ONICS™

Harmonic Mitigating Power Center (HMPC)

Owner's Manual

MIRUS International Inc.

IMPORTANT SAFETY INSTRUCTION

SAVE THESE INSTRUCTIONS - This manual contains important instructions for the ONICS™ HMPC that must be followed during installation, operation, and maintenance of the ONICS™ HMPC and its auxiliary equipment.

WARNING

OPENING ENCLOSURES EXPOSES HAZARDOUS VOLTAGES.
ALWAYS REFER SERVICE TO QUALIFIED PERSONNEL ONLY.

WARNING

As standards, specifications, and designs are subject to change, please ask for confirmation of the information given in this publication.

This manual is a controlled document; pages should not individually be removed from this binder.

NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

ONICS™

Harmonic Mitigating Power Center (HMPC)

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For service call
1 - 888 - TO - MIRUS
1 - 888 - 866 - 4787

HMPC-M001-C2

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MIRUS International Inc.

ONICS™ Harmonic Mitigating Power Center (HMPC) Owner's Manual

Warranty

Seller warrants to the Ultimate Purchaser (the purchaser who buys for use, and not for resale) that all products furnished under this order and which are manufactured by Seller will conform to final specifications, drawings, samples and other written descriptions approved in writing by Seller, and will be free from defects in materials and workmanship. These warranties shall remain in effect for period of twelve (12) months after delivery to the Ultimate Purchaser. But if the Seller installs the equipment or supplies technical direction of installation by contract, said one year shall run from the completion of installation, provided installation is not unreasonably delayed by Ultimate Purchaser. Parts replaced or repaired in the warrant period shall carry the unexpired portion of the original warranty. A unit placed with the Purchaser on consignment and then later purchased will be warranted for twelve (12) months from the time the Seller receives notification of the Purchaser's intent to purchase said consigned item. The foregoing in its entirety is subject to the provision that in no case will the total warranty period extend beyond 18 months from date Seller ships equipment from point of manufacture.

The liability of Seller hereunder is limited to replacing or repairing at Seller's factory or on the job site at Seller's option, any part or parts which have been returned to the Seller and which are defective or do not conform to such specifications, drawings or other written descriptions; provided that such part or parts are returned by the Ultimate Purchaser within ninety (90) days after such defect is discovered. The Seller shall have the sole right to determine if the parts are to be repaired at the job site or whether they are to be returned to the factory for repair or replacement. All items returned to Seller for repair or replacement must be sent freight prepaid to its factory. Purchaser must obtain Seller's Return Materials Authorization (RMA) prior to returning items. The above conditions must be met if warranty is to be valid. Seller will not be liable for any damage done by unauthorized repair work, unauthorized replacement parts, from any misapplication of the item, or for damage due to accident, abuse, or Act of God.

In no event shall the Seller be liable for loss, damage, or expense directly or indirectly arising from the use of the units, or from any other cause, except as expressly stated in this warranty. Seller makes no warranties, express or implied, including any warranty as to merchantability or fitness for a particular purpose or use. Seller is not liable for and Purchaser waives any right of action it has or may have against Seller for any consequential or special damages arising out of any breach of warranty, and for any damages Purchaser may claim for damage to any property or injury or death to any person arising out of its purchase of the use, operation or maintenance of the product. Seller will not be liable for any labor subcontracted or performed by Purchaser for preparation of warranted item for return to Seller's factory or for preparation work for field repair or replacement. Invoicing of Seller for labor either performed or subcontracted by Purchaser will not be considered as a liability by the Seller.

This warranty shall be exclusive of any and all other warranties express or implied and may be modified only by a writing signed by an officer of the Seller. This warranty shall extend to the Ultimate Purchaser but to no one else. Accessories supplied by Seller, but manufactured by others, carry any warranty the manufacturers have made to Seller and which can be passed on to Ultimate Purchaser.

Seller makes no warranty with respect to whether the products sold hereunder infringe any patent, U.S., Canadian or foreign, and Buyer represents that any specially ordered products do not infringe any patent. Buyer agrees to indemnify and hold Seller harmless from any liability by virtue of any patent claims where Buyer has ordered a product conforming to Buyer's specifications, or conforming to Buyer's specific design.

Buyer has not relied and shall not rely on any oral representation regarding the Product sold hereunder and any oral representation shall not bind Seller and shall not be part of any warranty.

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Direct all questions about the operation, repair, or servicing of this equipment to MIRUS International Inc. Customer Support Services. Include the part number, assembly number, and serial number of the unit in any correspondence. Should you require factory service for your equipment, contact MIRUS International Inc. Customer Support Services and obtain a Return Materials Authorization (RMA) prior to shipping your unit. Never ship equipment to MIRUS International Inc. without first obtaining an RMA.

Proprietary Rights Statement

Revision History

Revision: C2 New Release 2012/10/05

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Illustrations

Tables

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How to use this manual

This manual has been designed for ease of use and easy location of information.

To quickly find the meaning of terms used within the text, look to the Glossary.

This manual uses Note boxes to convey important information. Note boxes come in four varieties:

WARNING

A WARNING note box indicates information provided to protect the user and service personnel against safety hazards and/or possible equipment damage.

CAUTION

A CAUTION note box indicates information provided to protect the user and service personnel against possible equipment damage.

IMPORTANT

An IMPORTANT note box indicates information provided as an operating instruction or as an operating tip.

NOTE

A NOTE note box indicates information provided as an operating tip or an equipment feature.

1 Introduction

1.0 Scope

This manual provides information required for installation, operation, and maintenance of the **ONICS™ Harmonic Mitigating Power Center (HMPC)**. Please read this manual thoroughly before installing and operating your HMPC. Retain this manual for future reference.

The manual is divided into four sections:

Section I - Introduction

This section introduces the HMPC (see Figure 1-1, 1-2 and 1-3), including a general description of the system and its internal components, a description of available options, and system specifications.

Section II - Installation

This section describes installation of the HMPC, including receiving, handling, and storage procedures; prerequisites to installation; installation procedures; and start-up procedures.

Section III - Operation

This section presents operating information for the HMPC, including an overview of the system, its components, and their function; a description of the indicators and controls, and their function; and operational sequences to be followed for all conditions of normal, emergency, and maintenance operation.

Section IV - Maintenance

This section describes maintenance of the HMPC, including preventive maintenance, troubleshooting, and information about replacement parts.

A Glossary in the rear of the manual provides definitions of terms used within the text.

1.1 System Description

The HMPC is capable of serving as a power distribution center for most types of loads but is especially suited for non-linear loads. The HMPC takes input power and distributes that power to load devices. The HMPC monitors the supplied power when optional metering is selected. Models with isolation transformer electrically isolate the load. Single-line diagrams are shown in Figure 1-4, 1-5 and 1-6.

kVA	Model Nos.	Voltage Input	Input Amps	BTU[1] PER HR	Shipping Weight, LBS [kg]			
					HMPC084	HMPC126	HMPC168	HMPC252
050	HMPC...-AA-050	208V	139A	4400	1150 [522]	‡	‡	‡
	HMPC...-BA-050	480V	60A	4400	1150 [522]	‡	‡	‡
	HMPC...-CA-050	600V	48A	4400	1150 [522]	‡	‡	‡
075	HMPC...-AA-075	208V	208A	6800	1320 [599]	1795 [814]	1820 [825]	‡
	HMPC...-BA-075	480V	90A	6800	1320 [599]	1795 [814]	1820 [825]	‡
	HMPC...-CA-075	600V	72A	6800	1320 [599]	1795 [814]	1820 [825]	‡
100	HMPC...-AA-100	208V	278A	9100	1550 [703]	2025 [918]	2050 [930]	‡
	HMPC...-BA-100	480V	120A	9100	1550 [703]	2025 [918]	2050 [930]	‡
	HMPC...-CA-100	600V	96A	9100	1550 [703]	2025 [918]	2050 [930]	‡
125	HMPC...-AA-125	208V	347A	10,900	1600 [726]	2075 [941]	2100 [952]	‡
	HMPC...-BA-125	480V	150A	10,900	1600 [726]	2075 [941]	2100 [952]	‡
	HMPC...-CA-125	600V	120A	10,900	1600 [726]	2075 [941]	2100 [952]	‡
150	HMPC...-AA-150	208V	416A	12,800	1700 [771]	2175 [986]	2200 [998]	‡
	HMPC...-BA-150	480V	180A	12,800	1700 [771]	2175 [986]	2200 [998]	‡
	HMPC...-CA-150	600V	144A	12,800	1700 [771]	2175 [986]	2200 [998]	‡
200	HMPC...-BA-200	480V	241A	17,500	2100 [952]	2575 [1168]	2600 [1179]	3100 [1406]
	HMPC...-CA-200	600V	192A	17,500	2100 [952]	2575 [1168]	2600 [1179]	3100 [1406]
225	HMPC...-BA-225	480V	271A	18,400	2300 [1043]	2775 [1259]	2800 [1270]	3300 [1497]
	HMPC...-CA-225	600V	241A	18,400	2300 [1043]	2775 [1259]	2800 [1270]	3300 [1497]
300	HMPC...-BA-300	480V	361A	19,500	2700 [1227]	3195 [1449]	3220 [1464]	3740 [1700]
	HMPC...-CA-300	600V	289A	19,500	2700 [1227]	3195 [1449]	3220 [1464]	3740 [1700]
400	HMPC...-BA-400	480V	481A	28,600	3900 [1769]			
	HMPC...-CA-400	600V	385A	28,600	3900 [1769]			
500	HMPC...-BA-500	480V	602A	35,700	4600 [2087]			
	HMPC...-CA-500	600V	482A	35,700	4600 [2087]		Consult	
625	HMPC...-BA-625	480V	752A	46,300	5250 [2381]		Factory	
	HMPC...-CA-625	600V	601A	46,300	5250 [2381]			
750	HMPC...-BA-750	480V	902A	55,700	5600 [2540]			
	HMPC...-CA-750	600V	722A	55,700	5600 [2540]			

1. Heat based on 100% resistive load; actual will increase only slightly with non-linear loading.

‡ Not available.

Table 1-1 HMPC Characteristics

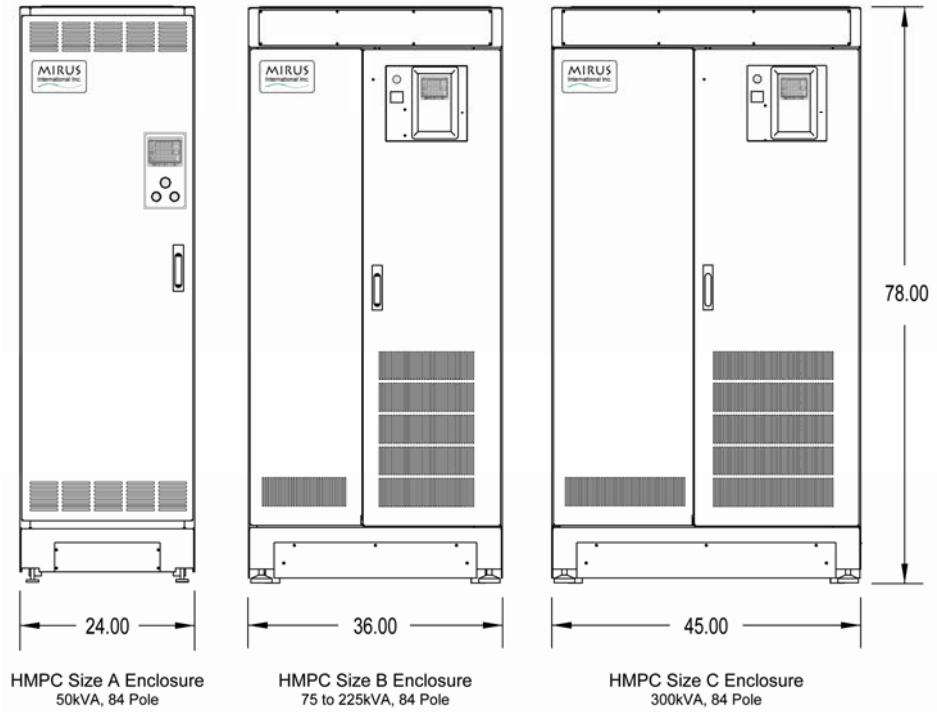


Figure 1-1 ONICS™ HMPC-084 Dimensional Layout

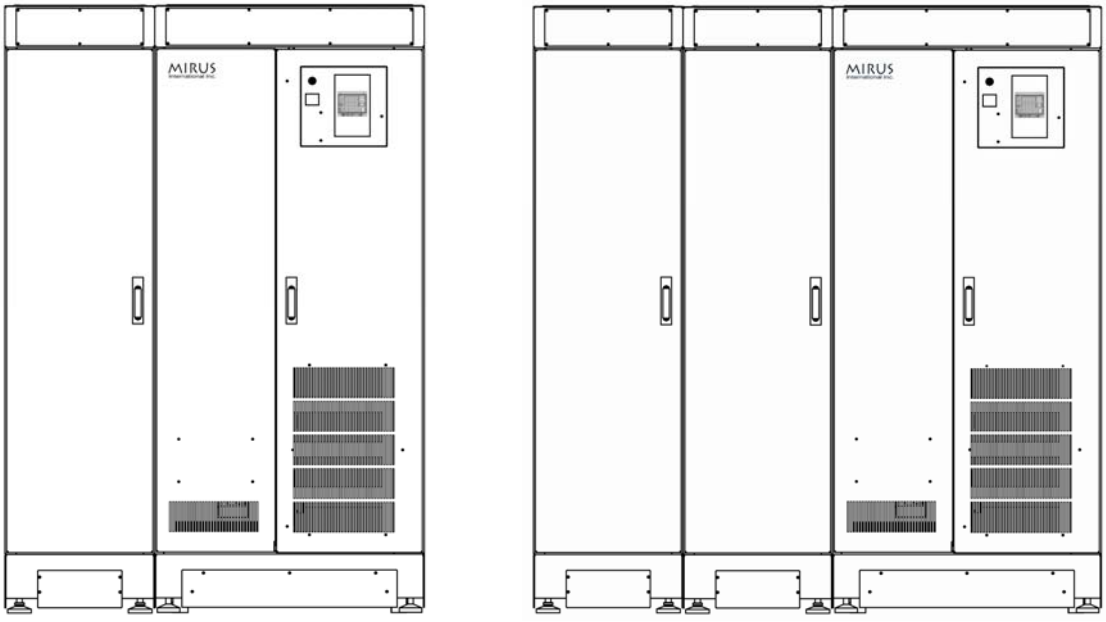


Figure 1-2 ONICS™ HMPC pictorial - Models HMPC-168 and HMPC-252

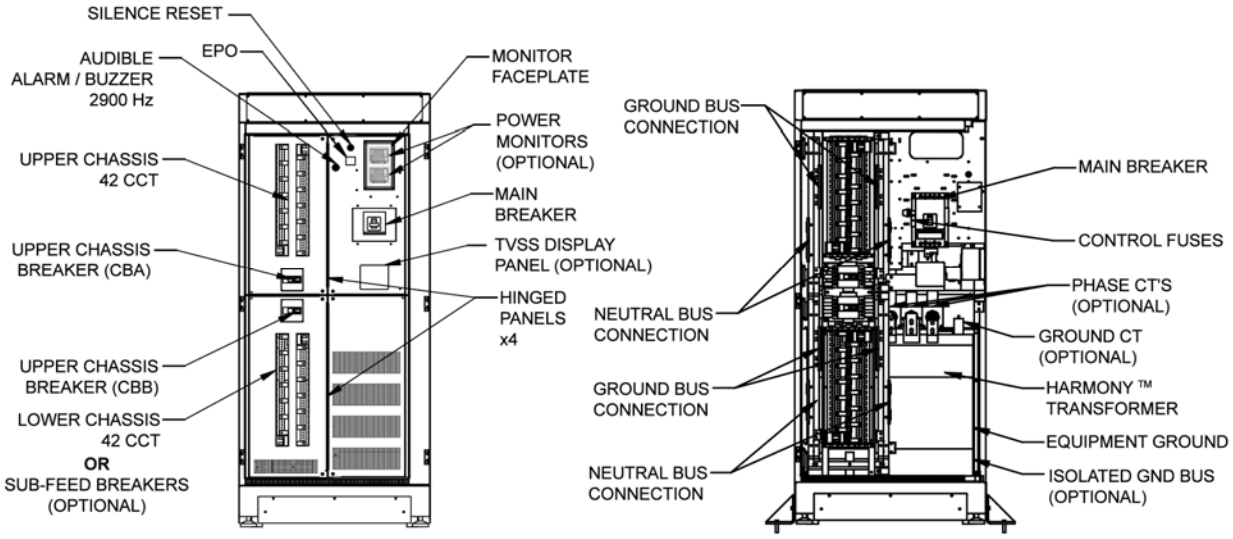


Figure 1-3 Location of major internal components

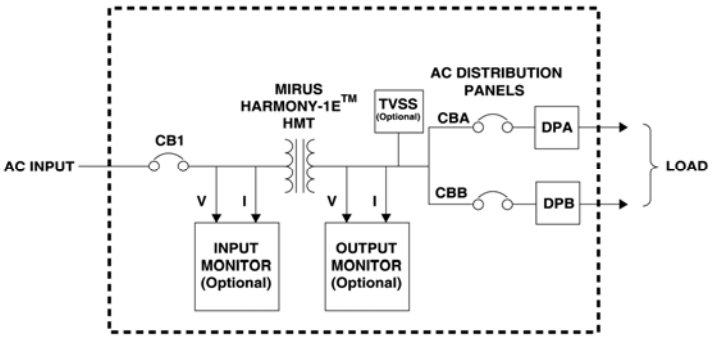


Figure 1-4 Single –line diagram of HMPC-084 with Harmony-1E™ HMT

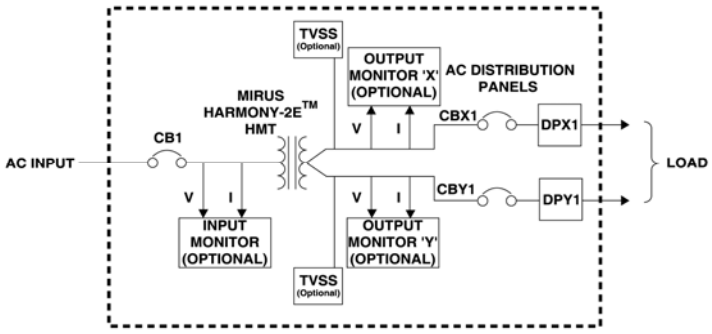


Figure 1-5 Single –line diagram of HMPC-084 with Harmony-2E™ HMT

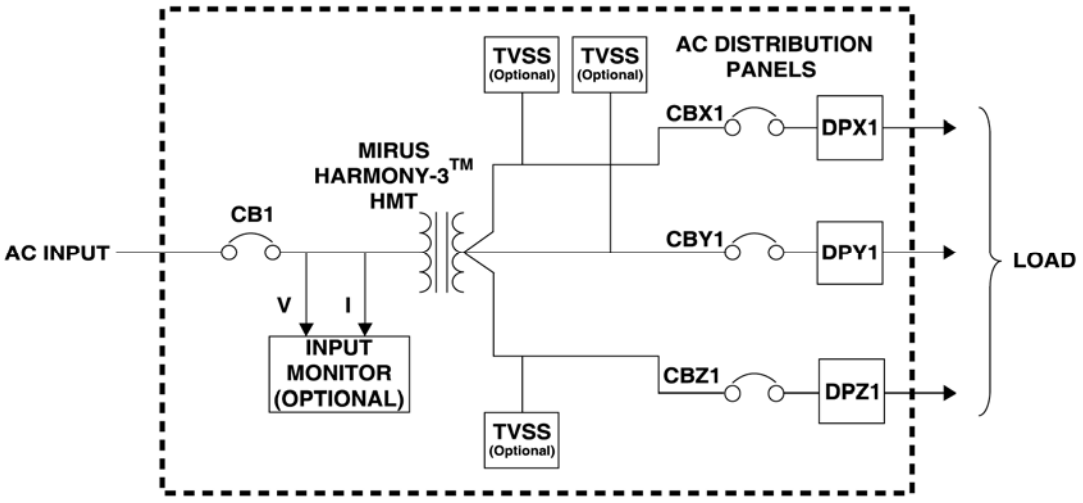


Figure 1-6 Single –line diagram of HMPC-126 or HMPC-252 with Harmony-3E™ HMT

For most applications, the HMPC is completely self-contained within a single enclosure comprised of one or more modular sections. The enclosure may house one or two optional monitors, and up to six 42-pole distribution panelboards (for a total of 252 poles). One of the panelboards may be substituted by larger molded-case circuit breakers (up to four 225 amps max. sub-feed breakers).

The HMPC is available in power ranges from 50 kVA to 750 kVA, with a wide range of models and options that include:

- Input J-Box
- Transient voltage suppression system (TVSS)
- MIRUS Harmony™ or ULLTRA™ Series Double-Shielded Harmonic Mitigating Transformer
- Isolated ground bus
- Floor stand
- Molded-case circuit breaker
- Manual restart
- Remote EPO pushbutton, column or wall-mounted

The HMPC meets the standards for the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

Model number information, along with associated power, size, and heat load data, is given in Table 1-1.

1.2 Major Components

The following is a description of the major components of the HMPC. Refer to Figure 1-3.

Circuit Monitor and Indicators

Figure 1-3 shows the internal view of the unit with the monitor, switches and the indicators.

The meter is a three-phase, digital multi-function power monitor providing simultaneous displays, remote capabilities and optional power quality analysis. It measures every electrical power function including: voltage, current, frequency, KW, KVAR, KVA, PF, total KWH, and total harmonic distortion. Some functions are optional (refer to Table 1-4). For possible monitoring configurations, refer to Figure 1-9.

'Emergency power off' (EPO) pushbutton shuts down the HMPC thereby disconnecting all power downstream of the input circuit breaker.

Silence Reset illuminated pushbutton will silence the audible alarm until a new alarm occurs.

'TVSS alarm' is triggered by the optional transient voltage suppression system.

'Xfmr Overtemp' is triggered when the transformer temperature reaches 170°C and latched on when temperature reaches 200° C.

'Alarm" LED is triggered by any fault condition from the power monitor or by an external dry contact.

'MIRUS Harmony™ Series Harmonic Mitigating Transformer (HMT)' is located in the transformer compartment behind the panelboards. Transformer connections are accessible by removing the side panel of the ONICS™ HMPC.

Basic Monitoring

1. The basic package consists of an EPO pushbutton, Horn, Pilot Light, Silence Pushbutton, Printed Circuit Board (with alarm inputs and output relays, refer to Figure 1-9) and Transformer Temperature Sensors (located in each coil); 170^0C alarm and 200^0C shutdown.

2. In addition to the transformer alarm, four additional alarms can be connected to the printed circuit board via terminals 3-6 on the P4 connector (refer to Figure 1-8 and the schematic shipped with HMPC). The inputs must be dry contacts and are connected between the ICOM terminal and their respective terminal. These inputs are user selectable for alarming only, or shutdown of the HMPC, via the DIP Switches located on the circuit board - factory set for alarm only (refer to Figure 1-7).

3. Three Remote Emergency Power Off (REPO) contacts can be connected to terminals 8-10 on the P4 terminal strip. DIPSwitches 5, 6, & 7 must be set as per Figure 1-7. If the REPO input is a Normally Closed contact, set the DIPSwitch to ON. If the REPO input is a Normally Open contact, set the DIPSwitch in the OFF position.

4. Three Form-C summary alarm relays are provided on the circuit board - connector P1 (refer to Figure 1-8).

	NOTE The INPUT connections to the circuit board MUST be DRY CONTACTS. DO NOT CONNECT A VOLTAGE TO THESE TERMINALS. Connecting a voltage to these terminals will damage the circuit board and VOID warranty. Refer to the schematic for connection purposes.

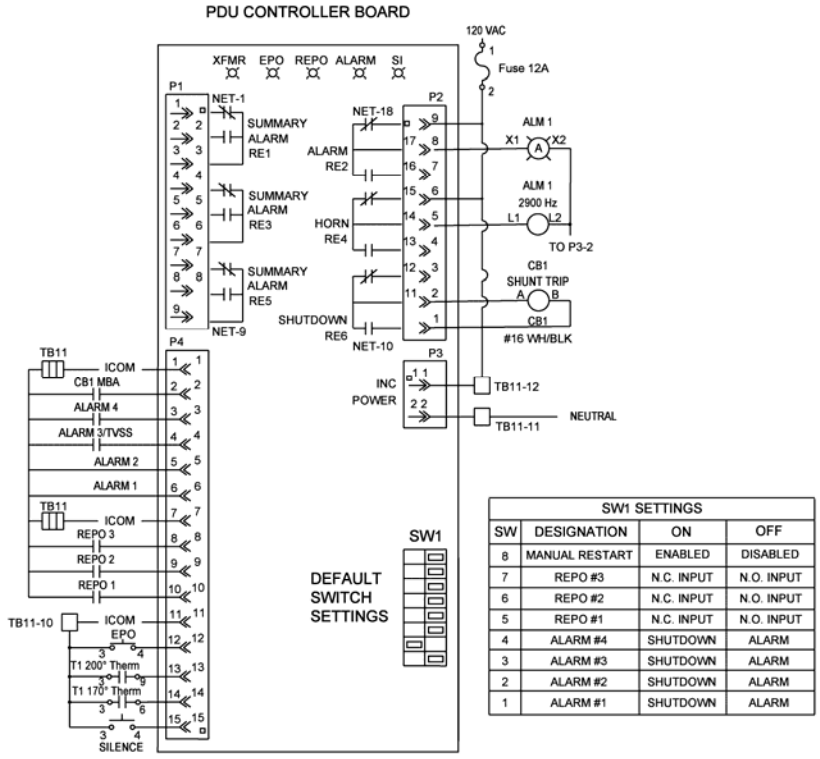


Figure 1-7 PDU Controller Board Layout / DIP SW Settings (SW1)

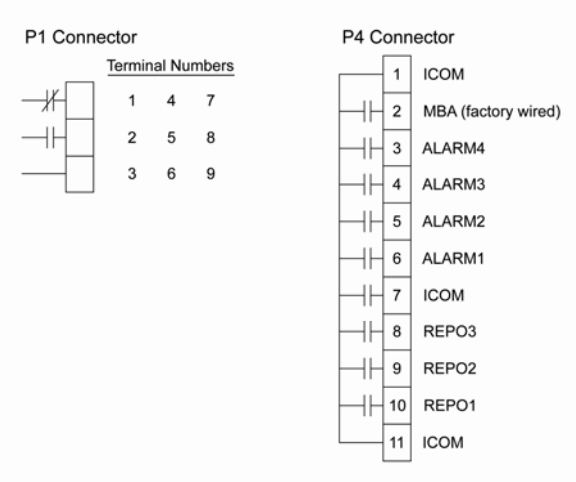


Figure 1-8 Summary Alarm Connections (P1) / Alarm and REPO I/P Connections (P4)

5. The power transformer's temperature sensor, set at 170^{0}C, will activate the horn and pilot light. An additional sensor is set for 200^{0}C. Should the transformer reach and/or exceed this temperature, the shunt trip will activate, de-energizing the main circuit breaker. If any of the transformer temperature alarms activate, the entire system should be examined to determine and eliminate the cause.

6. All alarms will activate the horn and pilot light. The pilot light will flash until the SILENCE pushbutton is depressed. Once pressed the light will remain on and flash as long as the alarm exists. Depressing the Silence pushbutton will also silence the horn. The sequence repeats itself whenever a new alarm occurs.

7. The EPO (Emergency Shutdown) pushbutton is located behind a protective cover. To shutdown the HMPC, lift the cover and push the button. This will energize the main circuit breaker's shunt trip, thus tripping the circuit breaker and de-energizing the unit.

	**CAUTION** THE CONTROL POWER IS STILL PRESENT WITH THE MAIN CIRCUIT BREAKER IN THE 'OFF' POSITION.

	**WARNING** **THE LINE SIDE (TOP) OF THE MAIN CIRCUIT BREAKER MAY BE LIVE WHEN THE CIRCUIT BREAKER IS IN THE 'OFF' OR 'TRIPPED' POSITION.**

8. Connector P2 is factory wired to activate the light (16-18), horn (terminals 13-15) and shutdown (terminals 10-12) circuits.

9. Connector P3 is factory wired and provides 24VAC to power the circuit board.

10. Four RED LEDs located at the top of the circuit board provide 'cause of alarm' information. The respective LED will remain illuminated one minute after the silence pushbutton has been depressed. To view the LED you must open the front doors and inside trim. The circuit board is located on the roof sheet above the main circuit breaker. A fifth GREEN LED will remain lit as long as the software is functioning properly. Should this LED de-energize, contact Mirus International Inc. immediately.

    The four RED LEDs are as follows:

    XFMR = Transformer Overheating
    EPO = EPO Pushbutton Depressed
    REPO = Remote EPO Pushbutton Depressed
    ALARM = External Alarm Activated

	**WARNING** **THE CIRCUIT BOARD IS POWERED FROM THE LINE SIDE (TOP) OF THE MAIN CIRCUIT BREAKER THROUGH A CONTROL TRANSFORMER. THE CIRCUIT BOARD WILL REMAIN POWERED WHEN THE CIRCUIT BREAKER IS IN THE 'OFF' OR 'TRIPPED' POSITION. TO DE-ENERGIZE THE CIRCUIT BOARD, DISCONNECT THE POWER FEEDING THE HMPC.**

11. If an HVAC alarm or shutdown circuit is required, use one of the ALARM inputs on the P4 terminal block and set the respective DIP Switch accordingly, as per Figure 1-7.

12. The Manual Restart feature is standard on the circuit board. Refer to Figure 1-7 and set DIP Switch 8 accordingly.

13. The circuit board layout is detailed in Figure 1-9 below. The circuit board is located behind the main doors and interior trim above the main circuit breaker. When viewing the circuit board inside the HMPC, the LEDs will be toward the front mounted on the roof sheet (above the main circuit breaker).

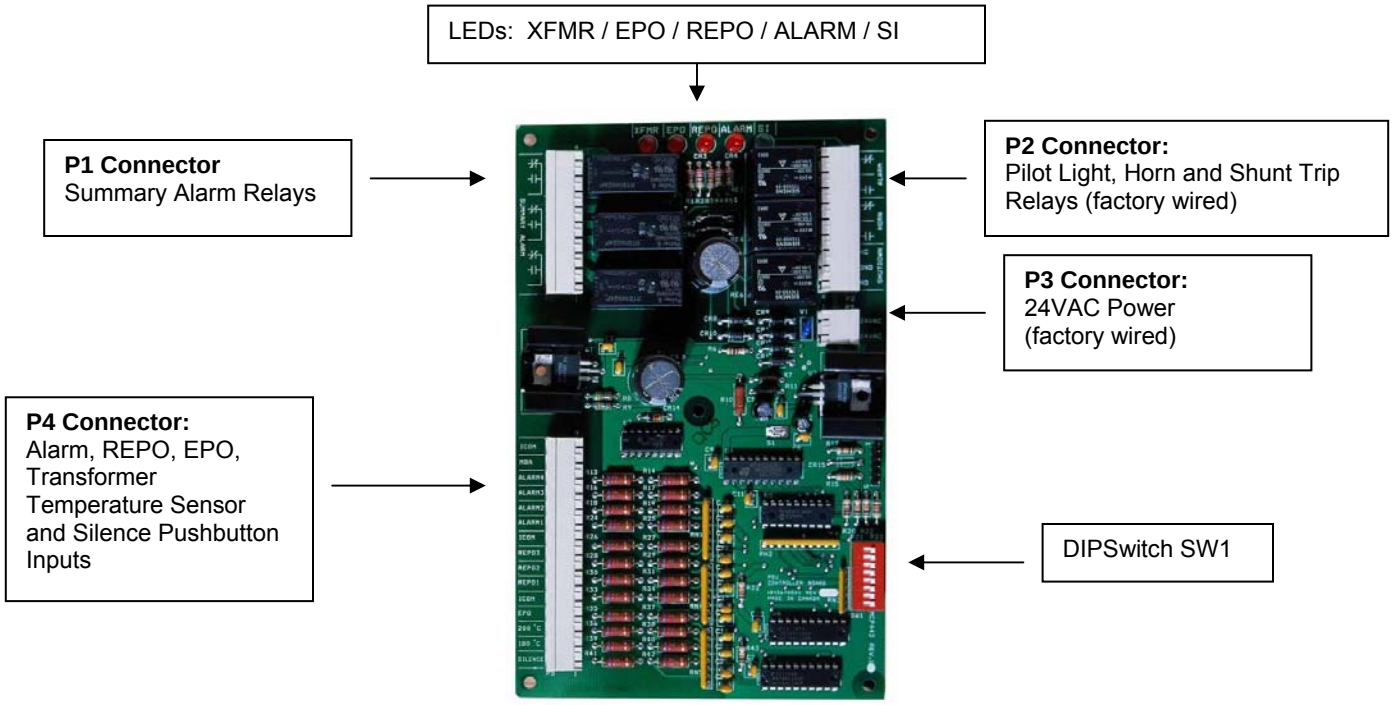


Figure 1-9 Printed Circuit Board detail

INDICATOR/ ANNUNCIATION:

Buzzer / Horn	Std
Alarm Reset / Silence Illuminated Pushbutton	Std
EPO Pushbutton	Std
Transformer High Temperature Alarm	Std
Transformer Over Temperature Alarm and Shutdown	Std

Table 1-2 Standard Indicator / Annunciation

Power Monitor (optional)

The Power Monitor is supplied in various configurations. The following table describes the types of monitors available with their option code.

POWER MONITOR :

Option Type	Description
M0	No Meter
M1	Power Monitor
M1R	Power Monitor with Relay O/P
M1C	Power Monitor with RS232 Communication
M1RC	Power Monitor with Relay O/P & RS232 Communication
M2	Advanced Power Monitor with Ethernet
M2R	Advanced Power Monitor with Ethernet & Relay O/P

Table 1-3 Available Power Monitor Configurations

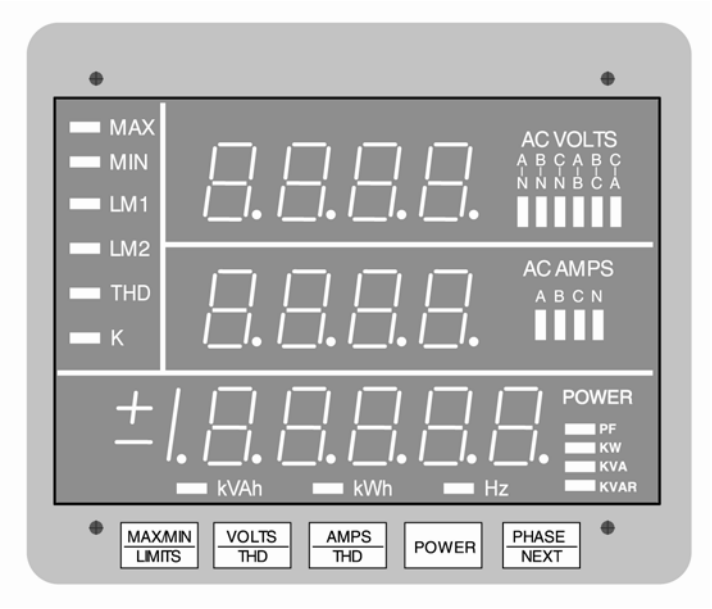


Figure 1-10 Power Monitor Front Panel

POWER MONITOR DISPLAY:	M1	M1R	M1C	M1RC	M2	M2R
Measurements						
3Φ Voltage (L-L)	Std	Std	Std	Std	Std	Std
3Φ Voltage (L-N)	Std	Std	Std	Std	Std	Std
3Φ Current	Std	Std	Std	Std	Std	Std
Neutral Current	Std	Std	Std	Std	Std	Std
Bi-Directional kW (3Φ and Total)	Std	Std	Std	Std	Std	Std
Bi-Directional kVA (3Φ and Total)	Std	Std	Std	Std	Std	Std
kVA (3Φ and Total)	Std	Std	Std	Std	Std	Std
PF (3Φ and Total)	Std	Std	Std	Std	Std	Std
Bi-Directional kWh	Std	Std	Std	Std	Std	Std
kVAh	Std	Std	Std	Std	Std	Std
Frequency	Std	Std	Std	Std	Std	Std
%THD	Std	Std	Std	Std	Std	Std
K Factor	Std	Std	Std	Std	Std	Std
Advanced Measurement Features						
Voltage Max/Min	Std	Std	Std	Std	Std	Std
Amps Demand Max/Min	Std	Std	Std	Std	Std	Std
kW Demand Max/Min	Std	Std	Std	Std	Std	Std
kVAR Demand Max/Min	Std	Std	Std	Std	Std	Std
kVA Demand Max/Min	Std	Std	Std	Std	Std	Std
PF Max/Min	Std	Std	Std	Std	Std	Std
Frequency Max/Min	Std	Std	Std	Std	Std	Std
%THD Max/Min	Std	Std	Std	Std	Std	Std
K-Factor Max/Min	Std	Std	Std	Std	Std	Std

Table 1-4 Power Monitor Display Features

(Table 1-4 continued on next page) →

(Table1-4 continued)

POWER MONITOR DISPLAY:	M1	M1R	M1C	M1RC	M2	M2R
User Defined Set points						
Over/Under Voltage	Std	Std	Std	Std	Std	Std
Over/Under Current	Std	Std	Std	Std	Std	Std
Over/Under kVA	Std	Std	Std	Std	Std	Std
Over/Under kW	Std	Std	Std	Std	Std	Std
Over/Under kVAR	Std	Std	Std	Std	Std	Std
Over/Under PF	Std	Std	Std	Std	Std	Std
Over/Under Frequency	Std	Std	Std	Std	Std	Std
Over %THD	Std	Std	Std	Std	Std	Std
Phase Reversal	Std	Std	Std	Std	Std	Std
Reverse Power	Std	Std	Std	Std	Std	Std
Logic and Hysteresis Function on Setpoints	Std	Std	Std	Std	Std	Std
Relay Output Control for all limits	Std	Std	Std	Std	Std	Std
Harmonic Measurements						
Phase Voltage %THD	Std	Std	Std	Std	Std	Std
Phase Current %THD	Std	Std	Std	Std	Std	Std
Phase Current K Factor	Std	Std	Std	Std	Std	Std
Harmonic Magnitudes	Std	Std	Std	Std	Std	Std
Harmonic Angles	Std	Std	Std	Std	Std	Std
Communications						
RS232	N/A	N/A	Std	Std	N/A	N/A
Ethernet	N/A	N/A	N/A	N/A	Std	Std
Alarm Output						
Relay Output	N/A	Std	N/A	Std	N/A	Std

Table 1-4(cont.) Power Monitor Display Features

1.3 Model Numbering

The model number of the unit, located on the inside, can be parsed to indicate important parameters of the HMPC. Possible values are shown in Figure 1-8.

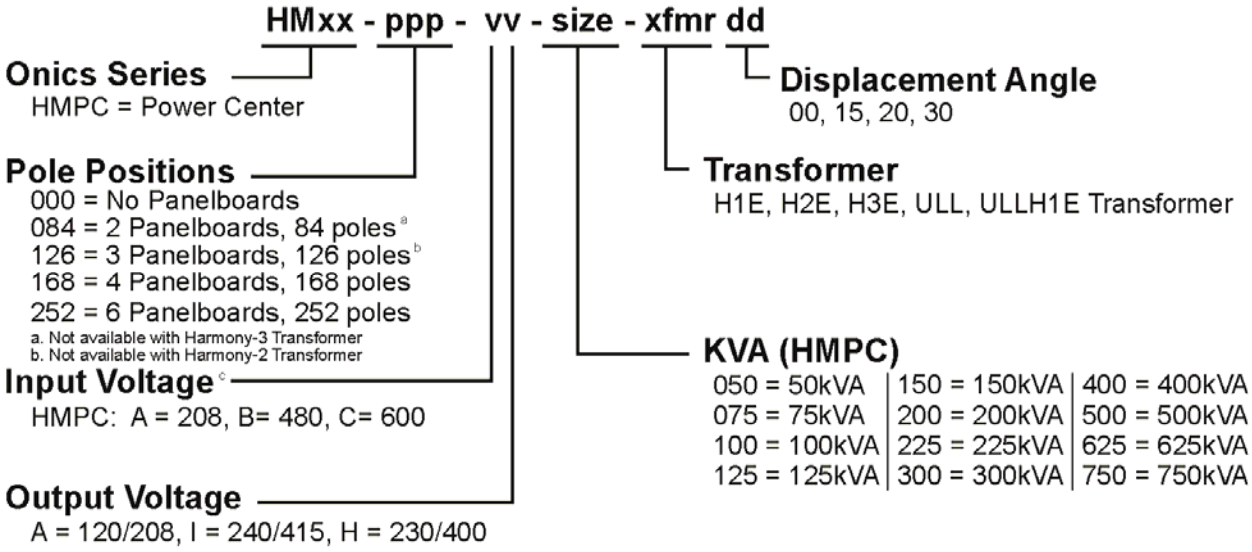


Figure 1-11 Nomenclature of HMPC

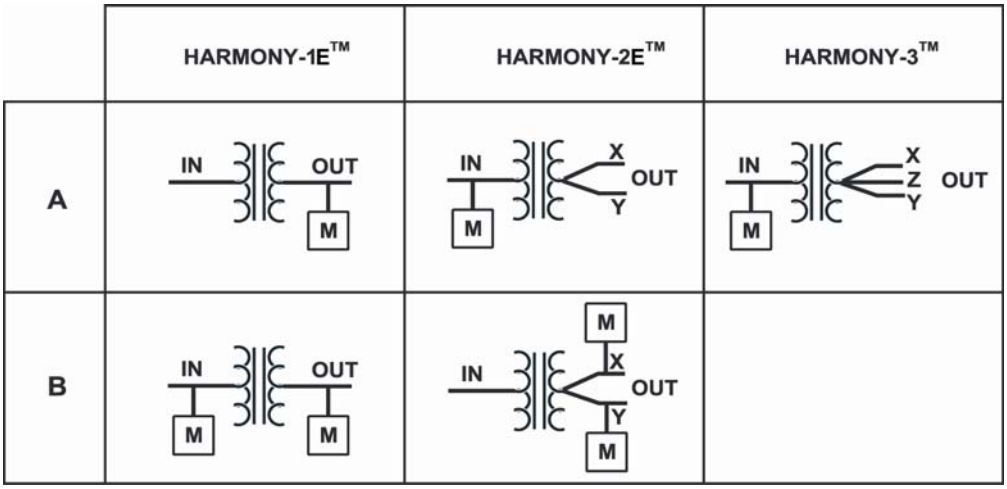


Figure 1-12 Possible Monitoring Configurations

1.4 Options

Most options must be specified at the time of the original order for factory installation. Some options can be field installed; contact your MIRUS Sales Representative for further information.

Junction box (J-Box)

Junction box (J-Box), provides cable entry or exit from the bottom of the HMPC through a raised floor.

Transient voltage suppression system (TVSS)

Transient voltage suppression system (TVSS), which is connected to the output (secondary) side of the main isolation transformer, is used to clip voltage transients. Installed internally in the HMPC.

Isolated ground bus

Isolated ground bus provides a termination point for the second ground wire from isolated ground receptacles. Installed internally in the HMPC.

Floor stand

Floor stand is used in applications where a raised floor installation is not possible and top or side conduit landings cannot be used.

Distribution circuit breakers

Distribution circuit breakers can be factory installed. Panelboards accept 1-, 2-, or 3-pole circuit breakers rated up to 100Amps / 3 pole.

Remote emergency power off (REPO)

Remote emergency power off (REPO) station makes it possible to disconnect power to the HMPC from a remote location in an emergency. When the REPO is activated, it trips the main input circuit breaker. The HMPC shuts down, along with all connected loads. Any number of REPO stations can be connected as required.

Main frame circuit breaker (Subfeed)

Main frame circuit breaker can be installed in place of panelboard B. Up to four 225 Ampere main frame circuit breakers can be installed.

1.5 Specifications

AC input ratings

Voltage:	see Section 1.3, Model Numbering
kVA:	see Section 1.3, Model Numbering
Phase:	3Ø, 3 wire plus ground
Frequency:	60 Hz

AC output ratings

Voltage:	208/120 VAC
Phase:	3Ø, 4 wire plus ground
Frequency:	60 Hz

Environmental Characteristics

Temperature	
Operating:	
50 to 150 kVA	-10° C to 40° C (14° F. to 104° F.)
200 to 750 kVA	-10° C to 35° C (14° F. to 95° F.)
Non-operating:	-40° C to 60° C (-40° F to 140° F)
Altitude:	
Operating:	152 meters below to 2,134 meters above sea level (500 feet below to 7,000 feet above sea level) without derating
Non-operating:	152 meters below to 7,620 meters above sea level (500 feet below to 25,000 feet above sea level)
Relative humidity:	
Operating:	10 to 90% non-condensing
Non-operating:	10 to 70% condensing
Acoustic noise level:	50 dB for sizes up to 150kVA 55 dB for sizes 200, 225 and 300kVA 60 dB for sizes 400 and 500kVA 64 dB for sizes 625 and 750kVA (typical, 'A' weighting at four feet from the front of the cabinet)
Cable Access and landing:	Bottom or Top

Harmonic Mitigating Transformer

Double shielded MIRUS Harmony™ Series Harmonic Mitigating Transformer (HMT) with 1, 2 or 3 phase-shifted, 3-phase, 4-wire outputs for harmonic cancellation (patented design). Each output has very low zero sequence impedance (Z < 0.95%, X < 0.3%)

Harmony-1E™ HMT

Harmonics Treated:	3rd, 9th, 15th (plus 5th and 7th in conjunction with other Harmony™ transformers)
Phase shift: [from input to output]	Order 0^o or -30^o
kVA:	Secondary rated at 100% of primary rating

Harmony-2E™ HMT

Harmonics Treated:	3rd, 5th, 7th, 9th, 15th, 17th and 19th
Phase shift: [from input to output(s)]	x = 0^o, y = -30^o
kVA:	Two secondaries, each rated at 60% of primary rating

Harmony-3E™ HMT

Harmonics Treated:	3rd, 5th, 7th, 9th, 11th, 13th and 15th
Phase shift: [from input to output(s)]	x = -10^o, y = -30^o, z = -50^o
kVA:	Three secondaries, each rated at 40% of primary rating

1.6 The MIRUS Harmony™ Series HMT and Its Benefits

At the heart of every ONICS™ Harmonic Mitigating Power Center (HMPC) is a high efficiency MIRUS Harmony™ Series Harmonic Mitigating Transformer (HMT). The MIRUS HMT improves power quality by producing substantially less voltage distortion than a standard or k-factor delta-wye (DY) transformer when feeding computer room equipment and personal computer systems. The Mirus HMT also, reduces energy consumption by lowering harmonic losses and meeting Energy Star efficiency levels.

Reducing voltage distortion is important because it decreases the degree of supply voltage flat-topping (loss of peak-to-peak voltage) seen by the switch-mode power supplies (SMPS) in these loads. It is not uncommon to find distribution systems with conventional or k-factor DY transformers where the RMS voltage is only marginally low but the peak voltage is more than 10% low.

One of the consequences of this voltage flat-topping is an increase in losses within the SMPS itself. For example, a 10% decrease in peak voltage (from 169.4V to 153V) will increase the SMPS line current by about 11% which will in turn increase the I^2R portion of the SMPS losses by about 23%. In addition, a 10% reduction in peak voltage will also reduce the power dip ride-through time of the computer load by about 37%. Installing a MIRUS HMT to supply the correct range of RMS and peak voltage to the power supplies of the computer room and pc systems will improve overall system reliability.

Most ONICS™ HMPCs are equipped with MIRUS Harmony-2E™ HMTs because of their excellent harmonic mitigation properties. The Harmony-2E™ HMT has two 3-phase, 4-wire output groups called X and Y with a common double-rated neutral X_0Y_0. The X group leads the Y group by 30 degrees and both groups have a special (patented) winding configuration that causes the balanced triplen harmonic fluxes in each group to cancel without coupling to the primary delta windings of the HMT. This keeps the triplen harmonic (3^{rd}, 9^{th} and 15^{th}) voltage distortion added by the HMT to a fraction of that which would be added by a conventional or k-factor DY transformer.

Because the X and Y secondary groups of the Harmony-2E™ are 30 degrees apart, the balanced portions of the 5^{th} and 7^{th} harmonic fluxes created by the 5^{th} and 7^{th} harmonic load currents also cancel out without coupling to the delta primary. Because the primary does not have to carry these harmonic currents, the winding losses and harmonic voltage drops (voltage distortion components) are lower than those which would occur in a DY transformer.

1.7 Balancing Loads for the Harmony-2E™ HMT

An ONICS™ HMPC with a Harmony-2E™ HMT always has an even number of power distribution panels (2, 4, or 6) so that the load can be easily split into 2 approximately equal parts (in kVA or in amperes). This will promote optimum cancellation of 5^{th} and 7^{th} harmonics. It is very important to note that excellent harmonic cancellation can be achieved without precise balancing. For example, a 60 to 40 load split will reduce 5^{th} and 7^{th} harmonics from 100 to 20, a very worthwhile 5 to 1 improvement.

Standard Panel Configurations

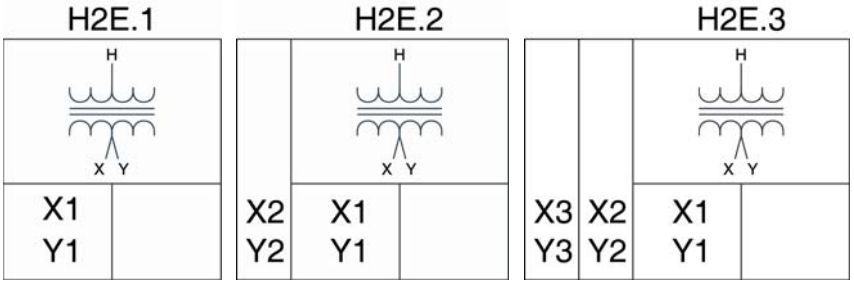


Figure 1-13 Harmony-2E™HMT Output Groups and Panel Configurations

Figure 1-10 shows the distribution panel nametags that should be used when scheduling and balancing loads. The X group output of the Harmony-2E™ HMT feeds panels X1, X2, and X3 while the Y group output feeds panels Y1, Y2, and Y3.

When scheduling the loads in the panels, split the 120VAC, single-phase SMPS loads between the X group and Y group panelboards. Usually this will be the majority of the loads.

If there should be any 208VAC, 3-phase SMPS loads, attempt to divide them evenly between the X and Y group panelboards as well.

208VAC, single-phase SMPS loads should also be split reasonably evenly between the X and Y group panelboards.

In a pinch, you can also balance three 208VAC, single-phase SMPS loads against one 208VAC, 3-phase SMPS load if the kVA total of the three matches the kVA of the one.

1.8 Balancing Loads for Harmony-3E™ and Harmony–1E™ HMTs

An ONICS™ HMPC equipped with a Harmony-3™ HMT will either have 3 or 6 panelboards fed from its 3 outputs (see Figure 1-12). The X group output feeds panels X1 and X2, the Y group output feeds panels Y1 and Y2 and the Z group output feeds panels Z1 and Z2. Cancellation of 5^{th}, 7^{th}, 11^{th} and 13^{th} harmonics is achieved by balancing the loads between the 3 groups as evenly as possible.

For Harmony-1E™ HMPC's (see Figure 1-11), balancing between the panelboards is not required since cancellation of 5^{th} and 7^{th} harmonics is accomplished upstream of the HMPC where these harmonics combine with those returning from other loads on the distribution system. If there are multiple Harmony-1E™ HMPCs fed from the same source, then half of them should be equipped with Harmony-1E™ HMTs with a 0 degree phase shift and the other half with a –30 degree phase shift. This will result in a 180 degree phase shift between the 5^{th} and 7^{th} harmonics and cancellation of their balanced portion.

Standard Panel Configurations

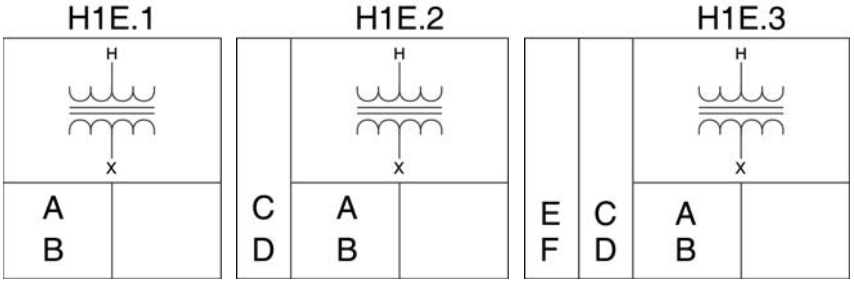


Figure 1-14 Harmony-1E™HMT Output Groups and Panel Configurations

Standard Panel Configurations

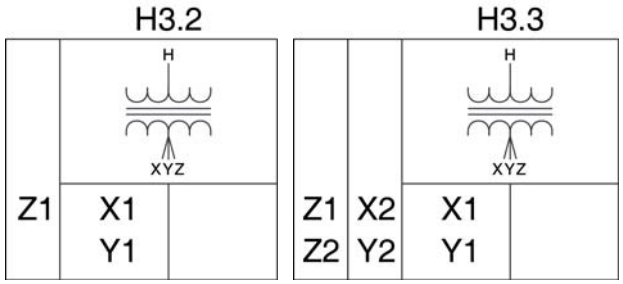


Figure 1-15 Harmony-3E™HMT Output Groups and Panel Configurations

1.9 Further Balancing Advice and Summary

There is no benefit in phase shifting 120VAC, 1-phase SMPS loads against 208VAC, 3-phase SMPS loads. The harmonic signatures of these types of loads are somewhat complementary so that some cancellation of 5th and 7th harmonics occurs *without* phase shifting them.

When performing the above balancing procedures, remember to check if the basic balancing between the 3-phases of any given group has been reasonably achieved. As always, the basic ABCABC… configuration of the panelboard pole positions aids in this regard. Achieving reasonable balance between the 3 phases will minimize the residual 3rd and 9th harmonic current appearing in the feeder to the HMPC.

Always remember that perfection is *not* required. A 60 to 40 split will yield a 5 to 1 improvement in 5th and 7th current harmonic suppression.

2 Installation

2.0 Scope

This section describes installation of the **ONICS™ Harmonic Mitigating Power Center (HMPC)**, including receiving, handling, and storage procedures, prerequisites to installation, installation procedures, and start-up procedures.

2.1 Receiving

Every effort is made to insure that the HMPC equipment arrives at its destination undamaged and ready for installation. Crating and packing is designed to protect internal components as well as the enclosure. The HMPC enclosures are skid mounted and suited for forklift movement, thus care should be exercised to protect the equipment from impact at all times.

Before accepting the shipment from the freight carrier, inspect the exterior surfaces of shipping container(s), packaging, and equipment for damage that may have occurred during transit. If the shipping containers or equipment show evidence of damage, note the damage on the receiving document (bill of lading) prior to signing for receipt of equipment.

The equipment should be unpacked immediately after receipt, and inspected again for damage to external painted panels and doors and to determine if any internal damage (broken components, disconnected wiring, loose connections, etc.) has occurred. Verify that the equipment nameplate corresponds with the equipment ordered.

	**NOTE** The unit should not be loosened from the shipping pallet until after all handling by forklift or pallet jack is completed. Complete internal inspection should be conducted only after the equipment has been positioned prior to electrical connection.

RECORD any external and internal damage observed for reporting to the transportation carrier. Call the carriers concerned at once for inspection, and request an inspection report. Do not contact Mirus International Inc. first – notify the carrier instead. If this precaution is not taken we cannot assist you in recovering the amount of the claim against the carrier. All claims should be as specific as possible and include purchase order (P.O.#) and serial numbers (S/N #), found on the nameplate.

A shipping label is affixed to the top of the shipping container which includes a variety of equipment and customer information, such as Purchase Order Number (P.O.#). Make certain that this information matches other shipping paper information.

Each HMPC is lagged to and shipped on a pallet. The pallet is opened at two ends for movement by a forklift. The entire unit is protected with shrink-wrap and may or may not be banded to the skid.

	WARNING THE SHIPPING BANDS MAY BE UNDER TENSION. APPROPRIATE EYE, FACE AND HAND PROTECTION MUST BE WORN WHEN REMOVING THE BANDS TO SAFEGUARD AGAINST INJURY.

Damage claims should be filed directly with the carrier. Replacements for damaged components can be ordered by calling 1-888-TO MIRUS (1-888-866-4787).

2.2 Handling

	NOTE Refer to the cabinet drawings furnished with the unit for size and weight information. Typical weight and dimensions are shown in Table 1-1, Figure 1-1, Figure 1-2 and Figure 2-4**.** **PICK UP HMPC FROM REAR SIDE ONLY**

1. Set the assembly in a level area. The HMPC equipment is packaged for forklift movement and the equipment must be protected from impact at all times. Once the equipment is in the installation location and ready to be installed, the exterior packaging material can be removed.

2. Remove HMPC from Pallet as follows:

TO REMOVE THE HMPC FROM THE PALLET:

- Remove the packaging material.
- Using a wrench, remove the two (2) metal angle brackets at the base of the HMPC.
- Using a wrench, remove both front and back kick plates with a wrench (refer to Figure 2-1).
- Using a forklift, carefully lift the HMPC from rear side only off the pallet and place it on the floor. A sling is recommended to ensure the unit does not tip or fall from forklift. The unit will now be resting on its castors and can be rolled in to its final position.

	CAUTION ONCE THE HMPC IS REMOVED FROM THE PALLET AND PLACED ON THE FLOOR, IT IS NOW RESTING ON ITS CASTORS AND MAY HAVE A TENDENCY TO ROLL. PROPER CARE MUST BE TAKEN TO SECURE THE HMPC AND ENSURE PERSONNEL SAFETY.

	CAUTION WITH THE LEVELING FEET UP AND THE UNIT SUPPORTED BY CASTERS ONLY, DO NOT STAND ON, OR IN, THE UNIT. THE MAIN UNIT MAY HAVE A TENDENCY TO TIP WHICH MAY RESULT IN SERIOUS INJURY. THE HMPC MUST BE RESTING ON ITS LEVELING FEET PRIOR TO WORKING ON, OR IN, THE UNIT.

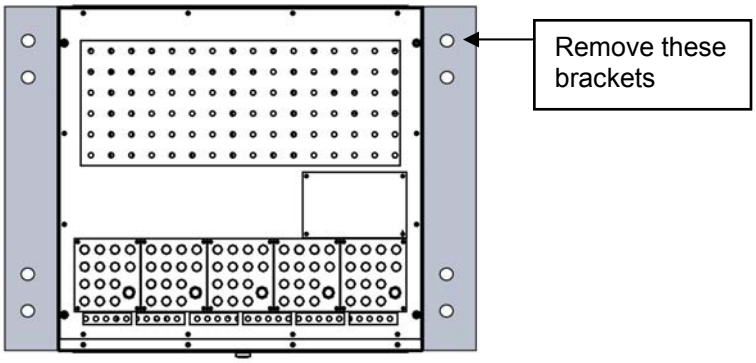


Figure 2-1 Removing HMPC from the pallet (Top View shown)

3. Roll unit to location of installation. If possible, roll the HMPC over a couple sheets of ¾" thick plywood on the computer room raised floor to evenly distribute the weight and protect the raised floor. Use care when positioning the unit over the floor cutout to avoid castors falling through the cutouts in the raised floor.

4. Position the HMPC over the cutouts in the floor as detailed in Figure 2-5. Once on the floor and in position, REPLACE the kick plates at the bottom front and rear of the HMPC.

5. TOP BOX REMOVAL (optional if equipped): If the height of the HMPC exceeds the height of the doorway, the top box can be easily detached by removing the four (4) silver (¼-20 x 6") bolts located in the four corner positions of the top box. Once removed, the PDU's height will be seventy-six inches (76") [193 cm]. After the PDU is in place and cleared of all doorways, reattach the top box using the same four bolts. Refer to Figure 2-2.

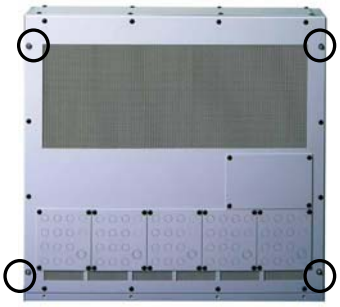


Figure 2-2 Top Box Removal (Top View shown)

6. Thirty-six inches (36”) (91 cm) of front access space is recommended for the HMPC. In addition, a MINIMUM of eighteen inches (18”) (46 cm) must be provided ABOVE the unit for ventilation. Check local codes and regulations for recommended clearances.
7. Floor loading should be considered to ensure that the HMPC does not exceed your raised floor load specifications. Refer to Table 1-1 weights and Figure 1-1 and Figure 1-2 for dimensional data.
8. BOTTOM CLEARANCE is required for exit of cables/conduit and/or for cooling airflow. This clearance is automatically provided by a raised floor (6 inches / 150mm minimum height). If the raised floor is not adequate to support the unit, optional floor pedestals may be used (consult factory for more information).
9. Located under each corner of the HMPC base is a leveling foot (Figure 2-3 and 2-7). Each leveling foot should be lowered to make firm contact with the floor. This procedure will help to keep the system stable and in place. Refer to Figure 2-4 for overall outer dimension of the HMPC.

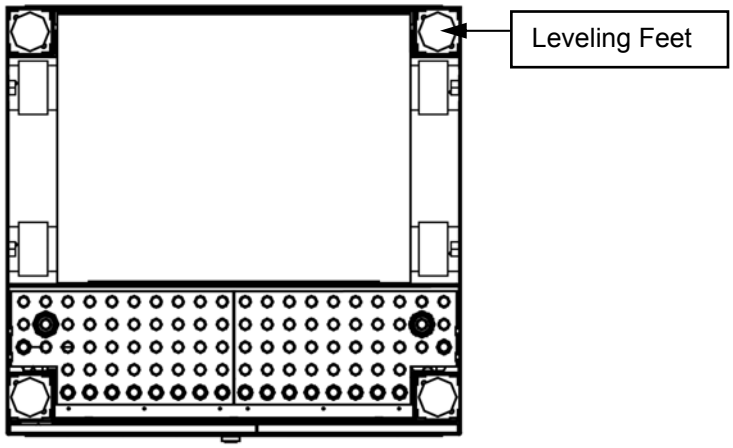


Figure 2-3 HMPC Bottom View showing leveling feet

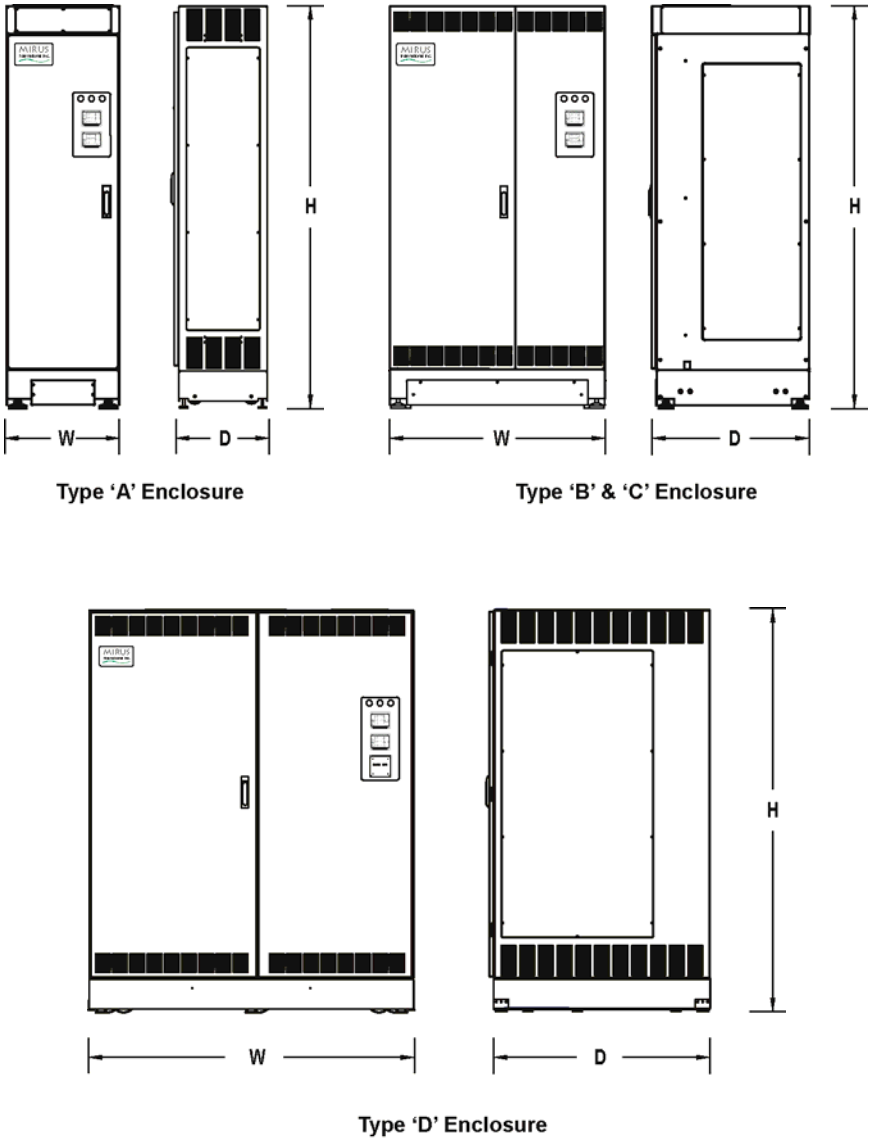


Figure 2-4 HMPC Dimensions

TYPE	42/84 Poles (W x D)	TYPE	126/168 Poles (W x D)	TYPE	252 Poles (W x D)	Height (H)
A	24 [610] x 24 [610]					75 [1905]
B	36 [914] x 32 [813]	B1	56 [1422] x 32 [813]	B1-1	76 [1930] x 32 [813]	78 [1981]
C	41 [1041] x 36 [914]	C1	61 [1549] x 36 [914]	C1-1	81 [2057] x 36 [914]	78 [1981]
D	66 [1676] x 45 [1143]	D1	86 [2184] x 45 [1143]	D1-1	106 [2692] x 45 [1143]	82 [2083]

1. Enclosure Dimensions are in (inches [mm]).
2. Standard configuration uses Sidecar Type-1 with front access.

2.3 Storage

Although well packaged, this equipment is not suitable for storage outdoors. The equipment warranty will not be applicable if there is evidence of outdoor storage. If the equipment is to be stored indoors for any period of time, it should be stored with its protective packaging material in place. Protect the equipment at all times from excessive moisture, construction dirt, corrosive conditions and other contaminants. It is strongly suggested that the packaged protected equipment be stored in a climate-controlled environment of 0° to 40°C with a relative humidity of 0% to 95% (non-condensing). Do not, under any circumstances, stack other equipment on top of a HMPC equipment enclosure, whether packaged or not.

2.4 Prerequisite to Installation

Installation drawings are provided with each HMPC. This section provides more information for a successful and efficient installation of the HMPC. Installation of equipment must be handled by skilled technicians and electricians familiar with the requirements of high energy electrical equipment. The installation must comply with the requirements of the National Electrical Code (NEC, ANSI/NFPA 70, latest issue) and with local codes and requirements as applicable. We strongly recommend contracting MIRUS Customer Support Services for start-up. Do not allow unqualified personnel to handle or operate the equipment.

Environmental considerations

The HMPC is intended for use in an environment where control of temperature and humidity is provided.

The HMPC generates heat and exhaust air through the top ventilation louvers of the enclosure. The facility air conditioning system can maintain this room temperature within specs. Heat loss data is given in section 1-5.

Mechanical considerations

Cable landing

HMPC dimensions are shown in Figure 2-4. The HMPC can be mounted on a raised or solid floor. Conduit landings are provided for bottom cable entry (top cable entry is also available). A floor stand option is offered for solid floor installations if bottom cable entry is not possible.

J Box

When the junction box (J-Box) option is ordered, it is normally shipped in advance of the HMPC, and may be installed prior to the arrival of the HMPC.

Floor

For installations on a raised floor, a floor tile cut-out is required for passage of air and cables. The floor tile cut-out is shown in Figure 2-5. Floor loading must be considered when installing on a raised floor or on an upper story of a multiple-story building. Floor loading data is provided on the installation drawings supplied with your equipment. Consult a structural engineer while planning your HMPC installation. Place the HMPC so the leveling jacks are as close as possible to the corners of the tiles.

Noise

Consideration should be given to the specific location of the HMPC cabinet to minimize the potential for sound transmission to surrounding structures and sound reflection. It is suggested that the following installation methods be included.

1. Provide a solid foundation for mounting the HMPC.
2. Provide flexible conduit to make the connections to the HMPC.
3. Locate the HMPC as far as practically possible from areas where high sound levels are undesirable.

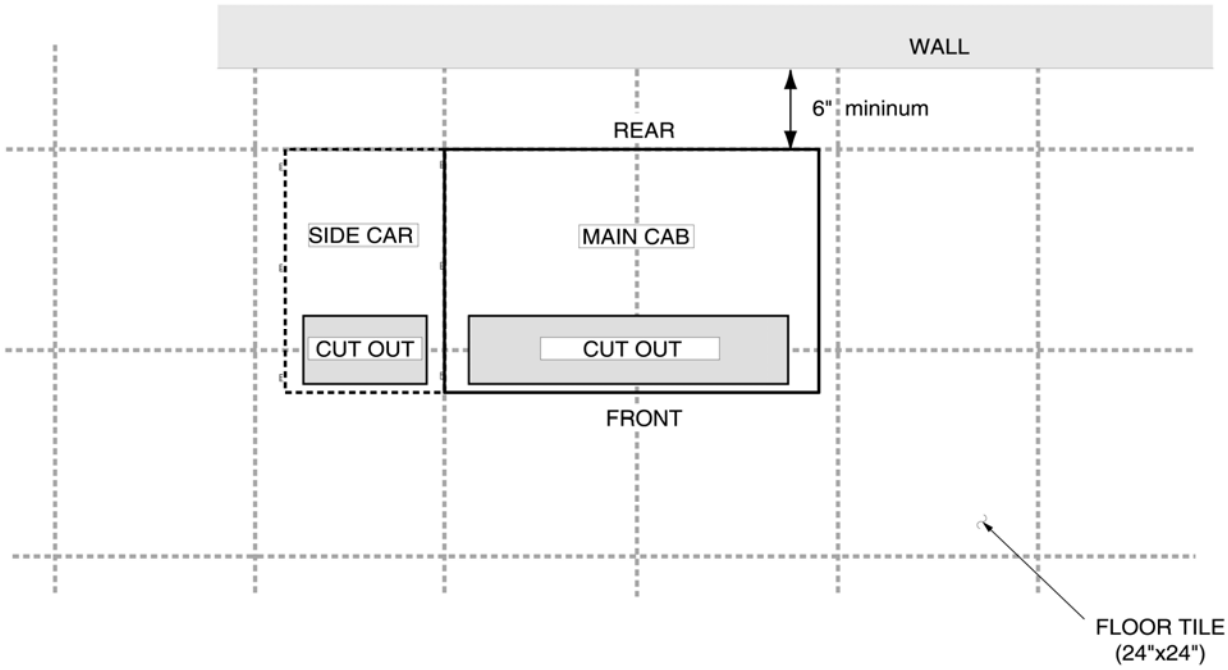


Figure 2-5 Placement, Showing Floor Tile Cut-Outs

	NOTE The placement diagram describes the general requirements for the HMPC installation. Specific requirements are described in the installation drawings shipped with your configuration.

Access

The HMPC requires a minimum of 36 inches (91 cm) front clearance for normal maintenance. A minimum of 18 inches (46 cm) clearance is required above the unit for ventilation.

Cooling

The HMPC is convection cooled. Cooling air is drawn through the bottom section of the enclosure and exhausted through the top. The HMPC does not use forced air or air filters. Care should be taken to ensure that the air intake and exhaust areas are not obstructed for air flow.

Electrical considerations

Grounding

An insulated grounding conductor; sized as required by the National Electrical Code (NEC) or local electrical code, must be installed as a part of the input branch circuit supplying the HMPC.

Per the National Electrical Code, article 250, the grounding conductor is to have green insulation, with or without yellow stripes and be grounded to the utility service safety grounding point (or other acceptable building ground, such as the building frame in the case of a steel frame structure), at the service equipment entrance.

All attached plug receptacles in the vicinity of the HMPC must be grounded in the same way. The conductors for those receptacle grounds are grounded to the safety ground (or other acceptable building ground, such as the building frame in the case of a steel frame structure), at the service equipment entrance.

Wiring for power and control cables is routed through the bottom of the enclosure (with an option for the top). This is shown in detail on the installation drawing for your configuration.

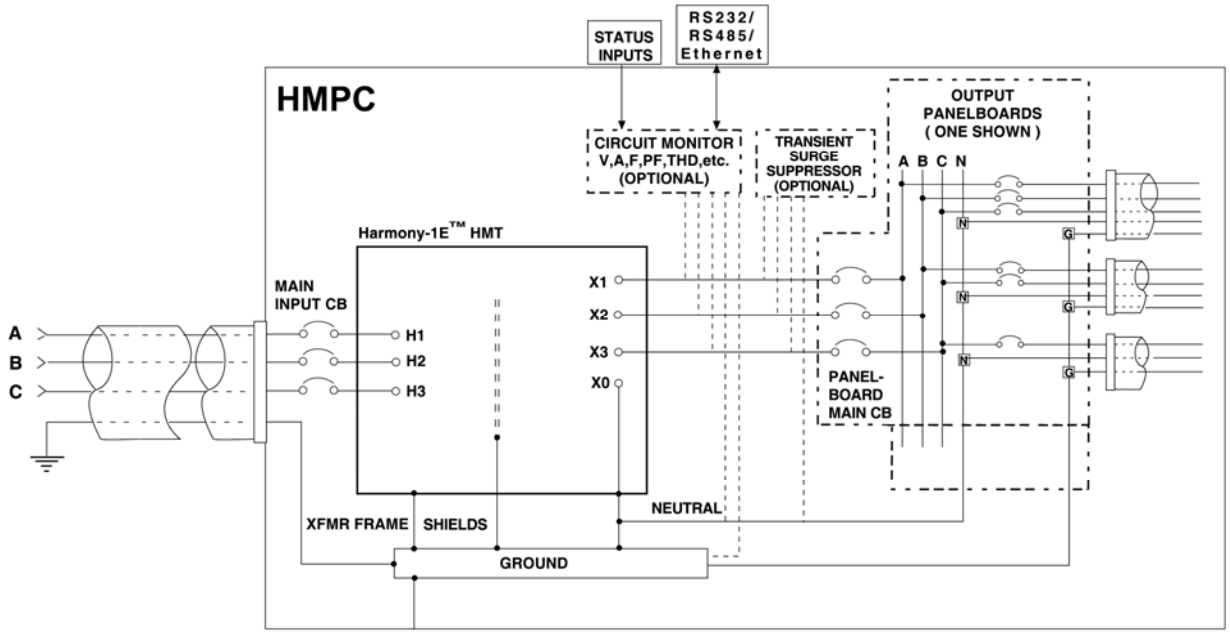


Figure 2-6 Grounding Within the HMPC Electrical Path

2.5 Installation Procedures

Installation procedures describe the general requirements for the HMPC installation. Specific requirements are described in the installation drawings shipped with your configuration.

The steps to be followed are:

- Placement
- Output circuit breaker installation
- Connection of input power, output power, and control cables
- Start-up of the system

Installation of the HMPC equipment must be handled by skilled technicians and electricians familiar with the special requirements of high-energy electrical equipment. The installation must comply with the requirements of the National Electrical Code (NEC, ANSI/NFPA 70, latest issue) and with local codes and requirements as applicable. We strongly recommend contracting MIRUS for start-up of the HMPC. Do not allow unqualified personnel to handle or operate the equipment.

2.5.1 Placement

Using the mechanical prerequisite information, determine the final location for the HMPC and any applicable options, and move them into place. Lower the leveling jacks (see Figure 2-7) on all four corners of the enclosure, to ensure proper stability. The load must be on the leveling jacks instead of the casters.

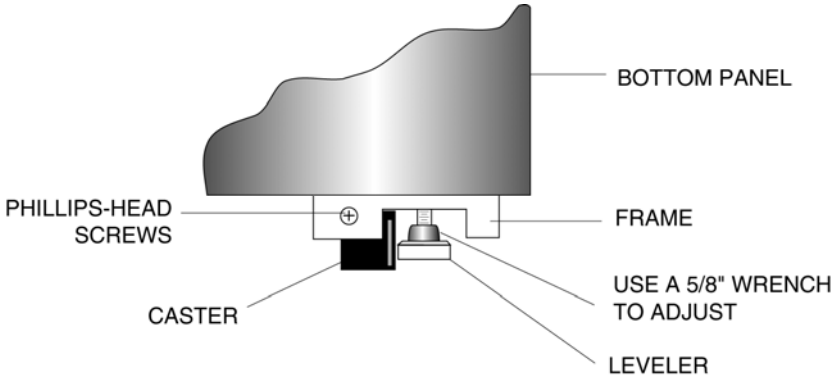


Figure 2-7 Leveling Jacks

2.5.2 Connections

WARNING

ONLY QUALIFIED PERSONNEL SHOULD PERFORM EQUIPMENT INSTALLATION AND START-UP. LETHAL VOLTAGES ARE PRESENT DURING START-UP PROCEDURES.

THE INSTALLATION OF THE HMPC MUST COMPLY WITH THE REQUIREMENTS OF ANSI/NFPA 75 AND NEC ART. 645 WHEN INSTALLED WITHIN A COMPUTER ROOM.

CONFIRM THAT ALL INCOMING LINE VOLTAGE, PRIMARY AND SECONDARY CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE ATTEMPTING ANY MAINTENANCE.

CONTROL CIRCUIT IS LIVE WHEN HMPC MAIN CIRCUIT BREAKER IS OFF. TO DE-ENERGIZE CONTROL CIRCUIT, DE-ENERGIZE CIRCUIT FEEDING THE PRIMARY SIDE OF THE HMPC.

CAUTION

ALL WIRING MUST CONFORM TO NATIONAL AND LOCAL CODES. SUFFICIENT ROOM MUST BE PROVIDED FOR ROUTING ALL POWER CABLES. ALL SIGNAL CABLES MUST BE ROUTED SEPARATELY FROM POWER CABLES.

1. Since all electrical and mechanical connections are accessible from the front of the unit, JUNCTION BOXES ARE NOT REQUIRED with Mirus HMPC's.

2. A DEDICATED FEEDER should provide the 3-phase input power to the unit.

3. Refer to Table 3 for typical conductor size data. ALL CONNECTIONS MUST COMPLY WITH NEC and other applicable codes. For proper torque values of all cable connections, refer to Tables A3 and A4.

4. The HMPCs main input feeder should consist of 3-phase conductors and one ground conductor (3W+G).

5. Conductors are coded as follows:

CONDUCTOR	CODED
Phase A	A
Phase B	B
Phase C	C
Ground	GREEN or Ground Symbol
Neutral	WHITE or N

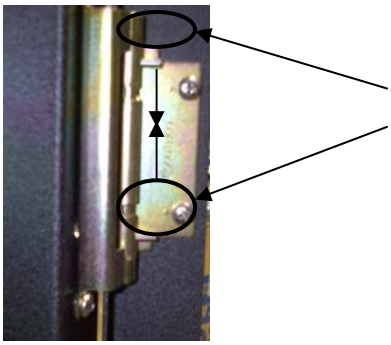
6. A handle mechanism interlocks the two main front doors of the cabinet. To open the door, pull out the bottom portion of the mechanism and turn in either direction.

7. A **KEY** will be tie wrapped to the structure inside the cabinet (both HMPC and Sidecar). After the HMPC has been installed, the cabinet can be locked to prevent unauthorized entry.

8. Located behind the main doors; the panelboard, main breaker and/or subfeed breaker trims can be removed to access internal components. To remove the trim, push and turn the ¼-turn fastener so that the arrow on its head points upward. Swing trim open. Squeeze the two levers on the hinge toward each other, turn inward and lock in place. Pull the trim toward you. To replace the trim, place movable hinge into stationary hinge, squeeze the levers, turn outward and release. Hinge pins should spring into position. Refer to Figure 2-8.

NOTE

Prior to removing the trims from the main assembly, DISCONNECT the GROUND STRAPS connected to the trim. Once the ground straps are disconnected, the trims can be removed from their hinges and placed in a safe area, away from the unit to prevent injury or damage to the HMPC or personnel. THE **TRIMS MUST BE REPLACED AND GROUND STRAPS RECONNECTED** PRIOR TO PLACING THE PDU IN SERVICE.



To REMOVE Trim:
Squeeze the upper and lower levers together, turn inward, release and lock in place. Pull trim toward you.

To REPLACE Trim:
Fit movable hinge into stationary hinge. Squeeze upper and lower levers together, turn outward and release levers. Hinge pins should spring back into place.

Figure 2-8 Hinge Removal for Trims

9. The HMPC's main doors can be removed by opening the door, removing the hinge pin and lifting the door from the hinge. Once the doors have been removed, ensure that the hinge pins are stored in a safe location for later use.

   THE DOORS MUST BE REPLACED PRIOR TO PLACING THE HMPC IN SERVICE.

10. All output computer power cable LOADS SHOULD BE REASONABLY BALANCED and terminated onto the 42-pole circuit breaker panelboards.

11. KNOCKOUTS are provided on the TOP and BOTTOM of the HMPC for cable connection. On the roof of the HMPC there are six (6) removable plates, held in place with 10-32 x ¾" captive screws. On each of the front five plates, there is one ¾" knockout available located in the bottom right hand corner. All other knockouts are ½" . There is also one removable blank plate, 6 in. x 10 in.**,** for top entry of the main power cables for the incoming circuit breaker(s). Power cables MUST NOT run in the vicinity of any control wiring. **Leave a minimum of 1" clearance between power cable and control wires.**

12. Inside the bottom of the HMPC there are two plates for cable connection. The plates supplied will contain knockouts for distribution and/or subfeed breakers. Two (2) 3" knockouts are available for the incoming main power cables. If subfeed breakers are required, a plate consisting of seven (7) 2.5" knockouts will be provided.

13. To avoid congestion and facilitate the addition of future loads, best practice would dictate that the knockouts toward the back of the cabinet be utilized first.

14. Refer to Figure 1-3 for location and connection of the incoming power and other electrical terminations.

2.5.3 Sidecar

Single Sidecar

The main HMPC PDU can house a maximum of two (2) 42-circuit panelboards. When additional panelboards are required, a Sidecar is attached to the main HMPC that can accommodate an additional two (2) 42-circuit panelboards. The first Sidecar will be shipped mounted and attached to the main unit. All remaining Sidecars will be shipped separately, unless otherwise specified.

A maximum of (2) Sidecars can be daisy-chained on either side of the HMPC via cable connection.

Sidecars are 20" W x 32"D x 78"H and can be mounted on the left or right hand side of the main unit, with the right hand side preferred. Once the Sidecar has been secured to the main structure, the unit becomes 100% FRONT ACCESSIBLE and there is no need to gain entrance via the side of the unit.

2.5.4 Sidecar Electrical Connection

The following procedure is applicable for connecting Sidecar's to HMPC's.

1. If shipped assembled to the main unit, the Sidecar will be electrically connected to the main unit.

2. If shipped separately, inside the Sidecar a length of cable will be attached to the existing bus bars (3-phase & neutral) in the back of the unit along with mounting hardware necessary for electrically connecting the Sidecar to the HMPC or adjacent Sidecar.

	**WARNING** **TURN OFF AND LOCK OUT POWER SUPPLYNG THE HMPC PRIOR TO CONNECTING SIDECAR TO THE MAIN UNIT. FAILURE TO DO SO CAN RESULT IN INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT. IN ADDITION, ENSURE THAT THE MAIN BREAKER IN THE PDU IS IN THE 'OFF' OR DE-ENERGIZED STATE.**

3. Decide which side of the HMPC will be adjacent to the Sidecar and prepare the floor cutout as per Figure 2-5. With a screwdriver, remove the panel on the HMPC adjacent to the Sidecar. **STORE** for later use. **DO NOT THROW AWAY**.

	**NOTE** **DO NOT DISPOSE OF THE REMOVABLE PANEL**. *After* the Sidecar has been mechanically and electrically connected to the main unit, the removable panel **MUST** be mounted on the Sidecar's exposed side. Once installed, there will not be any further need to access the Sidecar via this panel.

4. Position the Sidecar up against the main HMPC cabinet. CARE MUST BE TAKEN TO AVOID CASTERS FALLING THROUGH THE FLOOR CUTOUT.

5. Align and connect Sidecar to HMPC.

6. Through the exposed openings of the Sidecar, connect the HMPC and Sidecar's with provided cable. Torque the bolts as per Tables A3 and A4.

7. On the side of the HMPC, there are (8) 5/16 x 18 weld nuts, (4) each on the front and back vertical edge. Align the holes located in the Sidecar cabinet with these weld nuts. Using a wrench, thread the factory supplied hardware (5/16 x ¾" bolts) from the Sidecar into the HMPC. Ensure that the unit is rigid when attached to the main unit. Level the units by adjusting the leveling feet.

8. Connect the ground bus from the Sidecar to the main HMPC with the cable provided. Torque bolts as per Tables A3 and A4.

9. Once all the mechanical and electrical connections are made and verified, MOUNT the panel on the exposed face of the Sidecar.

2.5.5 Finishing the Installation

Make sure that all covers and doors are installed and closed for proper operation. Also make sure that all air intake and outlet areas are not obstructed, allowing proper air flow for equipment cooling and ventilation.

2.6 Startup Procedures

This section presents the procedures to be used for initial start-up of the HMPC, and the sequence to be followed any time that the system is restarted after having been shut completely down with no power applied to the system.

2.6.1 Checks Before Startup

Before starting the HMPC, read this HMPC Owner's Manual thoroughly. Be certain that you fully understand the operation of the indicators, controls, and operational sequences.
Before starting the HMPC, make sure of the following:

- Upstream power circuit breaker is open.
- Power cables have been properly connected to the input circuit breaker, or the power J-Box if installed.
- Voltage connected to the HMPC matches the HMPC nameplate and model number.
- Equipment has been properly grounded.
- All power and control connections are properly made and are tight.
- Intake and exhaust ventilation areas have no obstructions that might impair proper air flow.

2.6.2 Initial Startup

After verifying the information presented in Section 2.6.1:

- Close the upstream circuit breaker.
- Close the main circuit breaker CB1 and verify circuit monitor has the proper presentation
- Close the main panelboard circuit breaker.
- Close individual output circuit breakers as required.

2.6.3 Checks After Startup

Normal operation of the HMPC should be verified immediately after the initial start-up has been performed.

2.6.4 Electrical Checkout Instructions

	**WARNING** **ALWAYS BE SURE THAT ALL INOMING LINE VOLTAGE, PRIMARY AND SECONDARY CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE ATTEMPTING ANY MAINTENANCE.**

☐ 1. Confirm that the proper clearances and ventilation are as per Figure 2 and Figure 7. There should be a minimum of 18" clearance ABOVE the PDU. Refer to local codes and regulations for clearances in front of the PDU.

☐ 2. Remove front doors and interior trims as required. Please note that the panel on the side of the cabinet facilitates connection of the Sidecar to the PDU and should NOT have to be removed when installing the stand-alone PDU. All ground straps must be disconnected from the trims prior to removing them off the enclosure.

☐ 3. Confirm that all main, secondary and branch circuit breakers are in the 'OFF' position.

☐ 4. Inspect all wire and conductor insulation for damage.

☐ 5. Check all transformer and breaker connections for tightness and retorque if necessary as per Table 4.

☐ 6. Check all terminal block connections for tightness and retorque if necessary as per Table 4.

☐ 7. Verify that all cables meet or exceed conductor sizes as detailed in Table 3.

☐ 8. Remove any foreign objects from the interior of the unit. Intake and exhaust air screens must be clean and free of obstruction.

☐ 9. NOTE: AIR PASSAGES ABOVE, BELOW, IN FRONT AND BEHIND THE POWER TRANSFORMER MUST BE CLEAR AND FREE FROM DEBRIS.

☐ 10. Ensure that the cutouts in the floor are as per Figure 2 and Figure 7.

☐ 11. Verify input connections to the main input breaker, as well as, the equipment grounding and grounding electrode conductors.

☐ 12. Turn ON the building input power to the PDU.

☐ 13. Check the phase rotation at the main input breaker. Phase rotation should be A,B,C, left-to-right.

☐ 14. Verify and record the INPUT voltages on the main circuit breaker

Volts _____Phase A-B: **Volts _____Phase A-N:**

Volts _____Phase B-C: **Volts _____Phase B-N:**

Volts _____Phase C-A: **Volts _____Phase C-N:**

☐ 15. If the input voltage is incorrect, verify input voltage, check for wiring errors or improper transformer tap.

☐ 16. Turn on the PDU's main incoming circuit breaker. If the breaker trips within one (1) minute, contact Mirus International Inc. Customer Support Services or a factory representative for assistance.

☐ 17. Check the phase rotation at the line side of the terminals of the panelboard main breaker(s) and any subfeed circuit breakers. The rotation should be A,B,C, top-to-bottom (note that the main panelboard and subfeed breakers have been rotated 90 degrees, counter-clockwise)

☐ 18. Check ALARM INPUTS by placing a jumper between terminals P4-1 and P4-2, P4-1 and P4-3, P4-1 and P4-4 in the control section located above the main circuit breaker (refer to Figure 8). The horn will sound, pilot light will illuminate and summary alarms (P1-1 thru P1-9) will energize (refer to Figure 9). Remove jumper and reset by pushing the Silence pushbutton. To test the alarm shutdown circuitry, set DIPSwitches 1 thru 4 to the ON position and retest. NOTE: the main circuit breaker will need to be reset after each test. Reset DIPSwitches according to your application on site.

☐ 19. Check transformer 170^0C alarm by placing jumper between P4-11 and P4-14. Reset as per paragraph above.

☐ 20. Verify EPO circuit by placing a jumper between terminals P4-11 and P4-12 in the control section. This will energize the shunt trip, thus tripping the main circuit breaker. The horn will sound, pilot light will illuminate and summary alarm relays will energize. Remove jumper and reset by pushing the Silence pushbutton. Reset circuit breaker and REPEAT for each Remote EPO within the system (terminals P4-8, P4-9 and P4-10). DIPSwitches 5 thru 7 must be set accordingly as per Figure 8.

PLEASE NOTE THAT THE CONTROL CIRCUIT WILL BE ENERGIZED WHEN THE MAIN BREAKER IS IN THE TRIPPED OR OFF POSITION.

☐ 21. Verify 200^0C transformer test by jumpering P4-11 and P4-13. Follow same reset procedure as that for the EPO above.

☐ 22. Check the Manual Restart feature by setting DIPSwitch 8 to the ON position. De-energize the control circuitry by removing Fuse FU3. Upon detecting a power failure, the shunt trip will energize and trip the main circuit breaker. Replace the fuse and reset the circuit breaker. Place the DIPSwitch in the position according to customer requirements. Refer to Figure 8.

3 Maintenance

3.0 Scope

This section describes maintenance of the HMPC, including preventive maintenance, troubleshooting, and information about replacement parts.

3.1 Preventive Maintenance

The following preventive maintenance routines should be considered the minimum requirements; your installation and site may require additional preventive maintenance to assure optimal performance from HMPC and associated equipment. These routines should be performed twice a year.

The technician or electrician performing preventive maintenance on the HMPC must read this manual thoroughly and be familiar with the indicators, controls, and operation of the equipment.

	**IMPORTANT** Isolate and de-energize the equipment for all maintenance operations.

a. Ensure that the equipment is clean and free of loose dust, dirt, and debris. The exterior of the enclosures can be cleaned with a mild solution of soap and water, lightly applied with a lint-free cloth.
b. Inspect the air intake and exhaust plates and clean as required. Verify that air flows freely through the equipment. Clean the air intake and exhaust plates, and the enclosure interior, with a vacuum cleaner.

	**IMPORTANT** Operation of the remote circuit breakers will cause power to be removed if it is present and will cause power to be applied if it is not. Make sure that all loads are prepared to have power removed (all critical circuits have been shut down), or circuits are safe for power application (no maintenance procedures are being conducted and downstream circuit breakers are open and tagged) before remote operation of the circuit breakers.

c. Remotely operate all circuit breakers to verify that circuit breakers function properly.
d. Verify that all system monitoring functions operate properly.

3.2 Troubleshooting

The following is a list of the most frequent problems, their most likely cause, and the possible solutions in the form of actions to be taken. In the event that the suggested solution does not solve the problem, call MIRUS International Inc. Customer Support Services for assistance.

A. HMPC has no input power

Cause #1: No building power to the HMPC
Action: Restore building power
Have a qualified technician check the wiring continuity between the DPS input (J-Box option) and the building input power panel. Refer to section II for connections.
Cause #2: The HMPC is not properly connected to the optional J-Box.
Action: Have a qualified technician check the wiring continuity between the input (J-Box option) and the building input power panel. Refer to section II for connections.

B. Specific output circuit(s) have no power

Cause #1: Associated output circuit breaker(s) are OFF.
Action: Reset the circuit breaker(s).
Cause #2: The wiring between the circuit breaker(s) and the equipment(s) is faulty.
Action: Have a qualified technician check for wiring continuity and correct phase sequence between the circuit breaker(s) and the equipment(s).
Cause #3: The equipment associated with the circuit breaker is operating above the rated load.
Action: Schedule a load check of the equipment with a qualified technician; adjust for load balance if possible.
Cause #4: Defective circuit breaker.
Action: Replace defective circuit breaker.

C. No output from the HMPC, but the monitor is active.

Cause #1: Main input circuit breaker CB1 is off.
Action #1: Record which alarm indications are active.
Action #2: Reset alarm(s) and clear external signal.
Action #3: Check the alarm history display for reason the main input circuit breaker tripped:

a. Manual trip ... due to an emergency power off (EPO) button being pushed.
b. An "alarm shut-down" has occurred; determine the cause and take corrective action before resetting the main input circuit breaker CB1.
c. Automatic trip ... an external signal was received from the building wiring via the alarm interface instructing the HMPC to shunt-trip.
d. Output overload ... schedule a load check of the HMPC by a qualified technician.
e. Defective circuit breaker ... replace the circuit breaker.
f. Short circuit internal to the HMPC ... Troubleshoot the HMPC or call MIRUS International Inc. Customer Support Services.

Cause #2: Output power fuse(s) blown
Action: Replace fuse(s)

D. Output from the HMPC, but the monitor is not active.

Cause: Control power fuse(s) blown.
Action: Replace fuse(s)

E. Over/under voltage.

Cause #1: Upstream UPS or power conditioner is defective.
Action: Correct problem at the power source.

Cause #2: Voltage drop due to distance or excessive load on mains.
Action: Disconnect power and adjust transformer taps (see Figure 3-1); refer to the tap adjustment table on the transformer's nameplate.

	**IMPORTANT** Before changing transformer taps, verify that the over/under voltage condition is constant. Changing transformer taps will increase or decrease the ratio of input voltage to output voltage.

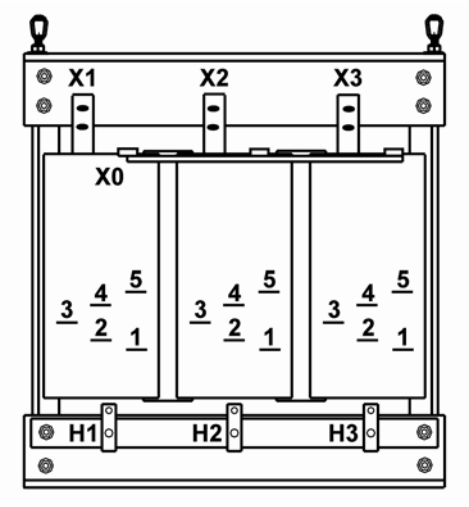


Figure 3-1 Transformer Taps, accessed from front of HMPC

3.3 Replacement parts

Two levels of replacement parts are available for the HMPC. These levels are designated A and B. The level that you should keep on hand for your installation will vary depending on the type of maintenance planned on site and the configuration of your HMPC. Having replacement parts on hand will prevent unacceptable delays due to time involved obtaining spare parts during critical periods, such as system start-up. Any items used during start-up will be replaced by MIRUS at no charge. Contact MIRUS International Inc. Customer Support Services for specific recommendations. A description of each level is provided below:

Level	Description
A.	This level of replacement parts is recommended when the user can tolerate short duration system down-time to obtain replacement parts in the event of a major system failure. This level of replacement parts consists of consumable items, specifically fuses.
B.	This level of replacement parts is recommended when the user can tolerate only a minimum of down-time in the event of a major system failure. This level of replacement parts consists of consumable items, specifically fuses, control transformer and a complete set of critical printed-circuit board assemblies (PCBs).

A Appendix

A.0 SPECIFICATIONS / DATA

		Width		Depth		Height		Weight	
	kVA	IN	CM	IN	CM	IN	CM	LB	KG
	50	24	61	24	61	75	191	1150	523
HMPC	75	36	91	32	81	78	198	1320	600
	100	36	91	32	81	78	198	1550	705
	125	36	91	32	81	78	198	1600	727
	150	36	91	32	81	78	198	1700	773
	200	36	91	32	81	78	198	2100	955
	225	36	91	32	81	78	198	2300	1045
	300	41	104	36	92	78	198	2700	1227
	400	66	168	45	114	82	208	3900	1769
	500	66	168	45	114	82	208	4600	2087
	625	66	168	45	114	82	208	5250	2381
	750	66	168	45	114	82	208	5600	2540

		Width		Depth		Height		Weight	
	kVA	IN	CM	IN	CM	IN	CM	LB	KG
	75	56	142	32	81	78	198	1840	836
HMPC	100	56	142	32	81	78	198	2070	941
with one (1)	125	56	142	32	81	78	198	2120	964
Side Car	150	56	142	32	81	78	198	2220	1009
Attachment	200	56	142	32	81	78	198	2620	1191
	225	56	142	32	81	78	198	2820	1282
	300	61	155	36	92	78	198	3220	1464
	400	86	218	45	114	82	208		
	500	86	218	45	114	82	208	*Consult*	*Factory*
	625	86	218	45	114	82	208		
	750	86	218	45	114	82	208		

		Width		Depth		Height		Weight	
	kVA	IN	CM	IN	CM	IN	CM	LB	KG
	200	76	193	32	81	78	198	3140	1427
	225	76	193	32	81	78	198	3340	1518
HMPC	300	85	216	36	92	78	198	3740	1700
with two (2)	400	106	269	45	114	82	208		
Side Car	500	106	269	45	114	82	208	*Consult*	*Factory*
Attachments	625	106	269	45	114	82	208		
	750	106	269	45	114	82	208		

Table A-1 Weight and Dimensional Data

A.1 SUGGESTED CONDUCTOR SIZING

Input Volts	KVA	Units with Harmony™ Transformers		
		Input FLA	Main Breaker	Suggested Wire Size (AWG)
208	50	139	175	2/0
	75	208	250	250 MCM
	100	278	350	500 MCM
	125	347	450	(2) 4/0
	150	416	600	(2) 350 MCM
480	50	60	80	4
	75	90	125	1
	100	120	150	1/0
	125	150	200	3/0
	150	180	225	4/0
	200	241	300	350 MCM
	225	271	350	500 MCM
	300	361	450	(2) 4/0
	400	481	600	(2) 350 MCM
	500	602	800	(2) 500 MCM
	625	752	1000	(3) 500 MCM
	750	902	1200	(3) 500 MCM
600	50	48	60	6
	75	72	100	3
	100	96	125	1
	125	120	150	1/0
	150	144	200	3/0
	200	192	250	250 MCM
	225	241	300	350MCM
	300	289	400	(2) 4/0
	400	385	500	(2) 250 MCM
	500	482	600	(2) 350 MCM
	625	601	800	(2) 500 MCM
	750	722	1000	(3) 350 MCM

Wire sizes based on NEC 1996 Table 310-16 using 75^0C copper conductors

Table A-2 Suggested Conductor Sizing

A.2 TORQUE SPECIFICATIONS

Wire Size AWG	No. of Wires	MAIN AND SUBFEED BREAKERS			
		TIGHTENING TORQUES FOR WIRE PRESSURE SCREW (Lb. In.)			
		Slotted Head Screw		Socket Head Screw	
		Over ¼" Slot Length	¼" and Less Slot Length	3/16" Socket	5/32" Socket
14 –10	1	35	20		
8	1	40	25		
6	1	45	35	120	100
4	1	45	35	120	100
3	1	50	35	120	100
2	1	50	40	120	100
1	1	50		120	100
1/0	1	50		120	100
2/0	1	50		120	100
3/0	1	50		120	100
4/0	1	50		120	100

* Please refer to additional instruction leaflets shipped with the equipment

Table A-3 Torque Specifications (Main Breakers)

Branch Breakers		
Wire Size AWG	**No. Of Wires**	**Torque (Lb. In.)**
14 – 10	1	20
8	1	25
6 – 4	1	27
3 – 1/0	1	45

* Please refer to additional instruction leaflets shipped with the equipment)

Table A-4 Torque Specifications (Branch Breakers)

G Glossary

Symbols

/	Used to represent "and/or."
%	Percent; of each hundred.
° F	Degrees Fahrenheit.
° C	Degrees Celsius.
@	At.
±	Plus or minus.
#	Number.
Ø	Phase.
ABC	Normal sequence of phases in three-phase power.
AC or ac	Alternating current.
Ambient air temperature	The temperature of the surrounding air.
AWG	American Wire Gauge, a standard unit for measuring wire cross-sectional area.
British Thermal Unit	A unit of heat equal to 252 calories (definition below).
BTU	British thermal unit. Defined as the amount of heat required to raise the temperature of one pound of water by 1° F.
Calorie	A unit of heat. One calorie is the amount of energy required to raise the temperature of one gram of water by one degree Celsius.
Carrier	The company or individual responsible for delivering goods from one area to another.
CB	Circuit breaker.
Conduit	A flexible or rigid tube surrounding electrical conductors.
Current rating	The maximum current that a piece of electrical equipment is designed to carry.
DC or dc	Direct current.

Earth ground	A ground circuit that has contact with the earth.
Electrician	Refers to an installation electrician qualified to install high-energy electrical components in accordance with national and local codes and regulations. Not necessarily qualified to maintain or repair electrical or electronic equipment; compare to Technician.
EPE	EPE Technologies, Inc. a subsidiary of Square D Company.
EPO	Emergency power off.
Fusible	Capable of being melted with heat.
GND	Electrical ground.
Hz	Hertz, a unit of measure for frequency; one cycle per second equal one Hertz.
Input branch circuit	The input circuit from the building's power panel circuit breaker to the equipment.
KVA	Kilovolt-Amperes; a measure of apparent power.
KVAr	Kilovolt-Amperes reactive.
KW	Kilovolt; a measure of real power.
LED	Light emitting diode.
MCM	Thousand circular mil; a unit of measure for wire sizes for multiple stranded over 4/0 AWG in diameter. M is from the Roman numeral system symbol for 1,000. Old unit of measure was kcmil.
MOV	Metal-oxide varistor.
NC	Normally closed.
NO	Normally open.
NEC	National electrical code, ANSI/NFPA 70.
NFPA	National Fire Protection Association.
NO	Normally-open.
OSHA	Occupational Safety and Health Act.
Packing list	The list of articles included with a given shipment.

PCA	Printed circuit assembly; refers to a printed wiring board (PWB) stuffed with electrical components.
P.F.	Power factor.
PWM	Power Management Module.
Remote Emergency Power Off	A switch used for emergency shutting down electrical equipment.
REPO	Remote emergency power off.
Shipping damage	Any damage done to an article while it is in transit.
Shipping pallet	A platform on which articles are fixed for shipping.
Technician	Refers to an electronic technician qualified to maintain and repair electronic equipment. Not necessarily qualified to install electrical wiring. Compare to Electrician.
TPS	Transient suppression plate.
TVSS	Transient voltage suppression system.
UL	Underwriter's Laboratories, Inc.
UPS	Uninterruptible power system.
Vac	Volts alternating current.
Vdc	Volts direct current.

Notes:

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