TOSHIBA

G9000 SERIES

INSTALLATION AND OPERATION MANUAL

480/480 V 1050/1330/1500/1660/2000kVA

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December 2022

TOSHIBA

IMPORTANT NOTICE

Never attempt to install, operate, maintain or dispose of this equipment until you have first read and understood all of the relevant product warnings and user directions that are contained in this Installation manual.

The installation of this equipment must only be performed by qualified personnel.

The Instructions contained in this manual are not intended to cover all of the details or variations in equipment or to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be required or should particular problems arise which are not covered sufficiently the matter should be referred to the local TOSHIBA sales office.

Nothing in this manual shall alter Toshiba International Corporation's standard terms and conditions or the conditions of any written sales contract.

Any Electrical or mechanical modifications to this equipment without prior written consent of TOSHIBA will void all warranties and may void UL/CUL listing. Unauthorized modifications may also result in personal injury, death, or equipment damage.

UNINTERRUPTIBLE POWER SYSTEM

If additional information or technical assistance is required call TOSHIBA Customer Support Center at 877-867-8773, or write to: Toshiba International Corporation, 13131 West Little York Road, Houston, TX 77041-9990: Attn: UPS Product Manager.

Keep this manual with the UPS equipment.

Job Number:_____

Model Number: _____

Serial Number:_____

Application:_____

Shipping Date:_____

Date of Installation:_____

Inspected By:_____

TOSHIBA

Purpose and Scope of Manual

This manual provides information on how to safely install, operate, and maintain your TOSHIBA power electronics product. This manual includes a section on General Safety Instructions that describes the warning labels and symbols that are used throughout the manual. Read the manual completely before installing, operating, or performing maintenance on this equipment.

This manual and the accompanying drawings should be considered a permanent part of the equipment and should be readily available for reference and review. Dimensions shown in the manual are in metric and/or the English equivalent.

TOSHIBA reserves the right, without prior notice, to update information, make product changes, or to discontinue any product or service identified in this publication.

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Printed in USA

Contacting TOSHIBA Customer Support Center

The TOSHIBA Customer Support Center can be contacted to obtain help in resolving any **Uninterruptible Power System** problem that you may experience or to provide after sales service support.

Toshiba Customer Support Center
8 a.m. to 5 p.m. (CST) – Monday through Friday
Tel (877) 867-8773
Fax (713) 896-5212
E-mail – *TIC-UPSservice@toshiba.com*

You may contact TOSHIBA by writing to:

TOSHIBA INTERNATIONAL CORPORATION.
SOCIAL INFRASTRUCTURE SYSTEMS GROUP
POWER ELECTRONICS DIVISION
13131 West Little York Rd.
Houston, TX 77041-9990
Attn: UPS Product Manager

For further information on Toshiba products and services, please visit our website at:

http://www.toshibaups.com

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TOSHIBA

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1 How to use this Manual

This manual is designed for ease of use, giving the user easy and quick reference to information.

This manual uses notice icons to draw attention to the user important information regarding the safe operation and installation of the UPS.

1.1 Notice Icons

The notice icons used in this manual are explained below, and should be taken into account and adhered to whenever they appear in the text of this manual.

WARNING

Warning: A warning symbol shows potentially hazardous situation or condition which could result in personal injury or death, if not avoided.

CAUTION

Caution: A caution symbol shows potentially hazardous situation or condition which could result in personal injury or equipment damage, if not avoided.

NOTE

Note: A Note symbol shows the information the user or the service personnel should observe during the UPS operation or service work.

PROHIBIT

Prohibit: A prohibit symbol shows the act the user or the service personnel should NEVER perform during the UPS installation, operation or service work.

Safety Recommendations: If any problems are encountered while following this manual, contact the Toshiba Customer Support Center.

1.2 Qualified Personnel

Only qualified persons are to install, operate or service this equipment according to all applicable codes and established safety practices.

A qualified person must:

1) Read this entire instruction manual carefully.

2) Be skilled in the installation, construction or operation of the equipment and aware of the hazards involved.

3) Be trained and authorized to safely energize, de-energize, clear, ground, lockout and tag circuits in accordance with established safety practices

4) Be trained and authorized to perform the service, maintenance or repair of this equipment

5) Be trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses, face shield, flash clothing, etc. in accordance with established practices

6) Be trained in rendering first aid.

2 Introduction

The Toshiba Uninterruptible Power Supply System (UPS) is designed to provide many years of reliable protection from power failure, brown-outs, line noise, and voltage transients. To ensure optimum performance of the equipment, follow the manufacturer's instructions. This manual contains instructions required to operate the UPS. Please read this manual carefully and retain it for future reference.

CAUTION

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the G9000 Series Uninterruptible Power Supply System that should be followed during installation, operation, and maintenance of the UPS and batteries.

WARNING

WARNING 1

Lethal voltages exist within the equipment during operation. Observe all warning and cautions in this manual. Failure to comply may result in serious injury or death. Obtain qualified service for this equipment as instructed.

WARNING

WARNING 2

In no event will TOSHIBA be responsible or liable for either indirect or consequential damage or injury that may come from the misuse of this equipment.

PROHIBIT

Do not modify the UPS entirely or partially.
Any modifications without authorization by TOSHIBA could result in personal injuries, death or destruction of the UPS.

2.1 Safety Precautions

UNINTENDED USAGE

This UPS shall NOT be used in the following applications. Use of this UPS in any of the below applications will result in serious injury or death:

PROHIBIT

- Medical operation room equipment
- Life support equipment
- Fire Prevention or Suppression Equipment

Always read all applicable regulations and standards for the application of this UPS. Special considerations are required when using this UPS in the following applications:

NOTE

- Nuclear Power Plants.
- Control Equipment.
- Transportation Equipment

WARNING

WARNING 3

The UPS is to be installed in a controlled environment.

Improper storage and installation environment may deteriorate insulation, shorten component life and cause malfunctions.

Keep the installation and storage environments according to the standards described in Table 2–1 and Table 2–2:

Table 2–1 UPS Installation Environment

No	Item	Environment standard	
1	Installation Location	Indoors	
2	Ambient temperature	Minimum temperature: 32°F(0°C) Maximum temperature: 104°F(40°C) The average temperature over any 24-hour period must be in the range 41° F (5°C) to 95°F(35°C).	
3	Relative humidity	The relative humidity must be held between 5 and 95%. There must be no condensation due to temperature changes.	
4	Altitude	This equipment is designed to operate without derating at 1980m (6500ft) above sea level.	
5	Dust	Dust in the room where the UPS is installed must not exceed normal atmospheric dust levels. In particular, that dust should not include iron particles, oils or fats, or conductive materials such as silicone.	
6	Inflammable gas following IEC654-4 Part 4	There should be no inflammable/explosive gas.	
		Hydrogen sulfide (H_2S)	No more than 0.003 PPM
		Sulfurous acid gas (SO_2)	No more than 0.01 PPM
		Chlorine gas (Cl_2)	No more than 0.002 PPM
		Ammonia gas (NH_3)	No more than 1 PPM
		Nitrous oxides (NO_x)	No more than 0.05 PPM
		Ozone (O_3)	No more than 0.002 PPM

Table 2–2 UPS Storage Environment

No	Item	Environment standard
1	Storage Location	Indoors, within original shipping container on a wood or metal pallet recommended
2	Ambient temperature	Minimum temperature: -4°F(-20°C) Maximum temperature: 104°F(40°C) The optimum storage temperature is 70°F(21°C). A higher ambient temperature will require more frequent energy storage system recharging (if included).
3	Locations to Avoid	• Locations that are subject to extreme temperature changes or high humidity. • Locations that are subject to high levels of dust or metal particles • Locations that are subject to excessive vibration • Inclined floor surfaces • Falling particles

WARNING

WARNING 4

This UPS does not include a Bypass input circuit breaker (MCCB) to protect bypass circuit. The Bypass input circuit breaker (MCCB) is to be field supplied and installed. Recommended Breaker (MCCB)'s Specifications are as follows:

Table 2–3 Rating of Bypass Input Circuit Breaker (100% Rated)

Capacity (kVA)	Bypass Voltage (V)	Bypass Rating (A)	Breaker (A)
1050	480	1263	1300
1330	480	1600	1600
1500	480	1804	1900
1660	480	1997	2000
2000	480	2406	2500

AC input and AC output overcurrent protection and disconnect devices shall be field supplied and installed. The DC circuit breaker (MCCB) shall be field supplied and installed. The overcurrent protection device should be installed in the Battery cabinet and rated as indicated in Table 3–9.

3 General

The TOSHIBA G9000 SERIES UPS is designed to provide continuous and clean electrical power to a critical load. Additionally the UPS monitors power conditions affecting the load. In the event of an input power failure, the UPS will supply power to the critical load for the specified battery time.

If the input power is not restored promptly, back up power from the UPS battery permits the orderly shutdown of equipment supported by the UPS. The UPS is simple to start-up, operate and maintain.

The G9000 SERIES UPS is available in models ranging from 100 to 2000kVA capacities. This manual covers the 1050-2000 kVA units only. Specifications are shown in **Section 3.3**.

This manual provides an overview of the G9000 SERIES components and their functions. The appearance and purpose of operator controls and indicators is described with procedures for operation, start-up, shutdown and basic maintenance included.

3.1 Definitions

UNINTERRUPTIBLE POWER SUPPLY SYSTEM (UPS) - All components within the UPS Cabinet, ancillary cabinets, and associated batteries that function as a system to provide continuous, conditioned AC power to a load. This is sometimes referred to as the "System".

UPS CABINET – The metal enclosure which is the main part of UPS and composed of the Bypass module, the 3～6 UPS modules, and the Cable Entry Section.

LINK CABINET – The metal enclosure in which buses between separately shipped UPS modules are connected.

UPS MODULE - The metal enclosure which contains the Converter / Inverter, Charger, and internal control systems required to provide specified AC power to a load.

CONVERTER / INVERTER - The UPS components which contain the equipment and controls necessary to convert input AC power to output AC power required by the critical load.

CHARGER - The UPS components which contain the equipment and controls necessary to regulate DC power required for battery charging and for supplying power to the Inverter.

BYPASS MODULE - The metal enclosure which contains the Bypass line, the static transfer switch, UPS operator controls, and internal control systems.

BYPASS LINE - The line which conducts electricity directly from the input power source to the critical load during maintenance or whenever the UPS is not operating in double conversion mode.

STATIC TRANSFER SWITCH - The device which connects the critical load to the bypass line when the Inverter cannot or should not supply continuous power to the load.

AC INPUT POWER - Power provided by the electrical utility company, or auxiliary generator, which is connected to the UPS Converter & Bypass for supplying the critical load.

BATTERY - The rechargeable battery strings which supply DC power to the inverter to maintain continuous AC power to the load during AC input power failure conditions.

3.2 Operation Overview

The UPS provides two power paths between the utility source and the critical load.

Figure 3-1 shows the path for normal operation, with the load powered by the inverter.

Figure 3-2 shows the path for bypass operation, with the load supplied through the static bypass line. Figure 3-3 shows the path for battery operation, with the load powered by the inverter.

3.2.1 Normal Operation: Load Power Supplied By Each System UPS Inverter

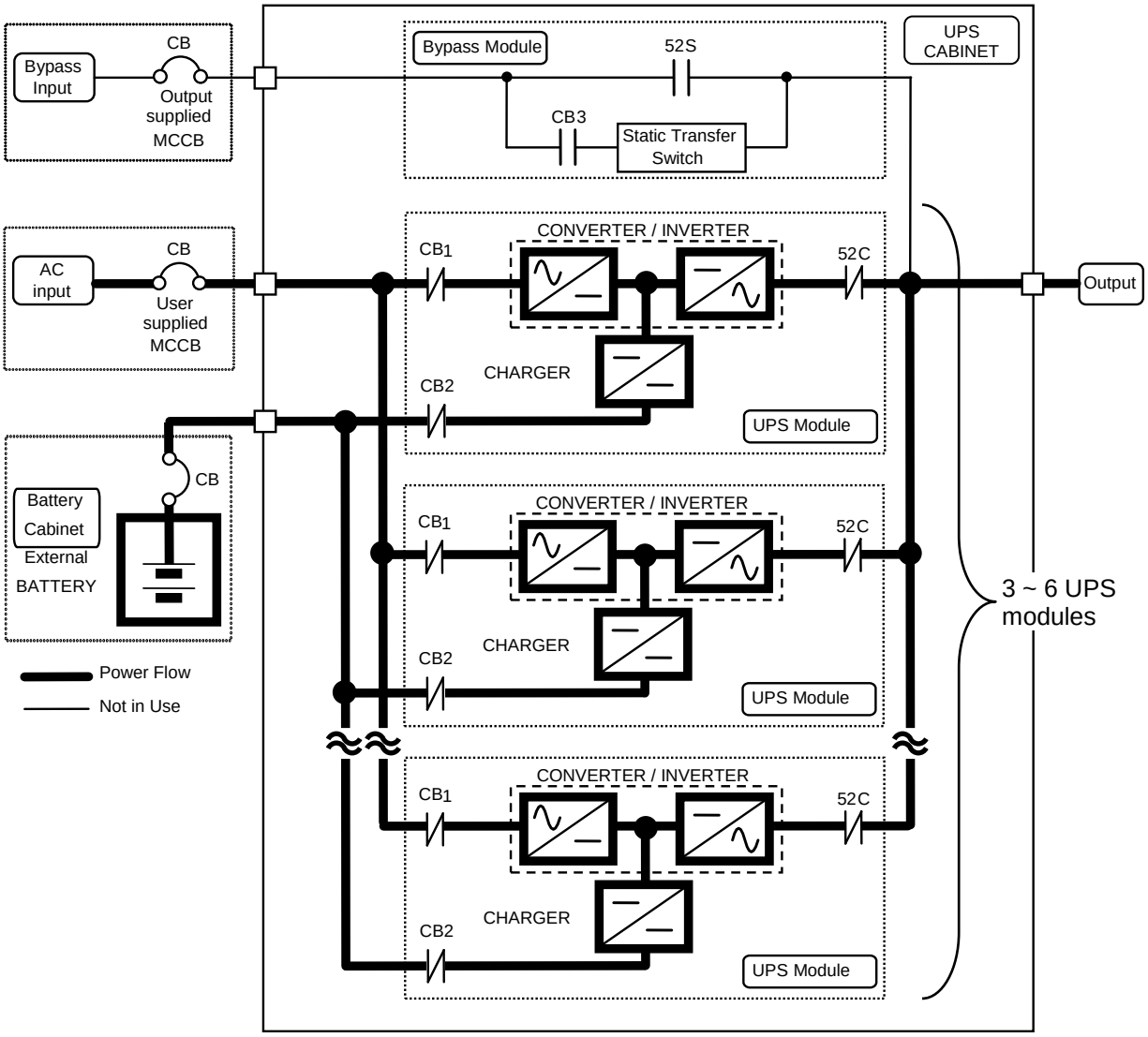


Figure 3-1 Single Line Diagram - Normal Operation: Load fed by UPS inverter

During normal operation, the path through the UPS inverter is used to power the load.

In Figure 3-1 input AC power is converted to DC by the Converter. DC power is utilized to charge the UPS battery and to provide power to the Inverter. The Inverter converts the DC power to regulated AC power to supply the critical load.

The conversion - inversion process eliminates any voltage transients or fluctuations existing in the input power before it reaches the critical load.

The power drawn by the critical load is equally shared between all UPS systems when multiple UPSs are in Parallel Operation. (Refer to Figure 5-6 that shows a sample of Parallel Operation System Configuration.)

CAUTION

When in Parallel Operation, the rectifier inputs to all G9000 UPS Systems in the Multi-Module System (MMS)-must be fed from a single source at all times including any operation of Automatic Transfer Switches. All G9000 bypass inputs must also be fed from a single source at all times (not necessarily the same source as the rectifier inputs).

In the event of a UPS module failure during Parallel Operation, the critical load power will be continually supplied and shared by all other UPS.

NOTE

The Bypass Input breaker and cables are to be supplied and installed by the user or contractor. (See WARNING 4 on page 6)

3.2.2 Bypass Operation: Load Power Supplied Through UPS Internal Static Bypass Line.

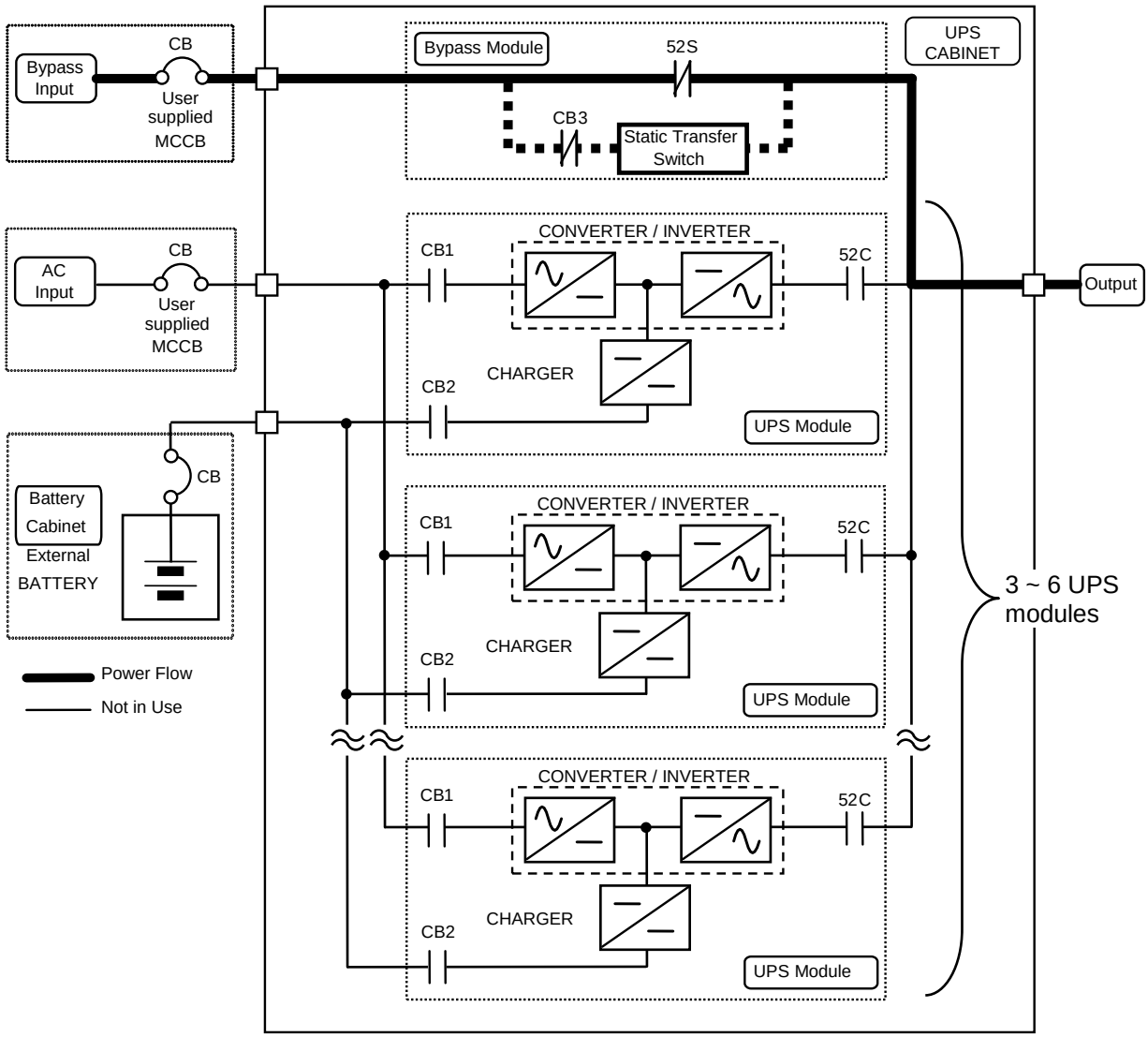


Figure 3-2 Single Line Diagram - Bypass Operation: Load Fed Through Static Bypass Line

Figure 3-2 shows the Internal Bypass line is a hard-wired line through 52S which supplies the critical load with unconditioned bypass input power. Upon switching to the Internal Bypass line, the Static Transfer Switch line through CB3 (herein after STS contactor CB3) supplies the power immediately, and then the Internal Bypass line through 52S supplies the power. In the event of switching to the Bypass line, the power to the critical load will be uninterrupted. The purpose of this Internal Bypass line is to route power to the critical load while the UPS module is de-energized either purposely or due to a failure (converter and inverter) and during Start-up before the system is fully operational.

In the case of Parallel Operation, internal static bypass line of each UPS will equally share the power supplied to the critical load whenever each cable length of bypass line is equal. In case that the cable length is unable to be equalized or kept within 5% difference, additional reactors will be necessary to compensate the difference in cable impedance.

In the event of a load overcurrent, the UPS transfers to bypass without interruption to the critical load. In the case of the Parallel Operation, all UPS will transfer to bypass without interruption to the critical load.

The internal control system determines the operation of the two paths, with the load powered from the inverter being the normal operation.

3.2.3 Battery Operation: Load Power Supplied by UPS battery.

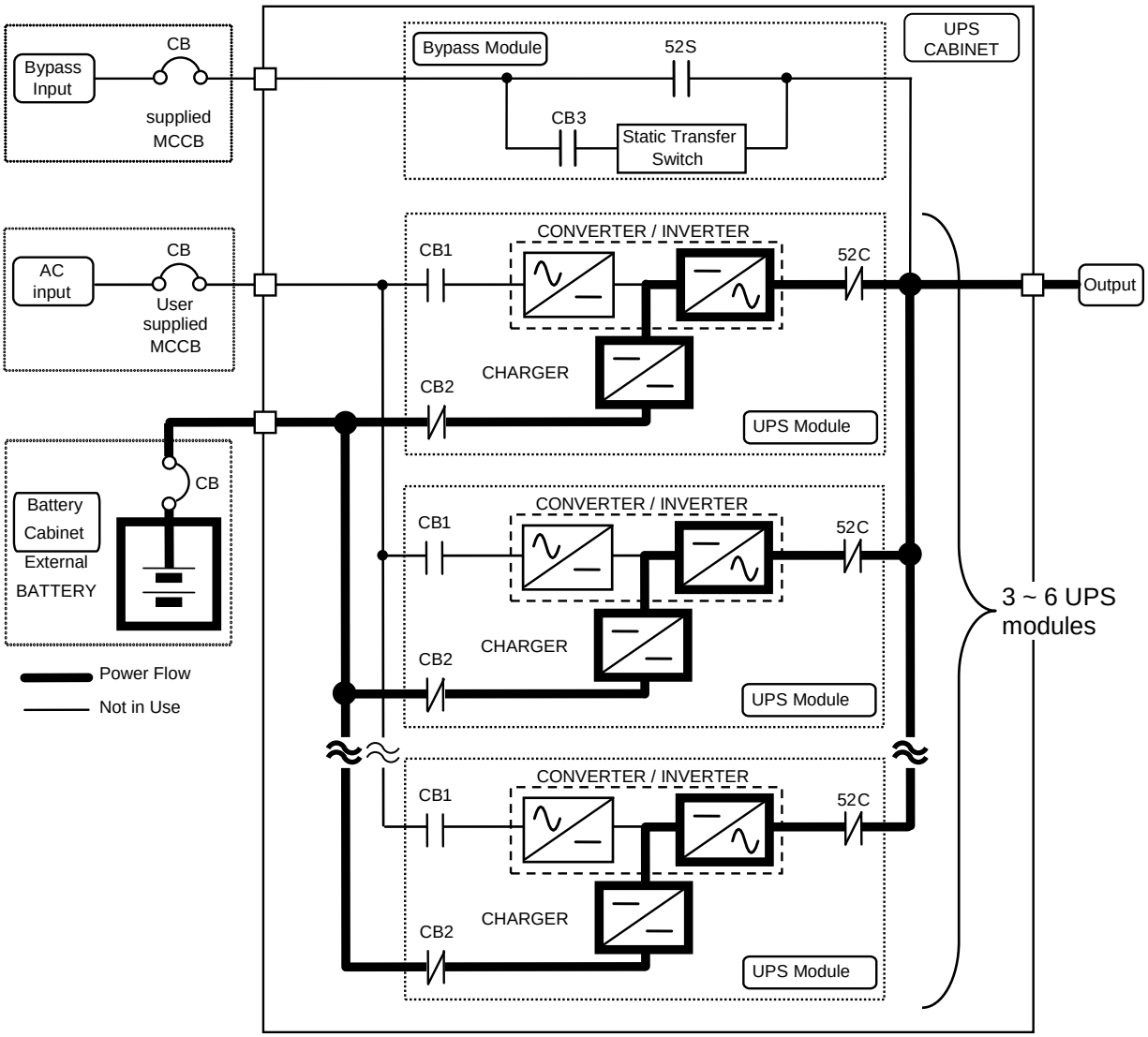


Figure 3-3 Single Line Diagram - Battery Operation – Load Fed by Battery

Figure 3-3 shows that in the event of AC input source failure or interruption, the UPS Converter(s)* will de-energize and the UPS battery(s)* will immediately supply DC power to the Inverter to maintain continuous AC power to the load. This operation will continue until:

a) The battery capacity expires and the inverter turns off, or

b) Input power is restored. When input power is restored the converter will simultaneously power the inverter and recharge the batteries.

A fully charged battery will provide power for the specified time at the rated load, or longer, at a reduced load.

*Multiple Converters/Batteries exist in the case of Parallel Operation

When in Parallel Operation, the power drawn by the load is equally shared between all UPSs regardless of whether or not any units are in Battery Operation.

3.2.4 Battery Charging Operation

As shown in Section 3.2.1, when the UPS is in normal operation, DC Power is utilized to charge the UPS batteries. The charging characteristics of the G9000 UPS are shown in Figure 3-4 and descriptions of the two charging periods are below.

Period (A): Charging voltage increases steadily from its minimum until it reaches the float voltage of the battery system. During this period, the charging current will be at its maximum as long as sufficient power is supplied to the UPS and there are no load conditions that prevent it. The maximum current is either the Maximum Recharge Current that the UPS system can provide (see the Battery section of Table 3–8) or a lower current limit set via the LCD screen to comply with the battery manufacturer recommendations. This current limit adjustment should only be performed by a Toshiba Authorized Service Provider.

Period (B): This period begins when the Charging Voltage reaches the float voltage of the batteries. The charging current will steadily decrease as the batteries approach their maximum state of charge. Once reached, the UPS will maintain the maximum state of charge on the batteries with minimal Charging Current.

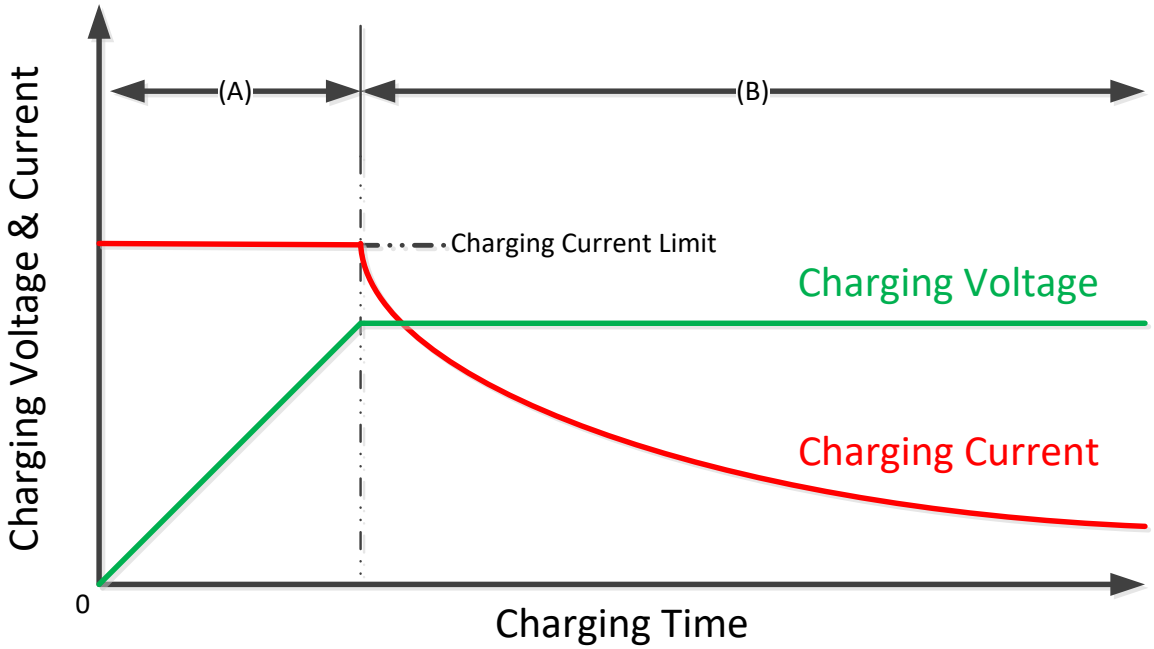


Figure 3-4 Typical Battery Charging Curve

3.2.5 UPS Parts Location

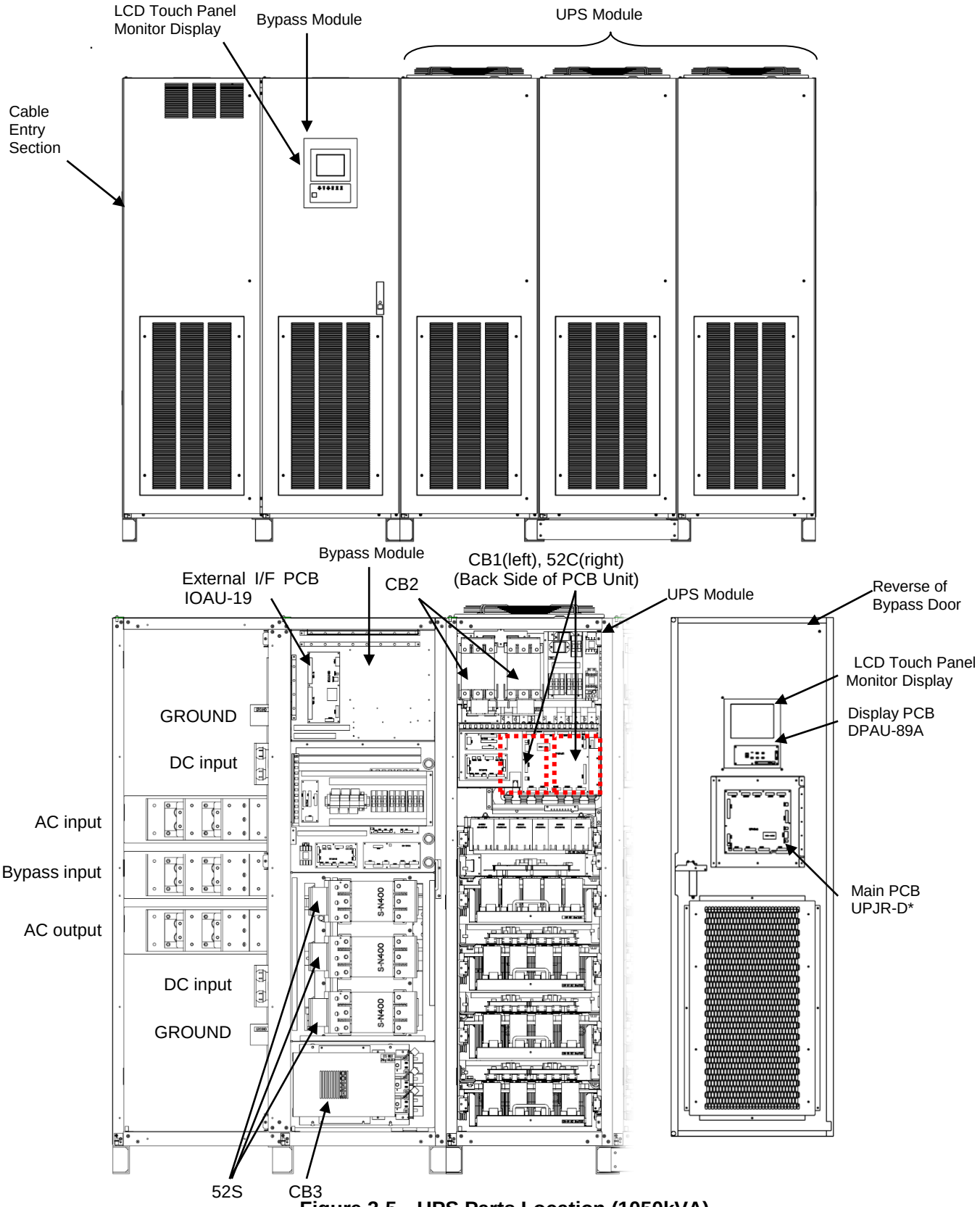


Figure 3-5 UPS Parts Location (1050kVA)

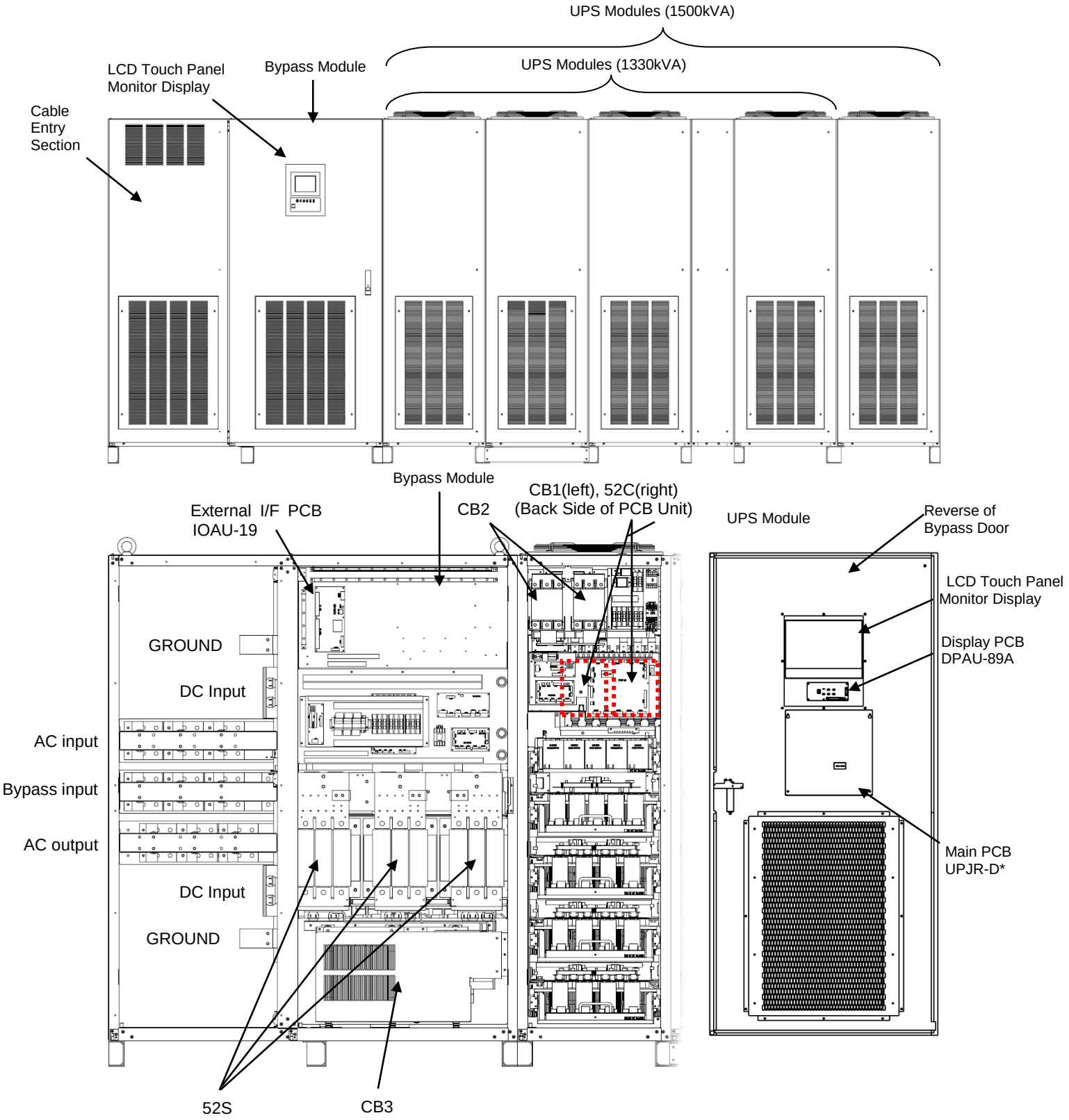


Figure 3-6 UPS Parts Location (1330-1500kVA)

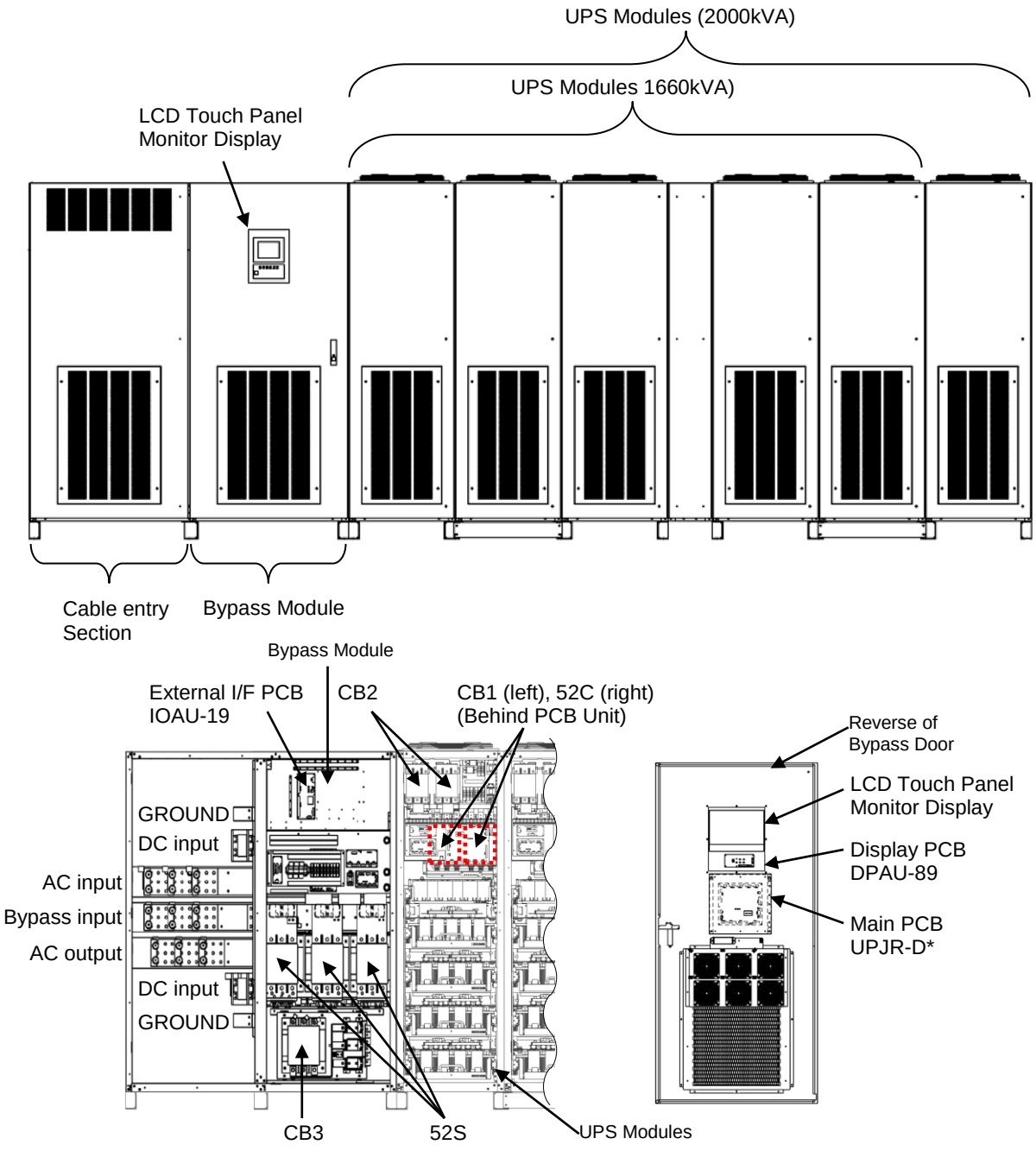


Figure 3-7 UPS Parts Location (1660-2000kVA)

Description of Parts Location Figures:

1. **LCD Touch Panel Monitor Display**

   The liquid crystal display (LCD) touch panel monitor display indicates power flow, measured values, fault codes, and error messages via user selectable display screens.

   Refer to Figure 4-1 for details.

2. **Display PCB DPAU-89**
3. **External Communication Connector**
4. **Main PCB UPJR-D***
5. **External I/F PCB IOAU-19**

   Signal I/F on IOAU-19 board

   - External contact signal terminal block

     Terminal block to connect contact signal input/output lines to and from external dry contacts.

     Refer to Figure 4-17 and Figure 4-19 for details.

6. **Control Relay PCB PSAU-78 (not shown)**
7. **Parallel I/F PCB IFAU-25 (not shown)**

   For use in Parallel Operation system application: Option

8. **AC input, Bypass input, AC output, DC input terminals**

   Refer to Figure 5-2 through Figure 5-4 for details

9. **GROUND**

   Refer to Figure 5-2 through Figure 5-4 for details

3.3 Specifications

The UPS nameplate displays the rated kVA as well as nominal voltages and currents. The nameplate is located on the backside of the Bypass module door.

Table 3–1 Power Specifications

Rated output Power	Input voltage 3 phase / 3 wire	Bypass input voltage 3 phase / 3 wire	Output voltage 3 phase / 3 wire
1050kVA / 1000kW	480V	480V	480V
1330kVA / 1330kW	480V	480V	480V
1500kVA / 1500kW	480V	480V	480V
1660kVA / 1660kW	480V	480V	480V
2000kVA / 2000kW	480V	480V	480V

Table 3–2 UPS Cabinet Information

UPS [kVA]	Width [in. (mm)]	Depth [in. (mm)]	Height [in. (mm)]	Net Weight [lbs. (kg)]	Typ. Heating at 100% load [kBTU/h]	Cable Knockout
1050	118.1 (3,000)	35.4 (900)	80.7 (2,050)	6,610 (3,000)	112.8	BOTTOM, TOP, LEFT SIDE
1330	167.3 (4,250)	35.4 (900)	80.7 (2,050)	9,590 (4,350)	159.7	BOTTOM, TOP, LEFT SIDE
1500	190.9 (4,850)	35.4 (900)	80.7 (2,050)	11,350 (5,150)	180.1	BOTTOM, TOP, LEFT SIDE
1660	198.8 (5,050)	35.4 (900)	80.7 (2,050)	11,790 (5,350)	199.4	BOTTOM, TOP, LEFT SIDE
2000	222.4 (5,650)	35.4 (900)	80.7 (2,050)	13,560 (6,150)	240.2	BOTTOM, TOP, LEFT SIDE

Table 3–3 1050kVA Shipping Information

Shipping Split	Width [in. (mm)]	Depth [in. (mm)]	Height [in. (mm)]	Net Weight [lbs. (kg)]
Bypass Cabinet	55 (1,400)	41 (1,045)	88 (2,240)	1,905 (865)
(3) Power Modules	90 (2,290)	43 (1,095)	88 (2,240)	5,550 (2,520)

Table 3–4 1330kVA Shipping Information

Shipping Split	Width [in. (mm)]	Depth [in. (mm)]	Height [in. (mm)]	Net Weight [lbs. (kg)]
Bypass Cabinet	70 (1,780)	41 (1,045)	88 (2,240)	2,675 (1,215)
(3) Power Modules	90 (2,290)	43 (1,095)	88 (2,240)	5,550 (2,520)
(1) Power Module & Link Cabinet	45 (1,145)	43 (1,095)	88 (2,240)	5,550 (2,075)

Table 3–5 1500kVA Shipping Information

Shipping Split	Width [in. (mm)]	Depth [in. (mm)]	Height [in. (mm)]	Net Weight [lbs. (kg)]
Bypass Cabinet	70 (1,780)	41 (1,045)	88 (2,240)	2,675 (1,215)
(3) Power Modules	90 (2,290)	43 (1,095)	88 (2,240)	5,550 (2,520)
(2) Power Modules & Link Cabinet	70 (1,780)	43 (1,095)	88 (2,240)	3,890 (1,765)
Connection Equipment	40 (1,020)	30 (765)	30 (765)	240 (110)

Table 3–6 1660kVA Shipping Information

Shipping Split	Width [in. (mm)]	Depth [in. (mm)]	Height [in. (mm)]	Net Weight [lbs. (kg)]
Bypass Cabinet	77 (1,960)	41 (1,045)	88 (2,240)	3,120 (1,415)
(3) Power Modules	90 (2,290)	43 (1,095)	88 (2,240)	5,550 (2,520)
(2) Power Modules & Link Cabinet	70 (1,780)	43 (1,095)	88 (2,240)	3,890 (1,765)
Connection Equipment	40 (1,020)	30 (765)	30 (765)	240 (110)

Table 3–7 2000kVA Shipping Information

Shipping Split	Width [in. (mm)]	Depth [in. (mm)]	Height [in. (mm)]	Net Weight [lbs. (kg)]
Bypass Cabinet	77 (1,960)	41 (1,045)	88 (2,240)	3,120 (1,415)
(3) Power Modules	90 (2,290)	43 (1,095)	88 (2,240)	5,550 (2,520)
(3) Power Modules & Link Cabinet	90 (2,290)	43 (1,095)	88 (2,240)	5,700 (2,590)
Connection Equipment	40 (1,020)	30 (765)	30 (765)	240 (110)

Table 3–8 Specifications

Rated Output kVA	**1050**	**1330**	**1500**	**1660**	**2000**
Rated Output kW	**1000**	**1330**	**1500**	**1660**	**2000**
AC INPUT					
Configuration	3 phase, 3 wire				
Voltage	480 V +15%* to -20% *(when in sync with bypass)				
Frequency	60 Hz ±10%				
Reflected Current THD	3% typ. at 100% load				
Walk-In Function	1-30 Seconds (in 1 second increments)				
STATIC BYPASS INPUT					
Configuration	3 phase, 3 wire				
Voltage	480 V ±10%				
Frequency	60 Hz ±5%				
BATTERY					
Type	Lead Acid, Wet Cell, Lithium Ion, Flywheel				
Ride Through	Application Specific				
Nominal Voltage	480 Vdc				
Minimum Voltage	400 Vdc				
Float Voltage	Programmable up to 545 VDC				
Maximum Recharge Current	200 A	266 A	300 A	332 A	400 A
Nominal DC Input Current	2159A	2871A	3238A	3584A	4318A
DC-AC Efficiency	>96%				
AC OUTPUT					
Configuration	3 phase, 3 wire				
Voltage	480 V				
Voltage Regulation	±1% (Balanced Load), ±2% (Unbalanced Load)				
Frequency	60 Hz				
Frequency Regulation	±0.01% in free running mode				
Power Factor	0.95	Unity (nominal)			
Power Factor Range	0.7 Lagging to 0.8 Leading (within output kW rating)				
Voltage THD	2% maximum THD at 100% linear load 5% maximum THD at 100% non-linear load				
Transient Response	±2% maximum at 100% load step ±1% maximum at loss/return of AC power ±5% maximum at load transfer to/from static bypass				
Transient Recovery Time	Less than 20ms				
Voltage Unbalance	2% maximum at 100% unbalanced load				
Phase Displacement	1 deg. maximum at 100% Load				
Inverter Overload	125% for 10 minutes 150% for 60 seconds				
Bypass Overload	500% for 1 cycle (with bypass available)				
ENVIRONMENTAL					
Cooling (Forced Air)	6,600cfm	8,800cfm	11,000cfm	11,000cfm	14,000cfm
Operating Temperature	32° F to 104° F (0° C to 40° C). Recommended : 68° F to 86° F (20° C to 30° C)				
Relative Humidity	5% – 95% Non-Condensing				
Altitude	0 to 6500 feet No Derating at 104° F (40° C)				
Location	Indoor (free from corrosive gases and dust)				
Audible Noise (Typical)	71dB	72dB	73dB	73dB	74dB
Paint Color	Munsell N1.5 (Black)				
Clearance Required	Top : 23.6 in. (600 mm), Front : 39.4 in. (1000 mm), Rear : 0 in. (0 mm) Sides: 0 in. (0 mm) with cabinets installed aside, otherwise 1 in. (25 mm)				

Table 3–9 Rating of Contactors, Breakers, and Fuses

	DEVICE NUMBER	APPLICATION	OUTPUT CAPACITY OF EQUIPMENT				
			1050kVA	1330kVA	1500kVA	1660kVA	2000kVA
			1000kW	1330kW	1500kW	1660k W	2000kW
Contactors	CB1	AC input contactor	452A				
	CB2	Battery contactor	285A				
	CB3	STS contactor	452A	704A			
	52C	Inverter output contactor	452A	452A			
	52S	Bypass contactor	1278A	1992A		2843A	
	88RC	Control circuit contactor	20A	20A			
Breakers	User supply	Battery disconnect breaker (Recommended)	See Appendix A: Installation Planning Guide				
	User supply	AC input breaker (Recommended)	See Appendix A: Installation Planning Guide				
	User supply	Bypass input breaker (Recommended)	See Appendix A: Installation Planning Guide				
Fuses	FP, FC, FN	DC fuse	315A / 690V				
	FBP, FBN	DC fuse	1000A / 600V				
	FBR1, FBR2, FBR3 FBR, FBS, FBT FBO1, FBO2, FBO3	Control power fuse	12A / 600V				
	FOA, FOB, FOC FIA, FIB FUA, FUB, FUC	Control power fuse	12A / 600V				
	FSU, FSV, FSW	Bypass input fuse*	2000A/550V	2800A / 650V		3600A / 550V	

* Provides 100kAIC included from factory.

Table 3–10 AC-AC Efficiency Specifications

Rated Output Power	25% Load	50% Load	75% Load	100% Load
1050kVA / 1000kW	96.30%	97.00%	97.10%	96.80%
1330kVA / 1330kW	96.08%	96.98%	96.85%	96.62%
1500kVA / 1500kW	96.08%	96.98%	96.85%	96.62%
1660kVA / 1660kW	96.08%	96.98%	96.85%	96.62%
2000kVA / 2000kW	96.08%	96.98%	96.85%	96.62%

4 Operator Controls and Indicators

The G9000 Series operator controls and indicators are located as follows (Door exterior):

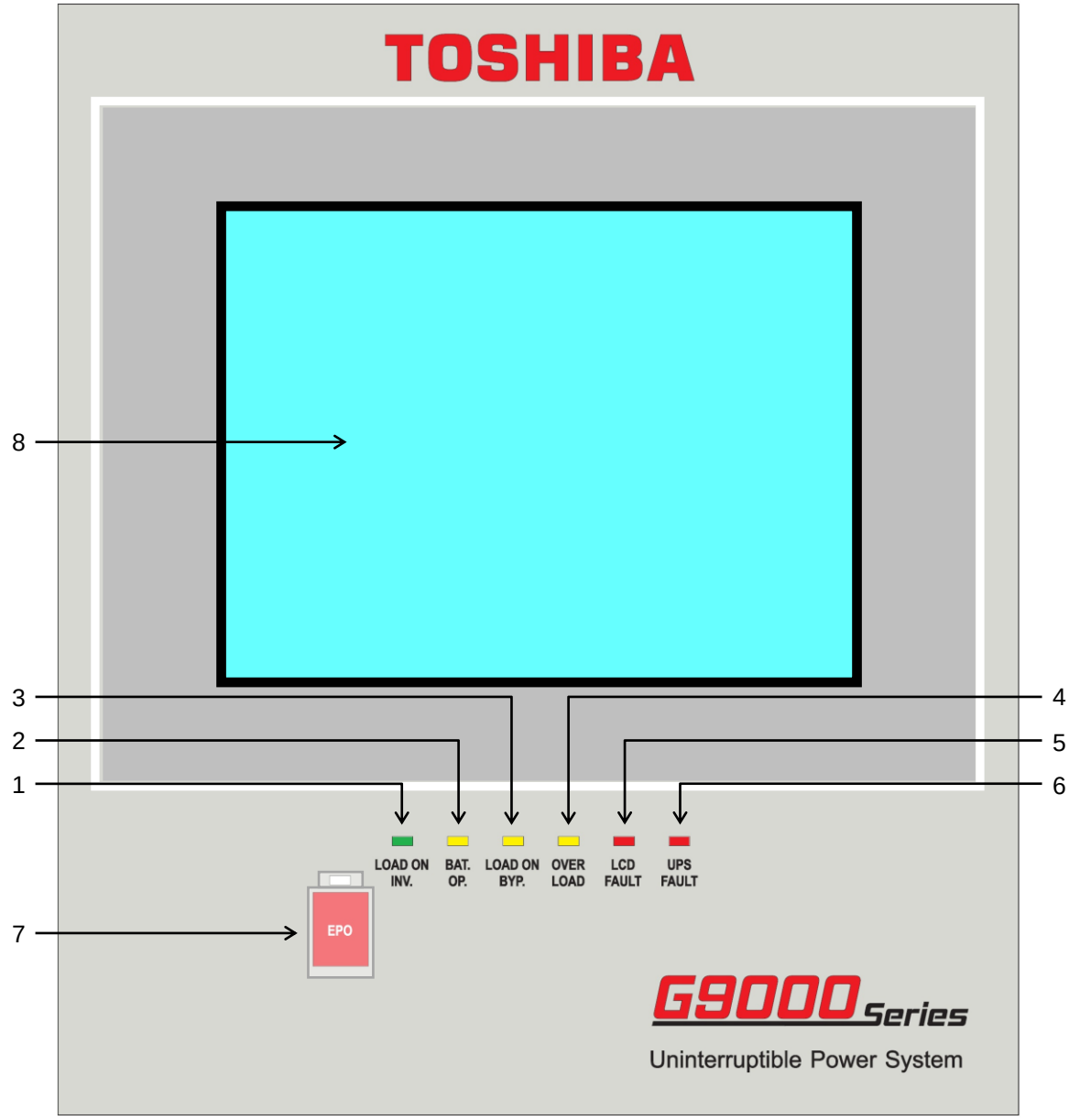


Figure 4-1 Operation/Display Panel (Front Panel)

4.1 LED Display

1) **Load on inverter [LOAD ON INVERTER](green)**
   Illuminates when power is supplied from inverter to the critical load.
   (Indicates the state of inverter transfer switch "52C".)
2) **Battery operation [BATTERY OP.](yellow)**
   Illuminates when power is supplied from batteries.
3) **Load on bypass [LOAD ON BYPASS](yellow)**
   Illuminates when power is supplied to load devices by static bypass.
   (Indicates the state of bypass transfer switch "52S".)
4) **Overload [OVERLOAD](yellow)**
   Illuminates in overload condition.
5) **LCD fault [LCD FAULT](red)**
   Illuminates when an error occurs.
6) **UPS fault [UPS FAULT](red) [Annunciator: intermittent or constant tones]**
   Illuminates when an error occurs in the system. In this case, the details of the error are indicated on the display panel.

4.2 EPO Button (Emergency Power Off Button)

When EPO button (7) is activated, the Emergency Power Off (EPO) function shuts down the UPS module. The critical load will lose power and also shutdown. The EPO function can be performed both locally and remotely.

4.3 Liquid Crystal Display

The Liquid Crystal Display (LCD) touch panel (8) indicates power flow, measured values, operational guidance, data records and error messages. The LCD panel has a back-light which facilitates viewing in different ambient lighting conditions. The LCD will automatically clear and turn off, if the screen is not activated within 3 minute period. The LCD is turned back on when it is touched again. The ERROR indicator is cleared after 24 hours and can be reproduced by pressing any key on the panel.

4.3.1 Menu

A) MAIN MENU

The LCD panel indicates power flow and measured values, while also operating the start/stop function. The LCD panel also allows the user to verify the status and operation of the UPS Module.

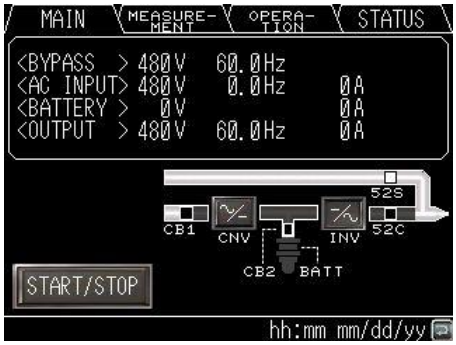


Figure 4-2 Main Screen

The following will be displayed when the START/STOP key on the MAIN MENU is pressed (Jump into **OPERATION MENU**):

1) Start/Stop Operation

The display indicates the Startup and Shutdown guidance for the UPS system. If this operation is PIN protected, the user is required to enter the security PIN before the screen can be accessed.

When in remote mode, the message “REMOTE operating model” will appear on this Screen. The user cannot operate the start and stop functions without changing the setup from remote mode to local mode.

When bypass voltage is abnormal, the message “Bypass voltage abnormal” will appear.

- Start: When the bypass voltage is abnormal, the LCD asks the operator if an interrupted transfer is acceptable (Load may be lost).

- Stop: When the bypass voltage is abnormal, the user cannot transfer from inverter to bypass line.

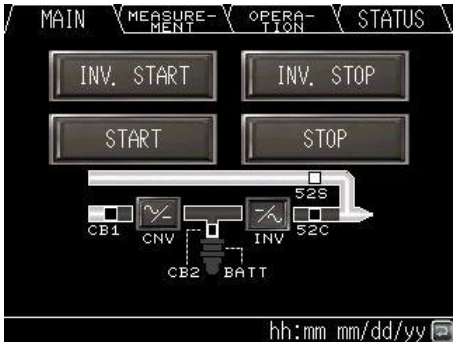


Figure 4-3 Start/Stop Operation

*Meaning of the icons in SMS (Single Modular System)

INV. START : Turns on UPS Converter and Inverter

INV. STOP : Turns off UPS Converter and Inverter

START : Output Transfer from Bypass Line to Inverter

STOP : Output Transfer from Inverter to Bypass Line

Follow Start/Stop operation guidance accordingly.

Figure 4-4 Start Operation

Figure 4-5 Stop Operation

B) MEASUREMENT MENU

This screen shows details of measured values. Input and Output values are displayed. During Battery operation, Remaining Battery Power and Run Time are also displayed.

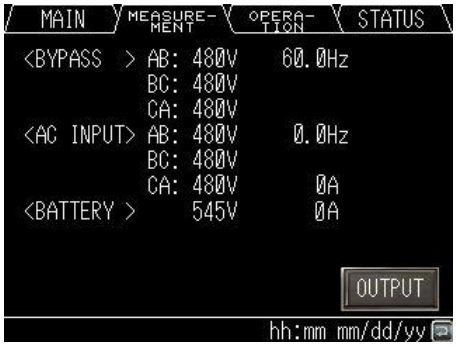


Figure 4-6 Input Values

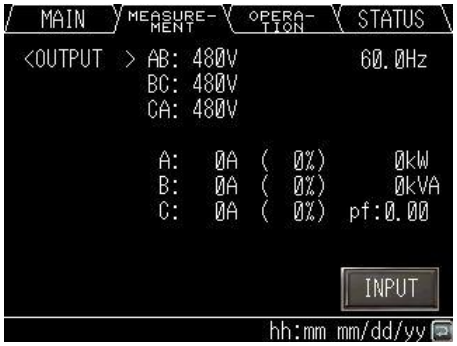


Figure 4-7 Output Values

C) OPERATION MENU

This screen prompts the user to select: (a) whether the start & stop operation will be performed by local or remote operation; (b) date & time adjustment; (c) battery equalizing charge. The battery equalizing charge operation key will appear when battery equalizing charge is set up (Setup is based on battery type).

Figure 4-8 Remote/Local Operation or Date & Time Adjustment Select

D) LOG MENU

This LOG MENU displays two Touch icons in EVENT LOG and BATTERY LOG.

Pressing the EVENT LOG icon, up to 50 condition/operation records will be displayed.

Press ▲ or ▼ button for page turning.

Pressing the BATTERY LOG icon, Number of battery operations and total battery operation time are displayed.

Figure 4-9 Log Menu

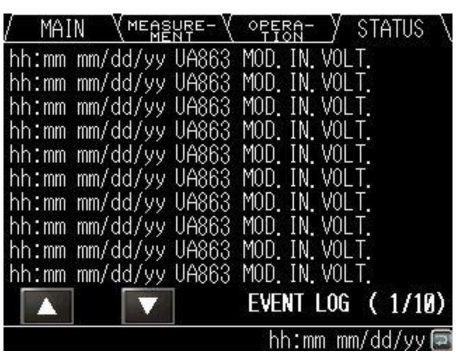


Figure 4-10 Event Log

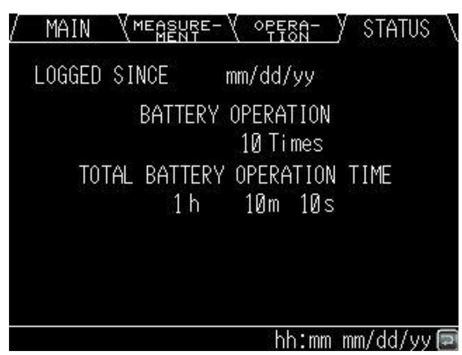


Figure 4-11 Battery Log

4.3.2 Input Power Failure

During an Input Power Failure, the UPS inverter will be powered by the UPS batteries. The following will be displayed on the main and measurement screen (Indication of battery operation and remaining battery time).

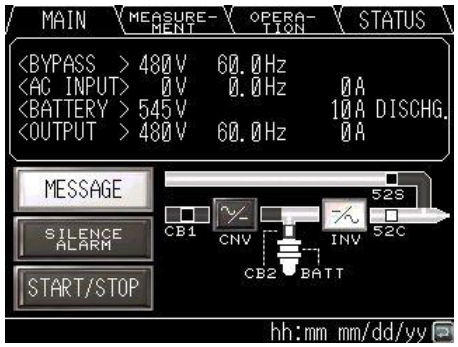


Figure 4-12 Main Screen (On Battery)

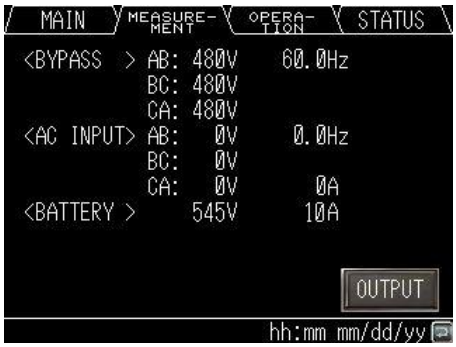


Figure 4-13 Measurement Screen (On Battery)

The LCD will display a battery low voltage message when the battery capacity is near depletion. The End of Battery Discharge announcement is displayed when the battery end voltage is reached. At this time, the inverter will perform an electronic shutdown to prevent battery loss of life typical from extreme deep discharge conditions and transfer to bypass if available. When the input power is restored, the inverter will automatically restart to power the load, and the batteries will be simultaneously recharged. If DC voltage reaches the cutoff voltage chosen for the DC power supply, the internal DC contactor will open. The End of Battery announcement is shown at the bottom of the screen.

4.3.3 Fault Indication

"MESSAGE" and "SILENCE ALARM" icons will appear on the main menu when UPS failure condition has occurred.

Figure 4-14 Main Screen (Fault Indication)

The following will be displayed when the MESSAGE icon on the main menu is pressed.

1) MESSAGE

The display shows a fault code, the description of the fault and a guidance of what action is to be taken by the user. A maximum of 10 faults are displayed at one time. If an input power failure occurs during a fault condition, the fault indication and input power failure announcement are alternatively displayed at 5 second intervals.

Figure 4-15 Message Screen

2) SILENCE ALARM

This icon will appear when a failure occurs. The audible alarm (announcing the failure) can be silenced by pressing this icon.

4.4 External Aux Contact Input and Output Terminal Blocks

The UPS is equipped with a series of input/output terminals for external annunciation of alarms and for remote access of certain UPS functions. The layout of terminals is shown in Figure 4-17 and Figure 4-19 with a functional description of the input/output port presented. OUT1 to OUT8 are user programmable, but have factory default settings as shown in Table 4–2.

The option to add another external I/F PCB “IOAU-19” is available, doubling signal outputs for OUT1 to OUT8.

4.4.1 Aux Contacts - Input

The Input terminal provides four (IN1 thru IN4) programmable contacts that can be set to any of the functions in these contacts can be programmed to provide any of the functions shown in Table 4–1. The default programmed values are indicated with an asterisk (*).

PROHIBIT

Do not apply voltages to remote access input terminals.
Damage to UPS may result.

Inputs require a dry NO (Normally Open) contact to be wired on the corresponding terminals on TN11-14 of IOAU-19. Closing this contact activates the selected functionality set for that input. The Inputs provide a signal or "wetting" voltage of 12VDC / 16.7 mA. See Figure 4-16. The function takes effect immediately upon contact closure, and is removed immediately upon opening. Note: 0.5-4s momentary switch is recommended below to avoid possible tripping of Alarm UA822.

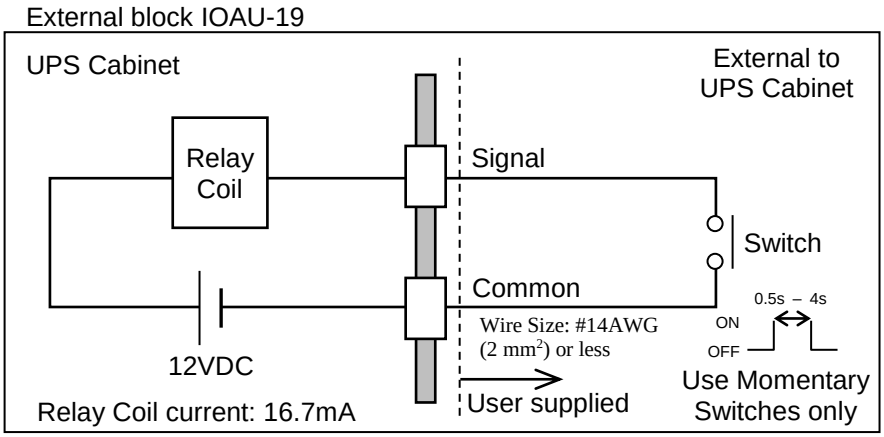
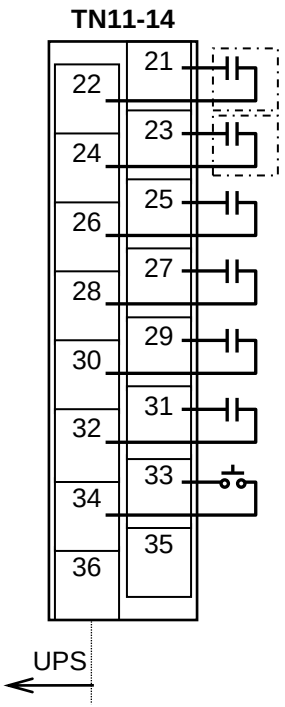


Figure 4-16 Control Wiring for Aux Input Contacts

See Figure 4-17, and Table 4–1.



TN11-14	Setting	Remarks
21-22	CB2 AX (Battery Breaker Panel)	User supplied dry contact
23-24	52L AX (Load Circuit Switch)	
25-26	IN1: REMOTE INVERTER START	
27-28	IN2: REMOTE INVERTER STOP	
29-30	IN3: BATTERY TEMP. HIGH	
31-32	IN4: POWER DEMAND	
33-34	REMOTE EPO	
35-36	N/A	

NOTE: For multiple battery cabinets, the Auxiliary Switches must be wired in series with UPS TN11-21 & TN11-22.

Figure 4-17 External Signal Input Terminal Block (with default settings)

CAUTION

In all cases, a switch having a protective cover is recommended in order to reduce the possibility of accidental operation.

These contacts can be programmed to provide any of the functions shown in Table 4–1. The default programmed values are indicated with an asterisk (*).

Table 4–1 External Input Functions

Code	Function	Description
0	NONE	
1 *	REMOTE INVERTER START	Starts UPS inverter from remote location. Use momentary (0.5 to 4 sec.) switches only. *This is the default setting on IN1*
2 *	REMOTE INVERTER STOP	Stops UPS inverter from remote location. Use momentary (0.5 to 4 sec.) switches only. *This is the default setting on IN2*
3 *	POWER DEMAND 1	Driven by any customer-provided NO (Normally Open) dry contact. Closing the contact limits the input current to a value (10-150% of the UPS's rated input) set in the TEST MENU – "Power Demand Level 1" by an Authorized Toshiba Service Provider. Opening the contact returns the UPS to its normal operation parameters. *This is the default setting on IN4*.
4	POWER DEMAND 2	Driven by any customer-provided NO (Normally Open) dry contact. Closing the contact limits the input current to a value (10-150% of the UPS's rated input) set in the TEST MENU – "Power Demand Level 2" by an Authorized Toshiba Service Provider. Opening the contact returns the UPS to its normal operation parameters.
5	BATTERY LIQUID LOW	Annunciates "UF158 BATTERY LIQUID LOW", and is used with an electrolyte level sensor in a wet cell battery system.
6 *	BATTERY TEMP ABNORMAL	Driven by any customer-provided NO (Normally Open) dry contact thermal detection device installed in the UPS's Battery Cabinet(s). When the contact closes, the UPS decreases its battery charging maximum limit to 95% of the set charging voltage. If the contacts stay closed (the battery temp is still abnormal) for two hours, the UPS will shut off its battery charger. (Battery operation will still possible) *This is the default setting on IN3*
7	GENERATOR OPERATION	Inhibits transfer to bypass.
8	ASYNCHRONOUS	Inverter operates in free run mode. (In other words, inverter is not tracking bypass as sync source.)
9	ANOTHER BUS SYNC	Inverter will sync to an external source. For use with External Sync packages.
10	REMOTE INVERTER (MMS)	Starts all UPS inverters in an MMS system from a remote location.
11	REMOTE BYPASS (MMS)	Stops all UPS inverters in an MMS system from a remote location.
12	EXT.BYP dV STR	Inverter voltage is adjusted to match bypass voltage.
13	USE IB LIMIT 2	Use battery charge rate 2. This level is set in the TEST MENU by an Authorized Toshiba Service Provider.
14	CHARGER STOP	Battery charger will be stopped.
15	EXTERNAL ALARM	Annunciates "UA890 EXTERNAL ALARM".
16	CB2 EX	Provides for another aux battery breaker (CB2) contact, similar in function to the standard battery aux contact.
17	CHARGE DEVICE ERR	Energy storage device error signal. Mainly used with flywheels to annunciate recharge fault.
18	CONVERTER OPE PROHIBITION	Stops the rectifier converter remotely.
19	REMOTE MOD.START	Starts UPS module from remote location. Use momentary (0.5 to 4 sec.) switches only.
20	REMOTE MOD.STOP	Stops UPS module from remote location. Use momentary (0.5 to 4 sec.) switches only.
31	TRACE TRIGGER	For use with the internal wave capture tool; for use by Authorized Toshiba Service Providers.

*: Default Settings from Factory.

4.4.2 Aux Contacts - Output

The Output terminal provides eight (OUT1 thru OUT8) form "A" NO (Normally Open) dry type programmable contacts to drive annunciation signals sourced or "wetted" by external monitoring devices. All output contacts are rated for NEC Class 2 operation (30VDC / 1ADC.)

The output dry contacts should be operated at their rated values or lower. Figure 4-18 illustrates a typical installation. The external relay can be a lamp, LED, computer, etc.

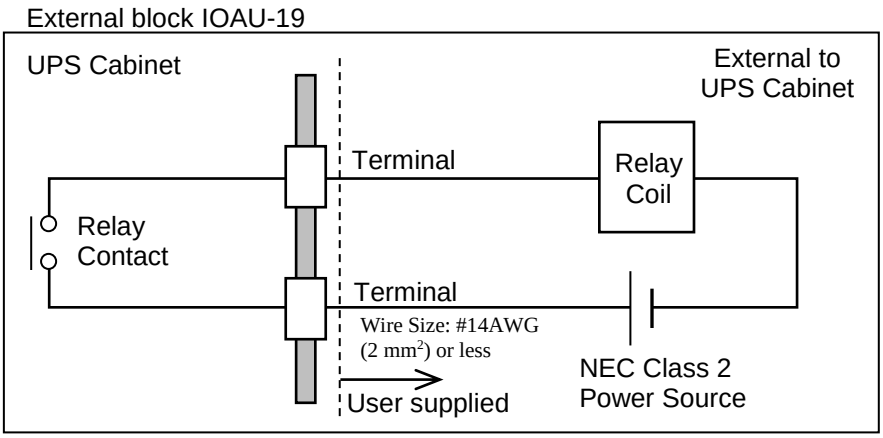
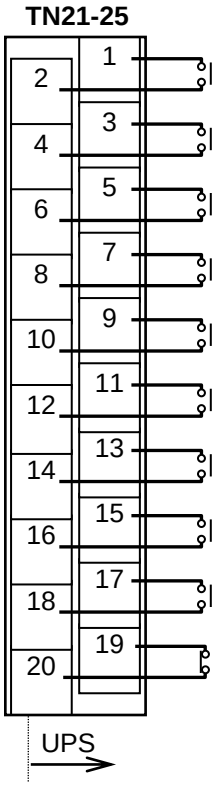


Figure 4-18 Control Wiring for Aux Output Contacts



TN21-25	Setting
1-2	SUMMARY ALARM
3-4	OUT1: LOAD ON BYPASS
5-6	OUT2: LOAD ON INVERTER
7-8	OUT3: BATTERY OPERATION
9-10	OUT4: CONVERTER OPERATION
11-12	OUT5: BATTERY LOW VOLTAGE
13-14	OUT6: OVERLOAD
15-16	OUT7: SPARE
17-18	OUT8: TOTAL ALARM
19-20	52C CONTACTOR STATUS ** Normally Closed Relay Contact **opens** when 52C Inverter Output contactor is **closed**

NOTE: Summary Alarm; activated when a major fault has occurred with the system.

Figure 4-19 External Signal Output Terminal Block (with default settings)

These contacts can be programmed to provide any of the functions shown in Table 4–2. The default programmed values are indicated with an asterisk (*).

Table 4–2 External Output Functions

Code	Function	Description
0	NONE	
1 *	TOTAL ALARM	TOTAL ALARM; activated when any minor, major, fault or alarm has occurred with the system. *This is the default setting on OUT8.*
2	MINOR FAULT	Activated when a minor fault has occurred with the system.
3	ALARM	Activated when an alarm has occurred with the system.
4	AC INPUT ABNORMAL	Activated when the input voltage or frequency is abnormal.
5	BYPASS ABNORMAL	Activated when the bypass voltage or frequency is abnormal.
6	BATTERY ABNORMAL	Activated when the battery is abnormal.
7	BATTERY LOW VOLTAGE 1	Activated when the battery voltage drops below Discharge Warning Voltage Level 1 during inverter operation. This level is set in the TEST MENU by an Authorized Toshiba Service Provider.
8 *	BATTERY LOW VOLTAGE 2	Activated when the battery voltage drops below Discharge Warning Voltage Level 2 during inverter operation. This level is set in the TEST MENU by an Authorized Toshiba Service Provider. *This is the default setting for OUT5.*
9	BATTERY DEPLETION	Activated when the battery voltage reaches the end voltage level during inverter operation.
10 *	OVERLOAD	Activated when an overload of 105% or more has occurred to the system. *This is the default setting on OUT6.*
11	OVERLOAD PREALARM	Activated when the load goes over 100%. This level is adjustable by an Authorized Toshiba Service Provider.
12	FAULT GROUP 1	Activated when the preset group of alarms (Fault Group 1) all occur to the system at once. These groups are set in the TEST MENU by an Authorized Toshiba Service Provider.
13	FAULT GROUP 2	Activated when the preset group of alarms (Fault Group 2) all occur to the system at once. These groups are set in the TEST MENU by an Authorized Toshiba Service Provider.
14	BYPS. SYNCHRONOUS	Activated when the inverter output voltage and bypass voltage are synchronous.
15	BYPS. ASYNCHRONOUS	Activated when the inverter output voltage and bypass voltage are asynchronous.
16	REMOTE OPE. ENABLE	Activated when any remote operation occurs (Stop/Start Inverter, etc.)
17 *	LOAD ON INVERTER	Activated when the load is supplied from the inverter. *This is the default setting on OUT2.*
18 *	LOAD ON BYASS	Activated when the load is supplied from the bypass. *This is the default setting on OUT1.*
19	LOAD ON AC	Activated when the power is supplied from the input via the UPS's rectifier/converter - inverter.
20 *	BATTERY OPERATION	Activated when the battery is operating following an AC power failure. *This is the default setting on OUT3.*
21 *	CONVERTER OPERATION	Activated when the converter is operating. *This is the default setting on OUT4*
22	INVERTER OPERATION	Activated when the inverter is operating.
23	CB1 CLOSE	Activated when CB1 (Input Contactor) is closed.
24	CB2 CLOSE	Activated when CB2 (Battery Breaker) is closed.
25	52S CLOSE	Activated when 52S (Bypass Contactor) is closed.
26	POWER DEMAND ON	Activated when Power Demand is activated by one of the Inputs.
27	EQUALIZING CHARGE	Activated when the UPS is charging the batteries at the equalizing charge level. This command boosts the charge voltage (500-640 V) for a preset duration (0-100 hr.)
28	ANOTHER BUS SYNC.OK	Annunciates that the UPS is successfully synchronized to an external source

*: Default output settings

4.5 RemotEye® 4 Introduction

The RemotEye® 4 is available as an optional UPS system monitoring tool. The RemotEye4 supplies a network function to monitor UPS units via Simple Network Management Protocol (SNMP), Modbus TCP/RTU, and BACnet IP/MSTP protocols as well as a graphical web interface (HTTPS).
The RemotEye® 4 module is installed at the rear of the front door in G9000 UPS units. The configuration of the RemotEye® 4 is shown in Figure 4-20 and Figure 4-22 shows detailed connection

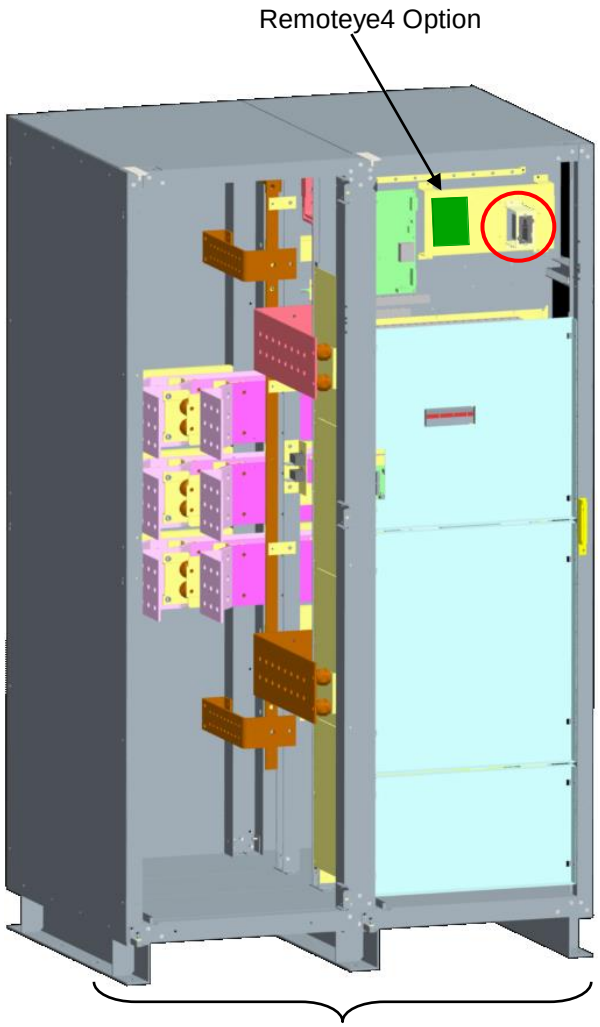


Figure 4-20 RemotEye® 4 Installation (Overview)

** Consult Toshiba International Corporation for details on"RemotEye®" monitoring software and its capabilities.*

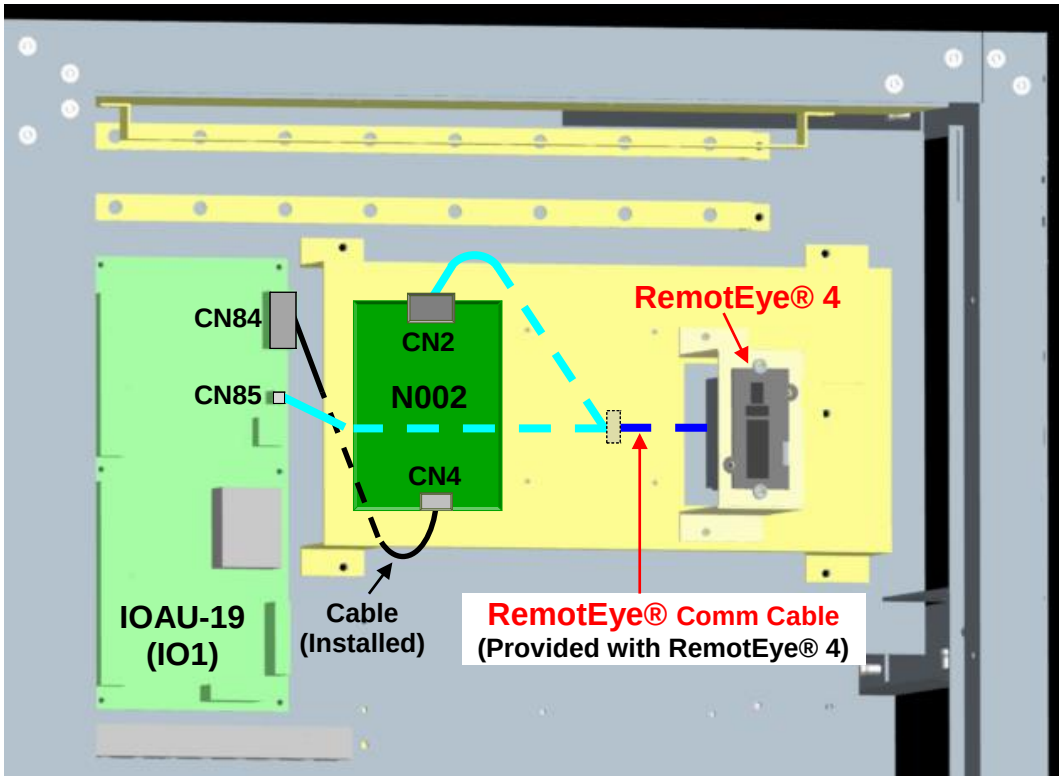


Figure 4-21 Detailed Configuration of RemotEye® Installation

Table 4–3 Parts List for UPS Monitoring

Parts No.	Part name	Quantity
1	RemotEye® 4 Module	1
2	RemotEye® Comm Cable	1

The Cables between RemotEye4 and IOAU-19 PCB/N002 are included in the RemotEye® 4 package. The cables can pass through under the panel to mount RemotEye® 4.

The RemotEye® 4 communicates with the UPS via a cable. The connection is described in Figure 4-22 below. Figure 4-23 shows the detail of D-sub 9Pin on N002.

CAUTION

The UPS has to be de-energized when the RemotEye® 4 module is installed for safety reason.

** Consult Toshiba International Corporation for details on "RemotEye® 4" monitoring software and its capabilities.*

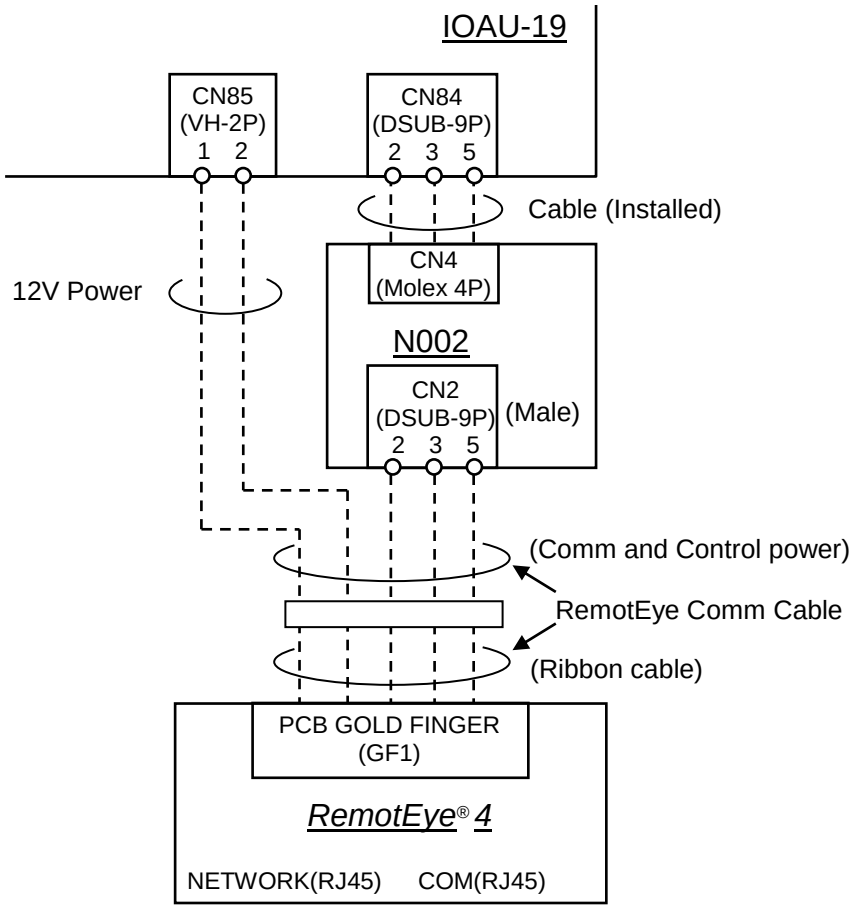
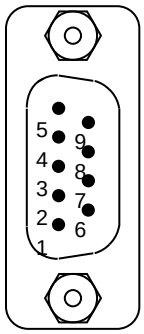


Figure 4-22 Connection Between IOAU-19 PCB (IO1) and RemotEye® Module

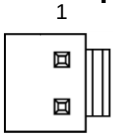
CN2 on N002



D-SUB 9Pin (Male)

DB9	Description	
Pin 1	-	Not used
Pin 2	RXD	Receive data
Pin 3	TXD	Transmit data
Pin 4	-	Not used
Pin 5	GND	Signal ground
Pin 6	-	Not used
Pin 7	-	Not used
Pin 8	-	Not used
Pin 9	-	Not used

Figure 4-23 Communication Connector (CN2, Dsub-9) on N002



VH 2Pin

CN85	Description	
Pin 1	+12VS	+12VDC
Pin 2	GND(S)	+12VDC ground

Figure 4-24 VH Connector (CN85) on IOAU-19 PCB (IO1)

5 Installation and Operation

5.1 Transportation and Installation

Table 5–1 How to Transport and Install the System

Transportation	Installation
Transport unit with forklift or pallet jack ONLY.	Using the 2 or 4 pre-drilled holes in the each UPS channel base*, anchor the unit using appropriate hardware. (Not provided) * 4x 4-holes bases and 3x 2-holes bases

PROHIBIT

Do not transport UPS cabinets laid horizontally.

Cabinets must be maintained upright within ± 15° of the vertical during handling.

NOTE

Floor shall be flat and level. 3 inches surrounding mounting holes shall be flush with cabinet mounting rails.

5.2 Installation Procedure

A) Note the Load Tolerance of the Floor

Refer to Table 5–2 for list of UPS weights.

Table 5–2 List of UPS Weights

UPS Capacity (kVA)	1050	1330	1500	1660	2000
Weight (lb.)	6,615	9,590	11,355	11,795	13,560

B) Minimum Clearance Required for Ventilation

Right side ..... 1 in. (25 mm) (not required when sidecars are used)

Left side ..... 1 in. (25 mm) (not required when sidecars are used)

Back side ..... 0.0 in. (0 mm)

Top side ..... 24 in. (600 mm) (for air flow)

C) Space Requirement for Routine Maintenance

Allow for the following space at the time of installation.

Front ..... 40 in. (1000 mm)

Sides ..... 0.0 in. (0 mm)

Back side ..... 0.0 in. (0 mm)

Top side ..... 20 in. (500 mm)

D) External Battery Supply

Please refer to the following when installing and maintaining batteries:

NOTE

1. The customer shall refer to the battery manufacturer's installation manual for battery installation and maintenance instructions.
2. The maximum permitted fault current from the remote battery supply and the DC voltage rating of the battery supply over-current protective device are shown in Table 5–3.

Table 5–3 Maximum Permitted Fault Current

UPS Capacity (kVA)	DC Voltage Rating (V)	Maximum Permitted Fault Current (A)
1050	480	25,000
1330	480	25,000
1500	480	25,000
1660	480	25,000
2000	480	25,000

5.3 Procedure for Cable Connections

1. Confirm the capacity of the UPS being installed. Identify the input/output power terminal blocks accordingly as shown in the Figure 5-1 through Figure 5-4.
2. Connect the internal control wire and power wire.
   (1) Control wire interconnect
      a) Battery CB ON Auxiliary to terminal TN11-21, 22 of external I/F PCB IOAU-19.
   (2) Power wire (AC input, Bypass input, AC output) Inter-connect
      a) From user's distribution panel
         1. X1 (A-phase) to A bus bar in UPS
         2. X2 (B-phase) to B bus bar in UPS
         3. X3 (C-phase) to C bus bar in UPS
      b) DC Input to UPS
         1. Positive cable to BP bus bar in UPS
         2. Negative cable to BN bus bar in UPS

NOTE

After the completion of the input power cables connection:
With a phase rotation meter, check that the phase rotation of the AC Input power terminals A, B and C as well as the Bypass Input power terminals A40, B40 and C40 are correct. The proper phase rotation is clockwise A(R) → B(S) → C(T).

3. Connect the grounding conductor from the input service entrance to the UPS Ground Bar (E).

REQUIRED

4. Two (2) sources feeding the UPS:

   (1) Before connection of alternate source, ensure that input bus bar jumper is removed. Connect the AC input power cables from the input service entrance to the AC input power terminals, identified as A, B, C in Figure 5-1 through Figure 5-4. Input cables must be sized for an ampere rating larger than the maximum input drawn by the converter. (Refer to equipment nameplate for current ratings.) Confirm that an external bypass input circuit breaker (MCCB) is installed (refer to WARNING 4, page 10). Connect the bypass input power cables from the input service entrance to the bypass input power terminals, identified as A40, B40 and C40 in through Figure 5-4. Bypass input cables must be sized for an ampere rating larger than the maximum output current capacity of the UPS. Refer to Table 5–4 for recommended cable sizes.

   (2) Connect the external signal terminal block as needed. Refer to Section 4.4 and Figure 4-16 through Figure 4-19 for functional description. 14 AWG ($2mm^2$), or less, shielded conductor is recommended.

5. One (1) source feeding the UPS:

   (1) Confirm that an external input circuit breaker sized to protect both the AC input and the bypass line is installed. (Refer to equipment nameplate for current ratings.) Connect the bypass input power cables from the input service entrance to the bypass input power terminals, identified as A40, B40 and C40 in through Figure 5-4. Input cables must be sized for an ampere rating larger than the maximum current capacity of the UPS. Refer to Table 5–4 for recommended cable sizes.

   (2) Using adequately sized conductors and referring to the appropriate figure identified in Figure 5-1 through Figure 5-4, connect jumper bypass terminals A40, B40, C40 to AC input power terminals A, B, C as identified in Figure 5-1 through Figure 5-4.

   (3) Connect the external signal terminal block as needed. Refer to Section 4.4 and Figure 4-16 thru Figure 4-19 for functional description. 14 AWG ($2mm^2$), or less, shielded conductor is recommended.

NOTE

1. **Confirm that all UPS internal contactors (breakers) "CB1", "CB2", and "CB3" are open before energizing UPS.**
2. **It is recommended that compression lugs be used to fasten all input/output power cables.**

6. Procedure for Cable Connections for Parallel Operation System

(1) Confirm the number of units to be connected in parallel. Identify the input/output power terminal blocks and control wire connections for parallel operation systems as shown in the appropriate Figure 5-1 through Figure 5-4.

(2) Connect the external control wire and power wire.

NOTE

Straight through, shielded CAT6 cables with metal shielded RJ-45 plugs on both sides are to be used for the parallel control signal cables. Use of any other cables could cause erroneous communication failures.

a) Control wire connection

Parallel configuration wiring (Refer to Figure 4-17 and Figure 5-7)

52L control signal from Toshiba Tie Cabinet (TTC) to UPS-n IOAU-19 (TN11-23, 24).

Parallel control signals, for TLAIN, TLAOUT, TLBIN, TLBOUT, CAIN, CAOUT, CBIN, CBOUT, DIAIN, DIAOUT, DIBIN, DIBOUT as shown in Figure 5-7 and Figure 5-8)

b) Power wire connection

From UPS AC Output Terminals to Toshiba Tie Cabinet (TTC)

(Refer to Figure 5-1 through Figure 5-4,

Figure 5-6 and Figure 5-7)

CAUTION

When in Parallel Operation, the rectifier inputs to all G9000 UPS Systems in the Multi-Module System (MMS)-must be fed from a single source at all times including any operation of Automatic Transfer Switches. All G9000 bypass inputs must also be fed from a single source at all times (not necessarily the same source as the rectifier inputs).

Table 5–4 Recommended Cable Quantities at 500kcmil

kVA Capacity	Input Voltage	Output Voltage	Input Side		Output Side		Bypass Side		DC Input Side	
			Cable Size	Torque in. lbs.	Cable Size	Torque in. lbs.	Cable Size	Torque in. lbs.	Cable Size	Torque in. lbs.
1050kVA	480V	480V	6 x 500kcmil	347 - 469 in. lbs.	5 x500kcmi	347 - 469 in. lbs.	5 x 500kcmil	347 - 469 in. lbs.	4 x 500kcmil **(2 String Min.)**	347 - 469 in. lbs.
1330kVA	480V	480V	7 x 500kcmil	347 - 469 in. lbs.	6 x 500kcmil	347 - 469 in. lbs.	6 x 500kcmil	347 - 469 in. lbs.	6 x 500kcmil **(2 String Min.)**	347 - 469 in. lbs.
1500kVA	480V	480V	8 x 500kcmil	347 - 469 in. lbs.	7 x 500kcmil	347 - 469 in. lbs.	7 x 500kcmil	347 - 469 in. lbs.	6 x 500kcmil **(2 String Min.)**	347 - 469 in. lbs.
1660kVA	480V	480V	9 x 500kcmil	347 - 469 in. lbs.	8 x 500kcmil	347 - 469 in. lbs.	8 x 500kcmil	347 - 469 in. lbs.	7 x 500kcmil **(2 String Min.)**	347 - 469 in. lbs.
2000kVA	480V	480V	11 x 500kcmil	347 - 469 in. lbs.	9 x 500kcmil	347 - 469 in. lbs.	9 x 500kcmil	347 - 469 in. lbs.	8 x 500kcmil **(2 String Min.)**	347 - 469 in. lbs.

*1 – Voltage drop across power cables not to exceed 2% of nominal source voltage.
*2 – Allowable ampere-capacities based on copper conductors with 75°C. insulation at ambient temperature of 40°C.
*3 – If using different cable type, rating, or in different site conditions, ensure that adjusted ampacity is equal to or larger than the sizes listed in the table.
*4 – Sized based on necessary overcurrent protection for maximum load.
*5 – The cable wire rating shown for each UPS model in this table is selected for general best fit for use on all input and outputs of the UPS. For complete set of cable rating/quantity recommendations, refer to Installation Planning Guides in Appendix A.
*6 – All wiring to be in accordance with all applicable national and/or local electrical codes.

Table 5–5 Recommended Hardware

UPS Capacity	Bolt size	Flat washer size	Split lock washer size	Nut size
1050kVA	M12 x 40mm	M12	M12	M12
1330kVA	M12 x 40mm	M12	M12	M12
1500kVA	M12 x 40mm	M12	M12	M12
1660kVA	M12 x 40mm	M12	M12	M12
2000kVA	M12 x 40mm	M12	M12	M12

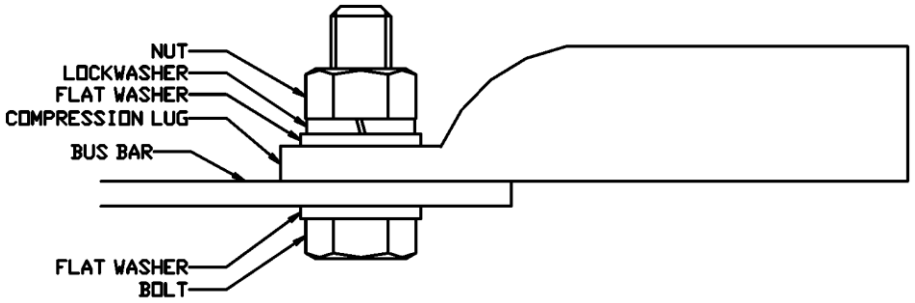


Table 5–6 Crimp Type Compression Lug

WIRE SIZE (CODE)	WIRE STRAND CLASS	RECOMMENDATION		CRIMP TOOL REQUIRED BURNDY TYPE Y35 OR Y46	
		VENDOR	CAT. NO.	COLOR KEY	DIE INDEX
250 MCM	B	BURNDY	YA29	YELLOW	16
		ILSCO	CRA-250L	YELLOW	16
	I	BURNDY	YA30-LB	---	1024
300 MCM	B	BURNDY	YA30	WHITE	17 / 298
		ILSCO	CRA-300L	WHITE	17 / 298
	I	BURNDY	YA32-LB	---	1026
350 MCM	B	BURNDY	YA31	RED	18 / 324
		ILSCO	CRA-350L	RED	18 / 324
	I	BURNDY	YA34-LB	---	1027
400 MCM	B	BURNDY	YA32	BLUE	19 / 470
		ILSCO	CRA-400L	BLUE	19 / 470
	I	BURNDY	YA36-LB	---	1027
500 MCM	B	BURNDY	YA34	BROWN	20 / 299
		ILSCO	CRA-500L	BROWN	20 / 299
	I	BURNDY	YA38-LB	---	1029
600 MCM	B	BURNDY	YA36	GREEN	22 / 472
		ILSCO	CRA-600L	GREEN	22 / 472
	I	BURNDY	YA39-LB	---	1030

NOTE: When using crimp type lugs, the lugs should be crimped to the specifications given in the manufacturer's instructions for both crimp tool and lug.

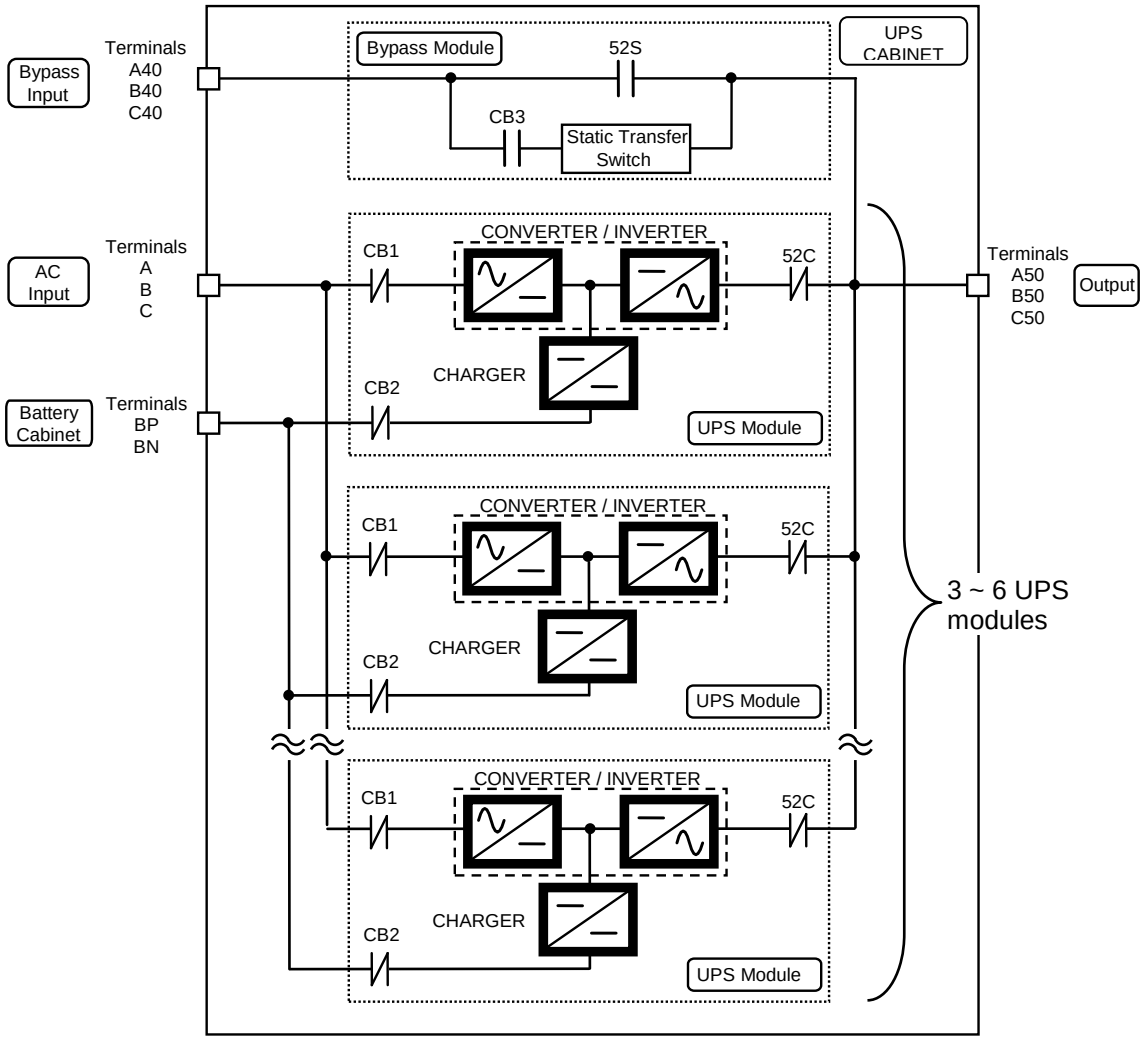
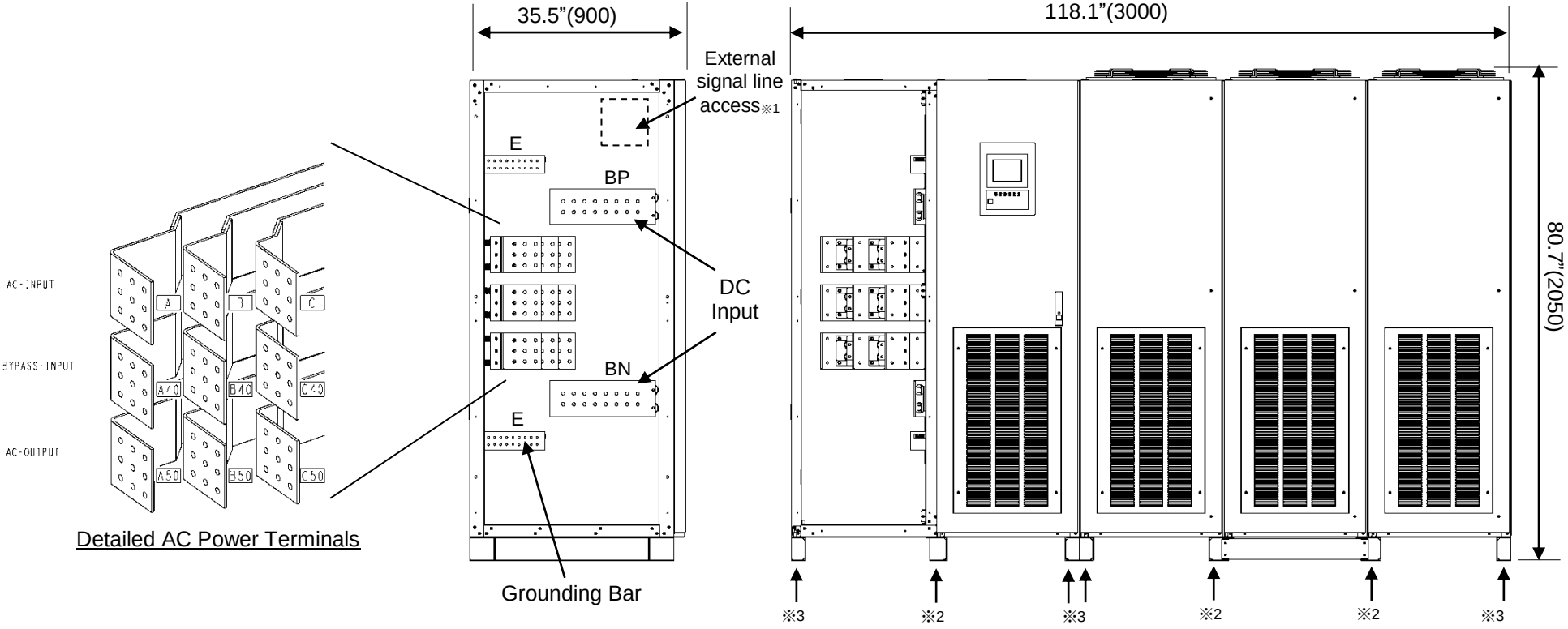
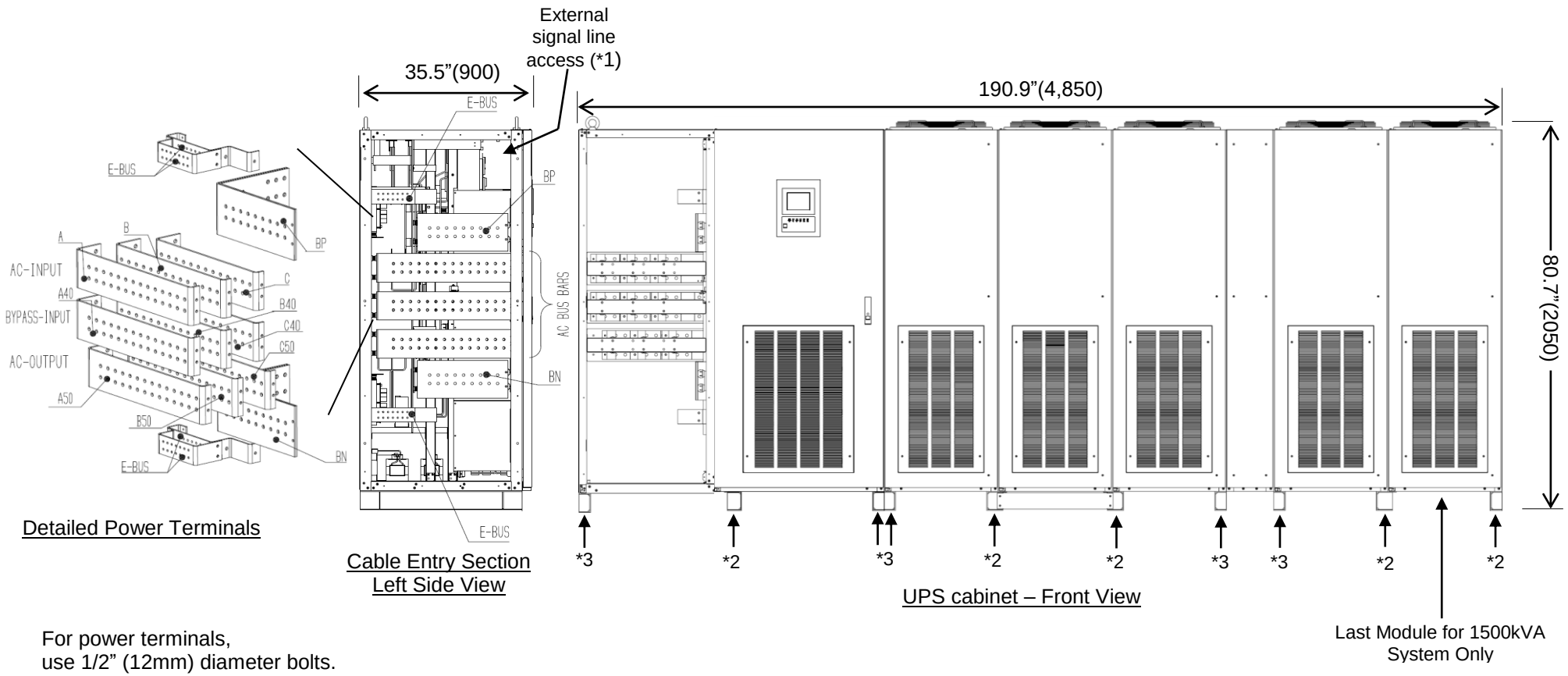


Figure 5-1 UPS Terminal Designation



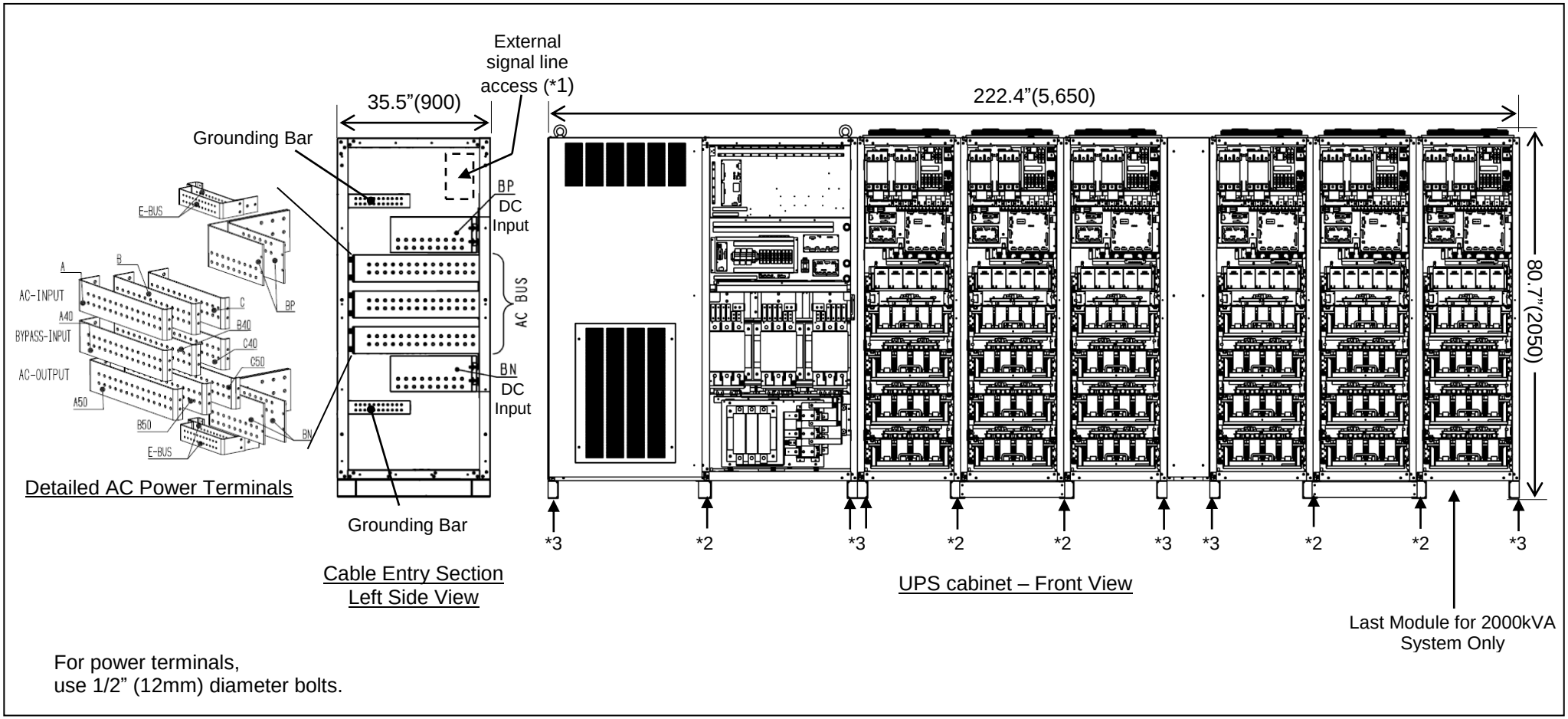
*1. Signal lines should be separated to the main circuit cables with more than 100mm insulating distance. The wiring also should fix to the frame to ensure the insulating distance satisfied the condition.
*2. 3x 2-holes bases
*3. 4x 4-holse bases

Figure 5-2 Diagram of Input/Output Bus Bars and Terminal Blocks (1050kVA)



*1: Signal lines should be separated to the main circuit cables with more than 100mm insulating distance.
The wiring also should fix to the frame to ensure the insulating distance satisfied the condition.
*2: 3x 2-holes bases
*3: 4x 4-holse bases

Figure 5-3 Diagram of Input/Output Bus Bars and Terminal Blocks (1330-1500kVA)



*1: Signal lines should be separated to the main circuit cables with more than 100mm insulating distance.
The wiring also should fix to the frame to ensure the insulating distance satisfied the condition.
*2: 3x 2-holes bases
*3: 4x 4-holse bases

Figure 5-4 Diagram of Input/Output Bus Bars and Terminal Blocks (1660-2000kVA)

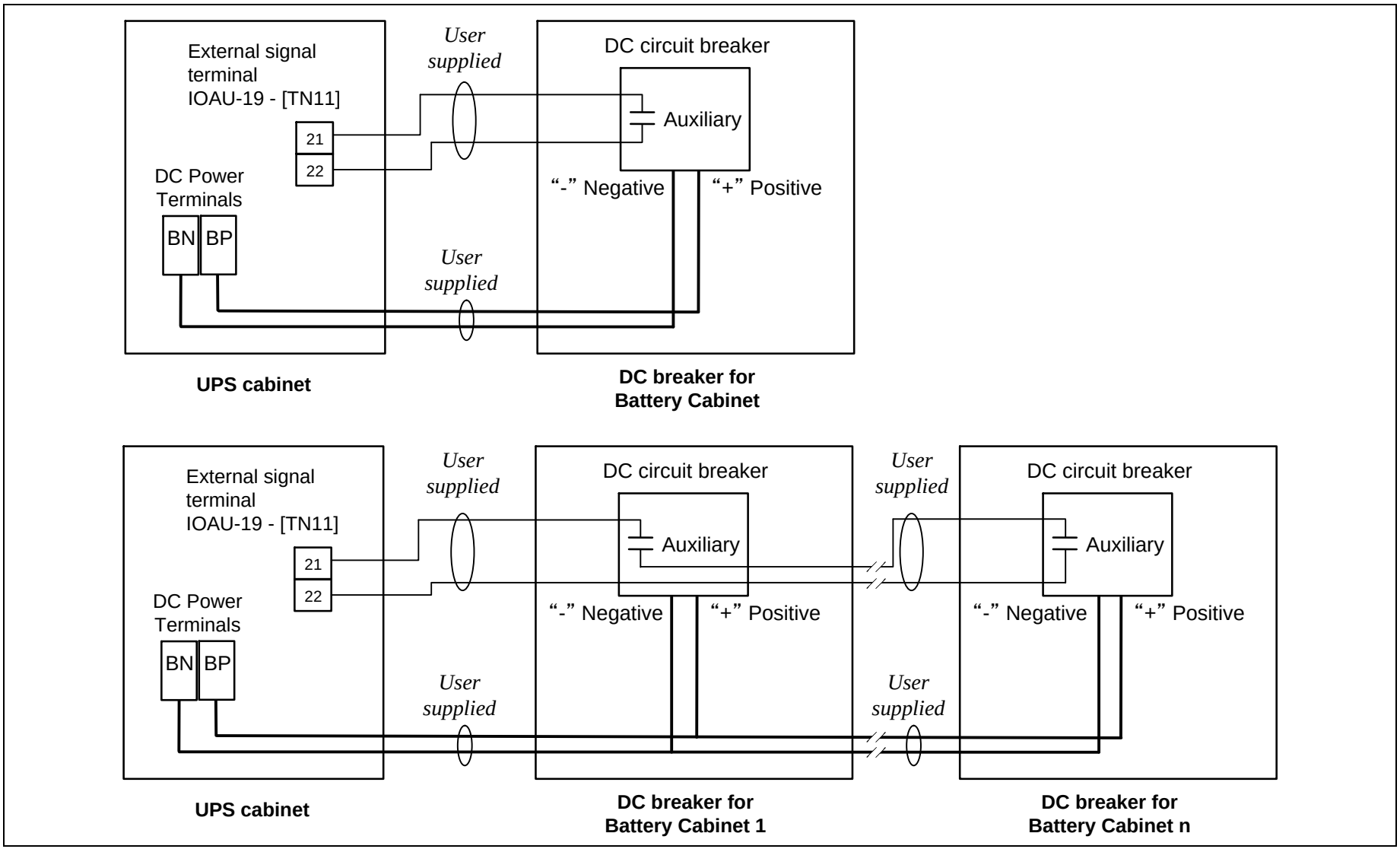


Figure 5-5 Diagram of Power Wire & Control Wire Inter-Connect between UPS and Battery

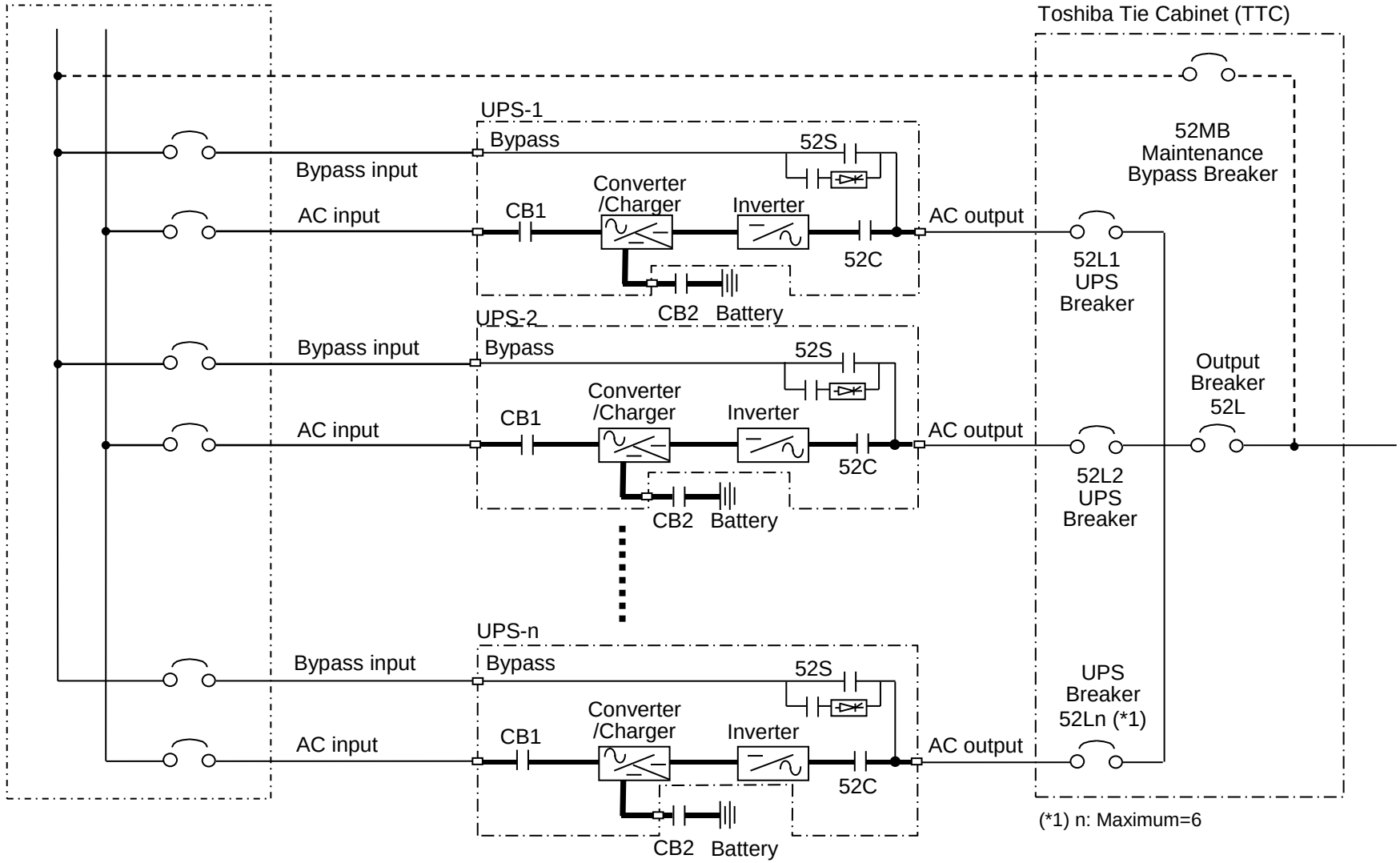


Figure 5-6 Diagram of Power Wire Connections (Parallel System Configuration)

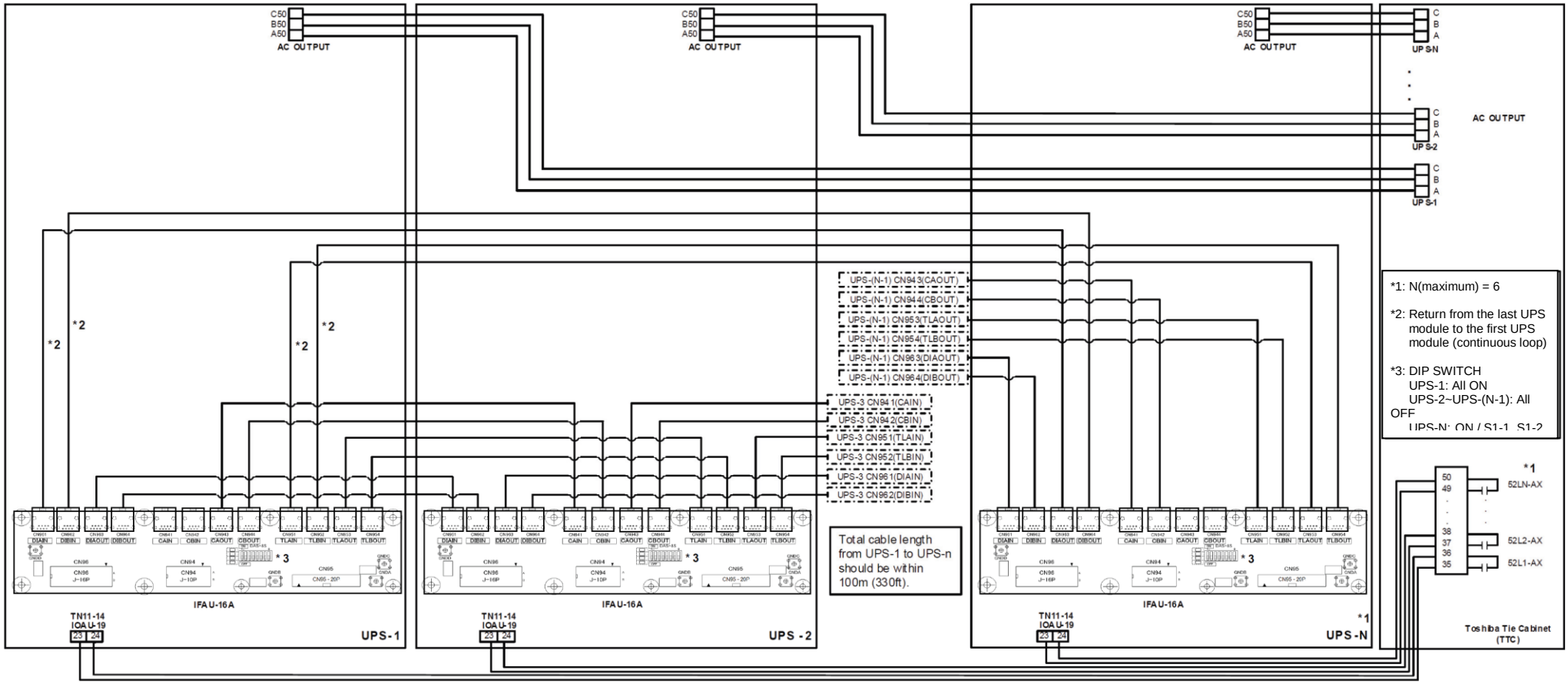
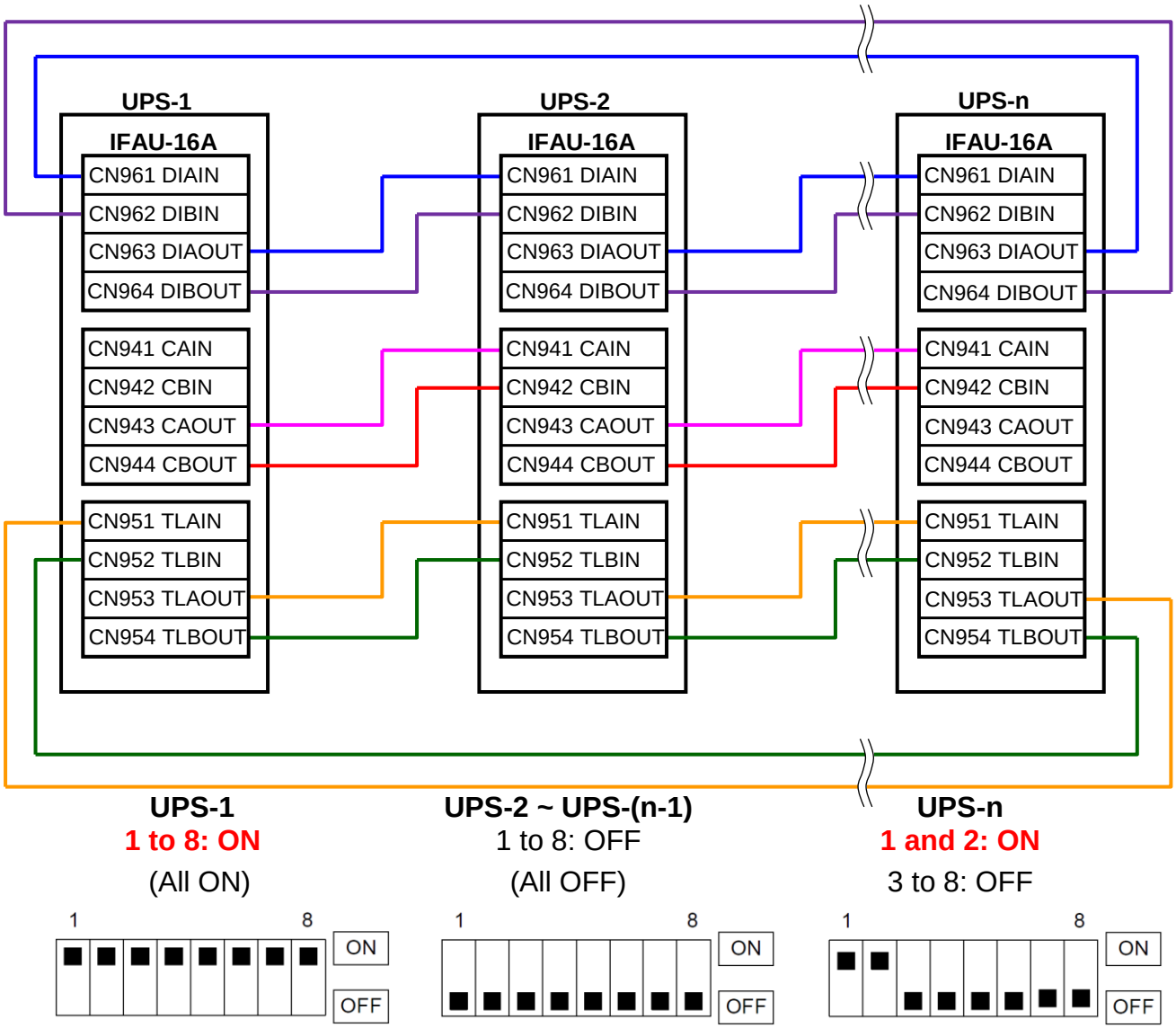


Figure 5-7 Diagram of Power Wire & Control Wire Connection (Parallel system connection 2x to 6x)

- Use Ethernet STP (Shielded Twisted Pair) Cable (Cat 6) with shielded RJ45 modular connectors for all communication cabling.
- Use of UTP (Unshielded Twisted Pair) Cable may cause malfunction.

- Total cable length from UPS-1 to UPS-n should be within 100m (330ft).



UPS-1
1 to 8: ON
(All ON)

UPS-2 ~ UPS-(n-1)
1 to 8: OFF
(All OFF)

UPS-n
1 and 2: ON
3 to 8: OFF

Figure 5-8 Detail of IFAU-16A Control Wire Connections for N units in MMS Configuration

Table 5–7 Status of Jumpers on Parallel Interface Board (IFAU-16A)

#	Device	Status
1	JP1	**SHORT**
2	JP6	**SHORT**
3	JP11	**OPEN**

5.4 Operating Procedures

NOTE: To avoid inadvertently placing the UPS online or offline the START and STOP switches must be pressed and held for a period of several seconds to execute the command.

- START – Press and hold the START switch for approximately 2 seconds.
- STOP – Press and hold the STOP switch for approximately 5 seconds.

For Parallel Operation system, refer to section "D) MMS Start-up Procedure".

(Parallel Operation system is herein after referred to as a MMS [Multi Module System])

On-screen guidance for Starting and Stopping the UPS can be obtained by pressing the OPERATION tab icon.

A) Start Operation

NOTE

Before the UPS startup, the internal Bypass line starts to supply the unconditioned bypass input power to the load if the External input (or Bypass) Circuit Breaker is closed. Be extremely careful with closing the External input (or Bypass) Circuit Breaker.

a) Verify the Battery Disconnect Circuit Breaker is open or in the tripped position. (User supplied)
b) Verify the External Bypass Input Circuit Breaker for each unit is closed. (User supplied)
c) If a dual source is feeding the UPS, close the External AC Input Circuit Breaker manually (User supplied).
d) The LCD panel boots up automatically, and the screen will show that the Load is powered by bypass line.
e) Select "OPERATION" tab, and then press the "START OPERATION" button to initiate UPS start-up. (Refer to Figure 4-4).
f) Follow the "START OPERATION" guidance accordingly until the completion of the inverter startup.

NOTE

When "REMOTE OPERATION MODE" is displayed on the LCD panel, the inverter start operation can only be performed remotely. If local inverter start operation is required (at the UPS), select "LOCAL ONLY" or "REMOTE & LOCAL" in the OPERATION MENU.

B) Stop Operation

If a total UPS shutdown is required, verify that the critical load is OFF.

CAUTION

Verify the load is OFF if the next step is to be performed.

Power to the load has been supplied through the bypass line. Power to load will be lost after execution of the next step. The load will drop.

WARNING

In bypass mode, all UPS power terminals are still alive. Lethal voltages are present. De-energize all external sources of AC and DC power. Before removing the covers, wait 5 minutes after de-energizing. Ensure that there is no-voltage present before handling UPS. Be careful of the devices even when all external sources of power have been removed since internal circuitry may still be energized.

NOTE

When "REMOTE OPERATION MODE" is displayed on the LCD panel, the inverter start operation can only be performed remotely. If local inverter stop operation is required (at the UPS), select "LOCAL ONLY" or “REMOTE & LOCAL” in the OPERATION MENU.

a) Select “OPERATION” tab, and then press the “STOP OPERATION” button to initiate transfer process. (Refer to Figure 4-5 & Figure 4-3).

b) Follow the “STOP OPERATION” guidance accordingly. During the procedure, UPS will transfer the power feeding from the Inverter supply to the Bypass line supply.

c) Both Converter and Inverter will remain energized until complete disconnection from all power sources.

d) If stopping both the Inverter and Converter is required, open the Battery Disconnect circuit breaker manually in accordance with guidance.

e) If a dual source is feeding the UPS, open the External AC Input Circuit Breaker (user supplied) manually.

f) If turning off all power to the critical load is desired, open the External Bypass Input Circuit Breaker (user supplied) manually.

C) Bypass Operation Procedure

** Transfer from Inverter to Bypass

1. Check for “SYNC” on the LCD.
2. Press the "START/STOP” icon on the LCD.
3. Follow the “STOP OPERATION” guidance and Press the "STOP" icon on the LCD.

** Transfer from bypass to inverter.

1. Press the "START/STOP" icon on the LCD.
2. Follow the “START OPERATION” guidance and Press the "START" icon on the LCD.

NOTE

When "REMOTE OPERATION MODE" is displayed on the LCD panel, the inverter start operation can only be performed remotely. If local inverter stop operation is required (at the UPS), select "LOCAL ONLY" or “REMOTE & LOCAL” in the OPERATION MENU.

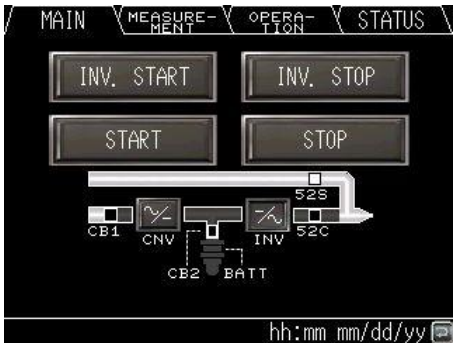
D) MMS Start-up Procedure

External Circuit Check (Ensure System is in Maintenance Bypass)

1. Verify that Tie Cabinet Maintenance bypass breaker 52MB is closed.
2. Verify that Tie Cabinet Output breaker 52CS is open.
3. Verify that Tie Cabinet UPS breakers 52L1, 52L2…and 52Ln are closed.

Start-up from UPS-1 to UPS-n

1. Start-up each UPS in accordance with “A) Start Operation”. Each UPS will start Inverter Operation synchronized with the bypass input.



Same figure as Figure 4-3

*Meaning of the icons in MMS

INV. START : Turns on UPS Converter and Inverter

INV. STOP : Turns off UPS Converter and Inverter

START : Parallel-on
(No effect in MMS Bypass Operation)

STOP : Parallel-off

Transfer from Maintenance Bypass to MMS Bypass Operation

1. Close Tie cabinet breaker 52CS.
2. Open Tie cabinet Breaker 52MB.

NOTE

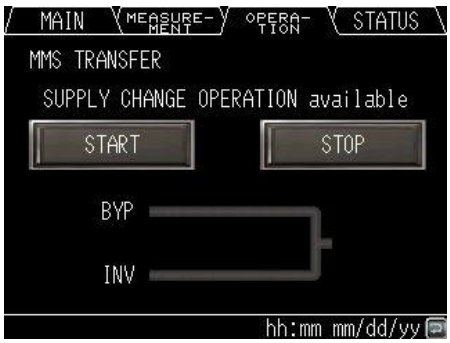
When "REMOTE OPERATION MODE" is displayed on the LCD panel, the inverter start operation can only be performed remotely. If local inverter start operation is required (at the UPS), select "LOCAL ONLY" or "REMOTE & LOCAL" in the OPERATION MENU.

Transfer from UPS MMS Bypass Operation To UPS MMS Inverter Operation

1. Transfer MMS Bypass Operation to MMS Inverter Operation from Operation Menu on any UPS LCD as shown in Figure 5-9.

Transfer from UPS MMS Inverter Operation To UPS MMS Bypass Operation

1. Transfer MMS Inverter Operation to MMS Bypass Operation from Operation Menu on any UPS LCD as shown in Figure 5-9.



*Meaning of the icons in MMS

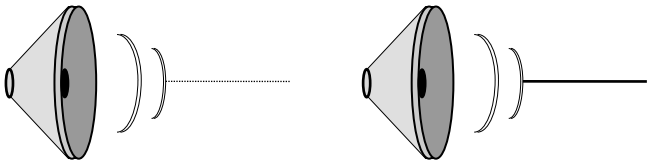
START : MMS Inverter Operation

STOP : MMS Bypass Operation

Figure 5-9 LCD Screen (MMS Operation)

6 Response to Ups Failure

UPS FAULT



Annunciator Silence

Depress “SILENCE ALARM” icon on Main Menu.

Recording of Fault

Refer to the list of fault codes in section 6.0 for error description.

Primary Action

Take necessary action according to display guidance.

Information to Service

When faults happen, contact the Authorized Toshiba Service Representatives or call Toshiba International Corporation at **1-877-867-8773**.

NOTE

Note

The error code indicated on the LCD display panel when an UPS alarms is very important.
In order to reduce repair time, please include this information, along with the operation and load status for all correspondence to Toshiba field service group.

7 Parts Replacement

7.1 Recommended Maintenance

Toshiba International Corporation recommends the UPS have regular preventative maintenance (PM) visits to ensure optimum operation and longevity. Toshiba recommends two Major PM's per year, at six month intervals.
A Major PM includes maintenance of the batteries and an offline inspection of the UPS. Contact Toshiba International Corporation Service Department at 1-877-867-8773 for further details.

7.2 Battery

Battery lifetime may vary according to the frequency of use and the average ambient operating temperature. The end of battery life is defined as the state of charge resulting in an ampere-hour capacity less than, or equal to, 80% of nominal capacity.
Battery replacement is recommended if its capacity is within this percentage.

7.3 UPS Component Parts

UPS components have a defined life expectancy (Fans, Capacitors, Filters, etc.)
Contact Toshiba International Corporation for a complete parts replacement schedule. Recommended replacement time interval varies with operating environment.
Contact Toshiba International Corporation for application specific recommendations.

Table 7–1 Standard Replacement Parts List

Parts name	Life Expectancy	Replacing method, etc.
Cooling fans	5 years*	Replace with a new one
Electrolytic Capacitors	15 years	Replace with a new one
AC filter Capacitors	15 years	Replace with a new one
Control Relays	15 years	Replace with a new one
Contactors	15 years	Replace with a new one
PCB	15 years	Renew UPS
Control power supply	15 years	Replace with a new one
LCD	10 years*	Replace with a new one
Fuses	10 years*	Replace with a new one
Thermal relays	10 years*	Replace with a new one

* Periodic replacements are needed.

WARNING

Any parts replacements (including modification) without authorization by Toshiba could result in personal injuries, death, destruction of the UPS, or voiding of UPS warranty.

7.4 Air Filters

Air filters can be obtained in bulk quantities from Toshiba International Corporation. Use only air filters specified by Toshiba.

Table 7–2 Replacement Air Filters

Module	Toshiba Part Number	Quantity
BYP	65905	2: 1500kVA
	T90-AF-20x30x1	2: 1330-2000kVA
UPS	65905	3: 1050kVA 4: 1330kVA 5: 1500/1660kVA 6: 2000kVA

8 Fault Codes

This section covers fault codes, their description and required action at time of error.

In the event of a fault occurring:

A) Verify and record the occurrence of the alarm. Note details of alarm message displayed on the LCD display panel.

Contact Toshiba International Corporation at 1-877-867-8773.

B) If a circuit breaker (MCCB) has tripped, depress the toggle to reset the breaker before closing it again.

8.1 Bypass Module Fault Codes

Table 8–1 Bypass Module Fault Code List

Code indication (Note 2)	Status Message	Meaning	Guidance	Audible Alarm	External relay contact (Note 1)
UA805	OVERLOAD	The output load current has exceeded 100% of the rated current.	WARNING: DECREASE LOAD	Intermittent sound	Overload
UA806	INVERTER OVERLOAD	The output load current peak has exceeded 220% of the rated current.	WARNING: DECREASE LOAD	Intermittent sound	Overload
UA807	INVERTER OVERLOAD	The output load current has exceeded 105% of the rated current.	WARNING: DECREASE LOAD	Intermittent sound	Overload
UA808	OVERLOAD	The output load current has exceeded 100% of the rated current during bypass supply.	WARNING: DECREASE LOAD	Intermittent sound	Overload
UA810	OVERLOAD	Short time over-current has exceeded 150% of the rated current.	WARNING: DECREASE LOAD	Intermittent sound	Overload
UA812	BYPS.VOLT.OUT RNG.	Bypass line voltage is out of the specific range.	CHECK BYPASS INPUT	Intermittent sound	Bypass Input Abnormal
UA813	BYPS.PHASE ABNL.	Bypass line power conductors are not wired in a proper phase sequence.	CHECK BYPASS INPUT	Intermittent sound	Bypass Input Abnormal
UA814	BYPS.FREQ.OUT RNG.	Bypass line frequency is out of the specific range.	CHECK BYPASS INPUT	Intermittent sound	Bypass Input Abnormal
UA815	TRANSFER PROHIBITION	Transfer to bypass is not available due to bypass abnormality.	-	Intermittent sound	-
UA817	EMERG.STOP ACTIV.	The emergency stop was activated by the EPO switch or an external contact.	-	Continuous sound	-
UA821	REM. BUTTON CLOSE	Remote start signal is being received continuously for a considerable time.	-	Intermittent sound	-
UA822	LOC. BUTTON ABNL.	Local start or stop signal is being received continuously for a considerable time.	CALL SERVICE ENGINEER	Intermittent sound	-
UA824	CB2 OPEN	The battery disconnect contactor CB2 in power converter module is opened.	CB2 OPEN	Intermittent sound	-
UA831	EMERG.BYPS.SW.ON	Emergency bypass switch has been turned on.	CALL SERVICE ENGINEER	Intermittent sound	-
UA833	52L OPEN	The load circuit breaker(52L) is turned off.	-	Intermittent sound	-
UA834	BATTERY DEPLETED	The battery voltage has reached the depleted level.	CALL SERVICE ENGINEER	-	End-of-Discharge
UA835	TRANS.INHIBITED	The UPS could not transfer to the bypass because the bypass source has an abnormality.	-	-	-
UA861	MODULE ALARM	A power converter module has detected an alarm condition.	CALL SERVICE ENGINEER	Intermittent sound	-
UA862	MODULE MINOR FAULT	A power converter module has detected a minor fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UA863	MOD.IN.VOLT.	A power converter module has detected input voltage abnormal.	CHECK INPUT POWER SOURCE	Intermittent sound	-
UA864	MODULE OVERLOAD	A power converter module has detected output overload.	WARNING : DECREASE LOAD	Intermittent sound	Overload
UA865	MOD.BAT.END	A power converter module has detected battery depleted.	CALL SERVICE ENGINEER	-	Alarm

Code indication (Note 2)	Status Message	Meaning	Guidance	Audible Alarm	External relay contact (Note 1)
UA866	BATT.END WA	A power converter module issues a warning on eminent battery depletion.	-	Intermittent sound	Alarm
UA867	OVERTEMPERTURE	Detection of overtemperature at the bypass bus bar.	CALL SERVICE ENGINEER	Intermittent sound	Alarm
UA890	EXTERNAL ALARM	External alarm relay turned on.	-	Intermittent sound	Alarm
UF006	CONVERTER ABNORMAL	Mixed operation (2 minutes)	CALL SERVICE ENGINEER	Intermittent sound	Major
UF055	CONVERTER ABNORMAL	Mixed operation (20 seconds)	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF151	BAT.VOLTAGE ABNL.	All power converter modules have detected battery float voltage abnormal.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF152	BAT.VOLTAGE ABNL.	Unable to equalize the voltage of various batteries after 24 hours.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF156	CHG.STOPPED	UF157 failure persisted for over two(2) hours.	CHECK BATTERY	Intermittent sound	Battery abnormal
UF157	BATTERY OVERTEMP.	Detection of overtemperature at the batteries.	CHECK BATTERY	Intermittent sound	Battery abnormal
UF158	BATTERY LIQUID LOW	Low level of battery electrolyte solution.	CHECK BATTERY	Intermittent sound	Battery abnormal
UF161	CHG.STOPPED	UF151 failure is running for over 24 hours.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF162	BATTERY ABNORMAL	Failure detection based on battery self-check.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF163	BAT.VOLTAGE ABNL.	All converter modules have detected battery voltage abnormal.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF172	BATTERY ABNORMAL	The external relay detected the battery fault.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF202	INVERTER UV.	Output voltage dropped.	CALL SERVICE ENGINEER	Continuous sound	Major
UF253	CTRL.CIRCUIT ERR.	Discrepancy between output voltage and bypass voltage during bypass operation.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF254	CTRL.CIRCUIT ERR.	Inverter voltage is out of the specification level during transfer.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF256	O/P VOLTAGE ABNL.	Output voltage is out of the specified range.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF258	LOAD ABNORMAL	Load transfer due to overload for over 4 times within 5 minutes.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF301	CTRL.CIRCUIT ERR.	AD reference has an abnormal value.	CALL SERVICE ENGINEER	Continuous sound	Major
UF302	CTRL.CIRCUIT ERR.	Detection of an external interruption during the software execution.	CALL SERVICE ENGINEER	Continuous sound	Major
UF303	CTRL.CIRCUIT ERR.	Timer does not reset in the specified period (WDT settings)	CALL SERVICE ENGINEER	Continuous sound	Major
UF305	CTRL.CIRCUIT ERR.	Detection of an abnormal clock speed in the CPU or FPGA.	CALL SERVICE ENGINEER	Continuous sound	Major

Code indication (Note 2)	Status Message	Meaning	Guidance	Audible Alarm	External relay contact (Note 1)
UF306	CTRL.CIRCUIT ERR.	Control power supply voltage is below the specified level.	CALL SERVICE ENGINEER	Continuous sound	Major
UF320	CTRL.CIRCUIT ERR.	Cable disconnection in the parallel interface board during load supply (SMS).	CALL SERVICE ENGINEER	Continuous sound	Major
UF321	CTRL.CIRCUIT ERR.	Cable disconnection in the parallel interface board during load supply (Individual Bypass System).	CALL SERVICE ENGINEER	Continuous sound	Major
UF322	CTRL.CIRCUIT ERR.	Major communication error during parallel operation (ΔI).	CALL SERVICE ENGINEER	Continuous sound	Major
UF323	CTRL.CIRCUIT ERR.	Major communication error during parallel operation (CAN).	CALL SERVICE ENGINEER	Continuous sound	Major
UF324	CTRL.CIRCUIT ERR.	Major communication error in both of the CAN signals during certain period.	CALL SERVICE ENGINEER	Continuous sound	Major
UF325	CTRL.CIRCUIT ERR.	Major communication error by fall-out of both of dual connectors.	CALL SERVICE ENGINEER	Continuous sound	Major
UF326	CTRL.CIRCUIT ERR.	Communication integrity error or No communication (SMS).	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF327	CTRL.CIRCUIT ERR.	Communication integrity error or No communication (Individual Bypass).	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF340	MODULE MINOR FAULT	A power converter module has detected major fault condition.	CALL SERVICE ENGINEER	Continuous sound	Major
UF341	#1 MAJOR FAULT	Power converter module #1 has detected major fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF342	#2 MAJOR FAULT	Power converter module #2 has detected major fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF343	#3 MAJOR FAULT	Power converter module #3 has detected major fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF344	#4 MAJOR FAULT	Power converter module #4 has detected major fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF345	#5 MAJOR FAULT	Power converter module #5 has detected major fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF346	#6 MAJOR FAULT	Power converter module #6 has detected major fault condition.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF349	MODULE MAJOR FAULT	All Power converter modules have detected major fault condition.	CALL SERVICE ENGINEER	Continuous sound	Major
UF371	CTRL.CIRCUIT ERR.	Major communication error in either of the CAN signals during certain period.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF372	CTRL.CIRCUIT ERR.	Unable to synchronize the inverter output and the bypass voltage.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF374	CTRL.CIRCUIT ERR.	Cable disconnection in the parallel interface board.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF375	CTRL.CIRCUIT ERR.	Unable to achieve synchronization for parallel operation.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF376	CTRL.CIRCUIT ERR.	No control response from another UPS although its detection is possible.	CALL SERVICE ENGINEER	Intermittent sound	Minor

Code indication (Note 2)	Status Message	Meaning	Guidance	Audible Alarm	External relay contact (Note 1)
UF377	CTRL.CIRCUIT ERR.	Logic signal abnormal (Supply OFF).	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF378	CTRL.CIRCUIT ERR.	No answer for sending synchronizing signal.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF381	CTRL.CIRCUIT ERR.	No module supply answer during UPS operation.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF382	CTRL.CIRCUIT ERR.	Module supply answer during UPS halt.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF383	CTRL.CIRCUIT ERR.	Module overcurrent answer continued for 10 seconds or more.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF384	CTRL.CIRCUIT ERR.	Minor communication error by fall-out of only A-side of dual connector.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF385	CTRL.CIRCUIT ERR.	Minor communication error by fall-out of only B-side of dual connector.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF401	52S ABNORMAL	Error to close the contactor 52S.	CALL SERVICE ENGINEER	Continuous sound	Major
UF402	52S ABNORMAL	Error to open the contactor 52S.	CALL SERVICE ENGINEER	Continuous sound	Major
UF420	52L OPERATION ERR.	Load circuit breaker 52L opened during inverter operation.	CALL SERVICE ENGINEER	Continuous sound	Major
UF451	52S ABNORMAL	Contactor 52S failed during load transfer from inverter to bypass.	CALL SERVICE ENGINEER	Intermittent sound	Minor
UF452	CB3 ABNORMAL	Contactor CB3 is not working properly.	CALL SERVICE ENGINEER	Intermittent sound	Minor

8.2 Ups Module Fault Codes

Table 8–2 UPS Module Fault Code List

Code indication (Note 2)	Status message	Meaning	External relay contact (Note 1)
MA801	I/P VOLT.OUT RNG.	Input line voltage is out of the specific range.	Alarm AC input abnormal
MA802	I/P FREQ.OUT RNG.	Input line frequency is out of the specified range.	Alarm AC input abnormal
MA803	I/P PHASE ABNL.	Input line power conductors are not wired in a proper phase sequence.	Alarm AC input abnormal
MA806	INVERTER OVERLOAD	The inverter output current has exceeded 110% for 1 min. or 130% for 30sec. of the rated current.	Alarm Overload
MA807	INVERTER OVERLOAD	The inverter output current has exceeded 110% of the rated current.	Alarm Overload
MA810	INVERTER OVERLOAD	Short time over-current has exceeded 150% of the rated current	Alarm Overload
MA817	EMERG.STOP ACTIV.	The emergency stop was activated by the EPO switch or an external contact.	Alarm
MA824	CB2 OPEN	The battery disconnect contactor CB2 open.	Alarm
MA834	BATTERY DEPLETED	The battery voltage has reached the depleted level.	Major End-of-Discharge
MA836	INVERTER OVERLOAD	The output load active power has exceeded 110% of the rated current.	Alarm Overload
MA870	BALANCER OVERLOAD	The UPS detected a neutral point voltage unbalance.	Alarm Overload
MF001	I/P CIRCUIT ABL.	Detection of a large variation of the reference error signal.	Major
MF002	CONV OVERCURRENT	Detection of converter overcurrent.	Major
MF003	CONVERTER ABNL.	Pre-charging circuit is not working properly.	Major
MF102	DC OVERVOLTAGE	DC voltage surpasses the overvoltage level.	Major
MF103	DC UNDERVOLTAGE	DC voltage dropped below the undervoltage level.	Major
MF104	DISCHARGE FAULT	Capacitor voltage is higher than 100V at 5 minutes after module stop.	Minor
MF108	CHOP OVERCURRENT	Detection of DC overcurrent.	Major
MF109	DC UNBALANCED	Major unbalance of the neutral point voltage.	Major
MF110	ZERO PHASE OC.	Major unbalance of the neutral point voltage.	Major
MF111	CTRL.CIRCUIT ERR.	Battery current unbalance.	Major
MF112	DC CIRCUIT ABNL.	Sudden change of the DC voltage level.	Major
MF119	DC GROUND FAULT	Detection of DC ground fault.	Major
MF128	CTRL.PWR. ABNL.	Power supply voltage to IGBT driver PCB is below the specified level.	Major
MF154	CB2 ABNORMAL	During UVT, status signal from CB2 is ON.	Minor
MF159	DC GROUND FAULT	Detection of DC ground fault.	Minor
MF160	CTRL.CIRCUIT ERR.	Abnormal behavior of DC current sensor.	Minor

Code indication (Note 2)	Status message	Meaning	External relay contact (Note 1)
MF162	BATTERY ABNORMAL	Failure detection based on battery self-check.	Minor
MF163	BAT.VOLTAGE ABNL.	Battery voltage is abnormal.	Minor
MF179	DC GROUND FAULT	Detection of DC ground fault continued for 5 minutes.	Minor
MF201	INVERTER OV.	Detection of output overvoltage.	Major
MF202	INVERTER UV.	Output voltage dropped.	Major
MF203	INVERTER OC.	Detection of inverter overcurrent.	Major
MF204	O/P CIRCUIT ABNL.	Detection of a large variation of the reference error signal (current reference and actual current).	Major
MF207	ZERO PHASE OC.	Inverter zero-sequence overcurrent.	Major
MF208	CTRL.CIRCUIT ERR.	Cross current is abnormal.	Major
MF210	52C ABNORMAL	Error to open the contactor 52C.	Major
MF213	OVERTEMPERATURE	Heatsink temperature exceeds thermal settings.	Major
MF214	COOLING FAN ABNL.	Thermal relay activated protection.	Major
MF217	INVERTER OV.	Detection of inverter output phase overvoltage.	Major
MF230	ZERO PHASE OC.	Detection of zero-sequence overcurrent.	Major
MF253	CTRL.CIRCUIT ERR.	Discrepancy between output voltage and inverter voltage, or between output voltage and bypass voltage.	Minor
MF254	COOLING FAN ABNL.	Thermal relay of cooling fan worked.	Minor
MF256	O/P VOLTAGE ABNL.	Output voltage is out of the specified range.	Minor
MF301	CTRL.CIRCUIT ERR.	AD reference has an abnormal value.	Major
MF302	CTRL.CIRCUIT ERR.	Detection of an external interruption during the software execution.	Major
MF303	CTRL.CIRCUIT ERR.	Timer does not reset in the specified period (WDT settings)	Major
MF305	CTRL.CIRCUIT ERR.	Detection of an abnormal clock speed in the DSP or FPGA.	Major
MF306	CTRL.CIRCUIT ERR.	Control power supply voltage is below the specified level.	Major
MF309	INV.VOLTAGE ABNL.	Inverter voltage is out of the specified range.	Major
MF320	CTRL.CIRCUIT ERR.	Cable disconnection in the parallel interface board during load supply.	Major
MF331	CTRL.CIRCUIT ERR.	Cable disconnection in the main driver PCB (Phase A)	Major
MF332	CTRL.CIRCUIT ERR.	Cable disconnection in the main driver PCB (Phase B)	Major
MF333	CTRL.CIRCUIT ERR.	Cable disconnection in the main driver PCB (Phase C)	Major
MF334	CTRL.CIRCUIT ERR.	Cable disconnection in the main driver PCB (Chopper))	Major

Code indication (Note 2)	Status message	Meaning	External relay contact (Note 1)
MF376	CTRL.CIRCUIT ERR.	Logic signal abnormal (Supply ON)	Minor
MF552	DUMMY FAULT	Dummy fault for test	Major

(Note 1) 1) "Major" is defined as a major failure. Load transferred from the inverter circuit to the static bypass line;
2) "Minor" is defined as a minor failure. UPS continues to operate normally, but cause of alarm must be identified;

(Note 2) Code indication means:

#A+++ ---------- Alarm
#F+++ ---------- Failure
#%0++ ---------- Rectifier circuit failure
#%1++ ---------- DC circuit failure
#%2++ ---------- Inverter circuit failure
#%3++ ---------- Control circuit failure
#%4++ ---------- Bypass system failure
#%8++ ---------- Alarm

“#” Bypass Module “U”, UPS Module “M”
“+” denotes any numeral from 0 to 9
“%” denotes either “A” or “F”

9 Daily Inspection

Please perform the daily inspection while the UPS is running. The daily inspection items are shown in Table 9–1.

NOTE

The customers can only inspect exterior or environment of cabinet. When the customers want to perform the detailed inspection, contact Toshiba International Corporation at 1-877-867-8773.

Table 9–1 How to Perform Daily Inspection

No.	Subject	Procedure			Criteria and/or Action needed
		Term	Period	Method/Tool	
1.	Environmental/ Ambient	Dust or Gas	Daily	Visual/Odor check	Ventilate room atmosphere if dusty or smelling gas.
		Dewdrops Condensation	Daily	Visual check	Fix the dripping source Dehumidify upon necessity.
		Temperature Humidity	Daily	Thermometer hygrometer	Temperature: 32 – 104 °F Humidity: 30 – 90% No condensation. To be controlled at about 77 °F by A/C.
2.	Cabinet Construction	Vibration or Audible noise	Daily	Touch and hearing	Check if fans have irregular sound. Contact service representative in case of abnormalities.
		Overheating	When needed	Touching exterior	Contact service representative in case of abnormalities.
		Air filter clog	When needed	Visual check	Clean/wipe if clogged or dusty.
3.	Operation	LCD sharpness Brightness Left-bottom LED	Daily	Visual check	No characters faded, illegible, or any other abnormalities. Left-bottom LED should be green. Contact service representative when the LED shows red with the backlight lost.
		Indication terms: Output voltage Output current AC input voltage Output frequency Battery voltage Battery current DC voltage	Daily	Visual check	Check indication terms/values if within the adequate window. Also check indication meters on surface of optional cabinet, if installed.
4.	LEDs	4 status LEDs	Daily	Visual check	Check if LEDs turn on, off or flash according to the operation.
		2 fault LEDs	Daily	Visual check	If UPS fault LED turns on, scroll the screen to see fault codes and record the codes. Contact service representative to tell about fault codes and UPS symptom.

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Appendix A Installation Planning Guides (IPG) & Outline Drawings

Installation Planning Guide for 1050kVA UPS

Standard System: 480V Input, 480V Output

General Mechanical Information

Dimensions (W x D x H)	Weight	Floor Loading	Approximate Full-Load Heat Rejection	Mechanical Clearance (Inches) from UPS for Ventilation and Maintenance Access				
Inches	Lbs.	Lbs./ft. ^{2}	kBtu/Hr	Top	Front	Bottom	Sides**	Back
118.2" x 35.5" x 80.7"*	6613	227	112.8	24"	39"	0"	0"	0"

* Height includes removable fan housing – Frame height is 78.7."

** 0" clearance for peripheral equipment, 1" clearance for walls.

Primary AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand Normal Mode (Recharge Mode)			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1031 (1134)	> 0.99	1240 (1351)	1400 AT (1600AF)	8	7	7	6	6	5

Alternate (Bypass) AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps (Max.)	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1050	0.95	1263	1300 AT (1600AF)	7	6	6	6	5	5

Battery Input (480VDC Nominal)

Battery Capacity Required for Full Load Output	Maximum Discharge at Full Load Output	Suggested External Overcurrent Protection	External Feeder Wire Size Per String **(Min 2):**					
kWB	Amps DC	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
			250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1035 @ 1.0 PF	2583	1300AT (1600AF)	6	6	5	5	4	4
		1300AT (1600AF)	6	6	5	5	4	4

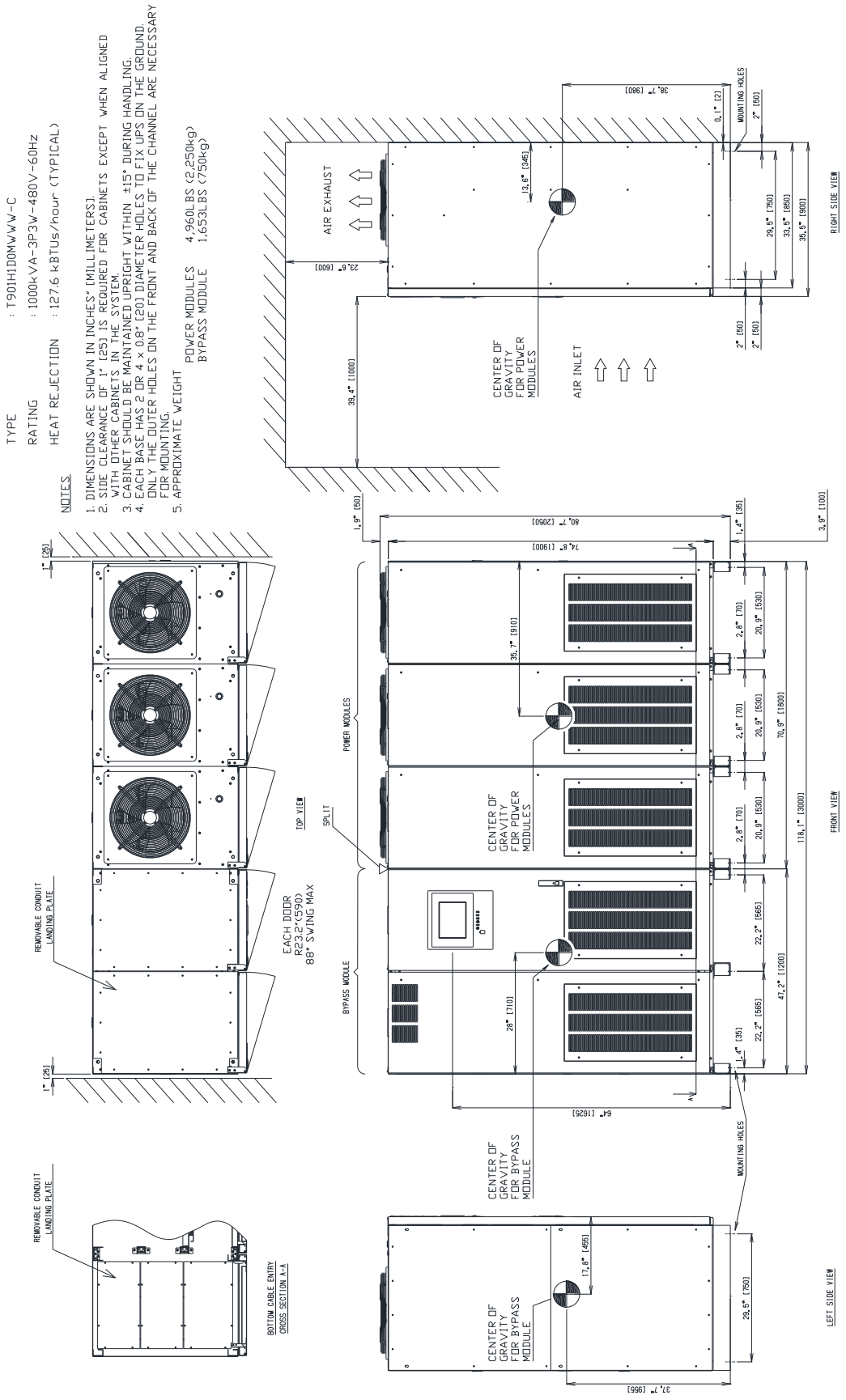
AC Output (480V 3-Phase / 3-Wire)

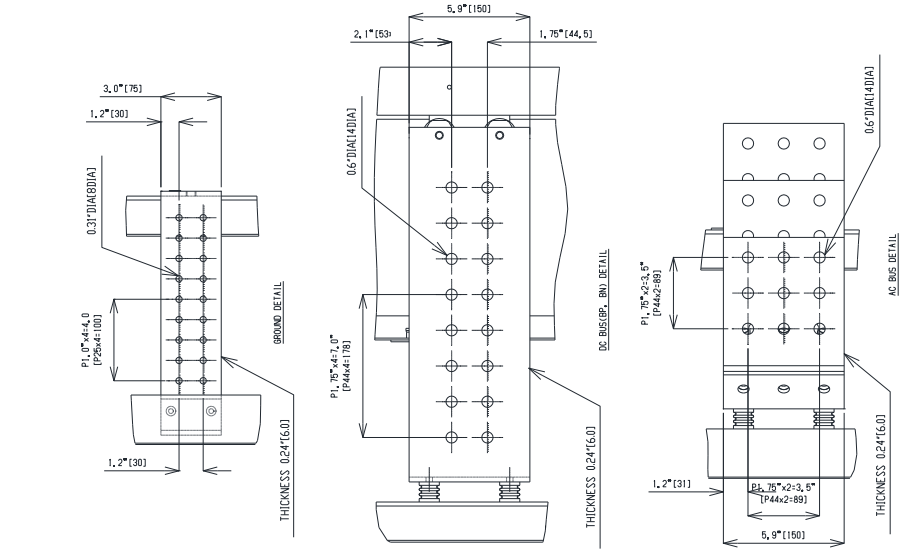
Rated Output Power			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1050	0.95	1263	1300 AT (1600AF)	7	6	6	6	5	5

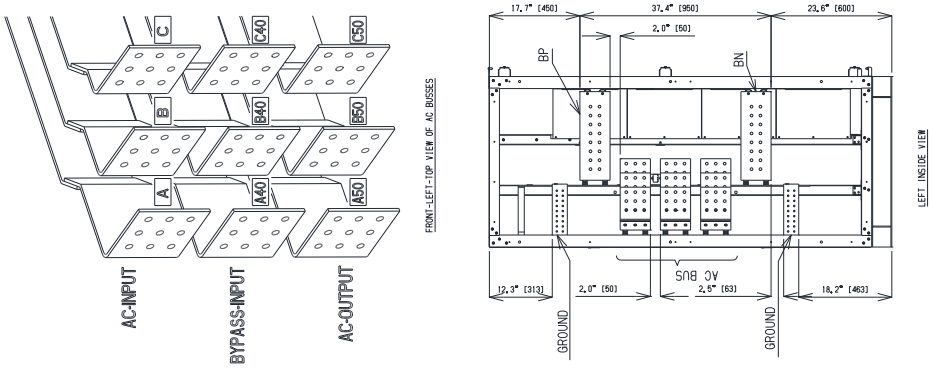
Important Notes:

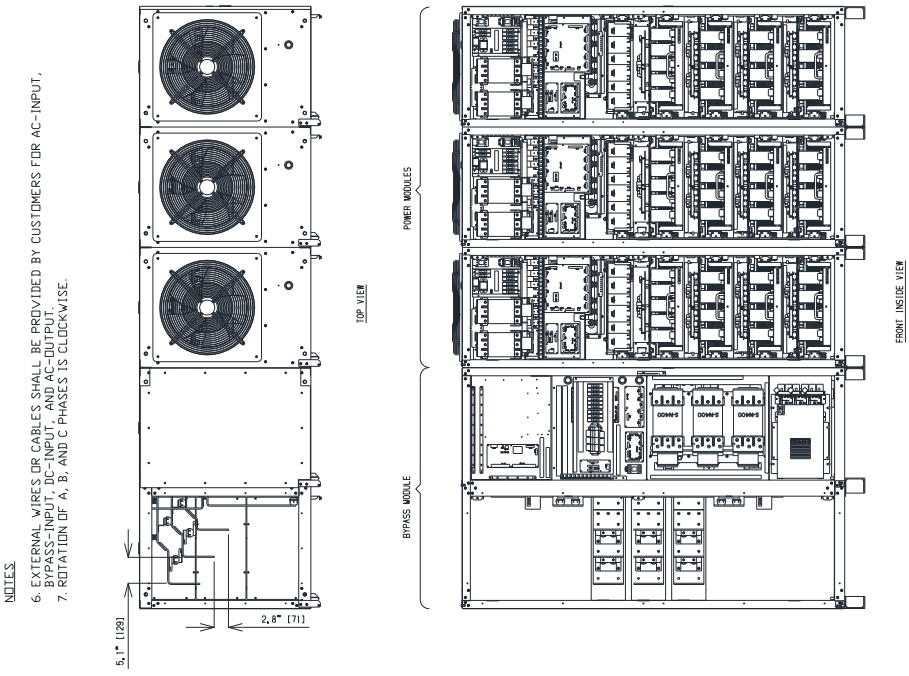
1. Maximum input current is limited to 108% of the full-load input current.
2. Output load conductors are to be installed in separate conduit from input conductors.
3. Control wires and power wires are to be installed in separate conduits.
4. Recommended AC input and output overcurrent protection based on continuous full load current per NEC 215.3.
5. Wiring shall comply with all applicable national and local electrical codes.
6. Grounding conductors to be sized per NEC Article 250-122. Neutral conductors to be sized per NEC Article 310.15.
   - Primary AC Input: 3ϕ, 3-wire + ground.
   - Alternate AC Input: 3ϕ, 3-wire + ground.
   - AC Output: 3ϕ, 3-wire + ground.
   - DC Input: 2-wire (Positive/Negative) + ground.
7. Nominal battery voltage based on the use of VRLA type batteries (2.0 volts/cell nominal).
8. Maximum battery discharge current based on lowest permissible discharge voltage for VRLA (1.67VPC).
9. DC wires should be sized to allow not more than a 2-volt drop at maximum discharge current.
10. Weights do not include batteries or other auxiliary equipment external to the UPS.
11. Cable sizing calculations based on the following method:
    - Base cable ampacity is determined by 75ºC rated copper conductor values in NEC Table 310.16.
    - Cable ampacity is derated using adjustment factor for 36-40ºC Ambient Operating Temperature per NEC Table 310.15(B)(1).
    - 3-Phase Cable ampacity is derated using correction factor for quantity 4-6 conductors in conduit per NEC Table 310.15(C)(1).
    - Cable meets bend radius limitations at the UPS terminals.

    NOTE: Consult latest edition of applicable national and local codes for possible variations.
12. Ratings/Quantities of wires and overcurrent protection devices are suggested minimums. Consult with a registered Professional Engineer within your local area for proper size selections.
13. All Overcurrent Protection Devices at or above 1200AT are assumed to be rated for 100% continuous load operation.

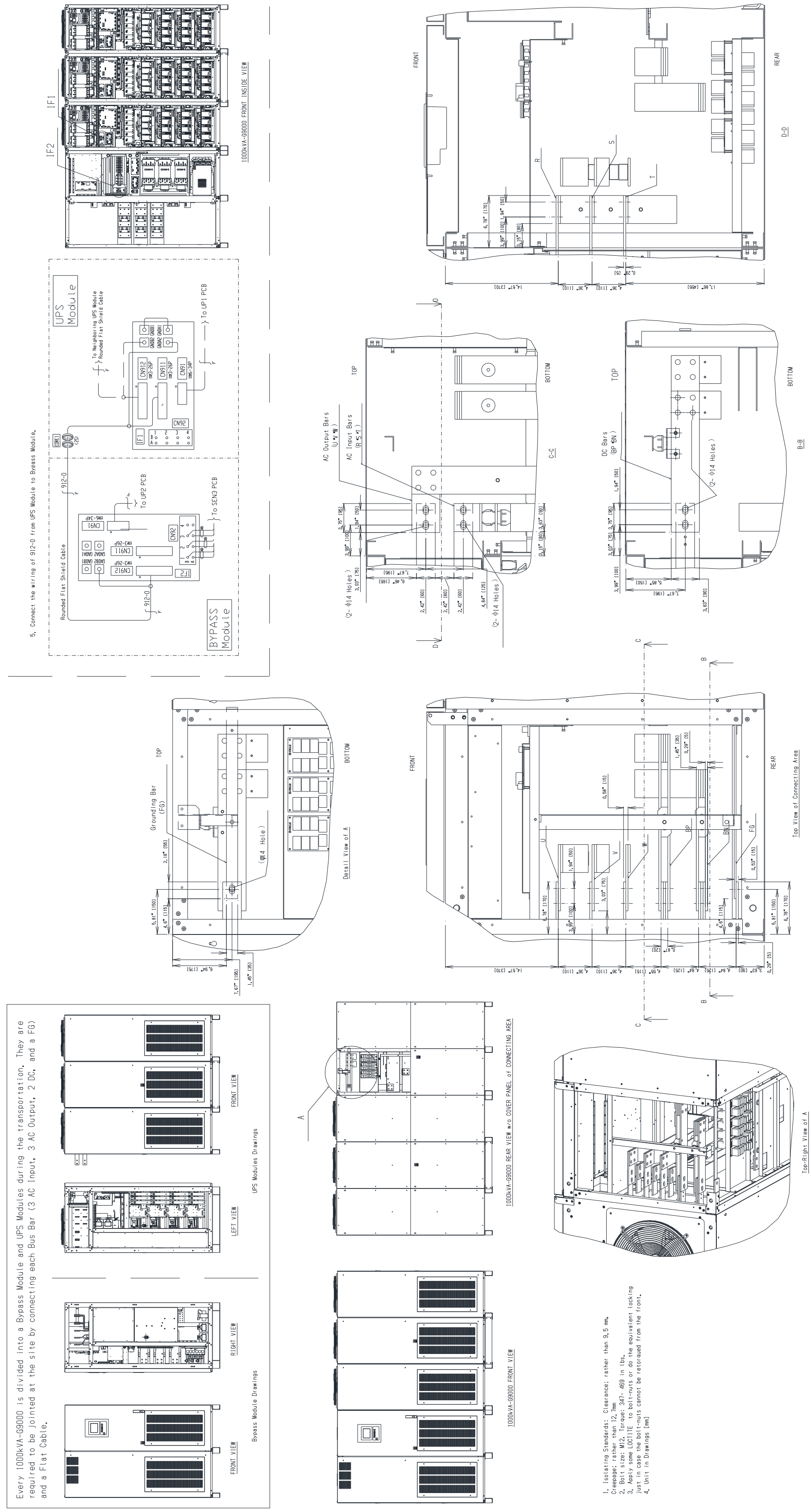

TYPE : T90IHIDOMWVW-C
RATING : 1000kVA-3P3W-480V-60Hz
HEAT REJECTION : 127.6 kBTUs/hour (TYPICAL)
NOTES
1. DIMENSIONS ARE SHOWN IN INCHES" [MILLIMETERS].
2. SIDE CLEARANCE OF 1" [25] IS REQUIRED FOR CABINETS EXCEPT WHEN ALIGNED WITH OTHER CABINETS IN THE SYSTEM.
3. CABINET SHOULD BE MAINTAINED UPRIGHT WITHIN ±15° DURING HANDLING.
4. EACH BASE HAS 2 OR 4 × 0.8" [20] DIAMETER HOLES TO FIX UPS ON THE GROUND. ONLY THE OUTER HOLES ON THE FRONT AND BACK OF THE CHANNEL ARE NECESSARY FOR MOUNTING.
5. APPROXIMATE WEIGHT POWER MODULES 4,960LBS (2,250kg) BYPASS MODULE 1,653LBS (750kg)
AIR EXHAUST
AIR INLET
CENTER OF GRAVITY FOR POWER MODULES
CENTER OF GRAVITY FOR BYPASS MODULE
RIGHT SIDE VIEW
LEFT SIDE VIEW
FRONT VIEW
TOP VIEW
POWER MODULES
BYPASS MODULE
SPLIT
MOUNTING HOLES
REMOVABLE CONDUIT LANDING PLATE
BOTTOM CABLE ENTRY
CROSS SECTION A-A
EACH DOOR R23.2"(590) 88° SWING MAX







NOTES.
6. EXTERNAL WIRES OR CABLES SHALL BE PROVIDED BY CUSTOMERS FOR AC-INPUT, BYPASS-INPUT, DC-INPUT, AND AC-OUTPUT.
7. ROTATION OF A, B, AND C PHASES IS CLOCKWISE.


Every 1000kVA-G9000 is divided into a Bypass Module and UPS Modules during the transportation. They are required to be jointed at the site by connecting each Bus Bar (3 AC Input, 3 AC Output, 2 DC, and a FG) and a Flat Cable.
FRONT VIEW
RIGHT VIEW
Bypass Module Drawings
LEFT VIEW
FRONT VIEW
UPS Modules Drawings
1000kVA-G9000 FRONT VIEW
1000kVA-G9000 REAR VIEW w/o COVER PANEL of CONNECTING AREA
1. Isolating Standards: Clearance; rather than 9.5 mm, Creepage; rather than 12.7mm
2. Bolt size: M12, Torque: 347- 469 in lbs.
3. Apply some LOCTITE to bolt-nuts or do the equivalent locking just in case the bolt-nuts cannot be retorqued from the front.
4. Unit in Drawings [mm]
Top-Right View of A
Grounding Bar (FG)
Detail View of A
Top View of Connecting Area
5. Connect the wiring of 912-0 from UPS Module to Bypass Module.
Rounded Flat Shield Cable
To UP2 PCB
To SEN3 PCB
To UP1 PCB
To Neighboring UPS Module Rounded Flat Shield Cable
BYPASS Module
UPS Module
1000kVA-G9000 FRONT INSIDE VIEW
AC Output Bars
AC Input Bars
DC Bars
C-C
B-B
D-D
FRONT
REAR
TOP
BOTTOM

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Installation Planning Guide for 1330kVA UPS

Standard System: 480V Input, 480V Output

General Mechanical Information

Dimensions (W x D x H)	Weight	Floor Loading	Approximate Full-Load Heat Rejection	Mechanical Clearance (Inches) from UPS for Ventilation and Maintenance Access				
Inches	Lbs.	Lbs./ft. ^{2}	kBtu/Hr	Top	Front	Bottom	Sides**	Back
167.3" x 35.5" x 80.7"*	9590	233	158.8	24"	40"	0"	0"	0"

* Height includes removable an housing – Frame height is 78.7."

** 0" clearance for peripheral equipment, 1" clearance for walls.

Primary AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand Normal Mode (Recharge Mode)			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1371 (1506)	> 0.98	1649 (1792)	1800AT (2000AF)	10	9	9	8	7	7

Alternate (Bypass) AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps (Max.)	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1330	1.0	1600	1600AT	9	8	8	7	6	6

Battery Input (480VDC Nominal)

Battery Capacity Required for Full Load Output	Maximum Discharge at Full Load Output	Suggested External Overcurrent Protection	External Feeder Wire Size Per String (**Min 2**):					
kWB	Amps DC	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
			250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1382@ 1.0 PF	3455	1800AT (2000AF)	8	7	7	6	6	5
		1800AT (2000AF)	8	7	7	6	6	5

AC Output (480V 3-Phase / 3-Wire)

Rated Output Power			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1330	1.0	1600	1600AT	9	8	8	7	6	6

Important Notes:

1. Maximum input current is limited to 108% of the full-load input current.
2. Output load conductors are to be installed in separate conduit from input conductors.
3. Control wires and power wires are to be installed in separate conduits.
4. Recommended AC input and output overcurrent protection based on continuous full load current per NEC 215.3.
5. Wiring shall comply with all applicable national and local electrical codes.
6. Grounding conductors to be sized per NEC Article 250-122. Neutral conductors to be sized per NEC Article 310.15.
   - Primary AC Input: 3ϕ, 3-wire + ground.
   - Alternate AC Input: 3ϕ, 3-wire + ground.
   - AC Output: 3ϕ, 3-wire + ground.
   - DC Input: 2-wire (Positive/Negative) + ground.
7. Nominal battery voltage based on the use of VRLA type batteries (2.0 volts/cell nominal).
8. Maximum battery discharge current based on lowest permissible discharge voltage for VRLA (1.67VPC).
9. DC wires should be sized to allow not more than a 2-volt drop at maximum discharge current.
10. Weights do not include batteries or other auxiliary equipment external to the UPS.
11. Cable sizing calculations based on the following method:
    - Base cable ampacity is determined by 75ºC rated copper conductor values in NEC Table 310.16.
    - Cable ampacity is derated using adjustment factor for 36-40ºC Ambient Operating Temperature per NEC Table 310.15(B)(1).
    - 3-Phase Cable ampacity is derated using correction factor for quantity 4-6 conductors in conduit per NEC Table 310.15(C)(1).
    - Cable meets bend radius limitations at the UPS terminals.

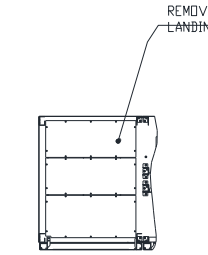
    NOTE: Consult latest edition of applicable national and local codes for possible variations.
12. Ratings/Quantities of wires and overcurrent protection devices are suggested minimums. Consult with a registered Professional Engineer within your local area for proper size selections.
13. All Overcurrent Protection Devices at or above 1200AT are assumed to be rated for 100% continuous load operation.

TYPE : T90IH1D3MWWW-C
RATING : 1330kVA-3P3W-480V-60Hz
HEAT REJECTION : 159.7kBTUs/hour (TYPICAL)

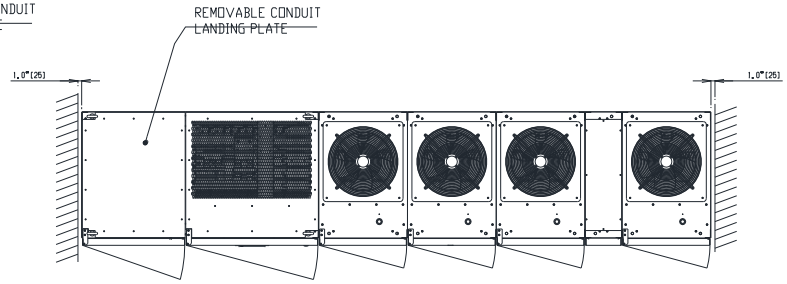
NOTES

1. DIMENSIONS ARE SHOWN IN INCHES"[MILLIMETERS]
2. SIDE SPACE '1"[25]' IS REQUIRED FOR CABINETS EXCEPT WHEN ALIGNED WITH OTHER CABINET IN THE SYSTEM.
3. CABINET SHOULD BE MAINTAINED UPRIGHT WITHIN ±15° DURING HANDLING.
4. EACH BASE HAS 2 OR 4 x 0.8"[20] DIAMETER HOLES TO FIX UPS ON THE GROUND. ONLY THE OUTER HOLES ON THE FRONT AND BACK OF THE CHANNEL ARE NECESSARY FOR MOUNTING.
5. UNIT WEIGHT

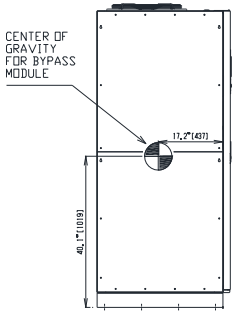
POWER MODULES (LEFT)	5,291LBS (2,400kg)
POWER MODULES (RIGHT)	1,874LBS (850kg)
BYPASS MODULE	2,425LBS (1,100kg)



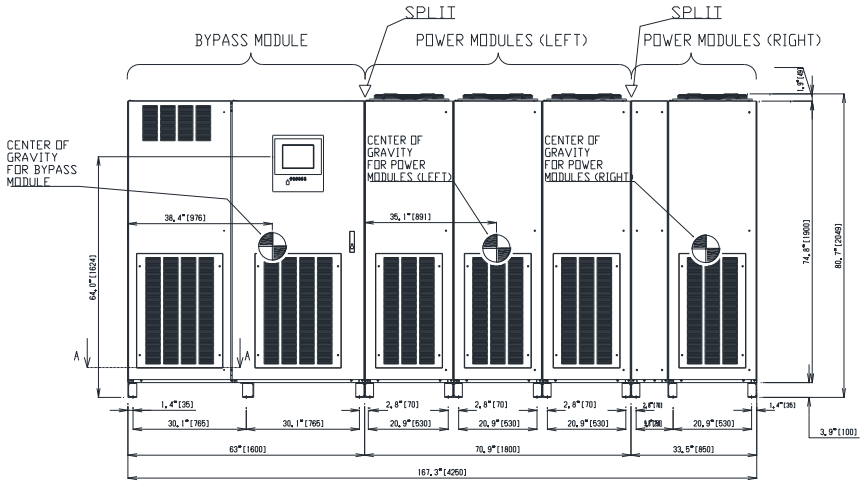
BOTTOM CABLE ENTRY
CROSS SECTION A-A



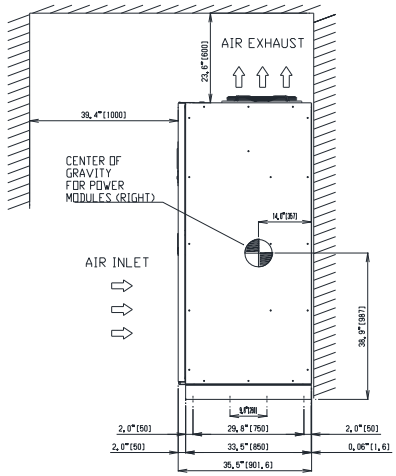
TOP VIEW



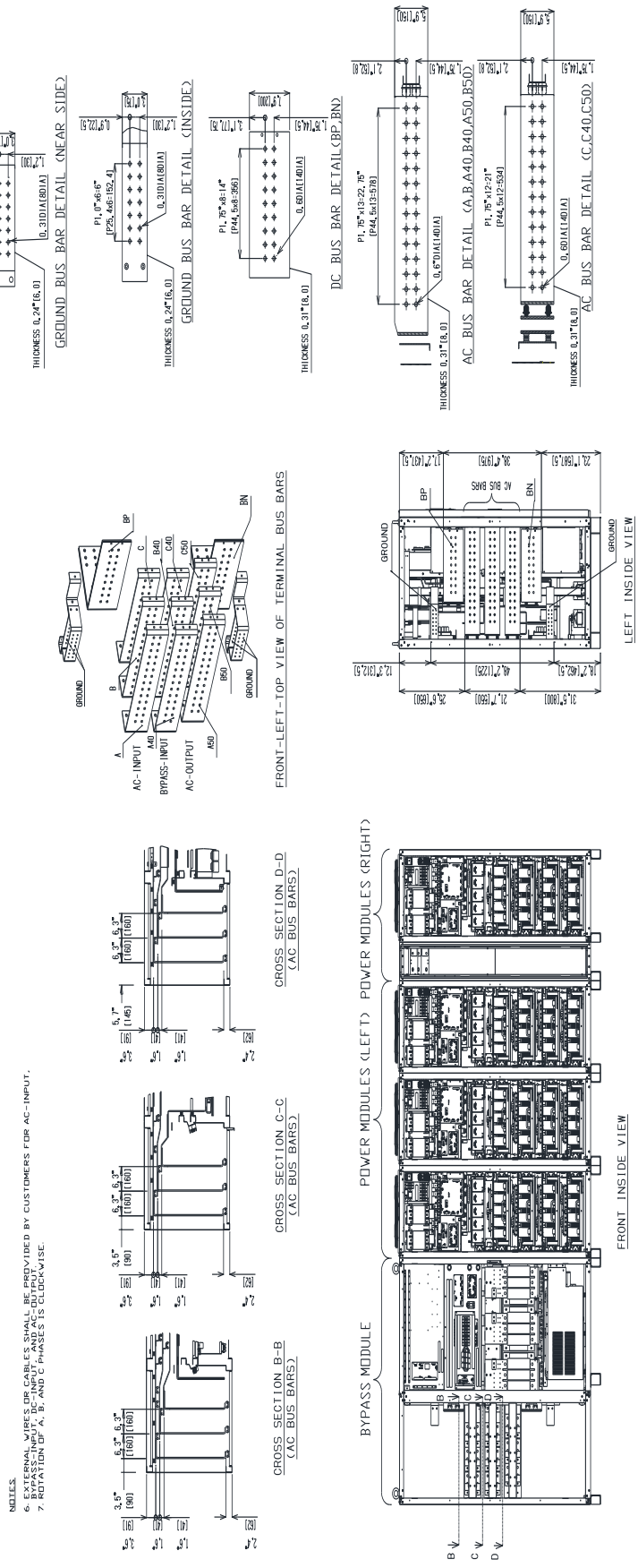
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW


GROUND BUS BAR DETAIL (NEAR SIDE)
GROUND BUS BAR DETAIL (INSIDE)
DC BUS BAR DETAIL (BP,BN)
AC BUS BAR DETAIL (A,B,A40,B40,A50,B50)
AC BUS BAR DETAIL (C,C40,C50)
FRONT-LEFT-TOP VIEW OF TERMINAL BUS BARS
LEFT INSIDE VIEW
CROSS SECTION D-D (AC BUS BARS)
CROSS SECTION C-C (AC BUS BARS)
CROSS SECTION B-B (AC BUS BARS)
BYPASS MODULE
POWER MODULES (LEFT)
POWER MODULES (RIGHT)
FRONT INSIDE VIEW
NOTES.
6. EXTERNAL WIRES (P CABLES) SHALL BE PROVIDED BY CUSTOMERS FOR AC-INPUT, BYPASS-INPUT, DC-INPUT AND AC-OUTPUT.
7. ROTATION OF A, B, AND C PHASES IS CLOCKWISE.

Installation Planning Guide for 1500kVA UPS

Standard System: 480V Input, 480V Output

General Mechanical Information

Dimensions (W x D x H)	Weight	Floor Loading	Approximate Full-Load Heat Rejection	Mechanical Clearance (Inches) from UPS for Ventilation and Maintenance Access				
Inches	Lbs.	Lbs./ft. ^{2}	kBtu/Hr	Top	Front	Bottom	Sides**	Back
190.9" x 35.5" x 80.7"*	11354	242	179.1	24"	40"	0"	0"	0"

* Height includes removable an housing – Frame height is 78.7."
** 0" clearance for peripheral equipment, 1" clearance for walls.

Primary AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand Normal Mode (Recharge Mode)			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1546 (1698)	> 0.98	1860 (2021)	2100AT (2400AF)	12	11	10	9	8	7

Alternate (Bypass) AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps (Max.)	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1500	1.0	1804	1900AT (2000AF)	11	9	9	8	7	7

Battery Input (480VDC Nominal)

Battery Capacity Required for Full Load Output	Maximum Discharge at Full Load Output	Suggested External Overcurrent Protection	External Feeder Wire Size Per String (**Min 2**):					
kWB	Amps DC	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
			250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1558@ 1.0 PF	3887	2000AT	9	8	8	7	6	6
		2000AT	9	8	8	7	6	6

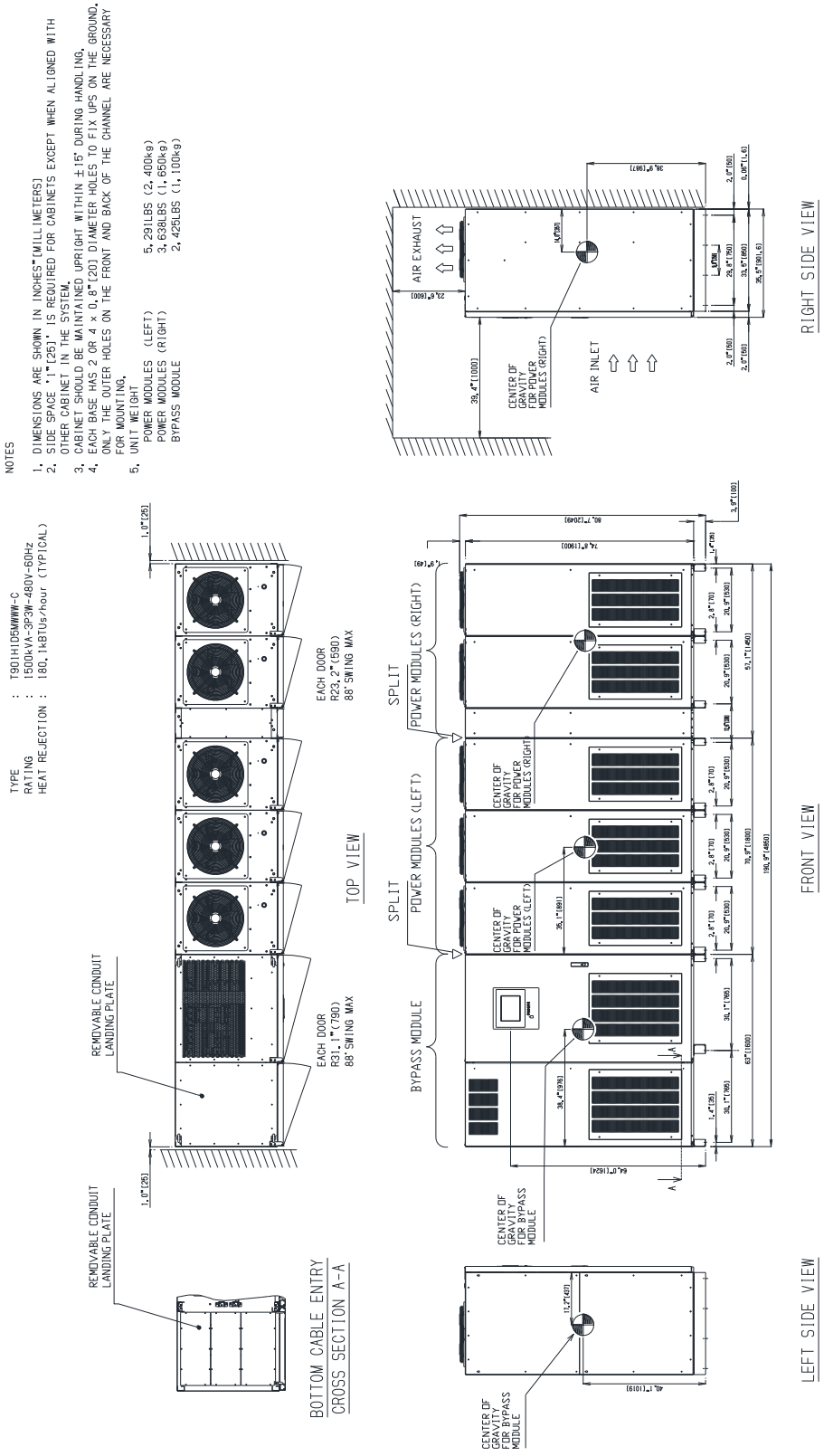
AC Output (480V 3-Phase / 3-Wire)

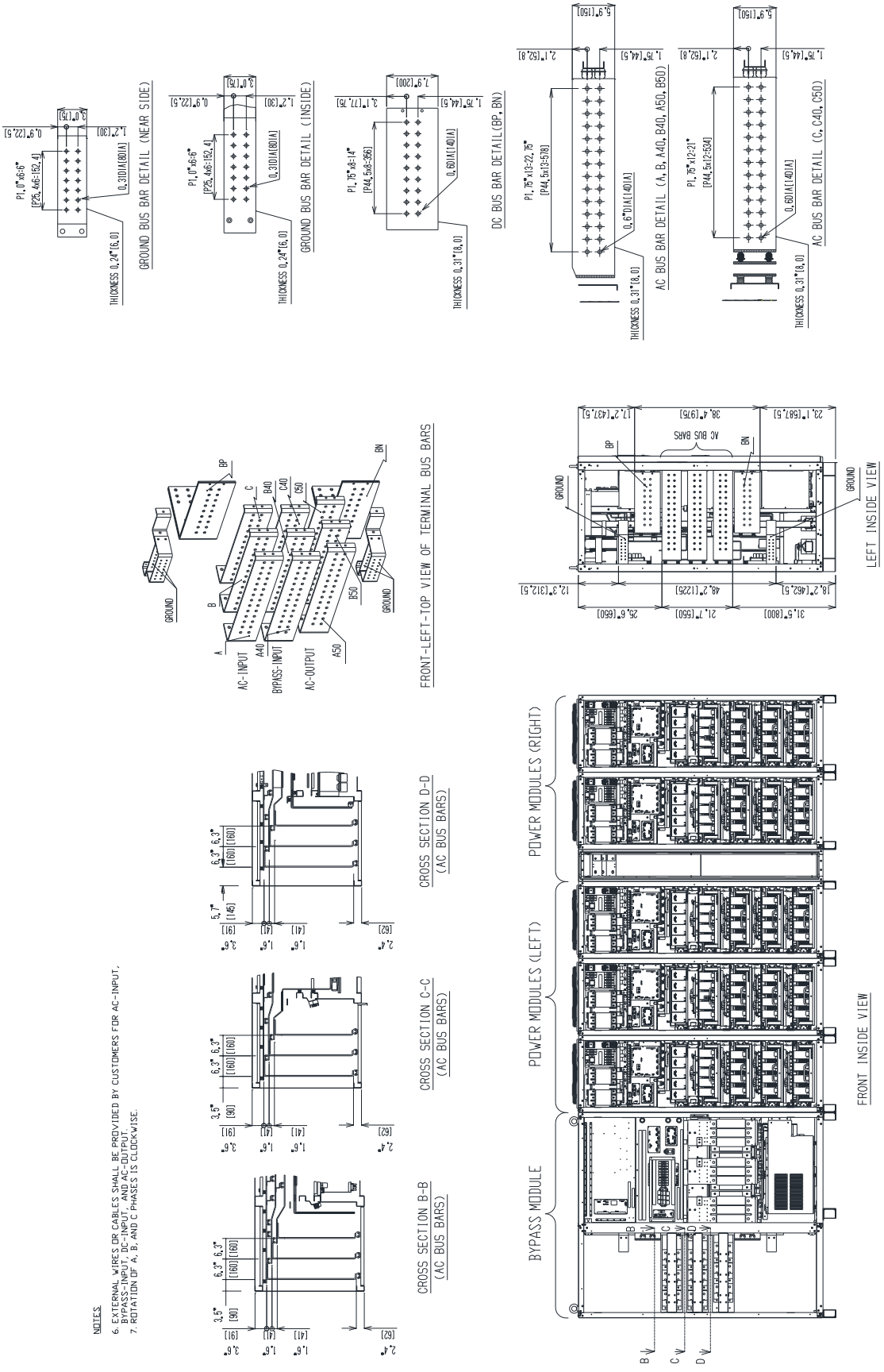
Rated Output Power			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
kVA	PF	Amps	Amps	Cable Quantity of Below kcmil at 75º C Temp. Rating					
				250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1500	1.0	1804	1900AT (2000AF)	11	9	9	8	7	7

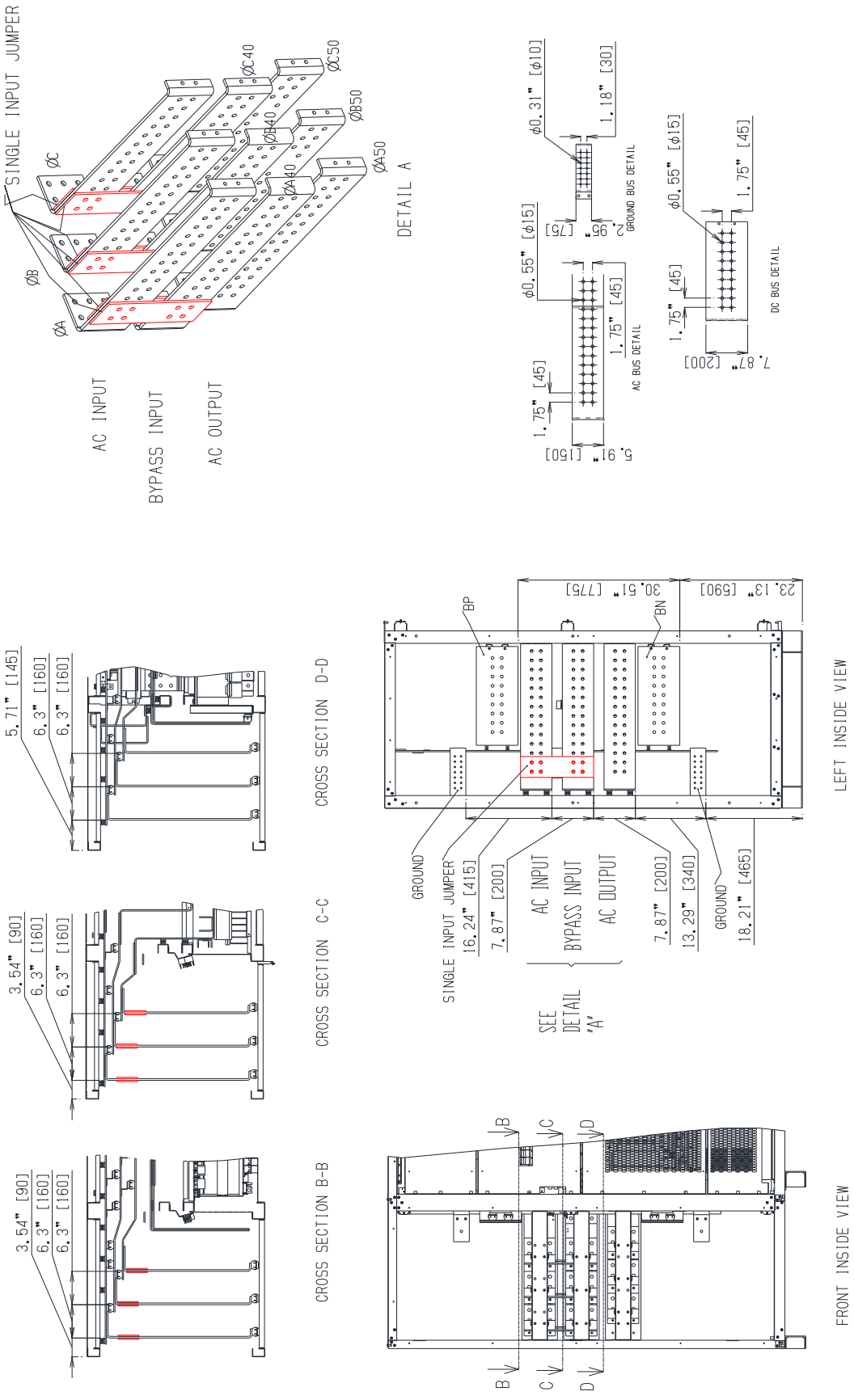
Important Notes:

1. Maximum input current is limited to 108% of the full-load input current.
2. Output load conductors are to be installed in separate conduit from input conductors.
3. Control wires and power wires are to be installed in separate conduits.
4. Recommended AC input and output overcurrent protection based on continuous full load current per NEC 215.3.
5. Wiring shall comply with all applicable national and local electrical codes.
6. Grounding conductors to be sized per NEC Article 250-122. Neutral conductors to be sized per NEC Article 310.15.
   - Primary AC Input: 3ϕ, 3-wire + ground.
   - Alternate AC Input: 3ϕ, 3-wire + ground.
   - AC Output: 3ϕ, 3-wire + ground.
   - DC Input: 2-wire (Positive/Negative) + ground.
7. Nominal battery voltage based on the use of VRLA type batteries (2.0 volts/cell nominal).
8. Maximum battery discharge current based on lowest permissible discharge voltage for VRLA (1.67VPC).
9. DC wires should be sized to allow not more than a 2-volt drop at maximum discharge current.
10. Weights do not include batteries or other auxiliary equipment external to the UPS.
11. Cable sizing calculations based on the following method:
    - Base cable ampacity is determined by 75ºC rated copper conductor values in NEC Table 310.16.
    - Cable ampacity is derated using adjustment factor for 36-40ºC Ambient Operating Temperature per NEC Table 310.15(B)(1).
    - 3-Phase Cable ampacity is derated using correction factor for quantity 4-6 conductors in conduit per NEC Table 310.15(C)(1).
    - Cable meets bend radius limitations at the UPS terminals.

    NOTE: Consult latest edition of applicable national and local codes for possible variations.
12. Ratings/Quantities of wires and overcurrent protection devices are suggested minimums. Consult with a registered Professional Engineer within your local area for proper size selections.
13. All Overcurrent Protection Devices at or above 1200AT are assumed to be rated for 100% continuous load operation.


NOTES
1. DIMENSIONS ARE SHOWN IN INCHES"[MILLIMETERS]
2. SIDE SPACE 1"[25]" IS REQUIRED FOR CABINETS EXCEPT WHEN ALIGNED WITH OTHER CABINET IN THE SYSTEM.
3. CABINET SHOULD BE MAINTAINED UPRIGHT WITHIN ±15° DURING HANDLING.
4. EACH BASE HAS 2 OR 4 x 0.8"[20] DIAMETER HOLES TO FIX UPS ON THE GROUND. ONLY THE OUTER HOLES ON THE FRONT AND BACK OF THE CHANNEL ARE NECESSARY FOR MOUNTING.
5. UNIT WEIGHT
POWER MODULES (LEFT) 5,291LBS (2,400kg)
POWER MODULES (RIGHT) 3,638LBS (1,650kg)
BYPASS MODULE 2,426LBS (1,100kg)
TYPE : T901H1D6WWWW-C
RATING : 1500kVA-3P3W-480V-60Hz
HEAT REJECTION : 180,1kBTUs/hour (TYPICAL)
TOP VIEW
EACH DOOR R23.2"(590) 88° SWING MAX
EACH DOOR R31.1"(790) 88° SWING MAX
REMOVABLE CONDUIT LANDING PLATE
BOTTOM CABLE ENTRY
CROSS SECTION A-A
FRONT VIEW
SPLIT
POWER MODULES (LEFT)
POWER MODULES (RIGHT)
BYPASS MODULE
CENTER OF GRAVITY FOR POWER MODULES (LEFT)
CENTER OF GRAVITY FOR POWER MODULES (RIGHT)
CENTER OF GRAVITY FOR BYPASS MODULE
RIGHT SIDE VIEW
AIR EXHAUST
AIR INLET
LEFT SIDE VIEW


GROUND BUS BAR DETAIL (NEAR SIDE)
GROUND BUS BAR DETAIL (INSIDE)
DC BUS BAR DETAIL(BP, BN)
AC BUS BAR DETAIL (A, B, A40, B40, A50, B50)
AC BUS BAR DETAIL (C, C40, C50)
THICKNESS 0.24"[6.0]
THICKNESS 0.31"[8.0]
FRONT-LEFT-TOP VIEW OF TERMINAL BUS BARS
AC-INPUT
BYPASS-INPUT
AC-OUTPUT
GROUND
AC BUS BARS
LEFT INSIDE VIEW
CROSS SECTION B-B (AC BUS BARS)
CROSS SECTION C-C (AC BUS BARS)
CROSS SECTION D-D (AC BUS BARS)
BYPASS MODULE
POWER MODULES (LEFT)
POWER MODULES (RIGHT)
FRONT INSIDE VIEW
NOTES
6. EXTERNAL WIRES OR CABLES SHALL BE PROVIDED BY CUSTOMERS FOR AC-INPUT, BYPASS-INPUT, DC-INPUT AND AC-OUTPUT.
7. ROTATION OF A, B, AND C PHASES IS CLOCKWISE.


SINGLE INPUT JUMPER
ØC
ØB
ØA
ØC40
ØC50
ØB40
ØB50
ØA40
ØA50
AC INPUT
BYPASS INPUT
AC OUTPUT
DETAIL A
ϕ0.31" [ϕ10]
1.18" [30]
GROUND BUS DETAIL
2.95" [75]
ϕ0.55" [ϕ15]
1.75" [45]
5.91" [150]
AC BUS DETAIL
ϕ0.55" [ϕ15]
1.75" [45]
1.75" [45]
7.87" [200]
DC BUS DETAIL
5.71" [145]
6.3" [160]
6.3" [160]
CROSS SECTION D-D
3.54" [90]
6.3" [160]
6.3" [160]
CROSS SECTION C-C
3.54" [90]
6.3" [160]
6.3" [160]
CROSS SECTION B-B
BP
BN
30.51" [775]
23.13" [590]
GROUND
SINGLE INPUT JUMPER
16.24" [415]
7.87" [200]
AC INPUT
BYPASS INPUT
AC OUTPUT
7.87" [200]
13.29" [340]
GROUND
18.21" [465]
SEE DETAIL "A"
LEFT INSIDE VIEW
B
C
D
B
C
D
FRONT INSIDE VIEW

Installation Planning Guide for 1660kVA UPS

Standard System: 480V Input, 480V Output

General Mechanical Information

Dimensions (W x D x H)	Weight	Floor Loading	Approximate Full-Load Heat Rejection	Mechanical Clearance (Inches) from UPS for Ventilation and Maintenance Access				
Inches	Lbs.	Lbs./ft. ^{2}	kBtu/Hr	Top	Front	Bottom	Sides**	Back
198.8" x 35.5" x 80.7"*	11795	241	198.2	24"	40"	0"	0"	0"

* Height includes removable an housing – Frame height is 78.7."
** 0" clearance for peripheral equipment, 1" clearance for walls.

Primary AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand Normal Mode (Recharge Mode)			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
				Cable Quantity of Below kcmil at 75º C Temp. Rating					
kVA	PF	Amps	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1711 (1879)	> 0.98	2058 (2236)	2300AT (2500AF)	13	12	11	10	9	8

Alternate (Bypass) AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
				Cable Quantity of Below kcmil at 75º C Temp. Rating					
kVA	PF	Amps (Max.)	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1660	1.0	1997	2000AT	12	10	10	9	8	7

Battery Input (480VDC Nominal)

Battery Capacity Required for Full Load Output	Maximum Discharge at Full Load Output	Suggested External Overcurrent Protection	External Feeder Wire Size Per String (**Min 2**):					
			Cable Quantity of Below kcmil at 75º C Temp. Rating					
kWB	Amps DC	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1724@ 1.0 PF	4301	2500AT	10	9	8	8	7	6
		2500AT	10	9	8	8	7	6

AC Output (480V 3-Phase / 3-Wire)

Rated Output Power			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
				Cable Quantity of Below kcmil at 75º C Temp. Rating					
kVA	PF	Amps	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
1660	1.0	1997	2000AT	12	10	10	9	8	7

Important Notes:

1. Maximum input current is limited to 108% of the full-load input current.
2. Output load conductors are to be installed in separate conduit from input conductors.
3. Control wires and power wires are to be installed in separate conduits.
4. Recommended AC input and output overcurrent protection based on continuous full load current per NEC 215.3.
5. Wiring shall comply with all applicable national and local electrical codes.
6. Grounding conductors to be sized per NEC Article 250-122. Neutral conductors to be sized per NEC Article 310.15.
   - Primary AC Input: 3ϕ, 3-wire + ground.
   - Alternate AC Input: 3ϕ, 3-wire + ground.
   - AC Output: 3ϕ, 3-wire + ground.
   - DC Input: 2-wire (Positive/Negative) + ground.
7. Nominal battery voltage based on the use of VRLA type batteries (2.0 volts/cell nominal).
8. Maximum battery discharge current based on lowest permissible discharge voltage for VRLA (1.67VPC).
9. DC wires should be sized to allow not more than a 2-volt drop at maximum discharge current.
10. Weights do not include batteries or other auxiliary equipment external to the UPS.
11. Cable sizing calculations based on the following method:
    - Base cable ampacity is determined by 75ºC rated copper conductor values in NEC Table 310.16.
    - Cable ampacity is derated using adjustment factor for 36-40ºC Ambient Operating Temperature per NEC Table 310.15(B)(1).
    - 3-Phase Cable ampacity is derated using correction factor for quantity 4-6 conductors in conduit per NEC Table 310.15(C)(1).
    - Cable meets bend radius limitations at the UPS terminals.

    NOTE: Consult latest edition of applicable national and local codes for possible variations.
12. Ratings/Quantities of wires and overcurrent protection devices are suggested minimums. Consult with a registered Professional Engineer within your local area for proper size selections.
13. All Overcurrent Protection Devices at or above 1200AT are assumed to be rated for 100% continuous load operation.

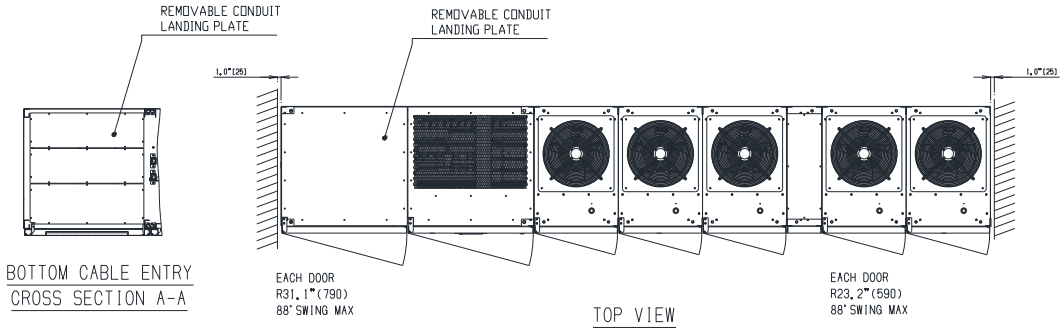
TOSHIBA

TYPE : T901H1D6MWWW-C
RATING : 1660kVA-3P3W-480V-60Hz
HEAT REJECTION : 199.4kBTUs/hour (TYPICAL)

NOTES

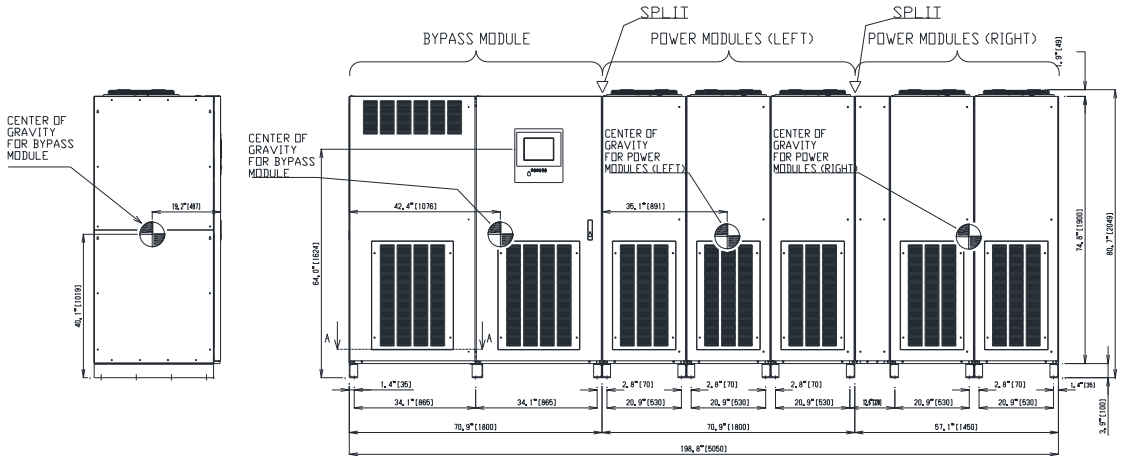
1. DIMENSIONS ARE SHOWN IN INCHES"[MILLIMETERS]
2. SIDE SPACE "1"[25]" IS REQUIRED FOR CABINETS EXCEPT WHEN ALIGNED WITH OTHER CABINET IN THE SYSTEM.
3. CABINET SHOULD BE MAINTAINED UPRIGHT WITHIN ±15° DURING HANDLING.
4. EACH BASE HAS 2 OR 4 x 0.8"[20] DIAMETER HOLES TO FIX UPS ON THE GROUND. ONLY THE OUTER HOLES ON THE FRONT AND BACK OF THE CHANNEL ARE NECESSARY FOR MOUNTING.
5. UNIT WEIGHT

POWER MODULES (LEFT)	5,291LBS (2,400kg)
POWER MODULES (RIGHT)	3,638LBS (1,650kg)
BYPASS MODULE	2,866LBS (1,300kg)



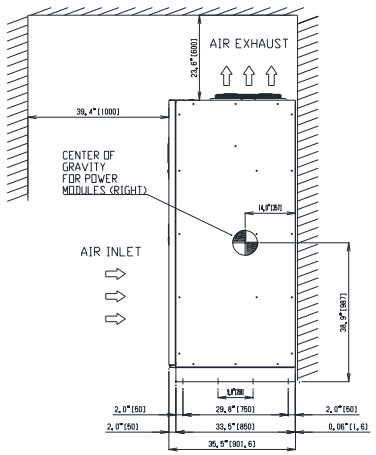
BOTTOM CABLE ENTRY
CROSS SECTION A-A

TOP VIEW

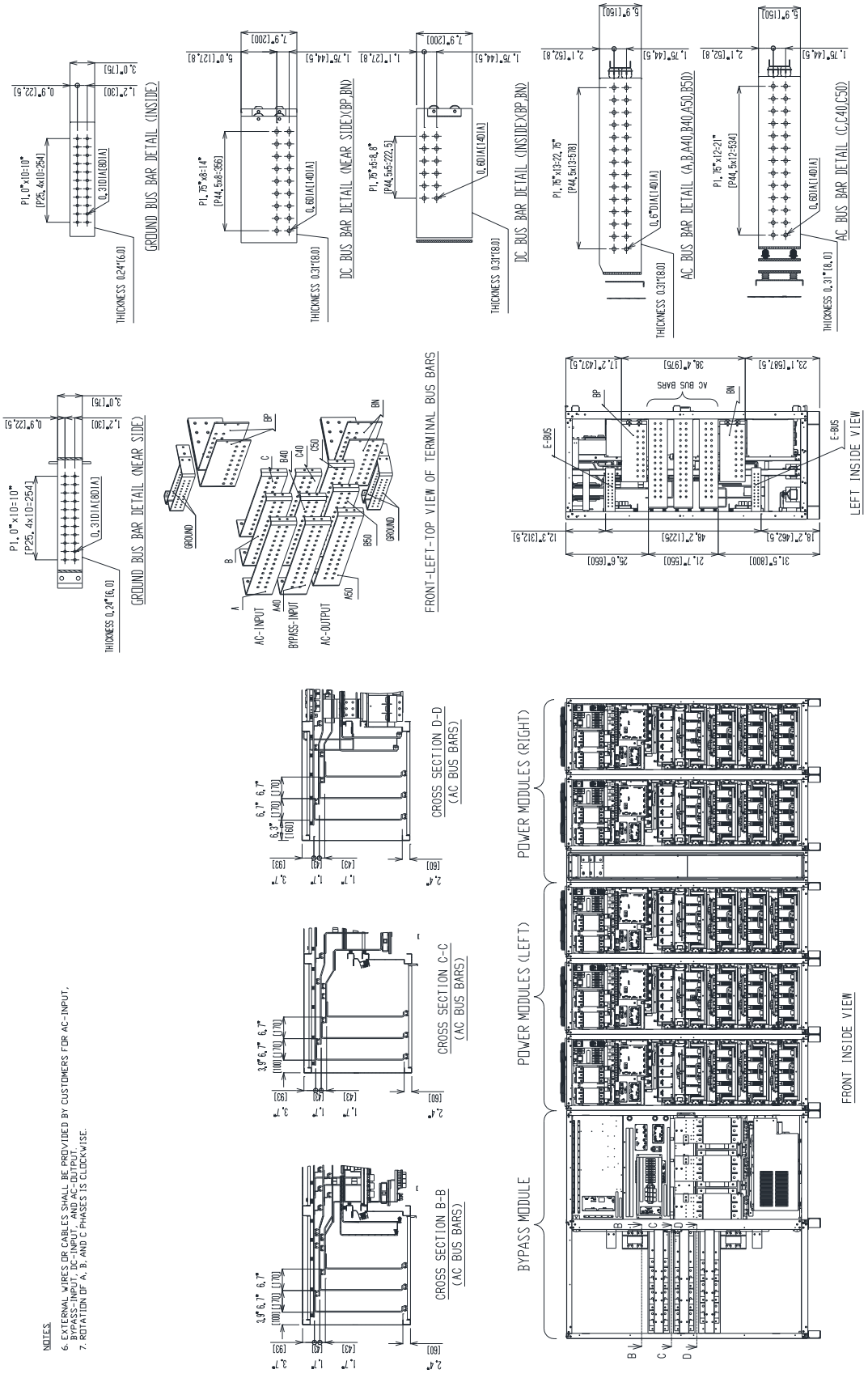


LEFT SIDE VIEW

FRONT VIEW



RIGHT SIDE VIEW



NOTES.
6. EXTERNAL WIRES OR CABLES SHALL BE PROVIDED BY CUSTOMERS FOR AC-INPUT, BYPASS-INPUT, DC-INPUT, AND AC-OUTPUT.
7. ROTATION OF A, B, AND C PHASES IS CLOCKWISE.

TOSHIBA

Installation Planning Guide for 2000kVA UPS

Standard System: 480V Input, 480V Output

General Mechanical Information

Dimensions (W x D x H)	Weight	Floor Loading	Approximate Full-Load Heat Rejection	Mechanical Clearance (Inches) from UPS for Ventilation and Maintenance Access				
Inches	Lbs.	Lbs./ft. ^{2}	kBtu/Hr	Top	Front	Bottom	Sides**	Back
222.4" x 35.5" x 80.7"*	13558	248	238.7	24"	40"	0"	0"	0"

* Height includes removable an housing – Frame height is 78.7."

** 0" clearance for peripheral equipment, 1" clearance for walls.

Primary AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand Normal Mode (Recharge Mode)			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
				Cable Quantity of Below kcmil at 75º C Temp. Rating					
kVA	PF	Amps	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
2061 (2264)	> 0.98	2479 (2694)	2700AT (3000AF)	16	14	13	12	11	10

Alternate (Bypass) AC Input (480V 3-Phase / 3-Wire)

Maximum Input Power Demand			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
				Cable Quantity of Below kcmil at 75º C Temp. Rating					
kVA	PF	Amps (Max.)	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
2000	1.0	2406	2500AT	14	12	12	11	9	9

Battery Input (480VDC Nominal)

Battery Capacity Required for Full Load Output	Maximum Discharge at Full Load Output	Suggested External Overcurrent Protection	External Feeder Wire Size Per String (**Min 2**):					
			Cable Quantity of Below kcmil at 75º C Temp. Rating					
kWB	Amps DC	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
2077@ 1.0 PF	5182	2600AT (3000AF)	12	11	10	9	8	8
		2600AT (3000AF)	12	11	10	9	8	8

AC Output (480V 3-Phase / 3-Wire)

Rated Output Power			Suggested External Overcurrent Protection	External Feeder Wire Size Per Phase:					
				Cable Quantity of Below kcmil at 75º C Temp. Rating					
kVA	PF	Amps	Amps	250kcmil	300kcmil	350kcmil	400kcmil	500kcmil	600kcmil
2000	1.0	2406	2500AT	14	12	12	11	9	9

Important Notes:

1. Maximum input current is limited to 108% of the full-load input current.
2. Output load conductors are to be installed in separate conduit from input conductors.
3. Control wires and power wires are to be installed in separate conduits.
4. Recommended AC input and output overcurrent protection based on continuous full load current per NEC 215.3.
5. Wiring shall comply with all applicable national and local electrical codes.
6. Grounding conductors to be sized per NEC Article 250-122. Neutral conductors to be sized per NEC Article 310.15.
   - Primary AC Input: 3ϕ, 3-wire + ground.
   - Alternate AC Input: 3ϕ, 3-wire + ground.
   - AC Output: 3ϕ, 3-wire + ground.
   - DC Input: 2-wire (Positive/Negative) + ground.
7. Nominal battery voltage based on the use of VRLA type batteries (2.0 volts/cell nominal).
8. Maximum battery discharge current based on lowest permissible discharge voltage for VRLA (1.67VPC).
9. DC wires should be sized to allow not more than a 2-volt drop at maximum discharge current.
10. Weights do not include batteries or other auxiliary equipment external to the UPS.
11. Cable sizing calculations based on the following method:
    - Base cable ampacity is determined by 75ºC rated copper conductor values in NEC Table 310.16.
    - Cable ampacity is derated using adjustment factor for 36-40ºC Ambient Operating Temperature per NEC Table 310.15(B)(1).
    - 3-Phase Cable ampacity is derated using correction factor for quantity 4-6 conductors in conduit per NEC Table 310.15(C)(1).
    - Cable meets bend radius limitations at the UPS terminals.

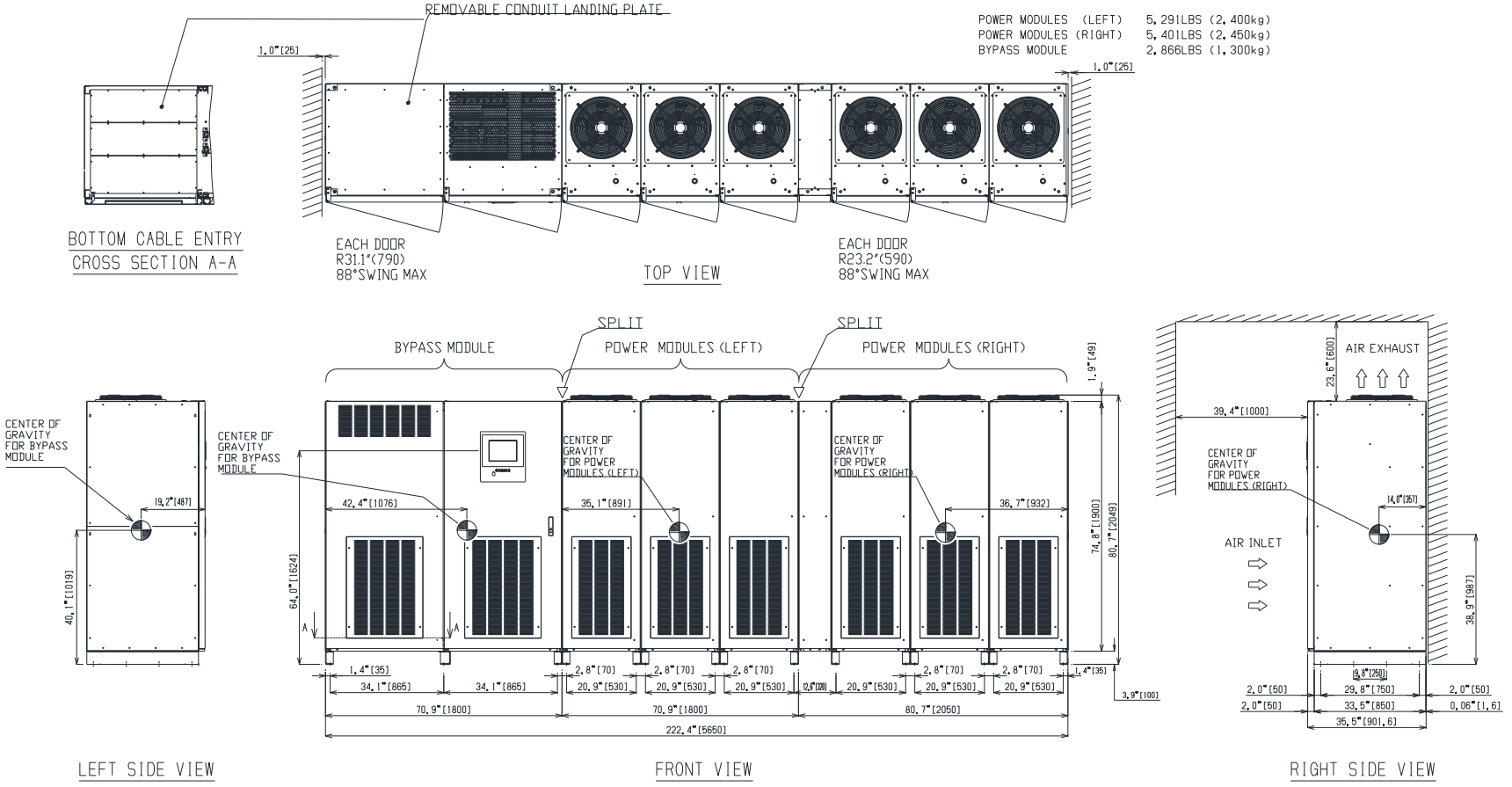
    NOTE: Consult latest edition of applicable national and local codes for possible variations.
12. Ratings/Quantities of wires and overcurrent protection devices are suggested minimums. Consult with a registered Professional Engineer within your local area for proper size selections.
13. All Overcurrent Protection Devices at or above 1200AT are assumed to be rated for 100% continuous load operation.

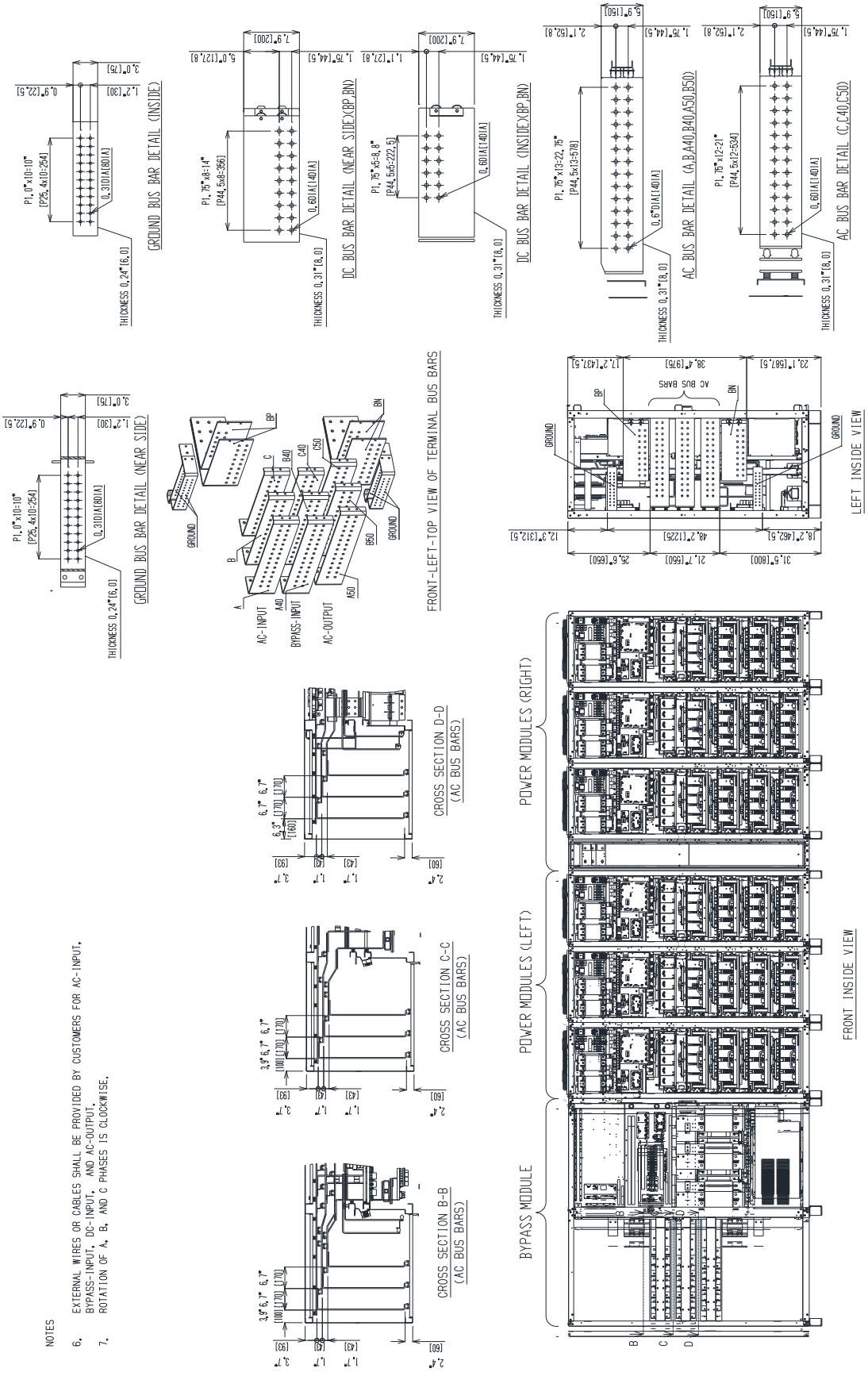
TYPE : T901H2DOMWWW-C
RATING : 2000kVA-3P3W-480V-60Hz
HEAT REJECTION : 240.2kBTUs/hour (TYPICAL)

NOTES

1. DIMENSIONS ARE SHOWN IN INCHES"[MILLIMETERS]
2. SIDE CLEARANCE OF 1" [25] IS REQUIRED FOR CABINETS EXCEPT WHEN ALIGNED WITH OTHER CABINETS IN THE SYSTEM.
3. CABINET SHOULD BE MAINTAINED UPRIGHT WITHIN ±15° DURING HANDLING.
4. EACH BASE HAS 2 OR 4 x 0.8" [20] DIAMETER HOLES TO FIX UPS ON THE GROUND. ONLY THE OUTER HOLES ON THE FRONT AND BACK OF THE CHANNEL ARE NECESSARY FOR MOUNTING.
5. APPROXIMATE WEIGHT

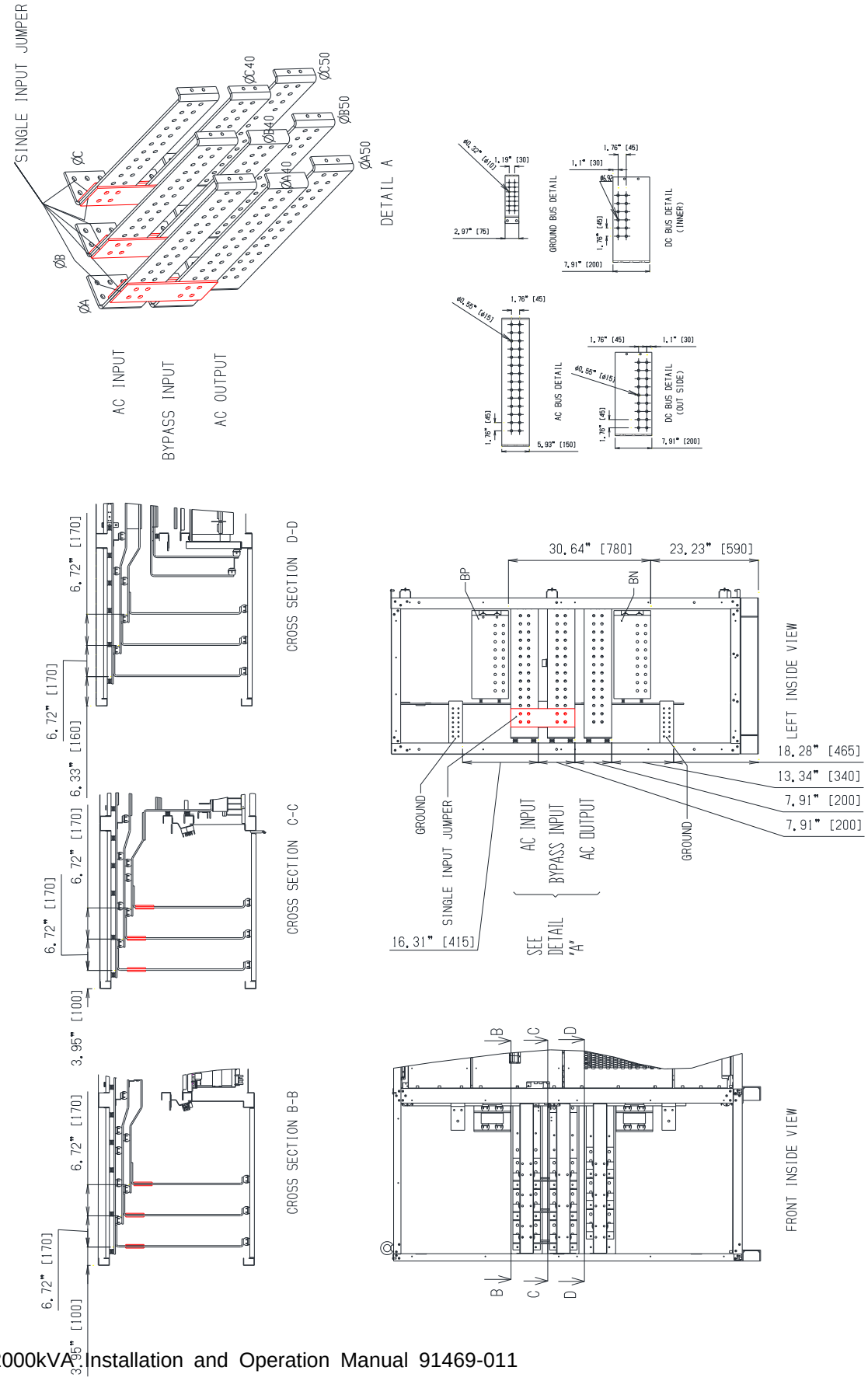
POWER MODULES (LEFT)	5,291LBS (2,400kg)
POWER MODULES (RIGHT)	5,401LBS (2,450kg)
BYPASS MODULE	2,866LBS (1,300kg)





NOTES

6. EXTERNAL WIRES OR CABLES SHALL BE PROVIDED BY CUSTOMERS FOR AC-INPUT, BYPASS-INPUT, DC-INPUT, AND AC-OUTPUT.
7. ROTATION OF A, B, AND C PHASES IS CLOCKWISE.


SINGLE INPUT JUMPER
ØC
ØB
ØA
ØC40
ØC50
ØB40
ØB50
ØA40
ØA50
AC INPUT
BYPASS INPUT
AC OUTPUT
DETAIL A
GROUND BUS DETAIL
DC BUS DETAIL (INNER)
AC BUS DETAIL
DC BUS DETAIL (OUT SIDE)
CROSS SECTION D-D
CROSS SECTION C-C
CROSS SECTION B-B
6.72" [170]
6.33" [160]
3.95" [100]
30.64" [780]
23.23" [590]
BP
BN
LEFT INSIDE VIEW
18.28" [465]
13.34" [340]
7.91" [200]
GROUND
SINGLE INPUT JUMPER
16.31" [415]
SEE DETAIL "A"
FRONT INSIDE VIEW

TOSHIBA

Appendix B Index

TOSHIBA INTERNATIONAL CORPORATION

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