with a forklift one to two inches (1"-2" [2.5-5cm]) above the pallet.
11. Slide the pallet completely away from the raised cabinet.
12. Carefully move the cabinet to the desired location and slowly lower the cabinet to the floor or other appropriate flat surface.
13. Remount the two kick panels.

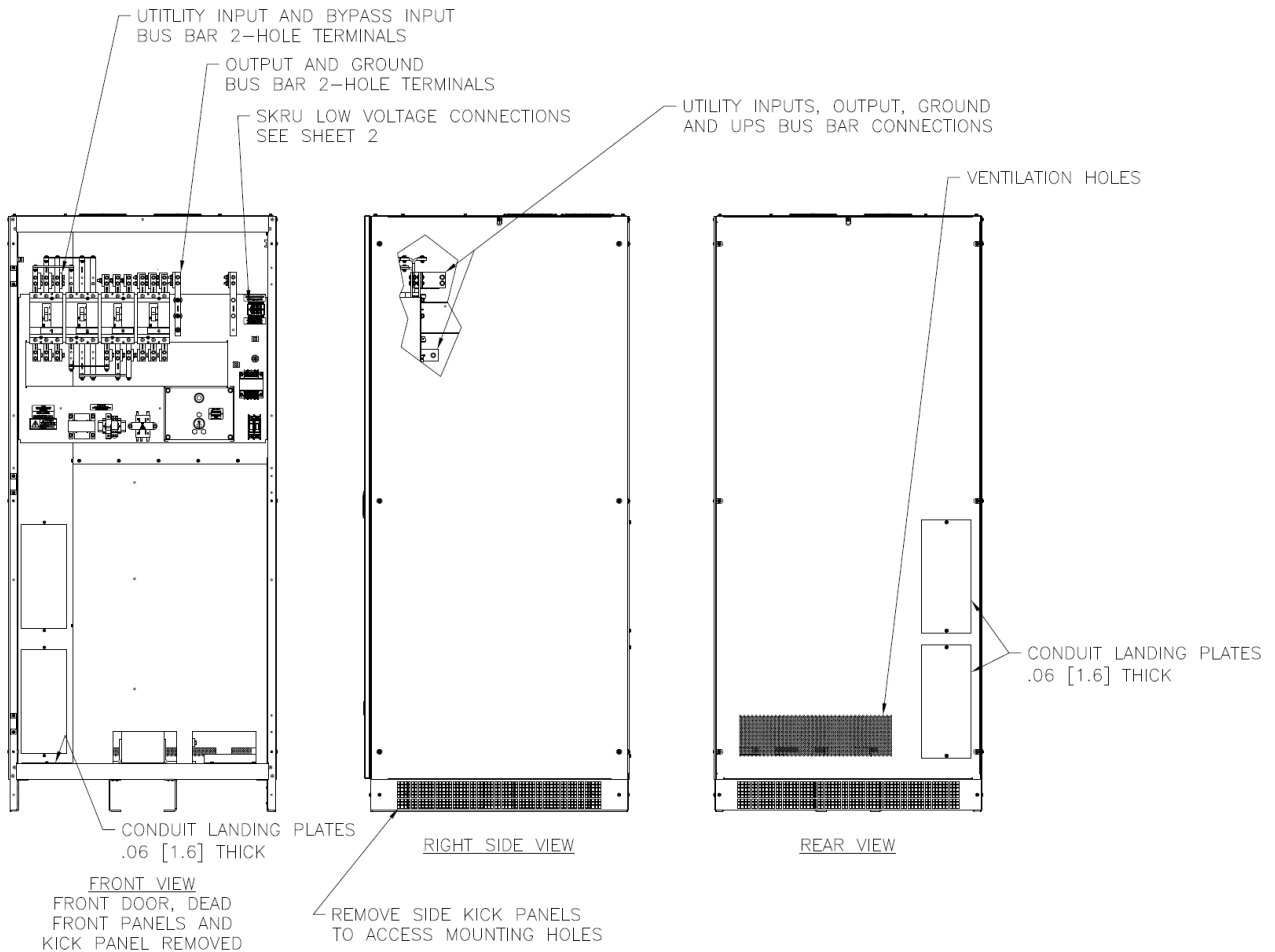


Figure 3 - Inside Front View of Transformer Cabinet

4. ELECTRICAL INSTALLATION

4.1 Overview

Each of the pieces of equipment covered by this manual has four sets of power connections:

1. Input from the power source, typically, from the electric utility.
2. Power routed to the input of the UPS.
3. Power from the output of the UPS.
4. Power to the load

There are four control connections between the Maintenance Bypass Switch Cabinet and the UPS that must be made.

A user accessible disconnect device must be provided (by other's) between the output of this cabinet and the load. Refer to **Table 2** for current requirements.

WARNING



Only qualified service personnel (such as a licensed electrician) should perform the installation and initial startup. There is a risk of electrical shock.

4.2 Wiring Preparation

1. Verify that the equipment is the proper type. The Maintenance Bypass Switch Cabinet (MBS) can be used in delta-delta or wye-wye applications, but the UPS must be properly configured (refer to the UPS manual).



- For delta-delta applications where an input neutral is not provided, the output neutral connection must not be used and the MBS to UPS neutral connections should be omitted.
2. Plan the locations of conduits. Two Conduit landing plates are provided at the top (see
 3. **Figure 1**) and bottom of the cabinet.
 - a. Connection from Utility source and connection to the critical load can entry the unit from top or bottom.
 - b. Connections between the MBS and UPS must be made at the bottom.
 - c. The low voltage control connection wires must be routed through the wire duct below the terminal block to the bottom landing plate in the rear of the cabinet to ensure physical separation between them and the power wiring.
 4. All wiring is to be in compliance with all applicable codes. See **Table 2** for recommended cable sizes.
 5. Verify that the source circuit capability is in compliance with the requirements shown in **Table 2**.

4.3 Wiring Installation

WARRANTY IS VOID if system is energized without approved startup/commissioning by a factory Authorized Service Provider. (U.S. & Canada only)

1. Switch off utility power to the distribution point where the UPS will be connected. Be absolutely sure that there are no hazardous voltages present.
2. Remove as many panels as needed for adequate access for wiring the cabinet.
3. Open the front door of the MBS Cabinet. If necessary, remove the top and bottom shield cover panels located in front of and below the circuit breakers by removing the screws that mount each panel in place.
4. Connect wires from the "TO UPS INPUT" terminal block to the input rectifier terminals in the UPS. (Refer to the UPS manual).
 - a. The terminals must be properly torqued (see **Table 3**).
 - b. Ensure proper phasing of the cables.
5. Connect wires from the "TO UPS BYPASS INPUT" terminal block to the input bypass terminals in the UPS. (Refer to the UPS manual).
 - a. The terminals must be properly torqued (see **Table 3**).
 - b. Ensure proper phasing of the cables.
6. Connect wires from the "FROM UPS OUTPUT" terminal block to the output terminals in the UPS. (Refer to the UPS manual).
 - a. The terminals must be properly torqued (see **Table 3**).
 - b. Ensure proper phasing of the cables.
7. Connect wires from the "OUTPUT TO LOAD" terminal block to the load.
 - a. The load may be an external distribution panel, etc.
 - b. If neutral is not needed by the load, then it does not need to be supplied.
 - c. The terminals must be properly torqued (see **Table 3**).
 - d. Ensure proper phasing of the cables.
8. Connect wires from the "UTILITY INPUT" terminal block to the input source power from the building distribution.
 - a. The terminals must be properly torqued (see **Table 3**).
 - b. Ensure proper phasing of the cables. The source needs to have A-B-C phase sequence.
9. Check all work. Replace the panels that were removed for access. **Ensure that the shield cover panels have been mounted in place. Failure to do so could subject personnel to lethal voltages.**

4.4 Control Connections

Four control connections must be made between the Transformer Cabinet with MBS arrangement and the UPS in order to provide backfeed protection, a required safety feature. There is also a provision to provide Remote Emergency Power Off (REPO). REPO causes the output breaker to trip, thereby removing power from the load. If the bypass path is active, then REPO trips the bypass breaker, removing power from the load. The UPS is also equipped with a REPO input, but that is a separate system and will require an additional contact (normally closed) on the REPO activation switch, if UPS REPO is desired (refer to the UPS manual).

The wiring to these low voltage ("ELV") connections must be kept separated from the higher voltage wiring. Refer to Figure 7 regarding the Low Voltage Terminal Block and to the UPS manual that shows the connection point in the UPS. Details regarding these connections are described below.

Connections Between the Maintenance Bypass Switch and the UPS

Since these wires affect the operation of the UPS, they should be protected. Running them in conduit is a good idea, even if local codes do not require conduit. It is also recommended that the wires are shielded twisted pairs. Alpha 6010C is a shielded cable with three twisted pairs and is available from a number of sources in various spool lengths.

Two pairs are required:

Pair 1 -- First wire from terminal 3 of the Low Voltage Connection Terminal Block (LVTB) of the Transformer Cabinet with MBS arrangement to terminal 11 of the Remote Commands and Alarms Connections on the UPS (RCA-UPS). Second wire from terminal 4 of LVTB to terminal 12 of RCA-UPS.

Pair 2 – First wire from terminal 10 of LVTB to terminal 1 of RCA-UPS. Second wire from terminal 11 of LVTB to terminal 2 of RCA-UPS.

Figure 7 is an electrical wiring schematic summarizing the connections to the Low Voltage Connection Terminal Block.

The REPO switch connections are also shown. Please note that typically only one of the REPO switch contacts is connected, depending on user preference, but both are shown to illustrate the wiring. The normally open switch connects across terminals 5 and 6 while the normally closed switch connects across terminals 8 and 9. Terminal 7 has a limited amount of unregulated dc power available to power an LED lamp to permit the use of a lighted switch for REPO. Contact Staco Energy Products Company for details if you desire to use this feature. Please also note that the Options Control Board in the Transformer Cabinet must be properly configured for the normally closed REPO switch to work.

Terminal Strip Torque Requirements

The terminals on the Customer Low Voltage Connection Terminal Block must be torqued to 5.3 to 7.0 inch-lbs. The terminals on the Control Connections (on the UPS) must be torqued to 4.4 inch-lbs.

Switch Settings

Switch "S2" on the Options Control Board (refer to Figure 6) is a four position "DIP" switch that has four small rocker switches. Pushing on the top half of each switch section closes the switch and turns it ON, pushing on the lower half turns the switch OFF. There are labels on the board to help identify the switch section.

The first section "PLT" enables "Power Loss Trip" (or Manual Restart) and should be OFF unless you want the Bypass and Inverter Output Breakers to trip on loss of power.

The second section "NCR" enables the Normally Closed REPO input and should be OFF unless there is a normally closed REPO switch connected.

The third section "OTT" is not implemented and should be turned OFF to avoid confusion.

The fourth section is not used and should be turned OFF to avoid confusion.

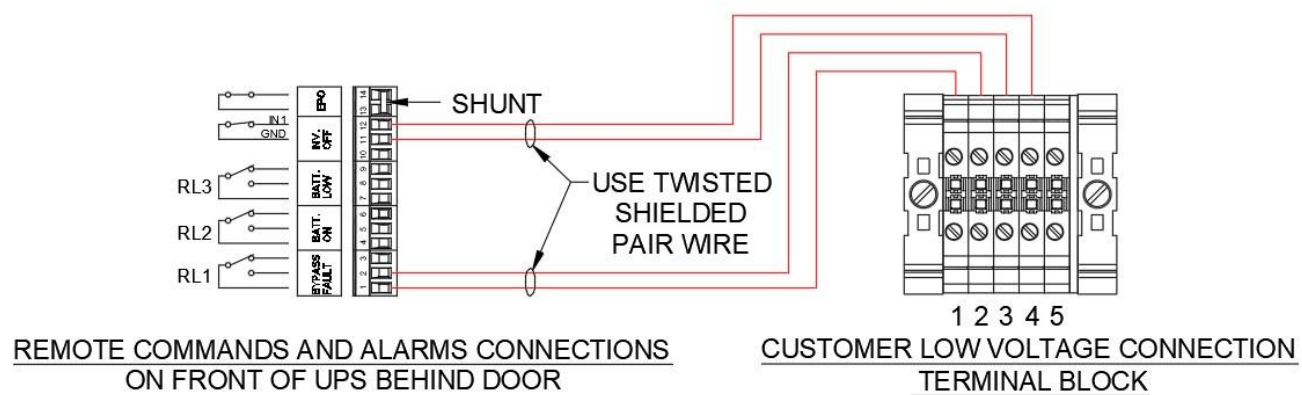


Figure 4 - Customer Low Voltage Connection Terminal Block

5. OPERATION

Refer to the User's Manual for the UPS for instructions on operating the UPS part of the system.



If the UPS is part of a parallel system, special operating instructions apply.

5.1 Maintenance Bypass Switch (MBS)

The purpose of the Maintenance Bypass Switch (MBS) is to facilitate servicing the UPS without removing power from the load. The main functional components of the MBS are three circuit breakers that are used as disconnect switches. The breakers each have three positions: off (down), on (up), and tripped (in between off and on).

This MBS is provided with Kirk® key interlocks. When appropriately applied, KIRK key interlock systems ensure that a pre-determined sequence of operation is followed. The SKPM consists of a keyed interlock, a solenoid, and a pair of auxiliary switches. The SKPM is designed to permit removal of the interlock key in response to an electric signal. Upon energizing the solenoid, the key can be turned and released. Turning the key operates the auxiliary switch.

The SKRU is designed to have a key “trapped” in its lock until a signal is sent to the solenoid. When the solenoid is energized the key can be rotated and released. Turning the key operates the auxiliary switch. The released key can then be utilized in an interlock sequence. By returning and rotating the key, it once again becomes “trapped” and the auxiliary switch goes back to its original state.

If a the SKRU indicating light is not energized, the SKRU will not release the key to unlock the breakers. Verify UPS is in Bypass and the control signals shown in **Figure 4** are accurate.

BKR1 supplies power from the supply (utility) to the bypass input of the UPS. For single input UPS configurations, it also supplies power to the rectifier input. In dual optional Utility Breaker cabinets, BKR1 supplies power from the bypass input of the UPS and BKR4 supplies the power from the utility supply to the UPS input.

BKR2 bypasses the path through BKR1, the UPS, and BKR3 and connects the supply directly to the load.

BKR3 connects the output of the UPS to the load.



BKR2 and BKR3 must never be closed at the same time unless the UPS is in bypass mode. Control signals support an interlock function to prevent BKR2 from being closed unless BKR3 is open or the UPS is in bypass mode.

WARNING



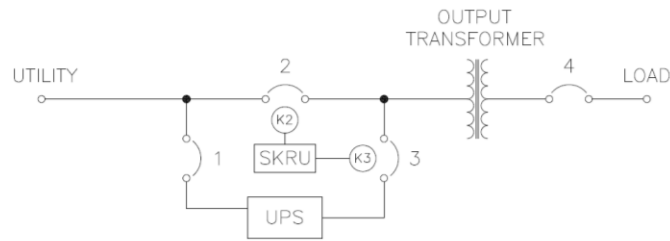
Always observe proper switching sequence to avoid loss of power to the load.

5.2 To place load on maintenance bypass:

1. Reference the UPS user's manual – manual transfer to bypass. Place UPS in bypass.
2. Verify the UPS is in bypass by observing the SKRU push-button is illuminated.
3. While pressing the SKRU push-button, rotate and remove key.
4. Insert key into K2 and retract bolt.
5. Set circuit breaker 2 to the closed/on position.
6. Set circuit breaker 3 to the open/off position.
7. Rotate key in K3 to extend bolt and remove key.
8. Place key into SKRU and rotate key to capture.
9. Load is on maintenance bypass.
10. Turn off UPS.
11. Set breaker(s) 1 (and 4 if available) to the open/off position.
12. The UPS is isolated and can be safely serviced. Follow all warnings and precautions in UPS user's manual.

5.3 To place load on ups:

1. Set breaker(s) 1 (and 4 if available) to closed/on position.
2. Start the UPS as instructed in UPS's user's manual.
3. Place the UPS in manual transfer to bypass, as instructed in the UPS user's manual.
4. While pressing the SKRU push-button, rotate and remove key.
5. Insert key into K3 and retract bolt.
6. Set circuit breaker 3 to the closed/on position.
7. Set circuit breaker 2 to the open/off position.
8. Rotate key in K2 to extend bolt and remove the key.
9. Place the key into SKRU and rotate key to capture.
10. Place the UPS in manual transfer to inverter, as instructed in the UPS user's manual.
11. Verify all lights on the UPS front display are correct.



TO PLACE LOAD ON MAINTENANCE BYPASS:

1. REFERENCE THE UPS USER'S MANUAL – MANUAL TRANSFER TO BYPASS. PLACE UPS IN BYPASS.
2. VERIFY THE UPS IS IN BYPASS BY OBSERVING THE SKRU PUSH-BUTTON IS ILLUMINATED.
3. WHILE PRESSING THE SKRU PUSH-BUTTON, ROTATE AND REMOVE KEY.
4. INSERT KEY INTO K2 AND RETRACT BOLT.
5. SET CIRCUIT BREAKER 2 TO THE CLOSED/ON POSITION.
6. SET CIRCUIT BREAKER 3 TO THE OPEN/OFF POSITION.
7. ROTATE KEY IN K3 TO EXTEND BOLT AND REMOVE KEY.
8. PLACE KEY INTO SKRU AND ROTATE KEY TO CAPTURE.
9. LOAD IS ON MAINTENANCE BYPASS.
10. TURN OFF UPS
11. SET BREAKERS 1 AND 4 TO THE OPEN/OFF POSITION.
12. THE UPS IS ISOLATED AND CAN BE SAFELY SERVICED. FOLLOW ALL WARNING AND PRECAUTIONS IN UPS USER'S MANUAL.

TO PLACE LOAD ON UPS:

1. SET CIRCUIT BREAKERS 1 AND 4 TO CLOSED/ON POSITION.
2. START THE UPS AS INSTRUCTED IN UPS'S USER'S MANUAL.
3. PLACE THE UPS IN MANUAL TRANSFER TO BYPASS, AS INSTRUCTED IN THE UPS USER'S MANUAL.
4. WHILE PRESSING THE SKRU PUSH-BUTTON, ROTATE AND REMOVE KEY.
5. INSERT KEY INTO K3 AND RETRACT BOLT.
6. SET CIRCUIT BREAKER 3 TO THE CLOSED/ON POSITION.
7. SET CIRCUIT BREAKER 2 TO THE OPEN/OFF POSITION.
8. ROTATE KEY IN K2 TO EXTEND BOLT AND REMOVE THE KEY.
9. PLACE THE KEY INTO SKRU AND ROTATE KEY TO CAPTURE.
10. PLACE THE UPS IN MANUAL TRANSFER TO INVERTER, AS INSTRUCTED IN THE UPS USER'S MANUAL.
11. VERIFY ALL LIGHTS ON THE UPS FRONT DISPLAY ARE CORRECT.

Figure 5 – Typical Circuit Breaker Sequence Label

6. MAINTENANCE

There are no wear items in the MBS that require periodic replacement. However, regular care will assure maximum availability of power.

Keep the ventilation openings in the cabinet free of dust and debris.

Wipe the cabinet exterior with a soft cloth, slightly dampened with water, to remove dust.

Consider performing periodic infrared temperature measurements on the circuit breaker terminations. This will require access to the cabinet interior. There are hazardous voltages present, and any work must be performed using caution. Only trained service personnel should perform this work. Elevated temperatures of the terminations usually are the sign of a loose connection but can also signal that a breaker is failing. Loose connections should only be serviced after removal of power.

If the system is powered down, consider removing accumulated dust from the cabinet interior using a vacuum cleaner.

7. TECHNICAL SPECIFICATIONS

Table 2 - Wire Size Requirements and Maximum Current Ratings

*Wire must be rated 75°C or higher

480 V Input:				
UPS rating (kVA)	Rated Current (A)	Supply Breaker (A)	Minimum Wire Size	Ground Wire Size
65	89	125	1/0	#6
80	109	150	2/0	#6
480 V Output:				
UPS rating (kVA)	Rated Current (A)	Load Breaker (A)	Minimum Wire Size	
65	78	150	#2	
80	96	150	1/0	

Table 3 –Terminal Tightening Torques
Input /Output/Neutral Terminal Torque

Bolt Size	Torque
1/4-20	75 inch - pounds

Ground Lug Torque

Wire Size	Torque
#6-4 AWG	45 inch - pounds
#2-1/0 AWG	50 inch - pounds

Low Voltage Terminal Torque

Wire Size	Torque
# 26-10 AWG	5.3 – 7.0 inch - pounds

Table 4 - Environmental Specifications

Altitude	De-rate load capability above 1000 meters 1% per 100 meters.
Operating Temperature	40° C Maximum
Humidity	Maximum 95%RH, Non-condensing