Leading AC Backup Technology

EXTERNAL WRAPAROUND MANUAL BYPASS SWITCH (MBS)

Installation and Operation Manual V1.0

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  Commercial Power as default source
- **AC BACKUP IN A DC ENVIRONMENT**
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- **HARSHEST AC INPUT CONDITIONS**
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Important Safety Instructions
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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
1.0	09/05/2018	-	First release of the Manual.

1. CE+T at a glance

CE+T Power designs, manufactures and markets a range of products for industrial operators with mission critical applications, who are not satisfied with existing AC backup systems performance and related maintenance costs.

Our product is an innovative AC backup solution that unlike most used UPS's

- Maximizes the operator's applications uptime;
- Operates with lowest OPEX;
- Provides best protection to power disturbances;
- Optimizes footprint.

Our systems are:

- Modular
- Truly redundant
- Highly efficient
- Maintenance free
- Battery friendly

CE+T puts 60+ years expertise in power conversion together with worldwide presence to provide customized solutions and extended service 24/7 – 365 days a year.

2. Abbreviations

TSI	Twin Sine Innovation
EPC	Enhanced Power Conversion
REG	Regular
DSP	Digital Signal Processor
AC	Alternating current
DC	Direct current
ESD	Electro Static Discharge
MET	Main Earth Terminal
MBP	Manual Bypass
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
PE	Protective Earth (also called Ground / GND)
N	Neutral
PCB	Printed Circuit Board
TRS	True Redundant Structure
MCB	Miniature Circuit Breaker
MCCB	Molded Case Circuit Breaker
CB	Circuit Breaker

3. Warranty and Safety Conditions*

WARNING:

The electronics in the power supply system are designed for an indoor, clean environment.

When installed in a dusty and/or corrosive environment, indoor, it is important to:

- Install an appropriate filter on the enclosure door, or on the room's air conditioning system.
- Keep the enclosure door closed during operation.
- Replace the filters on a regular basis.

Important Safety Instructions, Save These Instructions.

3.1 Disclaimer

- The manufacturer declines all responsibilities if equipment is not installed, used or operated according to the instructions herein by skilled technicians according to local regulations.
- Warranty does not apply if the product is not installed, used or handled according to the instructions in the manual.
- This equipment is shipped with a SHOCKWATCH monitor. If the SHOCKWATCH shows that the equipment was exposed to excessive force the warranty will be void.

3.2 Technical care

- This electric equipment can only be repaired or maintained by a "qualified employee" with adequate training. Even personnel who are in charge of simple repairs or maintenance are required to have knowledge or experience related to electrical maintenance.
- Please follow the procedures contained in this Manual, and note all the "DANGER", "WARNING" AND "NOTICE" marks contained in this Manual. Warning labels must not be removed.
- Qualified employees are trained to recognize and avoid any dangers that might be present when working on or near exposed electrical parts.
- Qualified employees know how to lock out and tag out machines so the machines will not accidentally be turned on and injure employees working on them.
- Qualified employees also know safety related work practices, including those by OSHA and NFPA, as well as knowing what personal protective equipment should be worn.
- All operators are to be trained to perform the emergency shut-down procedure.
- Never wear metallic objects such as rings, watches, or bracelets during installation, service and maintenance of the product.
- Maximum operating ambient temperature is 40°C (104°F).
- Insulated tools must be used at all times when working with live systems.
- When handling the system/units pay attention to sharp edges.
- This product is suitable for use in a computer room.

* These instructions are valid for most CE+T Products/Systems. Some points might however not be valid for the product described in this manual.

3.3 Installation

- This product is intended to be installed only in restricted access areas as defined by UL60950 and in accordance with the National Electric Code, ANSI/NFPA 70, or equivalent agencies.
- The Inverter System may contain output over current protection in the form of circuit breakers. In addition to these circuit breakers, the user must observe the recommended UL listed upstream and downstream circuit breaker requirements as defined in this manual.
- Please use extreme caution when accessing circuits that may be at hazardous voltages or energy levels.
- The modular inverter rack is a dual input power supply. The complete system shall be wired in a way that both input and output leads can be de-energized when necessary.
- REG systems and EPC systems that have no AC input wired and connected can be seen as independent power sources. To comply with local and international safety standards N (input) and PE shall be bonded. The bonded connection between N (input) and PE must be removed once the AC input is connected.
- AC and DC circuits shall be terminated with no voltage / power applied (de-energized).
- The safety standard IEC/EN62040-1-1 requires that, in the event of an output short circuit, the inverter must disconnect in 5 seconds maximum. The parameter can be adjusted on T2S ETH; however, if the parameter is set at a value > 5 seconds, an external protection must be provided so that the short circuit protection operates within 5 seconds. Default setting is 60 seconds.
- The system is designed for installation within an IP20 environment. When installed in a dusty or humid environment, appropriate measures (air filtering …) must be taken.
- Environment Conditions:
  - Storage Conditions: -40 to 70°C
  - Relative Humidity: 95%, non-condensing
  - Altitude above sea without de-rating: Less than 1500 m
Greater than 1500 m – de-rating at 0.8% per 100 m

3.3.1 Handling

- The cabinet shall not be lifted using lifting eyes.
- Remove weight from the cabinet by unplugging the inverters. Mark inverters clearly with shelf and position for correct rebuild. This is especially important in dual or three phase configurations.
- Empty inverter positions must not be left open. Replace with module or cover.
- This equipment is shipped with a SHOCKWATCH monitor. If the SHOCKWATCH shows that the equipment was exposed to excessive force the warranty will be void.

3.3.2 Surge and transients

The mains (AC) supply of the modular inverter system shall be fitted with Lightning surge suppression and Transient voltage surge suppression suitable for the application at hand. Manufacturer's recommendations of installation shall be adhered to. Selecting a device with an alarm relay for function failure is advised.

Indoor sites are considered to have a working lightning surge suppression device in service.

- Indoor sites Min Class II.
- Outdoor sites Min Class I + Class II or combined Class I+II. The modular inverter system/rack can reach hazardous leakage currents. Grounding must be carried out prior to energizing the system. Grounding shall be made according to local regulations.

3.3.3 Other

- Insulation test (Hi-Pot) must not be performed without instructions from the manufacturer.

3.4 Maintenance

- The modular inverter system/rack can reach hazardous leakage currents. Grounding must be carried out prior to energizing the system. Grounding shall be made according to local regulations.
- Prior to any work conducted on a system/unit make sure that AC input voltage and DC input voltage are disconnected.
- Inverter modules and shelves contain capacitors for filtering and energy storage. Prior to accessing the system/modules after power down, wait at least 5 minutes to allow capacitors to discharge.
- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.

3.5 Replacement and Dismantling

- ESD Strap must be worn when handling PCB's and open units.
- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose of the materials which are potentially harmful to the environment, in accordance with the local regulations in force in the country of installation.
- If the equipment is dismantled, to dispose of its component products, you must comply with the local regulations in force in the country of destination and in any case avoid causing any kind of pollution.

To download the latest documentation and software, please visit our website at www.cet-power.com

4. Purpose and Applicability

The purpose of this document is to detail the installation and operation instructions for the external wraparound manual bypass switch (*MBS*) cabinet with handshake interlock feature.

4.1 Product Model

This document applies to the following models of the Comm/net Systems, Inc external wraparound wall-mounted manual bypass switch (MBS):

- **016-1895-10 r02:** MBS; Rack Cabinet; 250A; 120/208VAC; 3PH; Rotary Switch Type; Make-Before-Break; Handshake Interlock; Up to (*4*) 3-pole breaker positions.
- **016-1898-10 r01:** MBS; Rack Cabinet; 500A; 120/208VAC; 3PH; Rotary Switch Type; Make-Before-Break; Handshake Interlock; (*2*) 500A output breakers.

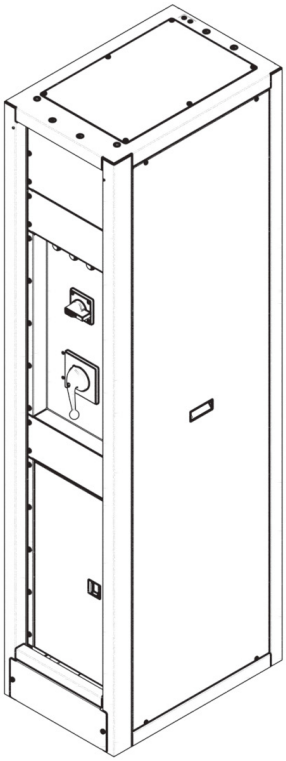


Figure 1. CSI Manual Bypass Switch (016-1895-10)

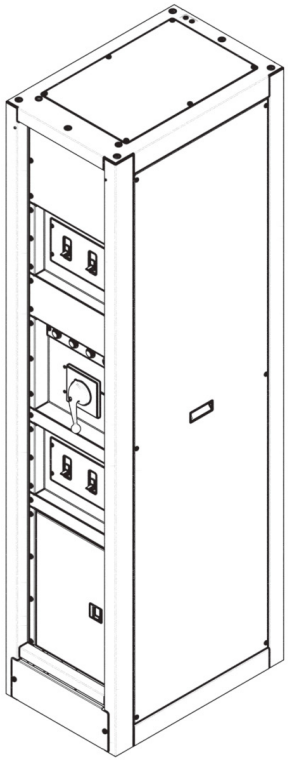


Figure 2. CSI Manual Bypass Switch (016-1898-10)

5. Theory of Operation

5.1 Introduction

The CSI external wraparound manual bypass switch (*MBS*) allows feeding critical AC loads directly from the main distribution panel (*MDP*). Correct operation of the switch will remove all AC power from the inverter, allowing for Replacement of inverter, maintenance, and operator safety.

5.2 Features

- Rotary make-before-break load switch.
- Electromechanical interlock feature to prevent movement of the source switch until the inverter is ready for bypass.
- Handshaking interlock feature compatible with CE+T inverters when bundled at time of purchase.
- Rotary ON/OFF inverter AC feed switch to safely remove AC power from the inverter (*016-1895-10 model*). Also allows testing of inverter while load is on Bypass.
- Clear status LED indicators & operating placards.
- Dry contacts for remote state monitoring.

6. Unpacking and Inspection

The Comm/net Systems MBS was carefully packaged at the factory to withstand the normal rigors of shipping. However, you should carefully inspect the box and contents to confirm that no damage has occurred in transit. Most shipping carriers require notification of shipping damage within twenty-four hours of delivery, and it is the responsibility of the recipient to inspect the shipment immediately upon receipt.

6.1 Package Contents

Included with your product are the following items:

- Manual bypass switch cabinet
- Panel access keys (*2*)
- Spare fuse for interlock board (*0.5A/250V Bussmann MDL Type*)
- User Manual

7. Installation

7.1 Installation Preparation

When selecting an installation location, ensure that all of the following conditions are met before proceeding.

7.1.1 Elevated Operating Ambient Temperature

Take care to install the equipment in an environment compatible with the maximum ambient temperature (*TMA*) specified in Section 9, page 22.

7.1.2 Reduced Air Flow

Installation of the equipment should be such that the amount of air flow required for safe operation of the equipment is not compromised.

7.1.3 Mechanical Loading

Ensure that the equipment is mounted in a manner suitable to support its weight (*use correct anchors*).

7.1.4 Circuit Overloading

Give consideration to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Use appropriate consideration for equipment nameplate ratings when addressing this concern.

7.1.5 Reliable Earthing

Maintain reliable earthing of equipment. Pay particular attention to supply connections other than direct connections to the branch circuit (*e.g., use of power strips*).

7.1.6 Disconnect Device

A readily accessible disconnect device must be incorporated in the building installation wiring.

7.2 Mounting

Notice:

- *This product must be installed within a restricted access location where access is through the use of a tool, lock and key or other means of security, and is controlled by the authority responsible for the location. This product must be installed and maintained only by qualified technicians.*
- *This product is intended for indoor applications only.*
- *NEMA1 / IP20 Environment.*

Caution!

Unit is top heavy and can present a tipping hazard. Equipment damage and injury can occur.

Step 1. Uninstall the bottom front panel by removing the *(2)* #12-24 screws *(see Figure 3)*.

Step 2. Uninstall the *(2)* larger rear panels by removing the *(12)* #12-24 screws *(see Figure 4)*.

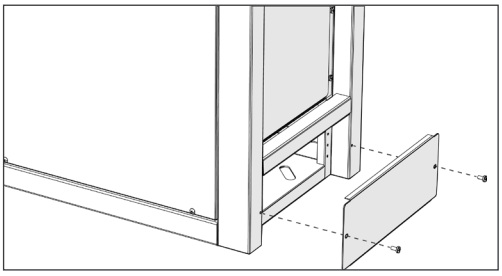


Figure 3. Bottom front panel

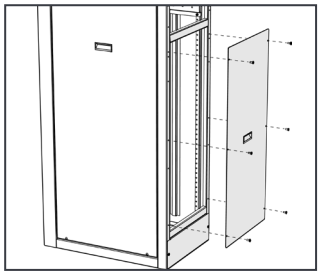


Figure 4. Larger rear panels

Step 3. Uninstall the bottom rear panel by removing the *(2)* #12-24 screws *(see Figure 5)*.

Step 4. Anchor the cabinet to the ground through the *(4)* mounting slots *(see Figure 6)*. Use anchors appropriate for the floor type.

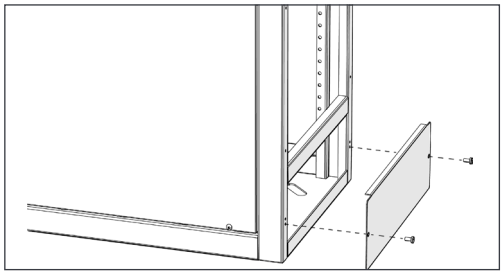


Figure 5. Bottom rear panel

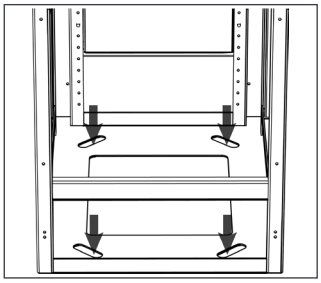


Figure 6. Mounting slots

7.3 Chassis Ground

Caution: Do not energize the MBS before chassis ground is connected.

The chassis ground is located on the top of the MBS cabinet *(see Figure 6)*. A two hole lug landing position is provided. See table below for termination information.

MPORTANT: Grounding hardware not included. A properly-sized grounding conductor must be installed per NEC (250.122).

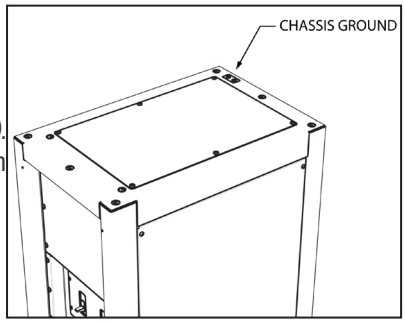


Figure 7. Chassis ground

Table 1: Ground Specifications

Two hole Landing Type	Hole/stud size	Center to Center	Recommended Torque value
Threaded insert	3/8 in.	1 in.	350 in/lbs

Step 1. Secure the ground cable to the chassis by tightening 3/8 in. hardware.

7.4 Top Covers

The MBS includes a removable top cover that cables can be routed through. Uninstall these covers by removing the #10-32 screws (see Figure 8). Drill or knock out any holes required for cable entry into these covers, and replace before feeding cable into the unit.

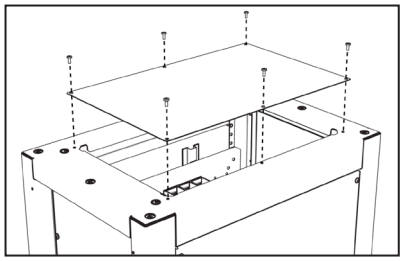


Figure 8. Top cover

7.5 Alarm/Bypass Operation Signal Input Wiring

Warning

- Prior to cable termination, ensure inverter ac feed switch is in off/open (0) position, source switch is in inverter (1) position, and main Breaker, if equipped, is in off/open position.
- Risk of electric shock. Can cause equipment damage, injury and death.
- Multiple power sources are present, ensure all input power feeds are not energized before Installing them. Electrical installation should only be performed by qualified personnel with proper tools and protective safety equipment.

Step 1. Ensure that no power is applied to the unit, then terminate the **REMOTE STOP**, **REQUEST**, **READY**, and **ALARM** wiring to the terminal blocks (see Figure 9).
These signals meet NEC Class 2 requirements.

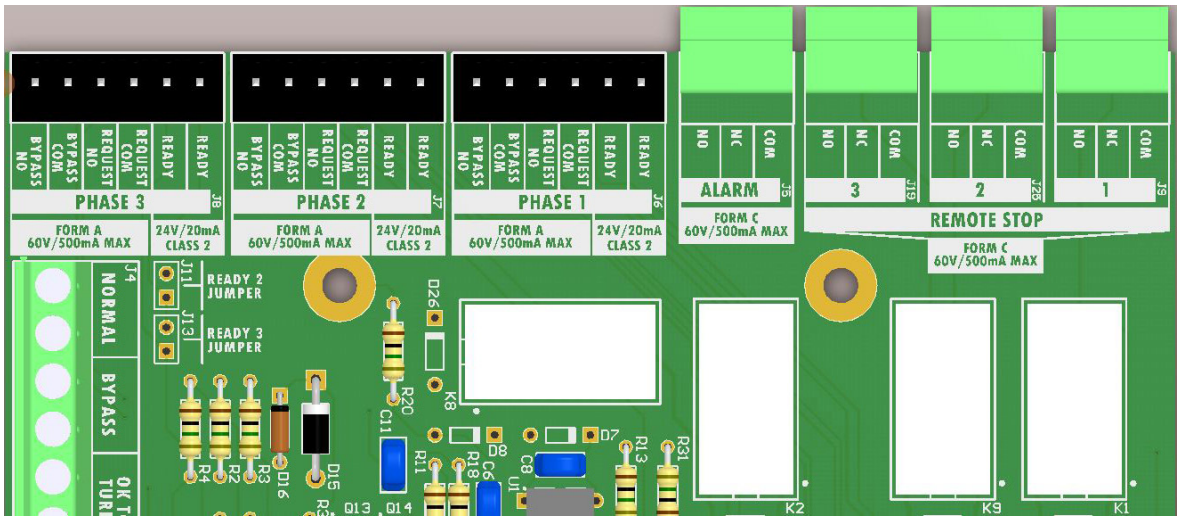


Figure 9. Alarm/Bypass Operation Signal Input Wiring

7.6 Power Cables

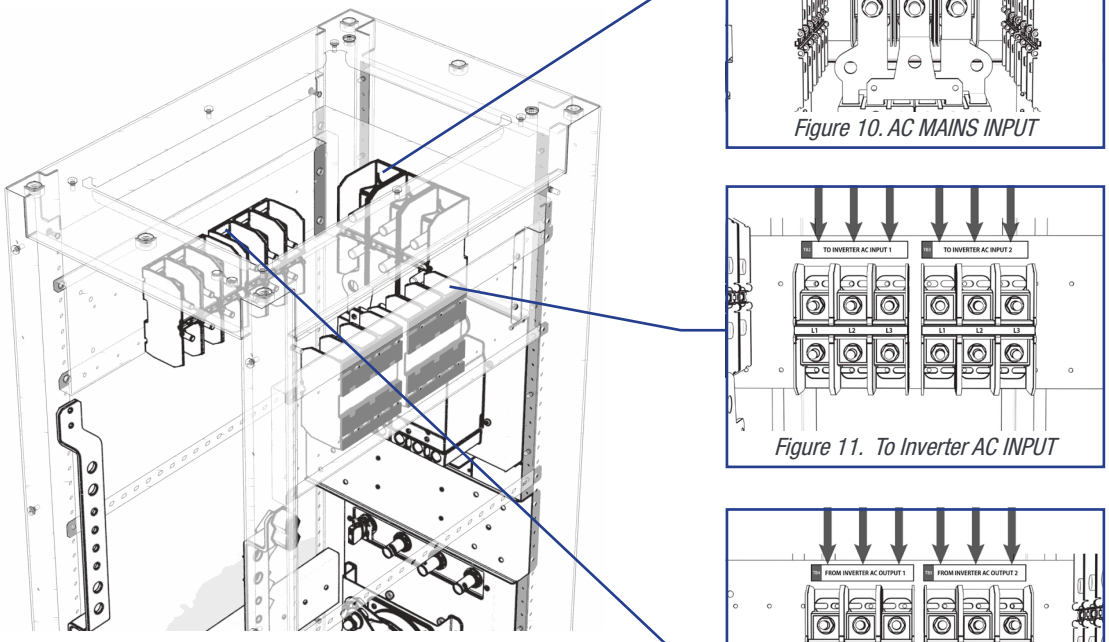
Warning

- Risk of electric shock. Can cause equipment damage, injury and death.
- Multiple power sources are present, ensure all input power feeds are not energized before manipulating connections. Electrical installation should only be performed by qualified personnel with proper tools and protective safety equipment.

Step 1. Terminate the **AC MAINS INPUT** cables to Line 1 (**L1**), Line 2 (**L2**), Line 3 (**L3**) on Terminal Block 1 (**TB1**). See Figure 10. Terminate the Neutral (N) and Protective Earth (**PE**) conductors to their respective bus bars marked (**N**) and ⏚ (see Figures 14 and 15).

Step 2. Terminate the **TO INVERTER AC INPUT** cables to Line 1 (**L1**), Line 2 (**L2**), Line 3 (**L3**) on Terminal Blocks 2 (**TB2**) and 3 (**TB3**) (016-1898-10 model only). See Figure 11. Terminate the Neutral (**N**) and Protective Earth (**PE**) conductors to their respective bus bars.

Step 3. Terminate the **FROM INVERTER AC OUTPUT** cables to Line 1 (**L1**), Line 2 (**L2**), Line 3 (**L3**) on Terminal Blocks 4 (**TB4**) and 5 (**TB5**) (016-1898-10 model only). See Figure 12. Terminate the Neutral (**N**) and Protective Earth (**PE**) conductors to their respective bus bars.



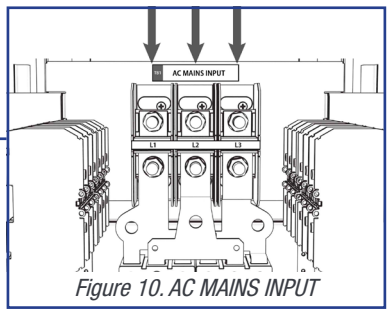


Figure 10. AC MAINS INPUT

Figure 11. To Inverter AC INPUT

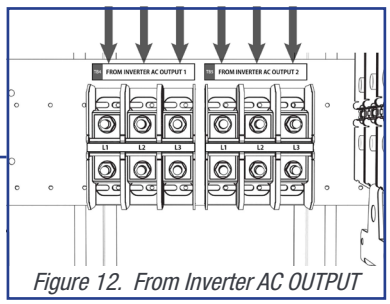


Figure 12. From Inverter AC OUTPUT

7.7 Adding Loads

Warning: Ensure Breakers are in the off position before proceeding.

Step 1. Remove the deadfront panel by uninstalling the *(9)* #12-24 screws *(see Figure 13)*.

Step 2. Terminate GROUND connection to GROUND bar *(see Figure 14)*.

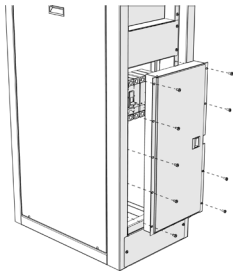


Figure 13. Deadfront

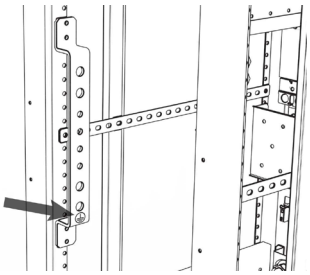


Figure 14. Ground bus bar

Step 3. Terminate NEUTRAL connection to NEUTRAL bus bar *(see Figure 15)*.

Step 4. Terminate Line 1 (**L1**), Line 2 (**L2**), and Line 3 (**L3**) cables to load side of circuit breaker(s) *(see Figure 16)*.

Step 5. Ensure all connections are tight.

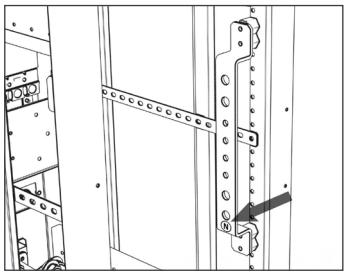


Figure 15. Neutral Bus Bar

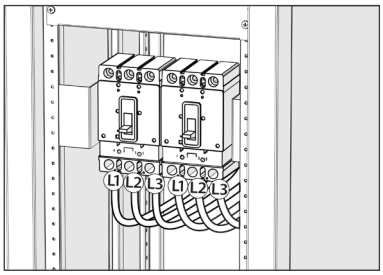


Figure 16. Connecting critical loads

7.8 Reinstall Components

Step 1. Ensure that all terminations are properly tightened and that there is no loose hardware, then replace all MBS panels.

Step 2. Energize the bypass switch by turning on the upstream feed breaker.

Step 3. Energize the inverter by rotating the INVERTER AC FEED switch to position 1 *(ON/CLOSED)* or closing AC FEED breakers. *(See Figure 17)*.

Step 4. Energize loads by turning load breakers to ON position.

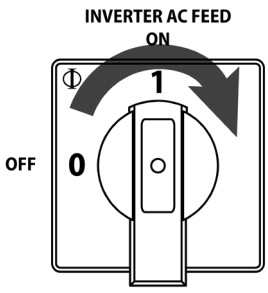


Figure 17. Inverter AC feed position 1 (ON/CLOSED)

8. Operation

Warning

- Incorrect use of this equipment can interrupt power to loads and cause a safety hazard.
- Only properly trained and qualified personnel should perform maintenance on the manual bypass switch.

8.1 Features Overview

The MBS includes two rotary switches located on the front of the panel:

- **INVERTER AC FEED** - this switch (*circuit breakers on 016-1895-10 model*) controls AC power to the inverter mains input.
- **SOURCE** - this switch determines whether loads are fed from the inverter (*NORMAL*) output or from the mains (*BYPASS*).

Above the two rotary switches are *(3)* LED indicator lights:

- **GREEN**: Indicates normal operation
- **ORANGE**: indicates bypass mode; inverter output is disconnected from loads
- **WHITE**: Indicates OK to switch; confirmation that a signal is received from the inverter that mains and inverter output are in phase

Near the OK TO SWITCH indicator is the PUSH TO REQUEST button:

- Allows the release of the solenoid interlock *(see Section 5.1.1)*

8.1.1 Handshaking Feature

To ensure the inverter source and bypass source are synchronized prior to switching, the MBS features a “handshaking” interlock scheme. When the PUSH TO REQUEST button is pressed, a signal is sent to the inverter requesting the normal phase shift be cancelled such that the inverter output is in sync with the bypass source. When the inverter has cancelled the phase shift, it will issue a “ready” signal to the MBS which will release the solenoid interlock and activate the OK TO SWITCH indicator. The inverter will reinstate the phase-shift automatically within 120 seconds, so it is recommended that the source switch should be operated within 10 seconds.

8.1.2 Inverter Stop

When the SOURCE switch is in the BYPASS position and the INVERTER AC FEED switch or breaker is in the OFF position, a stop signal is sent to the inverter *(REMOTE STOP contact closed)* causing the inverter to shut down.

8.1.3 Alarm Contacts

The MBS features alarm contacts that can be used to remotely monitor MBS status. The corresponding alarm relay will be active under any of the following conditions:

- Mains AC Fail
- SOURCE Switch Not in NORMAL Position
- INVERTER AC FEED Switch/Breakers Not in ON Position
- Interlock Control Power Supply Failure

8.2 Switching from NORMAL to BYPASS

Step 1. Depress and release REQUEST button.

Step 2. Wait for OK TO SWITCH indicator (*white*) to illuminate.

Step 3. Within ten seconds turn SOURCE switch from position 1 (*NORMAL*) to position 2 (*BYPASS*). See Figure 18.

Step 4. Verify that BYPASS indicator *(orange)* is illuminated.

Step 5. Turn INVERTER AC FEED switch or breakers to position 0 *(OFF/OPEN)*. See Figure 19.

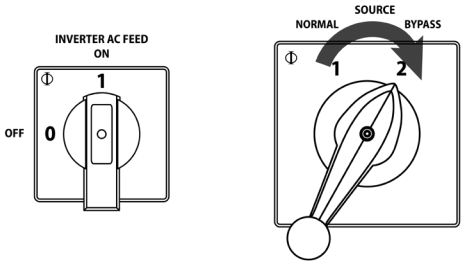


Figure 18. Switching SOURCE to BYPASS

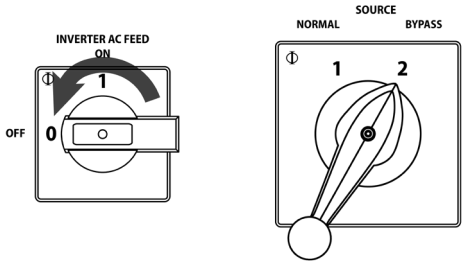


Figure 19. Turning off AC FEED

8.3 Switching from BYPASS to NORMAL

Step 1. Turn INVERTER AC FEED switch or breakers to position 1 *(ON/CLOSED)*. See Figure 20.

Step 2. Check that all inverter modules are operating *(module LEDs are green)*.

Step 3. Depress and release REQUEST button.

Step 4. Wait for OK TO SWITCH indicator (*white*) to illuminate.

Step 5. Within ten seconds turn SOURCE switch from position 2 *(BYPASS)* to position 1 *(NORMAL)*. See Figure 21.

Step 6. Verify that NORMAL indicator *(green)* is illuminated.

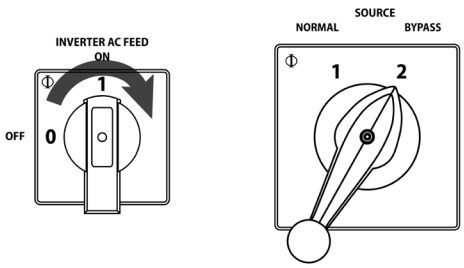


Figure 20. Turning on AC FEED

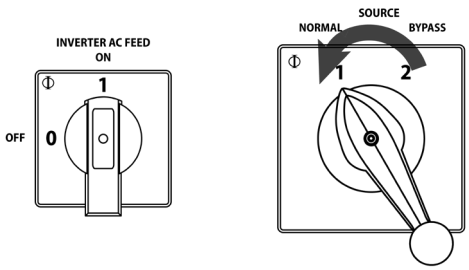


Figure 21. Switching SOURCE to NORMAL

8.4 Emergency Interlock Release

Warning

Be sure the two sources are synchronized prior to using this feature. Failure to do so may cause premature switch contact wear, switch damage, and/or loss of power to load equipment.

In situations where the inverter cannot provide the ready signal (*inverter not yet installed, or inverter failure*), a means is provided to release the interlock at the MBS. Press and hold the “OK TO SWITCH” indicator while turning the SOURCE switch.

9. Product Specifications

9.1 Specifications

Notice: Replace fuse with bussmann mdl type fuse and .05a/250v rating only.

Caution: Indoor use only.

TABLE 2. SPECIFICATIONS

	016-1895-10	016-1898-10
Input Voltage	120/208 VAC	120/208 VAC
Input Current	250 A	500 A
Maximum Input Interruption Device	250 A	500 A
Interrupt Rating	65 kA	65 kA
Fuse Replacement Information	Bussmann MDL type .05A/250V fuse ONLY	Bussmann MDL type .05A/250V fuse ONLY
Width	18 in.	18 in.
Height	84 in.	84 in.
Depth	27.56 in.	27.56 in.
UL File Number	Pending	Pending
UL Standard	UL 1008	UL 1008
NEMA Enclosure	Type 1	Type 1

10. Appendix

10.1 Mechanical Drawings

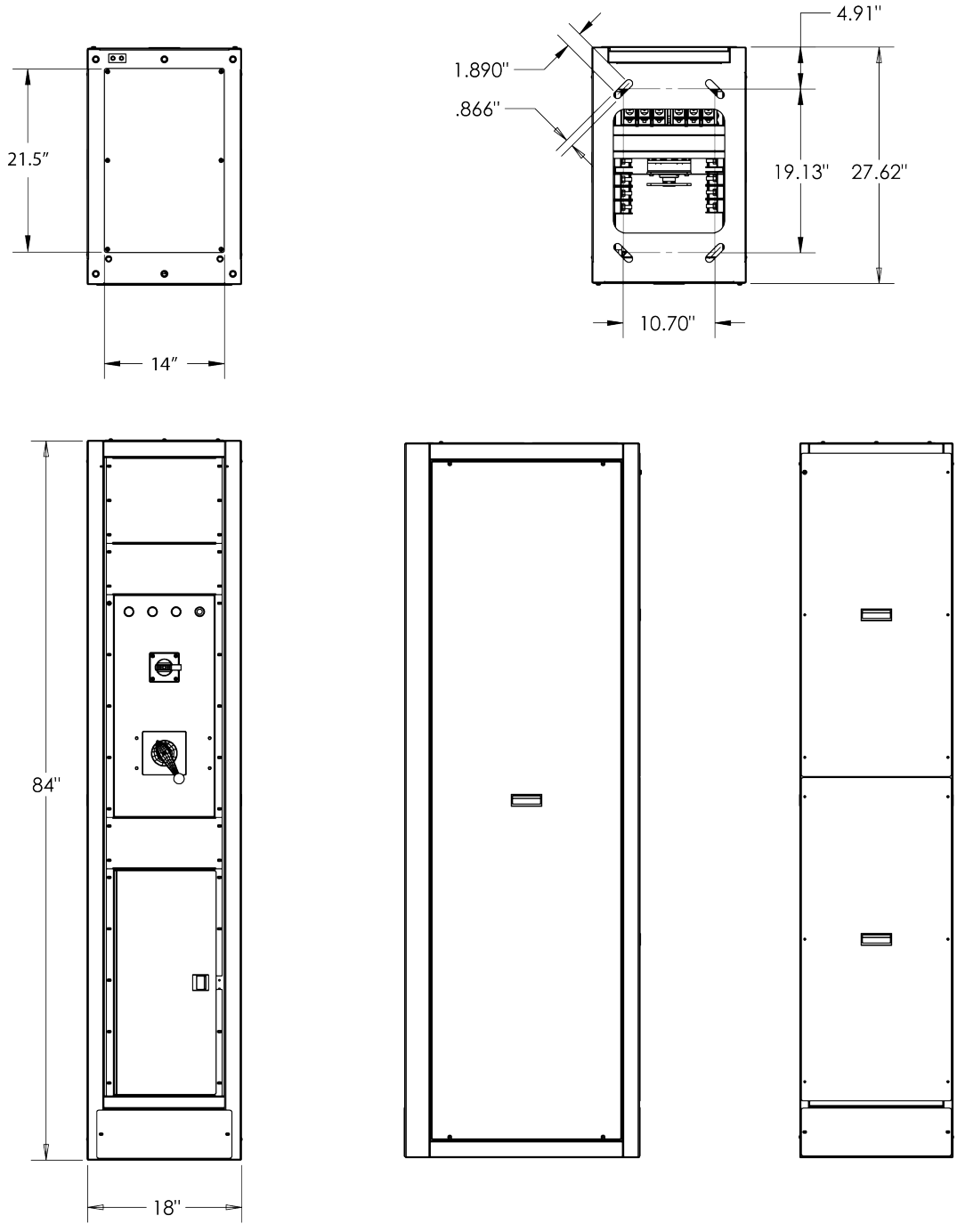


Figure 22. 250A External Wraparound Manual Bypass Switch Dimensions (016-1895-10 Model)

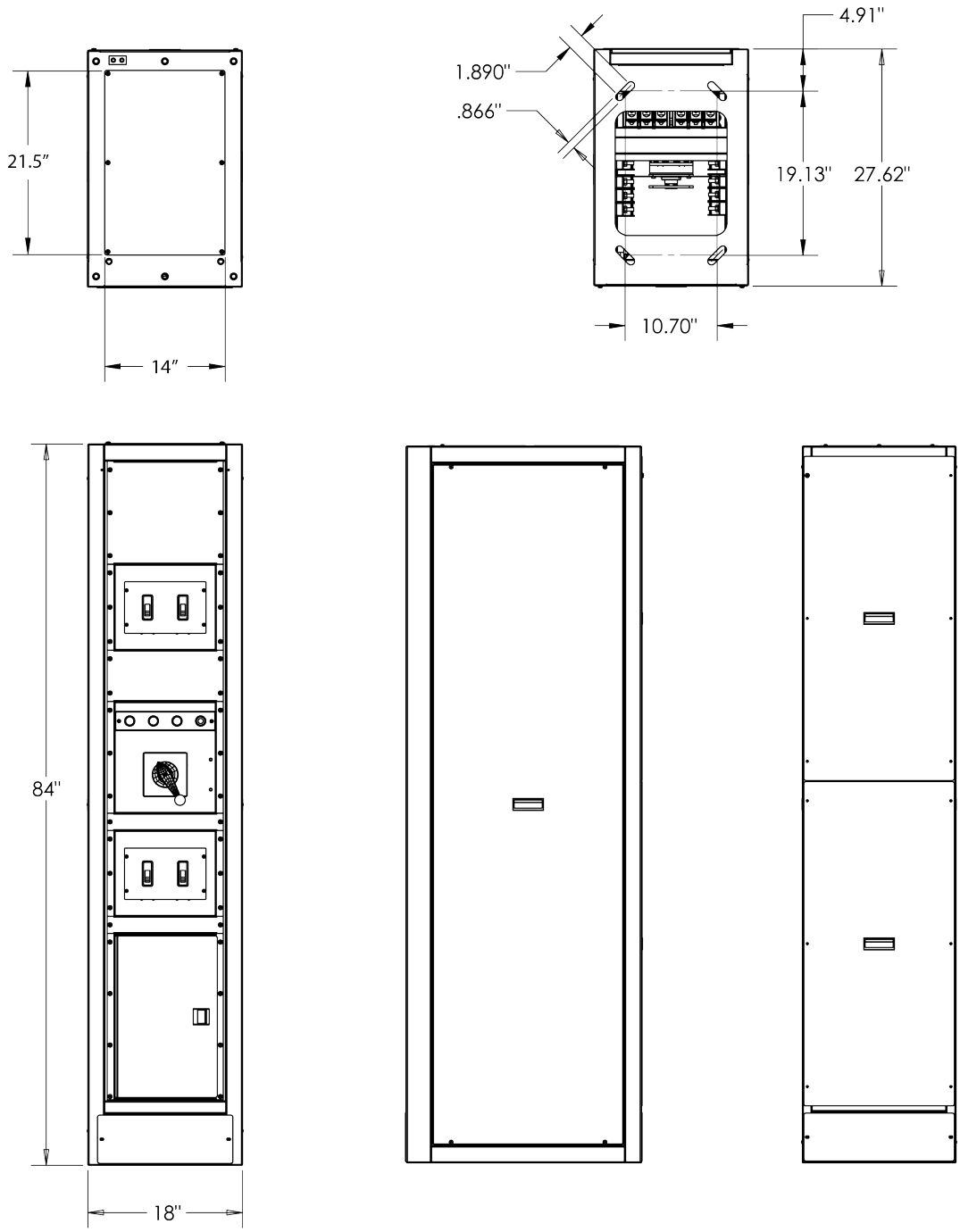


Figure 23. 500A External Wraparound Manual Bypass Switch Dimensions (016-1898-10 Model)

10.2 Supported Wire Sizes

TABLE 3. POWER TERMINAL BLOCKS (016-1895-10 MODEL)

WIRE GAUGE	RECOMMENDED TORQUE VALUE	STUD THREAD
10 AWG - 350 kcmil	8 - 14 lb.ft (10-20 Nm)	M10

TABLE 4. POWER TERMINAL BLOCKS (016-1898-10 MODEL)

TERMINAL BLOCK	WIRE GAUGE	RECOMMENDED TORQUE VALUE	STUD THREAD
TB1	4 AWG - 1000 kcmil	19 - 25 lb.ft (25 - 35 Nm)	M16
TB2 - TB5	10 AWG - 350 kcmil	8 - 14 lb.ft (10 - 20 Nm)	M10

TABLE 5. SIGNAL WIRING (ALL MODELS)

WIRE GAUGE	TERMINAL BLOCK
14-20 AWG	REMOTE STOP/REQUEST/READY/ALARM