

## Description

The Harmony input/output (I/O) system incorporates a variety of input and output devices (blocks) to interface process signals to the Symphony™ Enterprise Management and Control System. Blocks for analog, digital, and control I/O interface along with remote I/O communication combine to create a complete I/O system (Fig. 1). Refer to the *Harmony Input/Output System* overview for a complete system description.

The Harmony I/O system offers a complete solution in a modular, easy-to-use package. In addition to the I/O devices, the Harmony solution provides many options for ready-to-use I/O communications, I/O mounting, field wiring management, power distribution, and cooling. High fidelity simulation is available.

## Input/Output Blocks

I/O blocks that can handle a wide selection of I/O signal types are currently available (Table 1), while additional selections are being developed. Refer to the *Analog Input/Output*, *Control Input/Output*, and *Digital Input/Output* data sheets for I/O block details and specifications.

## I/O Communication System Components

The Harmony I/O communications network (Hnet) is comprised of the following components:

- *Block mounting column* (MCL-???) - protects and distributes Hnet to I/O blocks and repeater mounting units through internal cables and connectors.
- *Intercabinet Hnet cables* - fiber optic cables connect Hnet between enclosures.



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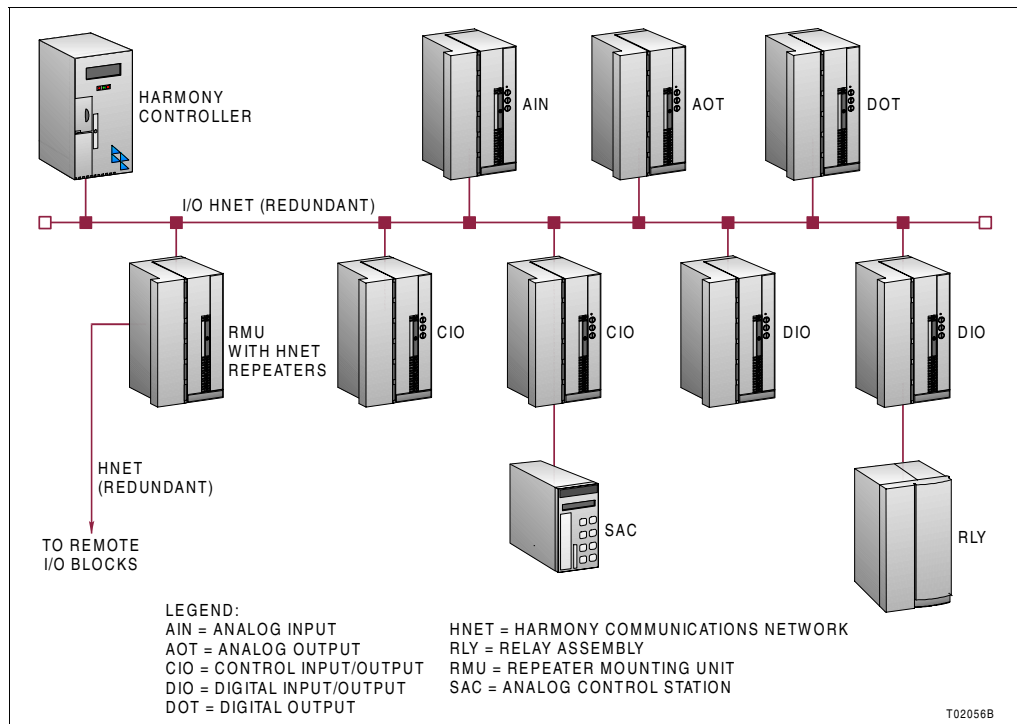


Figure 1. Harmony I/O System

Table 1. Harmony I/O Blocks

Block	Description
AIN-120	Current, high level voltage in
AIN-200	Isolated TC, high level voltage, low level voltage in
AIN-220	Isolated TC, high level voltage, low level voltage, current in
AIN-300	Isolated RTD in
AOT-150	Current out
BLK-100	Blank block
CIO-100	Control loop in/out
CIO-110	Electric drive/pulse positioner termination
DIO-400	Universal in, 24/48 VDC out
DOT-100	Onboard electromechanical relay out
DOT-120	Onboard monitored electromechanical relay out (with readback and fusing)
RLY-100	Electromechanical relay assembly
RLY-200	Solid state relay assembly

- **Intracabinet Hnet cables** (HRM-MCL) - connect Hnet within an enclosure. These cables connect Hnet between mounting columns.
- **Fiber optic Hnet repeater** (REP-RFO) - used to communicate with remote I/O. Repeaters are housed in repeater mounting units (RMU). Repeaters are required to connect Hnet between enclosures even if the distance between enclosures is short.
- **Hnet terminators** (MSC-TER) - provide proper Hnet segment termination. One terminator is used to terminate each end of intracabinet Hnet.

## I/O Communication System Specifications

Property		Characteristic/Value <sup>1</sup>																																				
Hnet (Fig. 2)	Communication rate	4 Mbaud																																				
	Devices	Up to 66																																				
	Intracabinet distance <sup>2</sup>	30 m (100 ft)																																				
	Intercabinet distance: 1 or 2 star segments 3 or more star segments	1,300 m (4,265 ft) for each segment (Fig. 3) 1,000 m (3,280 ft) for sum of two longest segments (Fig. 4)																																				
Fiber optic cable <sup>3</sup>	Fiber size	62.5/125 $\mu$ m																																				
	Fiber attenuation	-3.5 dB/km																																				
	Index	Graded																																				
	Wavelength	840 nm																																				
	Bandwidth	160 MHz/km																																				
	Connector type <sup>4</sup>	ST style with right angle strain relief, 40 mm (1.5 in.) bend radius																																				
	Transmission mode	Multimode																																				
Block mounting column	Internal Hnet cable length <sup>5</sup>	<table border="1"> <thead> <tr> <th rowspan="2">Block Height</th> <th colspan="2">Cable Length</th> </tr> <tr> <th>m</th> <th>ft</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.46</td> <td>1.50</td> </tr> <tr> <td>2</td> <td>0.84</td> <td>2.75</td> </tr> <tr> <td>3</td> <td>1.22</td> <td>4.00</td> </tr> <tr> <td>4</td> <td>1.60</td> <td>5.25</td> </tr> <tr> <td>5</td> <td>1.98</td> <td>6.50</td> </tr> <tr> <td>6</td> <td>2.36</td> <td>7.75</td> </tr> <tr> <td>7</td> <td>2.74</td> <td>9.00</td> </tr> </tbody> </table>			Block Height	Cable Length		m	ft	1	0.46	1.50	2	0.84	2.75	3	1.22	4.00	4	1.60	5.25	5	1.98	6.50	6	2.36	7.75	7	2.74	9.00								
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Repeater mounting unit	Nonredundant base capacity <sup>6</sup>	1 RMU module; 2 channel A repeaters; 2 channel B repeaters																																				
	Redundant base capacity <sup>6</sup>	1 RMU module; 1 blank module; 2 channel A repeaters; 2 channel B repeaters																																				
	Block logic power (per repeater): Voltage Current Power	21.6 VDC min; 25.5 VDC nom; 28 VDC max 105 mA typ; 115 mA max 2.68 W typ; 2.93 W max																																				
	Dimensions	<table border="1"> <thead> <tr> <th rowspan="2">Type</th> <th colspan="2">Height</th> <th colspan="2">Width</th> <th colspan="2">Depth</th> </tr> <tr> <th>mm</th> <th>in.</th> <th>mm</th> <th>in.</th> <th>mm</th> <th>in.</th> </tr> </thead> <tbody> <tr> <td>RMU module</td> <td>266</td> <td>10.5</td> <td>76</td> <td>3.0</td> <td>162</td> <td>6.4</td> </tr> <tr> <td>Nonredundant base</td> <td>267</td> <td>10.5</td> <td>138</td> <td>5.4</td> <td>169</td> <td>6.7</td> </tr> <tr> <td>Redundant base</td> <td>267</td> <td>10.5</td> <td>217</td> <td>8.5</td> <td>169</td> <td>6.7</td> </tr> </tbody> </table>			Type	Height		Width		Depth		mm	in.	mm	in.	mm	in.	RMU module	266	10.5	76	3.0	162	6.4	Nonredundant base	267	10.5	138	5.4	169	6.7	Redundant base	267	10.5	217	8.5	169	6.7
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### NOTES:

- All specification values are maximums unless stated otherwise.
- Intracabinet Hnet refers to Hnet within an enclosure not leaving the protection of the enclosure. This distance includes the length of the controller-to-column cable, all column-to-column cables, and the cables contained within the block mounting column.
- Typical cable example: AMP Zipcord P/N 502983-1 (riser) or P/N 502986-1 (plenum).
- Terminate the fiber optic cable with the appropriate ST connector according to the cable type (i.e., jacket material, bend radius, pull strengths, etc.). ST connectors can be plastic, steel, or ceramic ferrules. Typical connector example: AMP ST style, Epoxyless, P/N 504034-1 with right angle strain relief P/N 502667-6 (black).
- A redundant column contains two internal Hnet cables: one for the primary module slots and one for the backup module slots.
- Repeaters are **required** to connect Hnet between stand-alone enclosures even if the distance between enclosures is short. In the case of multibay enclosures, Hnet can extend to each bay without the use of repeaters as long as the 30 m (100 ft) limit is not exceeded.

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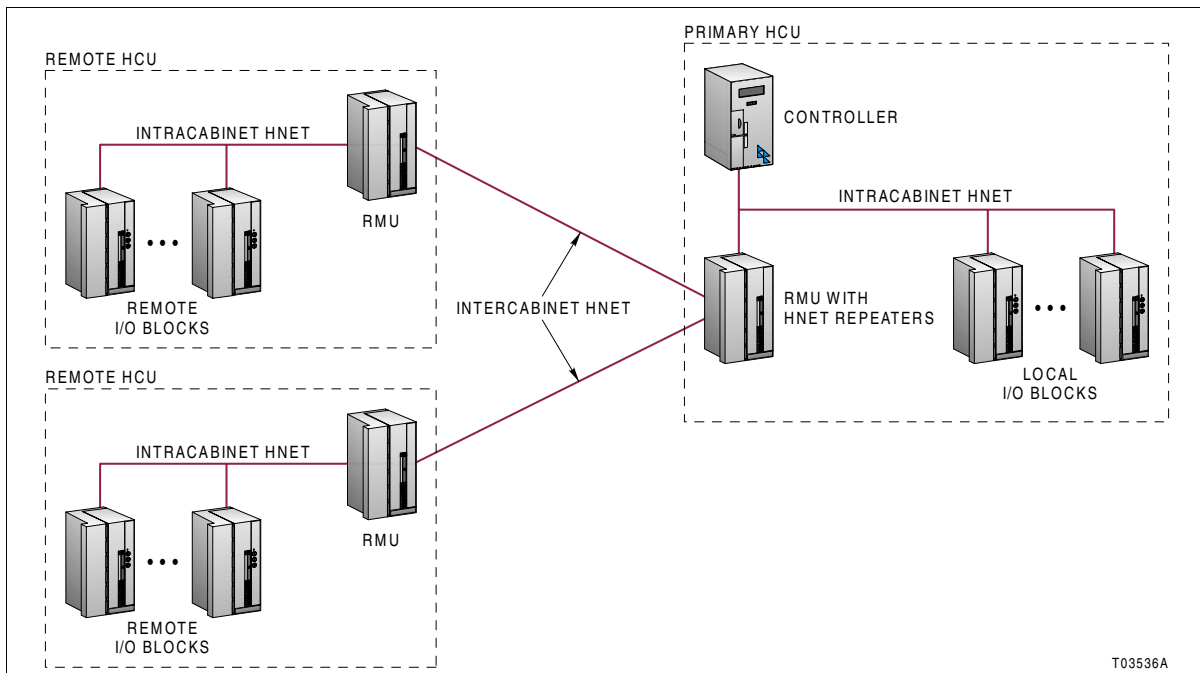


Figure 2. Hnet Communications

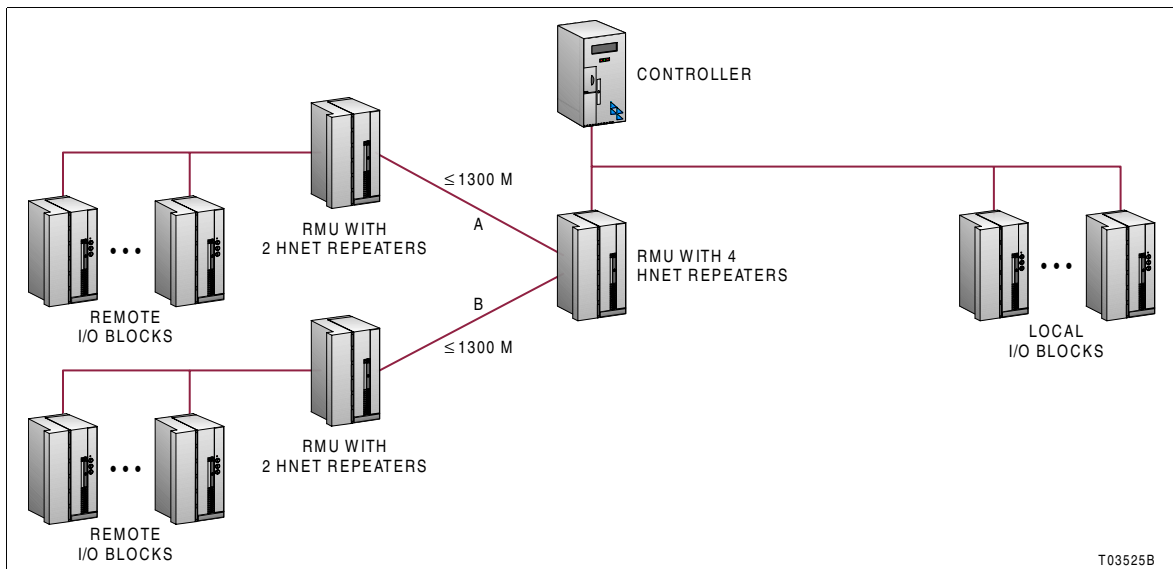


Figure 3. Hnet - Two Star Segments Example

## Block Mounting Hardware Accessories

- **Block mounting column** (MCL-???) - for attaching blocks: I/O, auxiliary, and repeater mounting units. Columns attach to the horizontal rails inside an enclosure. Blocks attach directly to the columns.
- **Blank block** (BLK-100) - fills an empty block position to maintain column air flow. A blank block is only required in the middle of a column where air flow would be disrupted with an empty column position. It is not required, however, in empty positions at the bottom of a column of blocks.

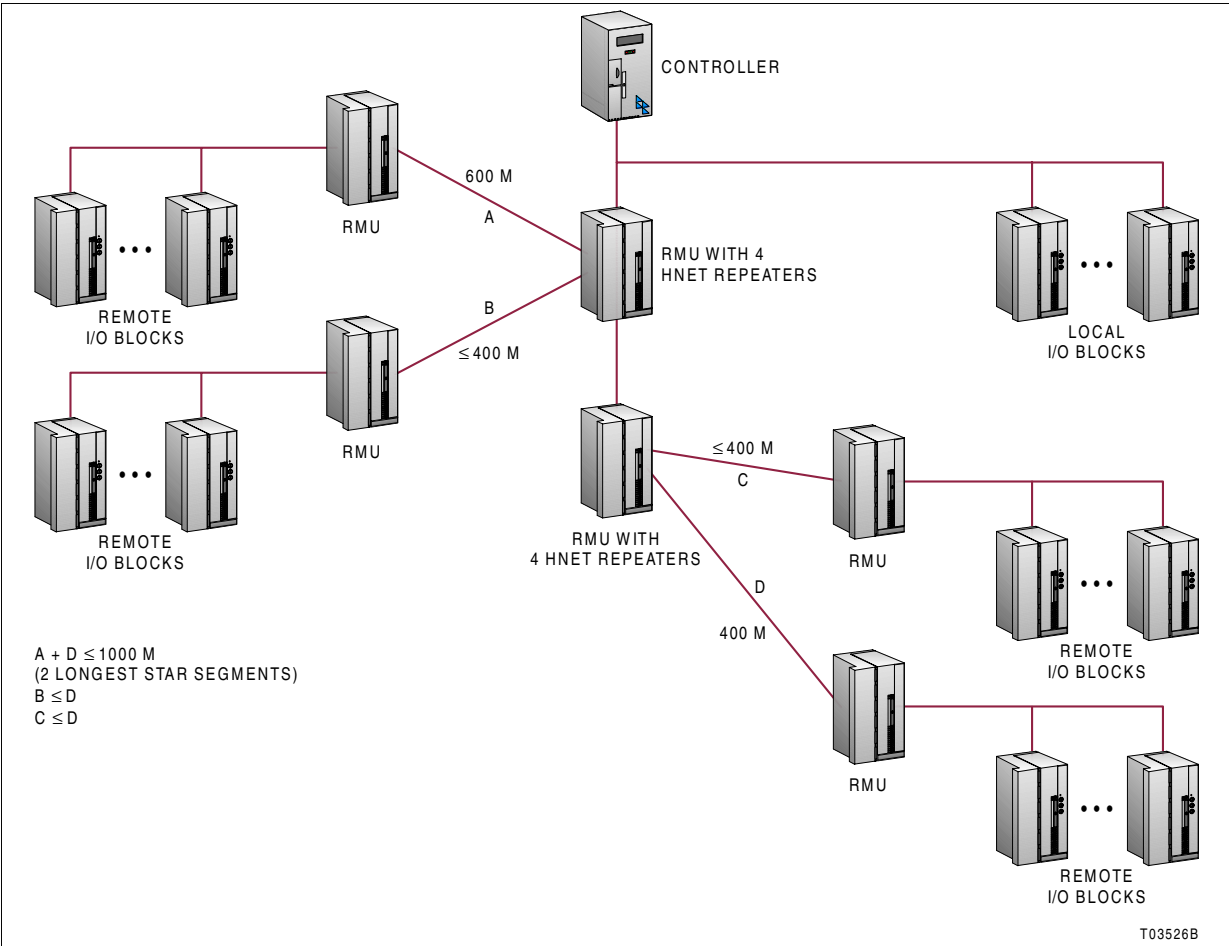


Figure 4. Hnet - Four Star Segments Example

Block Mounting Column Dimensions

Hardware	Height		Width (MCL-?10 Nonredundant)		Width (MCL-?20 Redundant)		Depth		
	mm	in.	mm	in.	mm	in.	mm	in.	
Block height	1	375	14.8	163	6.4	242	9.5	29	1.1
	2	644	25.4						
	3	913	35.9						
	4	1182	46.5						
	5	1451	57.1						
	6	1720	67.7						
	7	1989	78.3						

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## Power and Power Distribution

The I/O system uses two types of power:

- 24 VDC block logic power.
- 24 VDC, 48 VDC, 125 VDC, 120 VAC, and 240 VAC field power.

Redundant block logic power operates the internal circuitry for I/O modules and for repeaters in repeater mounting units. The I/O module houses the electronics of an I/O block. Field power operates field devices and some I/O channel circuitry depending on the block type.

### Power and Power Distribution Accessories

- *Column power cable* (HRM-PWR6).
- *Auxiliary power distribution panel power cable* (HRM-PWR2).
- *Auxiliary power distribution panel* (MSC-DIST) - needed in some cases to distribute block logic power (BLP) and internal field power (IFP). A power cable (HRM-PWR2) connects from a Modular Power System II power system to the distribution panel, then the individual mounting columns connect to the distribution panel. The distribution panel provides eight power connectors.

### Power and Power Distribution Accessories Specifications

Property	Characteristic/Value			
Block logic power (BLP)	<b>BLP</b>	<b>Min</b>	<b>Nom</b>	<b>Max</b>
	24 VDC	21.6 VDC	25.5 VDC	28 VDC
Internal field power (IFP) <sup>1</sup>	<b>IFP</b>	<b>Min</b>	<b>Nom</b>	<b>Max</b>
	24 VDC	21.6 VDC	25.5 VDC	28 VDC
Local field power (LFP) <sup>2</sup>	<b>LFP</b>	<b>Min</b>	<b>Nom</b>	<b>Max</b>
	24 VDC	19.5 VDC	25.5 VDC	28 VDC
	48 VDC	39 VDC	48 VDC	56 VDC
	125 VDC	95 VDC	125 VDC	144 VDC
	120 VAC	85 VAC	120 VAC	138 VAC
240 VAC	190 VAC	240 VAC	260 VAC	
Block mounting column <sup>3</sup>				
BLP A	5.6 A max			
BLP B	5.6 A max			
IFP	5.6 A max odd rows; 5.6 A max even rows			
Power distribution panel (MSC-DIST)				
BLP A	5.6 A max per column connector; 20 A max			
BLP B	5.6 A max per column connector; 20 A max			
IFP	8.0 A max per column connector; 20 A max			
Power distribution panel dimensions (MSC-DIST)	110 mm × 483 mm × 51 mm (4.3 in. × 19.0 in. × 2.0 in.)			

Property	Characteristic/Value
LFP terminals (I/O and auxiliary blocks)	3.0 A

**NOTES:**

1. Uses internal Harmony I/O system power distribution.
2. Connected locally to individual blocks.
3. Refer to **Block Mounting Column Dimensions** for block mounting column dimensions.

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## Block Cooling

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Enclosure mounted fans may provide sufficient air circulation to cool I/O blocks. In some cases additional block cooling accessories are required depending on:

- Ambient temperatures.
- Types of blocks installed in the enclosure.
- Block arrangement inside the enclosure.
- Power system arrangement.
- External enclosure to internal enclosure temperature rise.
- Internal enclosure to internal block temperature rise.
- Enclosure heat removal capabilities.

### Block Cooling Accessories

- **Column fan** (MSC-FAN11, MSC-FAN21) - mounts on a block mounting column and is used to increase air circulation to avoid potential hot spots within blocks mounted on a single column. The column fan does not exhaust air outside the enclosure.
- **Cooling fan assembly** (MSC-APC) - mounts on 483-millimeter (19-inch) spaced side rails and is used to improve air circulation within the enclosure and through blocks to avoid potential hot spots. It directs airflow through up to four columns of blocks. The cooling fan assembly does not exhaust air outside the enclosure.

## Block Cooling Accessories Specifications

Property	Characteristic/Value									
<b>Column Fans (MSC-FAN11, MSC-FAN21)</b>										
Number of fans MSC-FAN11 MSC-FAN21	2 4									
Fan Voltage Current Power Speed Max air flow Noise Life expectancy Status Operating temperature Dimensions MSC-FAN11 MSC-FAN21	14 VDC min; 24 VDC nom; 27.6 VDC max 0.14 A typ; 0.21 A max 3.36 W typ; 5.04 W max 3,600 RPM 1.2 m <sup>3</sup> /min. (42.0 cfm) 39.0 dB typ; 42.0 dB max 50,000 hours continuous operation at 25° C (77° F) 24 VDC open-collector -10° to 70° C (14° to 158° F) 38.1 mm × 117 mm × 165.1 mm (1.5 in. × 4.6 in. × 6.5 in.) 38.1 mm × 206 mm × 165.1 mm (1.5 in. × 8.1 in. × 6.5 in.)									
Overvoltage category	I									
<b>Cooling Fan Assembly (MSC-APC)</b>										
Number of fans	3 (cools up to 4 block columns)									
Fan Power requirements	<table border="1"> <tbody> <tr> <td>Voltage</td> <td>120 VAC (50/60 Hz)</td> <td>240 VAC (50/60 Hz)</td> </tr> <tr> <td>Current</td> <td>0.33 A typ; 0.36 A max; 0.82 A locked rotor</td> <td>0.18 A typ; 0.20 A max; 0.42 A locked rotor</td> </tr> <tr> <td>Power</td> <td>40.5 W typ; 41.4 W max</td> <td>40.5 W typ; 41.4 W max</td> </tr> </tbody> </table>	Voltage	120 VAC (50/60 Hz)	240 VAC (50/60 Hz)	Current	0.33 A typ; 0.36 A max; 0.82 A locked rotor	0.18 A typ; 0.20 A max; 0.42 A locked rotor	Power	40.5 W typ; 41.4 W max	40.5 W typ; 41.4 W max
Voltage	120 VAC (50/60 Hz)	240 VAC (50/60 Hz)								
Current	0.33 A typ; 0.36 A max; 0.82 A locked rotor	0.18 A typ; 0.20 A max; 0.42 A locked rotor								
Power	40.5 W typ; 41.4 W max	40.5 W typ; 41.4 W max								
Speed Max air flow Noise Life expectancy Operating temperature	3,400 RPM 8.5 m <sup>3</sup> /min. (300 cfm) 54.8 dB typ; 56.5 dB max 53,000 hours continuous operation at 40° C (104° F) -10° to 70° C (14° to 158° F)									
Fan assembly status	24 VDC open-collector									
Dimensions (overall assembled)	221 mm × 461 mm × 584 mm (8.7 in. × 18.2 in. × 23.0 in.)									
Overvoltage category	II									

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## Related Documents

Number	Document Title
WBPEEUD210505??	Simulation Block SIM-100, Data Sheet
WBPEEUD240001??	Harmony Analog Input/Output, Data Sheet
WBPEEUD240002??	Harmony Digital Input/Output, Data Sheet
WBPEEUD240003??	Harmony Control Input/Output, Data Sheet



Number	Document Title
WBPEEUS240008??	Harmony Input/Output System, Overview

## Environmental Specifications

Environment	Operating	Storage and Transportation
Air quality	Noncorrosive	Noncorrosive
Altitude	Sea level to 3,048 m (10,000 ft)	Sea level to 12,000 m (40,000 ft)
Relative humidity (noncondensing)	20% to 95% up to 55°C (131°F) 20% to 45% at 55° to 70°C (131° to 158°F)	20% to 95% up to 55°C (131°F) 20% to 45% at 55° to 70°C (131° to 158°F)
Temperature (internal block)	0° to 70°C (32° to 158°F)	-40° to +85°C (-40° to 185°F)
Vibration	10 to 60 Hz, 1.37 mm (0.054 in.) pp 60 to 150 Hz, 1.0 G sine	0.74 G <sub>RMS</sub> longitudinal 0.20 G <sub>RMS</sub> transverse 1.04 G <sub>RMS</sub> vertical 10 to 500 Hz random
Shock	—	15 G, 11 msec

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## Design Standards and Certifications

Category	Standard	Description
Safety	CSA C22.2 No. 142	Safety standards for process control equipment
	ANSI/ISA <sup>®</sup> S82.01-1994	
	IEC 61010-1	
	CSA C22.2 No. 1010.1	
Environmental	IEC 60068-2-1,2,14	Operating temperature
	IEC 60068-2-3,30	Operating relative humidity
	MIL-STD-810E 502.3 & 501.3	Storage/transportation temperature
	ISA S71.04 (level 1 liquids, solids, gases)	Air quality
	IEC 60068-2-6	Operating vibration (sinusoidal)
	MIL-STD-810E 514.4	Storage/transportation vibration Category 1, basic transportation
Vibration	MIL-STD-810E 514.4	Transportation
	IEC 60068-2-27	Shock
	IEC 61298-3	Endurance
EMI, RFI, and electrical surge	IEC 61000-4-2 (level 3)	ESD
	IEC 61000-4-3 (level 3)	EMI susceptibility
	IEC 61000-4-4 (level 3)	Electrical fast transient
	IEC 61000-4-5 (level 3)	Electrical surges
	IEC 61000-4-6 (level 3)	Conducted immunity
	IEC 61000-4-8 (level 3)	Magnetic fields
	CISPR-11	Radiated emissions

Category	Standard	Description
Flammable atmospheres	CSA C22.2 No. 213	Nonincendive equipment
	ISA S12.12	Nonincendive equipment
	FM Class 3611	Division 2 equipment
Flammability of product components	IEEE® 383	Intercabinet cables
	UL rating VW-1	Intracabinet cables
	UL 94 V-0, V-1, or V-2	Flammability of plastic materials
CE mark directives	73/23/EEC	Low voltage directive
	89/336/EEC	EMC directive
	92/31/EEC	
	90/683/EEC	CE marking directives
	93/68/EEC	
	93/465/EEC	
Certifications	CSA	Certified for use as process control equipment in an ordinary (nonhazardous) location
	Factory Mutual (FM) (Pending for MSC-FAN11, MSC-FAN21)	Approved for use in Class I; Division 2; Groups A, B, C, D; hazardous locations.

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