Technical Note

ReFlex Power™ Mating Connectors for Mainframe

AMETEK PROGRAMMABLE POWER

Document No. W380318-01 Rev E • 1/23/2009

PURPOSE

Provide mating connector information for the ReFlex Power™ Mainframe.

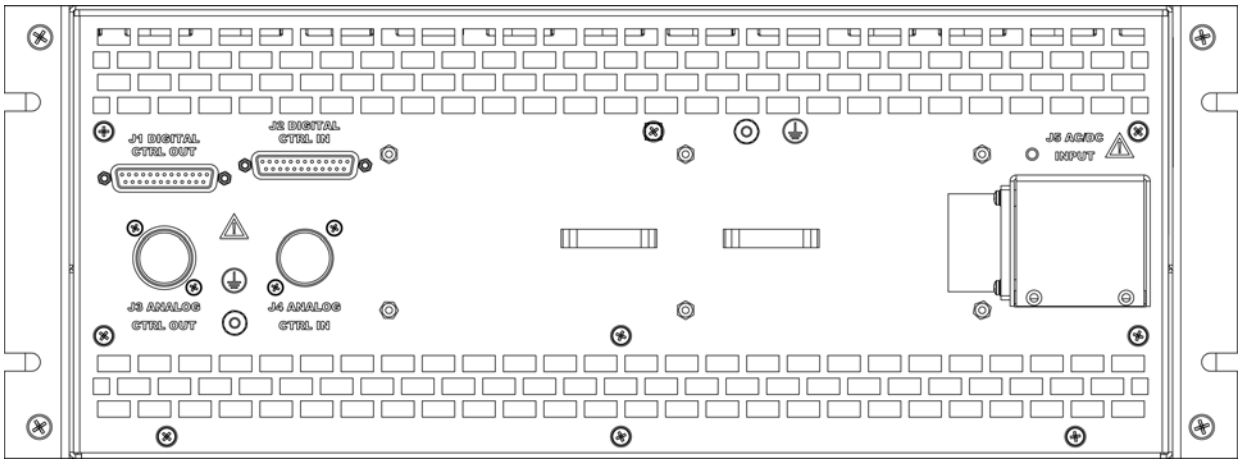

Figure 1. Mainframe Rear Panel View

The ReFlex Power™ Mainframe chassis rear panel connectors, J1 through J4, provide signal interconnections in multiple Mainframe ReFlex Power™ systems. Mainframes are connected in a daisy-chain manner using the Interconnect Cable Assemblies, P/N 5380054-01, P/N 5380054-02 or 5380054-03, between pairs of Mainframes. Up to eight Mainframes can be controlled by a single ReFlex Power™ Controller module (RFPC).

- **J1** and **J3** are output connectors that provide digital and analog control signals, respectively, to a following Mainframe further down in the daisy-chain.
- **J2** and **J4** are input connectors that accept digital and analog control signals, respectively, from a preceding Mainframe further up in the daisy-chain.

AMETEK recommends using one of the following AMETEK Cable Assemblies:

- Interconnect Cable Assembly, 36", P/N 5380054-01
- Interconnect Cable Assembly, 97", P/N 5380054-02
- Interconnect Cable Assembly, 135", P/N 5380054-03

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MATING CONNECTOR KIT

J5 is the AC/DC input power connector to a Mainframe. AMETEK Mating Connector Kits:

- ReFlex Power™ Mainframe AC/DC Input Mating Connector Kit - AMETEK Part No. 5380318-01, mates with RFP-M0000-001-0000, RFP-M0000-001-1E00, RFP-M0000-REC-0000, RFP-M0000-REC-1E00 and RFP-M0000-001-2J00, and includes the following:

Bill of Material

Item	AMETEK Part No.	Description	Qty	Manufacturer Part No.	Manufacturer	Suggested Source(s)
1	855-130-02	Conn, 7P, 8AWG, Plug, P-Earth, S	1	DL3106A24-10S	Amphenol	Arrow Electronics: http://www.arrownac.com/ Newark: http://www.newark.com/
2	855-16A-X3	Conn, Cable Clamp, SS 24/28 w/Bushing	1	M85049/41-16A, or MS3057-16A	ITT Cannon, Amphenol / Bendix	PEI-Genesis: http://www.pei-genesis.com/

- ReFlex Power™ Mainframe AC/DC Input Mating Connector Kit with 2-Meter Unterminated AC Line Cord - AMETEK Part No. 5380317-01, mates with RFP-M0000-001-0000, RFP-M0000-001-1E00, RFP-M0000-REC-0000, RFP-M0000-REC-1E00 and RFP-M0000-001-2J00, and includes the following:

Bill of Material

Item	AMETEK Part No.	Description	Qty	Manufacturer Part No.	Manufacturer	Suggested Source(s)
1	855-130-02	Conn, 7P, 8AWG, Plug, P-Earth, S	1	DL3106A24-10S	Amphenol	Arrow Electronics: http://www.arrownac.com/ Newark: http://www.newark.com/
2	855-16A-X3	Conn, Cable Clamp, SS 24/28 w/Bushing	1	M85049/41-16A, or MS3057-16A	ITT Cannon, Amphenol / Bendix	PEI-Genesis: http://www.pei-genesis.com/
3	890-887-07	Cable, 10AWG X 7W, 600V, 80C	2m	87707	Alpha Wire & Cable	Alpha Wire Company: http://www.alphawire.com/index.cfm Industrial Electric Wire & Cable: http://www.iewc.com

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J5 AC/DC INPUT CONNECTOR

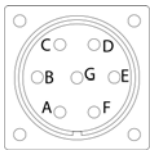

Figure 2. J5 Connector, Rear Panel View

Recommended Vendors:

- AC Connector: Amphenol P/N DL3106A 24-10S, Strain Relief P/N M85049/41-16A
- Input Power Cable: Alpha Wire & Cable P/N 87707

Pin	Name	Function	Signal Level
F	L1	Input: line-1	90-264VAC; 210-300VDC
E	L1-RTN	Input: return for line-1	90-264VAC; 210-300VDC
A	L2	Input: line-2	90-264VAC; 210-300VDC
G	L2-RTN	Input: return for line-2	90-264VAC; 210-300VDC
B	L3	Input: line-3	90-264VAC; 210-300VDC
C	L3-RTN	Input: return for line-3	90-264VAC; 210-300VDC
D	CHAS-GND	Safety ground	Chassis ground

Wire size: 10 AWG Maximum; dependent on input source voltage and permitted line drop at 24A per line maximum current for fully populated Mainframe

GND, CHASSIS GROUND

GND, Chassis Ground			
Pin	**Name**	**Function**	**Signal Level**
E1	GND	Chassis safety ground; 8-32 stud	Chassis ground

INPUT POWER REQUIREMENTS

The input configuration accepts a wide variety of sources: single-phase and three-phase AC inputs, as well as DC. With single-phase inputs, the AC input range spans nominal voltages from 100VAC to 240VAC. Three-Phase inputs could be derived from sources configured as delta (3-wire plus ground) and wye (4-wire plus ground). With a delta source, the allowed input voltage is 200VAC, while with a wye source, the input voltage could be 115/200VAC or 230/400VAC. Regardless of the input service, modules are connected either line-to-line or line-to-neutral so that the operating voltage applied to the modules is within the range of 85-264VAC. The allowed frequency range is 50/60/400Hz. The DC input is based on a nominal 270VDC, with an operating range from 210VDC to 300VDC.

CAUTION

Connecting to a wye source at 230/400VAC must be from line to neutral so that the voltage applied to a module input is less than 264VAC. Exceeding the input voltage rating could result in damage of the module.

The input current is dependent on the total aggregate output power supplied by the modules installed in the Mainframe. The maximum input current is limited by the power dissipation produced in the backplane power distribution, interconnects, and wiring. With a limit of 24A per input line, the Mainframe is capable of provided up to 6,000W of aggregate output power.

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The input power connector of the Mainframe has three pairs of line connections plus ground, seven contacts in total. Each pair of input lines is distributed through the backplane to a group of four backplane slot connectors, all connected in parallel. The load that would be applied to a particular AC/DC input line is dependent on the location of the modules in the Mainframe slots.

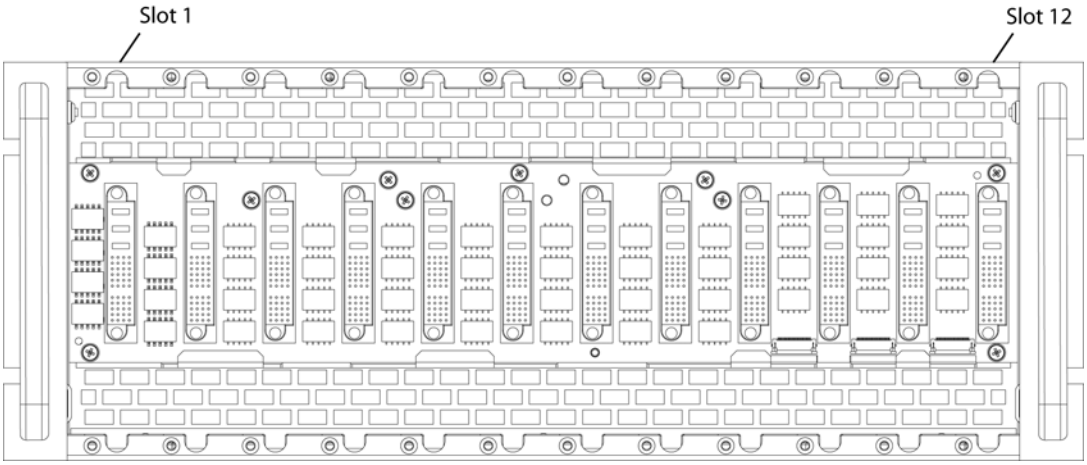

Figure 3. Slot Numbering Assignment, Empty Mainframe Front View

The slots are grouped in sets of four: Slot 1-4, Slot 5-8, and Slot 9-12. Slot 1 is the left-most slot, as viewed from the front (refer to Figure 3). Each of the backplane connectors of a set of four slots is connected in parallell and is supplied by one pair of the AC/DC input lines. In a double-width and triple-width module, the module connector is located so that it mates to a backplane connector in the right-most slot, as viewed from the front of the Mainframe. Refer to Figure 4 for a diagram showing the power distribution from the input connector to the twelve Mainframe slots.

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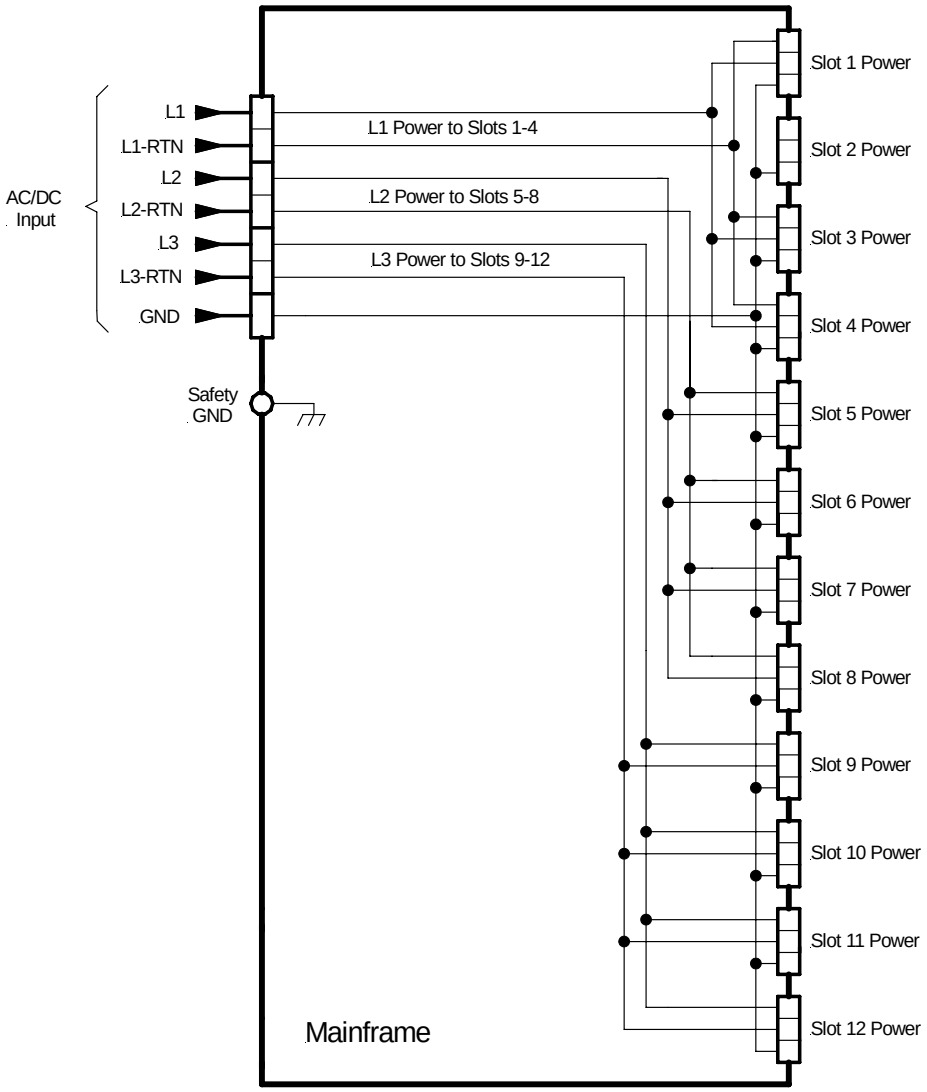

Figure 4. Input Power Distribution (Slot 1 at top is left-most slot of Mainframe front view, as in Figure 3).

With single-phase service, all input lines are connected in parallel. Effectively, the three groups of slots (each group comprising four individual slots) are connected in parallel. However, with three-phase inputs, each line is connected to a separate group of paralleled slots. Therefore, the physical location of a module in the Mainframe will determine from which input line the module will draw power. Balancing of phase currents can be achieved only if the power modules are installed into the Mainframe so that there is an equal distribution of current between the three groups of slots, and provided that the same total load is applied to the set of modules in each group. Refer to the following Input Power Allocation table for the power allocation from the input connector pins to the Mainframe slots.

In multi-Mainframe systems, each Mainframe has an independent AC/DC input. The interconnect cable that daisy-chains the Mainframes together does not route input power between assets. Therefore, the input power is not shared among the assets comprising the system.

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Input Power Allocation					
Input Service	**Phases**	**Input Designation**	**Input Connector Pin**	**Input Service Connection**	**Slot Supplied**
100/115/120VAC 200/208VAC 220/230/240VAC	1	L1	F	Phase	Slot 1-4
		L1-RTN	E	Return	
		L2	A	Phase	Slot 5-8
		L2-RTN	G	Return	
		L3	B	Phase	Slot 9-12
		L3-RTN	C	Return	
		GND	D	Ground	Slot 1-12
		Safety GND	Chassis GND	Ground	Chassis
200/208VAC	3, Delta	L1	F	Phase-A	Slot 1-4
		L1-RTN	E	Phase-B	
		L2	A	Phase-B	Slot 5-8
		L2-RTN	G	Phase-C	
		L3	B	Phase-C	Slot 9-12
		L3-RTN	C	Phase-A	
		GND	D	Ground	Slot 1-12
		Safety GND	Chassis GND	Ground	Chassis
200/208VAC 220/230/240VAC	3, Wye	L1	F	Phase-A	Slot 1-4
		L1-RTN	E	Neutral	
		L2	A	Phase-B	Slot 5-8
		L2-RTN	G	Neutral	
		L3	B	Phase-C	Slot 9-12
		L3-RTN	C	Neutral	
		GND	D	Ground	Slot 1-12
		Safety GND	Chassis GND	Ground	Chassis
210-300VDC	DC	L1	F	Source	Slot 1-4
		L1-RTN	E	Return	
		L2	A	Source	Slot 5-8
		L2-RTN	G	Return	
		L3	B	Source	Slot 9-12
		L3-RTN	C	Return	
		GND	D	Ground	Slot 1-12
		Safety GND	Chassis GND	Ground	Chassis

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AC/DC INPUT DISCONNECT DEVICE

The ReFlex Power™ system does not have any means to disconnect it from the AC/DC input service. The front panel POWER switch of the Controller module in the Mainframe does not disconnect the AC/DC input line from the modules or Mainframe. Ensure that a suitable disconnecting device is incorporated into the system installation, so that isolation will be provided when it is opened. The switch or circuit breaker must be located close to the ReFlex Power™ system, within reach of the operator, and clearly labeled as the disconnection device. In multi-Mainframe systems, each Mainframe has an independent AC/DC input, so the input disconnect device should simultaneously open/close the input connection to all assets comprising the system.

WARNING

To prevent a shock hazard, ensure that the AC/DC input disconnect device is open, and that the safety ground conductor is connected to the rear panel ground stud, before inserting/removing modules into/from the Mainframe. The Mainframe backplane input power distribution remains energized whenever the AC/DC input is connected.

AC/DC INPUT OVERCURRENT PROTECTION

The Mainframe distributes the input power through backplane connectors to three groups of four slots connected in parallel. Each group is connected to a separate pair of pins of the input connector (one line and return per connection); the connector has six power pins plus ground. To properly size the current rating of the disconnect device, the total load current that will be drawn from an input line must be determined based on the location of modules within a Mainframe. The backplane connector from which a module will draw input current is also dependent on the width of the module. The Module Backplane Slot Connections table below, presents the number of slots that a particular module will occupy, to which slot the module will be connected to draw input power, and the maximum current that the module will draw.

Module Backplane Slot Connections

Module Model	Width	Number of Slots Occupied	Slot Supplying Input Power	Maximum Input Current (at 103.5VAC and full load)
RFP-C1LAN-000-XXXX	single	1	single	0.2A
RFP-F1000-001-XXXX	single	1	single	2.8A
RFP-D1016-021-XXXX RFP-D1065-5A1-XXXX	single	1	single	4A
RFP-D2033-030-XXXX RFP-D2450-2A3-XXXX	double	2	right-most	12A
RFP-A30XK-875-XXXX	triple	3	right-most	12A
RFP-L3500-375-XXXX	triple	3	right-most	1.1A
RFP-L3500-750-XXXX	triple	3	right-most	1.1A

For example, a Mainframe with six HPDC modules (each 2U wide) would have modules plugged into the following locations: slot 2, slot 4, slot 6, slot 8, slot 10, and slot 12 (see Figure 3). The slots would be connected to the input connector, as follows: line L1 connected to slots 2 and 4, line L2 connected to slots 6 and 8, and line L3 connected to slots 10 and 12. If the modules supplied full rated output power, and the AC input were three-phase, wye with nominal 230/400VAC, each input line would supply 10.8A.

As another example, a Mainframe with four AC power modules would have modules plugged into the following locations: slot 3, slot 6, slot 9, and slot 12. The slots would be connected to the input connector, as follows: line L1 connected to slot 3, line L2

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connected to slot 6, and line L3 connected to slots 9 and 12. The input current would not be balanced from a three-phase source. If the modules supplied full rated output power, and the AC input were three-phase, wye with nominal 230/400VAC, lines L1 and L2 would each supply 5.4A, but line L3 would supply 10.8A.

The maximum output power per single group of four slots is produced when two HPDC 1kW modules are installed in the group. This sets the maximum aggregate output power limit of the Mainframe at 6kW. The resultant maximum current per input connector line and per input service line is presented in the following Mainframe Input Current Demand table. In general, to determine the actual input currents, the current requirements of the modules that are installed in each group must be summed. This would determine the requirement for the AC/DC input overcurrent protection current rating.

Mainframe Input Current Demand

Input Service	Input Service Connection	Maximum Input Service Line Current	Maximum Mainframe Input Connector Line Current	Maximum Aggregate Output Power per Mainframe	Maximum Output Power per Slot Group: Slots 1-4, 4-8, and 8-12
100V	1-phase	24A	24A	5kW	1.7kW
115/120V		24/23A	24/23A	6kW	2kW
200/208V		14/13.5A	14/13.5A	6kW	2kW
220/230/240V		13/12.4/11.9A	13/12.4/11.9A	6kW	2kW
200V or 208V	3-phase, delta 3-wire, plus ground	24.3A or 23.4A	14A or 13.5A	6kW	2kW
115/200V or 120/208V	3-phase, wye 4-wire, plus ground	24A or 23A	24A or 23A	6kW	2kW
220/380V, 230/400V, or 240/415V	3-phase, wye 4-wire, plus ground	13/12.4/11.8A	13/12.4/11.9A	6kW	2kW
270VDC	DC	12A at 210VDC	12A at 210VDC	6kW	2kW

AC/DC INPUT SAFETY GROUND CONNECTION

The AC/DC input connector provides a safety ground termination. The input power cable should include a safety ground wire to connect the chassis of the Mainframe to the safety ground of the AC/DC power source. Depending on the installed modules, and operating voltage/frequency, the AC input leakage current could exceed 3.5mA; therefore, a second safety ground connection is also required. It should be connected to the safety ground stud on the rear panel of the Mainframe.

WARNING

A separate, dedicated safety ground wire must be connected to the Mainframe rear panel safety ground stud. Operating the ReFlex Power™ system with the safety ground wire disconnected could result in a shock hazard.

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