

PFC Mini-EL™

Power Factor Corrected AC-DC Switcher



Design Guide

and

“Quick Install” Instructions



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PFC Mini-EL™

Power Factor Corrected AC-DC Switcher

Overview

The PFC Mini-EL is an extremely low profile switching power supply that combines the advantages of power factor correction and high power density. It can provide up to 6 isolated outputs (3 slots) and each slot accommodates the following Vicor DC-DC Converters.

1st Generation: 1 Full Size (VI-200) or 2 Junior modules (VI-J00)

2nd Generation: 1 Maxi, 2 Minis (Micros cannot be used)

The use of these converters give the PFC Mini-EL the inherent power flexibility typical of all Vicor products. Accepting input voltages of 85 Vac to 264 Vac, and 100 to 380 Vdc, the PFC Mini-EL can provide up to 1,500 Watts in a package size of 1.72" H (43,6mm) x 6" W (152,4mm) x 13.2" L (335,3mm). The PFC Mini-EL is factory configured to meet user requirements.

A special 7 output PFC Mini is available in four models. See page 16 for more details.

Standard Features

- Power Factor Correction: 0.99 at 115 Vac; 0.95 at 230 Vac
- Universal Input: 85-264 Vac, 47-500 Hz, or 100-380 Vdc
- Power Output: 1,500W at 230 Vac; 800W at 115 Vac
- Up to 6 isolated outputs (3 slots)
- Fan cooled
- Full power to 45°C; half power at 65°C
- Conducted EMI:

1st Generation (VI-200, VI-J00)	2nd Generation (Maxi, Mini)
FCC Class B	FCC Class A
EN 55022 Class B	EN 55022 Class A
	(certain configurations meet EN55022 Class B.)
- Low ripple: 50mVp-p max. 15V & less; 150mVp-p max. >15V to 24V; 1%Vout p-p max above 24V
- Harmonic Distortion complies with EN61000-3-2
- AC Power OK status signal
- Autosense (for more information, see page 8 and page 12)
- Output overcurrent protection on all outputs
- Output overvoltage protection and Output overtemperature limiting (not applicable when using VI-J00)
- Ride-through (holdup) time: >20 ms at 1,200W load (nominal line)
- Size: 1.72" H (43,6mm) x 6" W (152,4mm) x 13.2" L (335,3mm)
- Safety Agency Approvals: CE Marking, cTÜVUS

Optional Features

- Extended temperature range output converters
- Current Share Board - See page 20
- BatMOD current sources available (see page 16 for more information)
- Connector kits available (#19-130047 and # 19-130050)

Part Numbering

PFC Mini-EL	PMx₁-x₂ x₃-xxx -EL	x₁	Number of outputs
	e.g. PM4-22-501-EL	x₂	Number of 1st Gen VI-200 & VI-J00 modules
		x₃	Number of 2nd Gen Maxi and Mini modules
		xxx	Sequential number assigned by Westcor
		EL	Extended length

Mechanical Considerations

The PFC Mini-EL can be mounted on either of two surfaces using standard 8-32 (4 mm) size screws. Maximum allowable torque is 4.4 in. lbs., and the maximum penetration is 0.16 in. (4mm).

When selecting a mounting location and orientation, the unit should be positioned so air flow is not restricted. Maintain a 2" (5,1cm) minimum clearance at both ends of the PFC Mini-EL, and route all cables so airflow is not obstructed. The power supply draws air in at the fan side/AC input side and exhausts air out the load side. If air-flow ducting is used, avoid sharp turns that could create back pressure. The fans move approximately 20 CFM of air.

Avoid excessive bending of output power cables after they are connected to the output terminals. For high-current outputs, use cable ties to support heavy cables and minimize mechanical stress on connectors. Be careful not to short-out to neighboring outputs. The maximum torque recommended on output nuts is 10 in. lbs.

Avoid applications in which the unit is exposed to excessive shock or vibration levels. In such applications, a shock absorbing mount design is required.

PFC Mini-EL Do's and Don'ts

- Use twisted pair 20-22 AWG wire when installing Remote Sense.
- To prevent damage to supply, verify polarity of remote sense connection before turning supply on.
- Always turn the power supply off, before disconnecting input or output wires.
- When using the remote sense feature, the +Out and -Out load wires should never be disconnected while the supply is operating. Failing to do so could damage the power supply.
- Do not restrict airflow to the unit. The cooling fan draws air into the unit and forces it out at the output power terminals.
- Run the output (+/-) power cables next to each other to minimize inductance.
- Do not attempt to repair or modify the power supply in any manner. Contact Westcor's Repair Service.
- Insert proper fault protection at power supply input terminals (i.e., a fuse).
- Use proper size wires to avoid overheating and excessive voltage drop.

Technical Description

The PFC Mini-EL consists of an off-line single phase, power-factor-corrected front end, EMI filter, cooling fan, customer interface, associated housekeeping circuits, low noise filters and a selection of Vicor's DC-DC converters.

Input AC mains voltage is applied to a terminal block. The input current is passed through an EMI filter designed to meet conducted noise limit "B" specifications in FCC Part 15 and EN55022, Class B (with 1st Gen modules. If 2nd Gen modules are used, it meets FCC Class A and EN 55022 Class A. Certain configurations meet Class B).

At start-up, inrush current is limited by a PTC thermistor. The PTC is shunted out shortly after initial power-up by a DC bus voltage sense circuit driving a relay. After rectification, the input voltage is put through a boost converter that keeps the AC input current sinusoidal and synchronized with the input AC voltage (in compliance with EN61000-3-2). The boost converter delivers a regulated input to the hold-up capacitors and a high voltage backplane. The backplane supplies power to the DC-DC converters that provide the desired low voltage regulated outputs.

Voltage conversion is achieved by Vicor's family of Zero-Current-Switching (ZCS) DC-DC converters. These are forward converters in which the main switching element switches at zero current. This patented topology has a number of unique attributes: low switching losses; high frequency operation, resulting in reduced size for magnetics and capacitors; excellent line and load regulation; wide adjustment range for output; low EMI/RFI emission and high efficiencies.

At initial power-up, the PFC Mini-EL outputs are disabled to limit the inrush current and to allow the DC bus potential to settle out to the correct operating level. A low-power flyback converter operating with PWM current-mode control converts the high voltage DC bus into regulated low voltage to power the internal housekeeping circuits and DC cooling fans.

The internal housekeeping Vcc comes up within 2 s after the application of input power. Once the high voltage bus is within operating limits, the AC Power OK signal asserts to a TTL "1," indicating the input power is OK, and enables the power outputs. An auxiliary Vcc output of 5 Vdc sourcing up to 0.3A is provided for peripheral use.

An output Enable/Disable function is provided by using an optocoupler to control Vicor's DC-DC converters. If the Enable/Disable control pin is pulled low, the optocoupler turns on and disables the output. The nominal delay associated for an output to come up when measured from release of the Enable/Disable pin is 5-10 ms. The General Shutdown function controls all outputs simultaneously and works in a similar manner.

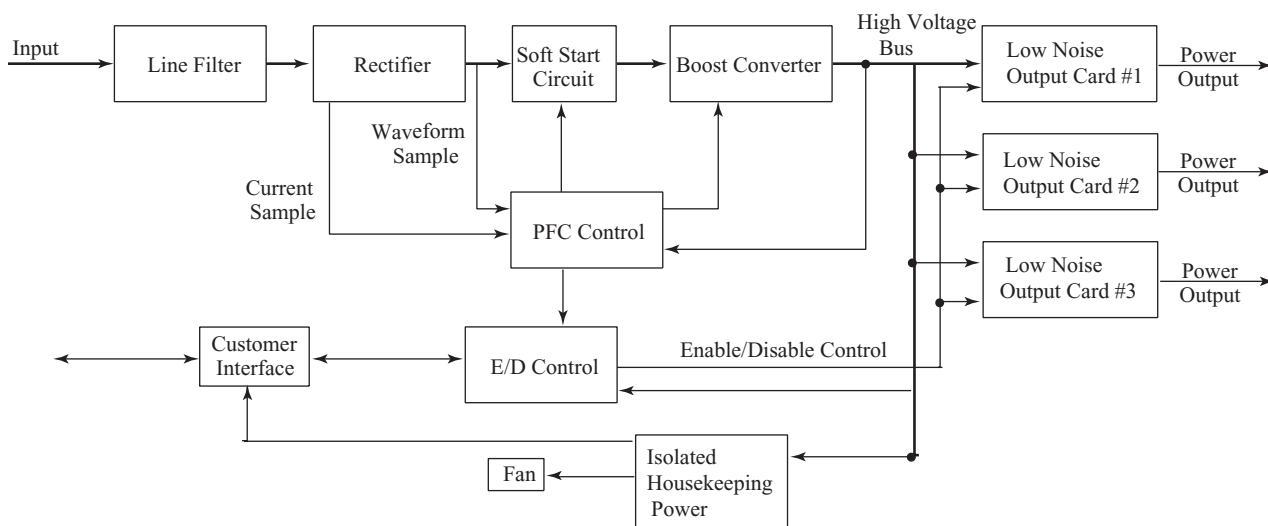
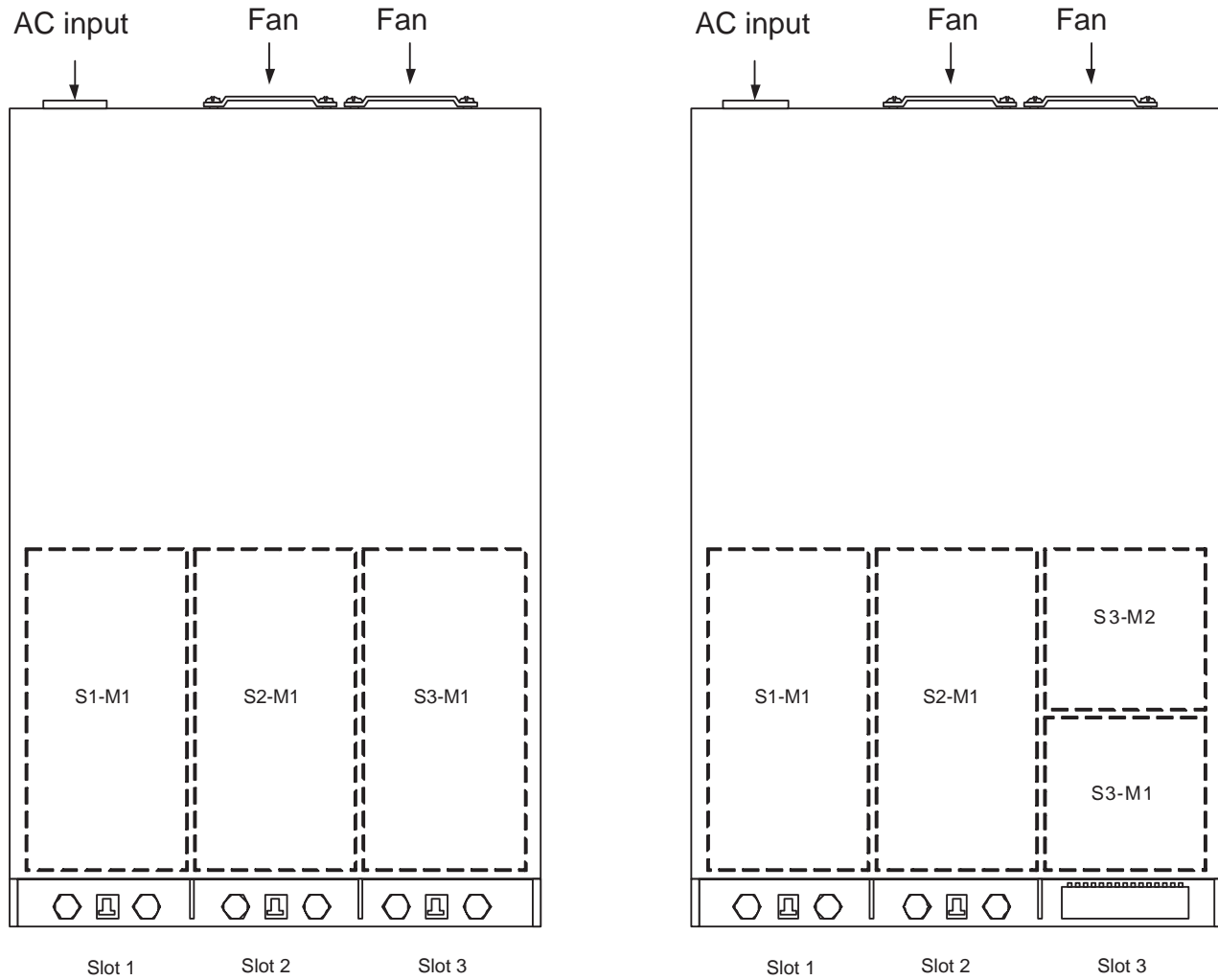


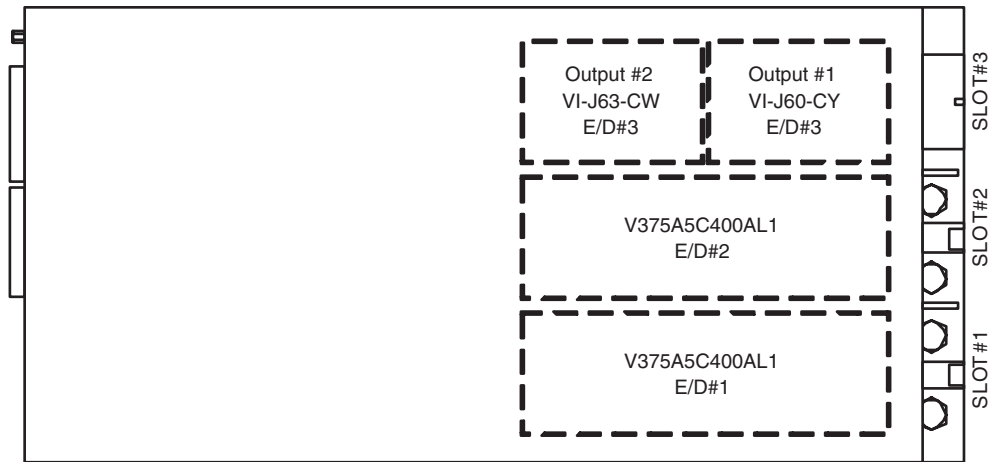
Figure 1. PFC Mini-EL Architecture

PFC Mini-EL Configuration Layout



Shown above are two sample PFC Mini-EL configuration layouts. The PFC Mini-EL has three slots and each slot accomodates either full or half brick modules. Quarter bricks cannot be used.

PFC Mini-EL Configuration Layout



Configuration Example:

SLOT#	VOLTS	AMPS	WATTS	Modules
1	5.0	80	800	V375A5C400AL1
2				V375A5C400AL1
3 (M1)	5.0	10	50	VI-J60 CY
3 (M2)	24.0	4.2	100	VI-J63CW

E/D = Enable/Disable

PFC Mini-EL “Quick Install” Instructions (See pg 10 for mechanical drawings)

Mounting the PFC Mini-EL

- * Mount the PFC Mini-EL on either of two sides.
- * Use #8-32 or 4mm mounting screws. Maximum penetration should not exceed 0.16" (4mm).
- * Maintain 2" (5,1cm) clearance at both ends of power supply for airflow.

Input Connections

Input Power MBJ1

- * Apply input AC power to terminal block MBJ1 using a pressure screw terminal.
- * Strip length of AC power conductors to be .35 inches.
- * Maximum torque is 4.4 lb-in.
- * **Place a fuse or circuit breaker in the input line for safety requirements.**
- * The connector manufacturer recommends the wires not be tinned. A ferule can be used to prevent fraying.

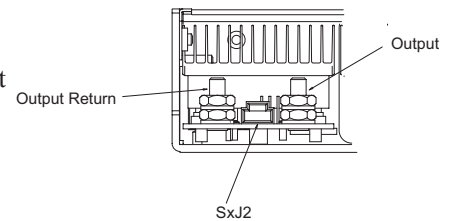
INPUTS: 115-230 VAC 1Ø 47 TO 500 Hz 300VDC ---	NOTE: DO NOT OPERATE WITHOUT EARTH GND	L1	L2/N	
NOTE: SET SCREW MAX TORQUE = 4.4 IN. LBS.		INPUT CONNECTIONS MBJ1-1 EARTH GROUND MSJ1-2 L2-NEUTRAL MBJ1-3 L1		
LABEL NO: 94-00047 REV B				

Output Connections

Power Connections

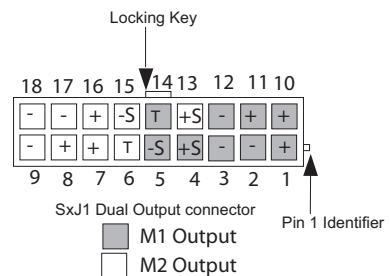
Installing single output ring lugs and/or bus bars on output studs:

- * The right stud is Positive and the left stud is the Return on single output cards.
- * Remove the top nut and place ring lug over output stud.
- * Do not remove the lower nut next to the PCB.
- * Replace and tighten the nut to a torque of **10 inch pounds. Do Not Over-Tighten Nuts.**



Installing power connectors on dual output cards (18 pin connectors):

- * SxJ1-1¹, SxJ1-10, SxJ1-11 are Positive for output #1, while pins SxJ1-2, SxJ1-3, SxJ1-12 are the Return. SxJ1-7, SxJ1-8 and SxJ1-16 are Positive for output #2, while pins SxJ1-9, SxJ1-17 and SxJ1-18 are the Return.
- * Use Molex mating receptacle #39-01-2140 with #39-00-0039 terminals.
- * Attach 18-24 AWG stranded wire using Molex tool #11-01-0197.



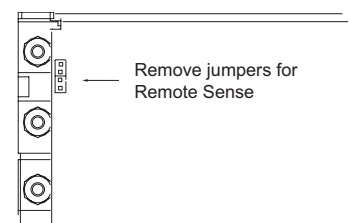
¹ Where x refers to the slot number.

Sense Connections

The PFC Mini-EL is equipped with a feature called **Autosense**. If Remote Sense connections are not made or needed, no Local Sense selection is necessary - simply hook up the output and the PFC Mini-EL will automatically operate in Local Sense. If remote sense connections are made, the PFC Mini-EL will operate in a Remote Sense mode.

Sense Connections on single output card

- * If Remote Sense is desired, remove jumpers MBJ1 and J3, located behind the sense connector.
- * Connector pin SxJ2-2 is the +Sense and SxJ2-3 is the -Sense.
- * Use Molex mating receptacle #50-57-9403 with #16-02-0103 terminals.
- * Attach terminals to 20-22 AWG stranded twisted pair wire using Molex tool # 11-01-0208.
- * Attach opposite end of sense lines to point where regulation is desired.
- * **Verify that sense lines are not cross-connected.**



Sense Connections on dual output cards

- * If Remote Sense is desired, remove jumpers on MBJ1 and J3, located on either side of the output connector.
- * Connector pin SxJ1-4 is the +Sense and SxJ1-5 is the -Sense for output #1. SxJ1-13 is the +Sense and SxJ1-15 is the -Sense for output #2.
- * Use Molex mating receptacle #39-01-2180 with #39-00-0039 terminals.
- * Attach 18-24 AWG stranded twisted pair wire using Molex tool #11-01-0197

Trim Connections

Trim Connections on single output cards:

- * SxJ2-1 provides Trim access.
- * Use Molex mating receptacle #50-57-9403 with #16-02-0103 terminals.
- * Attach 20-22 AWG stranded wire using Molex tool #11-01-0208.

Trim Connections on dual output cards:

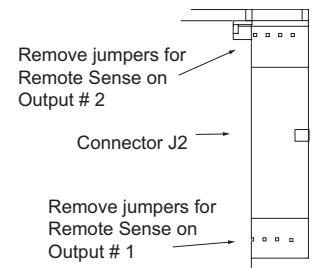
- * SxJ1-14 provides Trim access for output #1, and SxJ1-6 provides Trim access for output #2.
- * Use Molex mating receptacle #39-01-21 with #39-00-0039 terminals.
- * Attach 18-24 AWG stranded wire using Molex tool #11-01-0197.

Current Trim Connections when using BatMods:

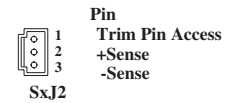
- * SxJ2-1 provides Current Trim access.
- * Use Molex mating receptacle #50-57-9403 with #16-02-0103 terminals.
- * Attach 22-24 AWG stranded wire using Molex tool #11-01-0208.

Interface Connections

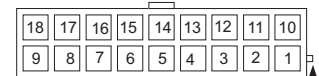
- * J3-1 to 3 are Enable/Disable for cards 1-3, respectively.
- * J3-4 is Signal Ground, J3-5 is +5V, J3-6 is AC Power OK, and J3-7 is General Shutdown.
- * Use mating receptable AMP P/N 205204-4 with terminals AMP P/N 66506-9.
- * Attach terminals to 18-24 AWG stranded wire.



Trim Connector



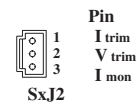
Locking Key



SxJ1 Dual Output connector

Pin 1 Identifier

BatMod Current Source Connections



J3 INTERFACE CONNECTION

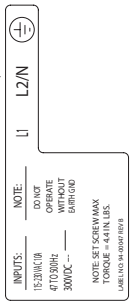
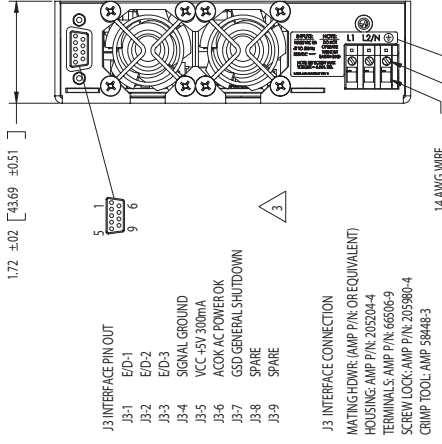
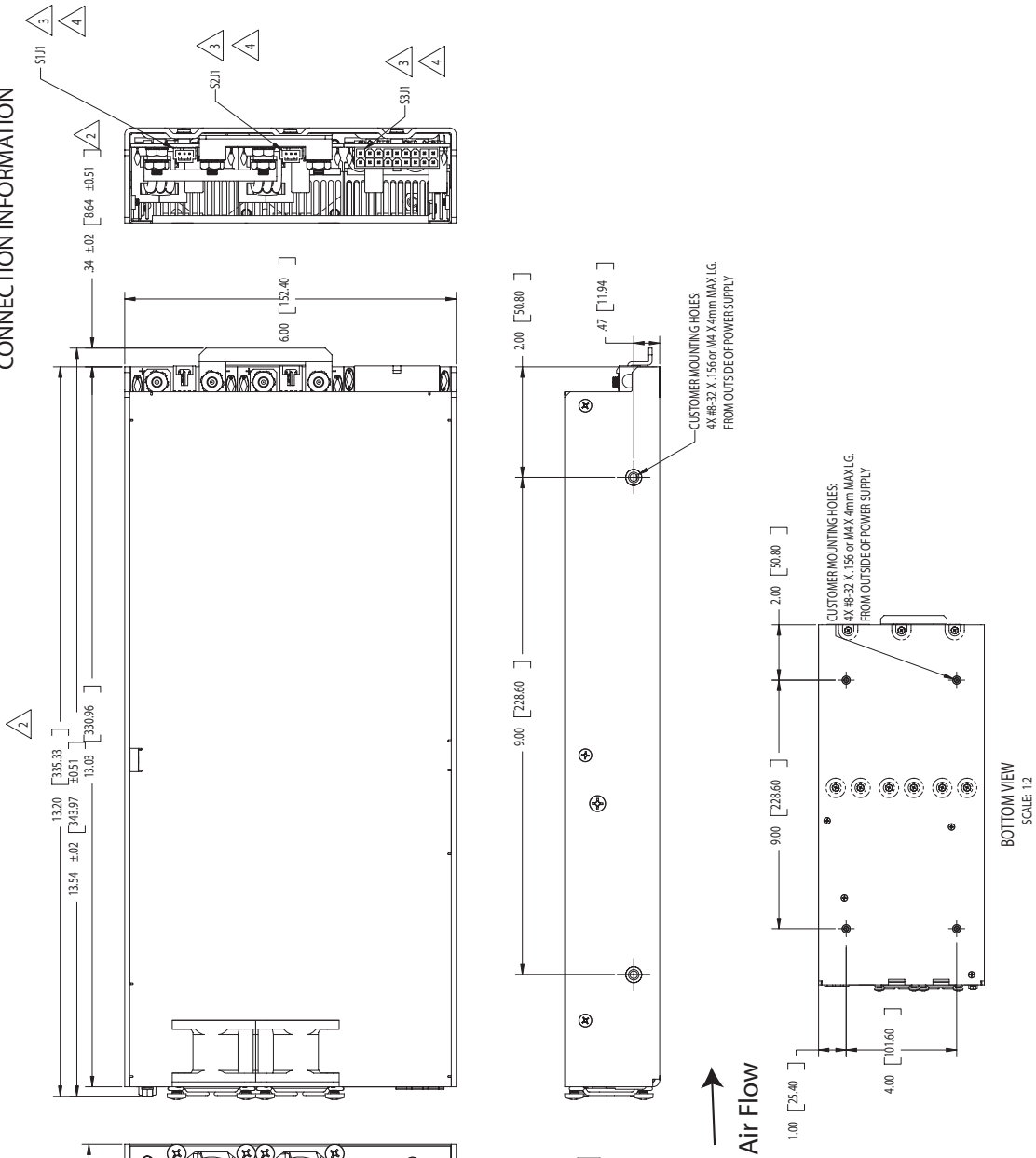
MATING HDWR:
HOUSING: AMP P/N 205204-4
TERMINALS: AMP P/N 66506-9
SCREW LOCK: AMP P/N 205980-4
CRIMP TOOL: AMP 58448-3

J3 INTERFACE PIN OUT

J3-1	E/D-1
J3-2	E/D-2
J3-3	E/D-3
J3-4	SIGNAL GROUND
J3-5	VCC +5V 300mA
J3-6	ACOK AC POWER OK
J3-7	GSD GENERAL SHUTDOWN
J3-8	SPARE
J3-9	SPARE

PFC Mini-EL Mechanical Drawings

SEE PAGE 11 FOR DETAILED OUTPUT CONNECTION INFORMATION

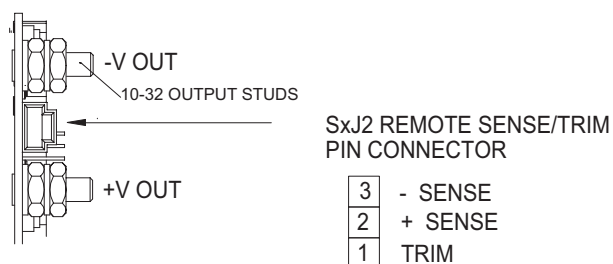


Air Flow

1. INTERPRET DRAWING PER ANSII 14.5-1994
2. WITH OPTIONAL BUS BAR
3. A COMPLETE SET OF MATING CONNECTORS CAN BE PURCHASED FROM WESTCOR BY SPECIFYING CONNECTOR KIT P/N: 19-130047. A KIT CONTAINING 40 EACH OF THE HI POWER 12 AMP 16 AWG CRIMP PINS IS P/N: 19-130050.
4. REF DESIGNATION LEGEND
 MB = MOTHER BOARD
 S1 = (SLOT 1) DAUGHTERBOARD MODULES E/D 1
 S2 = (SLOT 2) DAUGHTERBOARD MODULES E/D 2
 S3 = (SLOT 3) DAUGHTERBOARD MODULES E/D 3

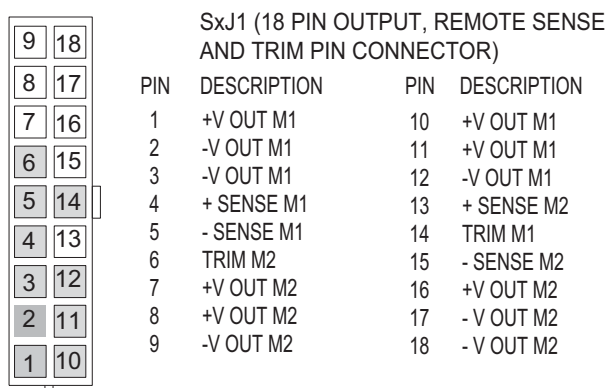
Output Connectors for PFC Mini-EL

A. SINGLE OUTPUT SLOT



MATING CONNECTOR:
 HOUSING: MOLEX P/N 50-57-9403
 TERMINALS: MOLEX P/N 16-02-0103
 USE CRIMP TOOL: MOLEX P/N 11-01-0208

B. DUAL OUTPUT SLOT - 18 Pin Housing



MATING CONNECTOR:
 18 PIN HOUSING: MOLEX (39-01-2180)
 TERMINAL FEM CRIMP 18-24 AWG: MOLEX (39-00-0039)
 USE CRIMP TOOL: MOLEX (11-01-0197)

FOR HIGH OUTPUT CURRENTS (>9A/PIN)
 TERMINAL FEM CRIMP 16AWG: MOLEX (44476-3112)
 USE CRIMP TOOL: MOLEX (11-01-0199)

■ M1 Output
 □ M2 Output

OPTIONAL CONNECTOR KIT FOR PFC Mini-EL (PART # 19-130047. Available for purchase from Westcor)

ITEM	QTY	DESCRIPTION	VENDOR # 1	PART NO.
1	3	HOUSING 3 POS .100 CTR W/LATCH	MOLEX	50-57-9403
2	10	TERM FEM CRIMP 22-24AWG SEL GOLD	MOLEX	16-02-0103
**		CRIMP TOOL FOR ITEM 2	MOLEX	11-01-0208
3	1	HOUSING FEMALE D-SUB 09 PIN	AMP	205204-4
3	10	TERM MALE CRIMP 22-24 AWG TIN	AMP	66506-9
3	1	SCREW LOCK MALE (1 PAIR)	AMP	205980-4
**		CRIMP TOOL FOR ITEMS 3	AMP	58448-3
4	3	HOUSING 18 POS .165 CTR W/LATCH	MOLEX	39-01-2180
5	60	TERM FEM CRIMP 18-24 AWG SEL GOLD	MOLEX	39-00-0039
**		CRIMP TOOL FOR ITEM 5	MOLEX	11-01-0197

** ITEMS FOR REF ONLY (NOT INCLUDED IN KIT)

PART # FOR OPTIONAL HIGH OUTPUT CURRENT PINS CONNECTOR KIT IS 19-130050.

Interface Connections

Chassis Input Power Terminals (MBJ1)

Input AC power is applied to terminal block MBJ1 using a pressure screw terminal that accepts a maximum wire size of 14 AWG. The insulation should be stripped 0.35 inches and the maximum torque applied to the screws should not exceed 4.4 lb-in. The connector manufacturer recommends the wires not be tinned. A ferrule (Phoenix P/N 32-00-58-0, provided in optional connector kit) can be used to prevent fraying. MBJ1-1 (GND) is Earth Ground for safety; MBJ1-2 (L2) and MBJ1-3 (L1) are the other "hot" connections.

A fault clearing device, such as a fuse or circuit breaker, with a maximum 15A rating at the power supply input is required for safety agency compliance. It should be sized to handle the start-up inrush current of 30A at 115 Vac and 60A at 230 Vac.

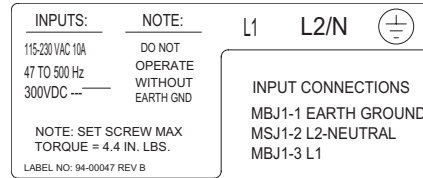


Figure 2. Input Power Terminal MBJ1

Output Power Connections

There are two types of output power terminals available in the PFC Mini-EL. Outputs from full-sized converters are terminated in two 10-32 plated steel bolts. The positive polarity of the output is the right bolt when viewed from the output end. Outputs from half-sized converters terminate in a Molex connector. Each power output is isolated, so outputs of positive or negative polarity can be configured through proper selection of the output reference terminal.

In order to minimize parasitic cable inductance and reduce EMI, the output power cables should be routed in close proximity to one another, and large current loops should be avoided. To avoid excessive voltage drop, do not undersize power cables, especially for high current outputs. Excessive cable inductance coupled with large capacitive loading can introduce instability in switching power supplies. This problem can be avoided with proper system design. Consult Vicor's Applications Engineering Department for assistance with applications that use long cable lengths and excessive load capacitance.

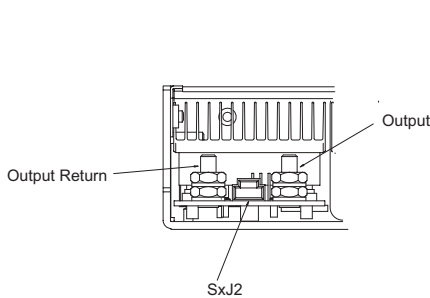
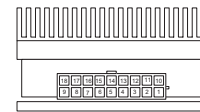


Figure 3. Power Connections for Single Output



18 Pin DUAL MINI AND JR. MODULE OUTPUT CONNECTIONS

PIN DESCRIPTION	PIN DESCRIPTION
SxJ1-1. +OUTPUT M1	SxJ1-10. +OUTPUT M1
SxJ1-2. -OUTPUT M1	SxJ1-11. +OUTPUT M1
SxJ1-3. -OUTPUT M1	SxJ1-12. -OUTPUT M1
SxJ1-4. +SENSE M1	SxJ1-13. +SENSE M2
SxJ1-5. -SENSE M1	SxJ1-14. TRIM M1
SxJ1-6. TRIM M2	SxJ1-15. -SENSE M2
SxJ1-7. +OUTPUT M2	SxJ1-16. +OUTPUT M2
SxJ1-8. +OUTPUT M2	SxJ1-17. -OUTPUT M2
SxJ1-9. -OUTPUT M2	SxJ1-18. -OUTPUT M2

Figure 4. Power connections for Dual Output

+Sense/-Sense (SxJ2/SxJ1) (Not applicable when using BatMod current source.)

The PFC Mini-EL is equipped with Autosense. If Remote Sense connections are not made or needed, no Local Sense selection is necessary - simply hook up the output and the PFC Mini-EL will automatically operate in Local Sense. If remote sense connections are made, the PFC Mini-EL will operate in a Remote Sense mode.

When Local Sense is used, the power supply will regulate the output at the output terminals. The voltage appearing at the load may drop slightly due to voltage drop in the power cables. If it is necessary to compensate for voltage

drop along the output power cables, the output can be trimmed up or configured for Remote Sense. Use stranded twisted pair 20-22 AWG wire for the Remote Sense lines. Remote Sense can compensate for a voltage drop of up to 0.5V, or 0.25V on each leg.

The Sense connector for a single output board is a 3 pin connector providing the +Sense connection on SxJ2-2 and the -Sense connection on SxJ2-3. The Sense connector for a dual output board is a 18 pin connector that also provides the output and trim connections. +Sense and -Sense for the first output are located on SxJ1-4 and SxJ1-5, respectively. +Sense and -Sense for the second output are located on SxJ1-13 and SxJ1-15, respectively.

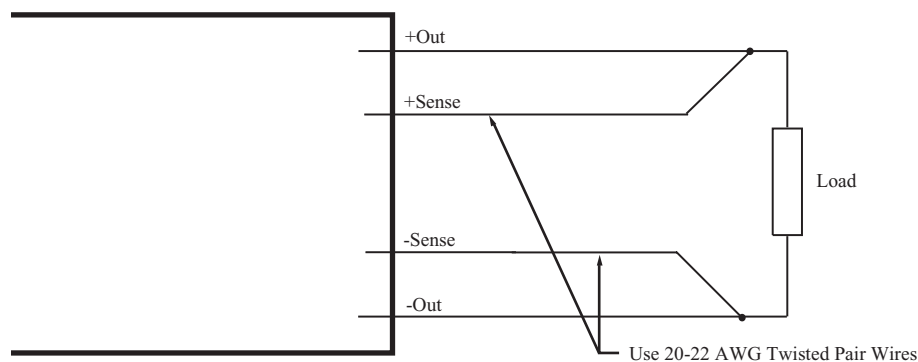


Figure 5. Remote Sense

External Trim (SxJ2/SxJ1) (Not applicable when using BatMod current source)

OUTPUT MODULE	V_{ref}	R_{TH}
VI-200/VI-J00 $\geq 3.3V$	2.5V	10k Ω
VI-200/VI-J00 $< 3.3V$	0.97V	3.88k Ω
2 nd Generation (Predefined)	1.23V	1k Ω
2 nd Generation (User Defined)	1.23V	Consult Factory

Table 1. Module Internal Reference Voltages and Thevenin Resistances.

The output voltage can be trimmed using an optional factory installed Trim potentiometer or with the Trim pin. The Trim potentiometer is located next to the output connectors. If external trim is used, the Trim pin at SxJ2 is referenced to the -Sense pin and can be used for external control of the output voltage. For dual output cards, the Trim pins are available at SxJ1-14 and SxJ1-6 for outputs 1 and 2, respectively. A 10% increase to the trim pin voltage will result in a 10% increase in output voltage. Reducing the trim pin voltage by 10% will result in a 10% decrease in output voltage.

Note: Converters are sometimes pretrimmed at the factory if a nonstandard output voltage is requested. If a nonstandard voltage is requested, the resistor calculations will differ from those below. Consult the factory for assistance.

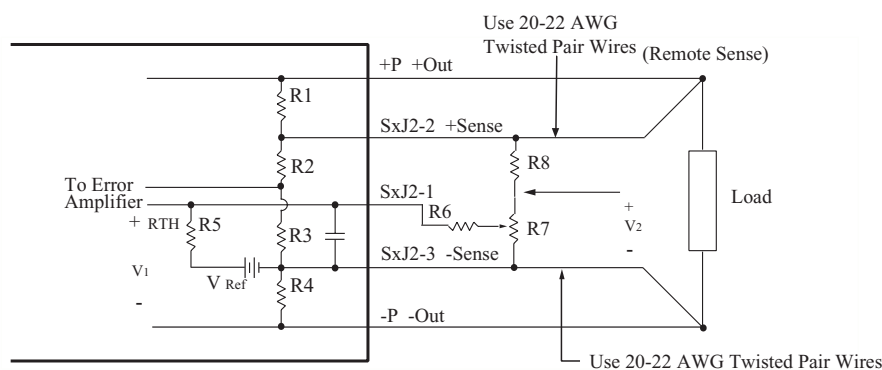


Figure 6. External Trim

Example:
±10% trim adjust on a 12V nominal output.

Figure 6 shows a typical variable trim circuit. Using a 10k trimpot (R7), the resistor values for R6 and R8 can be calculated as follows:

$$V_1 = V_{ref} + 10\% = 2.75V \quad \text{Given: } V_{ref} = 2.5V \text{ (see Table 1)}$$

$$I_{R5} = (2.75V - V_{ref})/R_{TH} = (2.75V - 2.5V)/10k\Omega = 25\mu A \quad \text{Given: } R_{TH} = 10k\Omega \text{ (see Table 1)}$$

Setting the bottom limit:

$$V_{R6} = 2.5V - 10\% = 2.25V$$

And since $I_{R5} = I_{R6} = 25\mu A$,

$$R6 = V_{R6}/I_{R6} = 2.25V/25\mu A = \underline{90k\Omega}$$

$$V_2 = V_1 + V_{R6} = 2.75V + 2.25V = 5V$$

$$I_{R7} = V_2/R7 = 5V/10k\Omega = 500\mu A$$

$$I_{R8} = I_{R7} + I_{R6} = 525\mu A$$

$$V_{R8} = (V_{nom} + 10\%) - V_2 = 13.2V - 5V = 8.2V \quad \text{Given: } V_{nom} = 12V$$

$$R8 = V_{R8}/I_{R8} = 8.2V/525\mu A = \underline{15.62k\Omega}$$

Consult Applications Engineering when trimming outputs below 5V.

Signal Ground (J3-4)

Signal Ground on J3-4 is an isolated secondary ground reference for all J3 interfacing signals. This is **not** the same as Earth Ground on input power connector MBJ1.

Enable/Disable (J3-1 to J3-3)

The Enable/Disable control pins allow outputs to be sequenced either on or off. J3-1 through J3-3 are the control pins for output cards 1 through 3, respectively. For 2-output cards, both outputs are enabled or disabled with a single control. The Enable/Disable pins should be pulled low to less than 0.7V with respect to Signal Ground to disable the outputs. They will source 4mA maximum. These pins should be open circuited or allowed to exceed 4.5V when enabled. Do not apply more than 5V to these inputs.

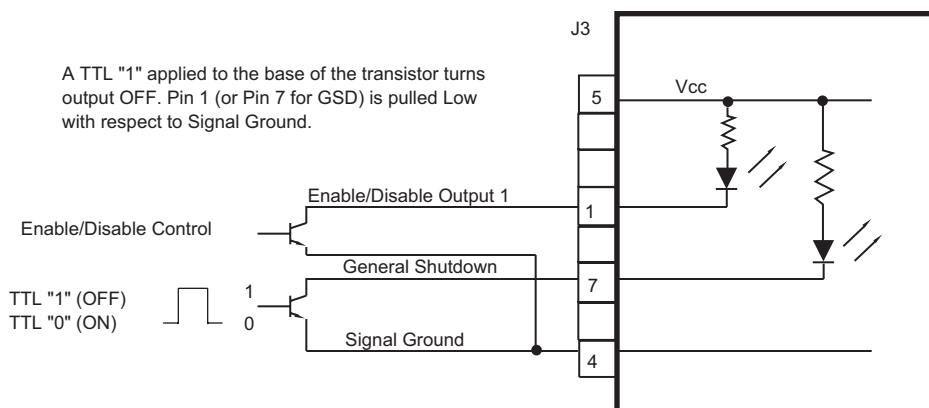


Figure 7. Enable/Disable and General Shutdown

Enable/Disable control of 2nd Generation Module Arrays

When using the Enable/Disable function on an output that consists of two or more 2nd Gen modules, it is necessary to connect the E/D pins of the corresponding module locations together such that both modules are commanded to turn ON or OFF simultaneously.

Example: S1 and S2 has been configured as a single output parallel array (see Fig. 8)

In order to disable the 48V output, E/D 1 and E/D 2 should be shorted together as shown in Fig. 8. With E/D 1 and 2 connected together, a single switch can then be used to remotely enable and disable the output.

**Note: For single output 2nd Gen power supply configurations, the simplest method of remotely enabling and disabling the output is to use the General Shutdown (GSD) function.

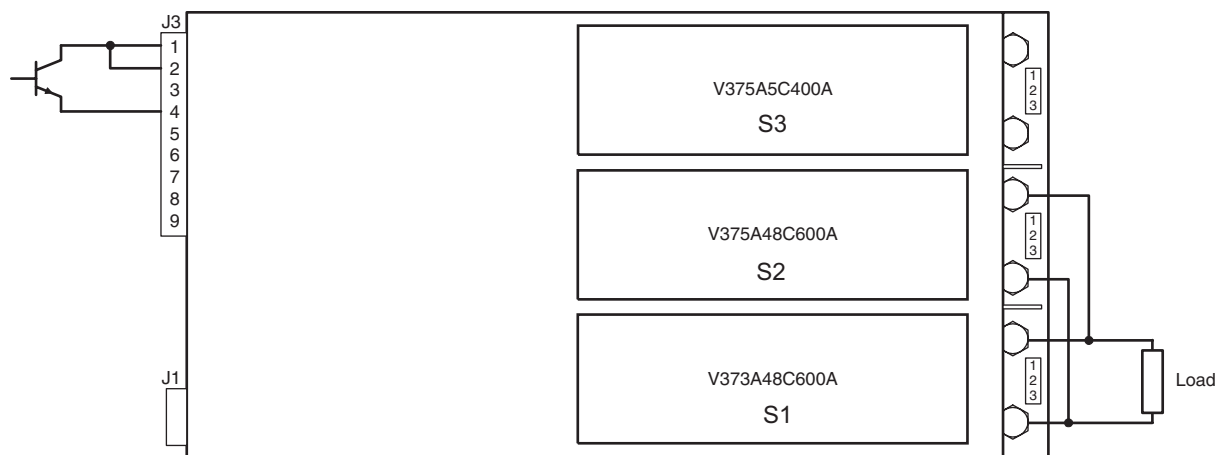


Figure 8. Enable/Disable Control of 2nd Gen Module Arrays

General Shutdown /GSD (J3-7)

The GSD control pin on J3-7 allows simultaneous shutdown of all outputs. This pin must be pulled down to less than 0.7V, and will source 4mA maximum to shut down all outputs. The GSD pin should be open circuited or allowed to exceed 4.5V when not in use, or when the outputs are to be enabled. Do not apply more than 5V to this input at any time. Normal open circuit voltage is 1.5 to 3V with respect to Signal Ground.

AC OK (J3-6)

AC OK is an active high TTL compatible signal and provides a status indication of the AC input power. It is on pin J3-6 and is capable of sinking 16 mA maximum. This signal switches to a TTL "1" when the high voltage bus exceeds low-line condition during turn-on. Upon loss of input power, the bus voltage will drop, causing the AC OK signal to go low. A minimum of 3 ms holdup time is provided for a 1,200W load following the loss of the AC OK signal.

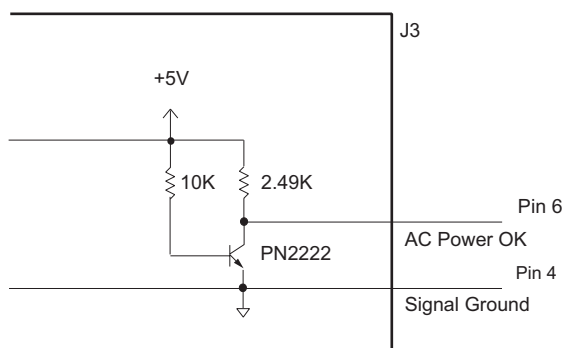


Figure 9. AC OK

Auxiliary Vcc +5V/0.3A (J3-5)

The Vcc on J3-5 is an auxiliary 5V regulated power source. It is +5 Vdc +/-5% with respect to Signal Ground and can supply 300 mA maximum. It is short-circuit-proof, but if shorted, all outputs will shut down through the Enable/Disable circuitry.

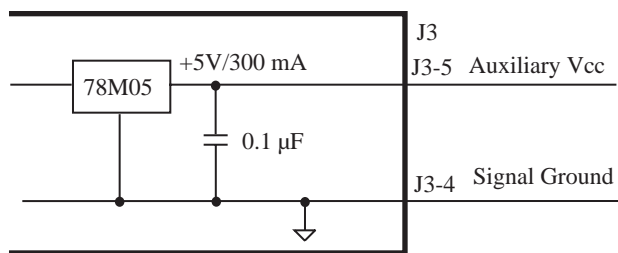


Figure 10. Auxiliary Vcc

Using a BatMod Current Source in the PFC Mini-EL

The BatMod is a programmable current source that can also be used as a constant voltage converter. It has three control signals that can be found on SxJ2. All three are referenced to the -Out pin. Current Trim (SxJ2-1) is an input signal with an analog voltage of one to five volts that can adjust the sourced current rating from 0 to 100%. **Voltage must be applied to the Current Trim input for the module to provide power.** The Voltage Trim (SxJ2-2) is an input signal that can be set for a maximum voltage with a fixed resistor, or adjusted by using an external voltage source. A source voltage referenced to the -Out of 1.25 to 2.5V for a 50% to 100% of rated voltage adjustment. Leaving the Voltage Trim open will set the trim limit to maximum. The Current Monitor (SxJ2-3) is an output signal that indicates the amount of current being sourced. It is a linear voltage/current relationship in which one volt corresponds to 0% of sourced current, and five volts corresponds to 100% of sourced current.

Single Output Power Supplies (Arrays)

Westcor’s standard configuration for single output power supplies is to set the left module (as seen from looking at the power supply output) as the controlling module of the array.

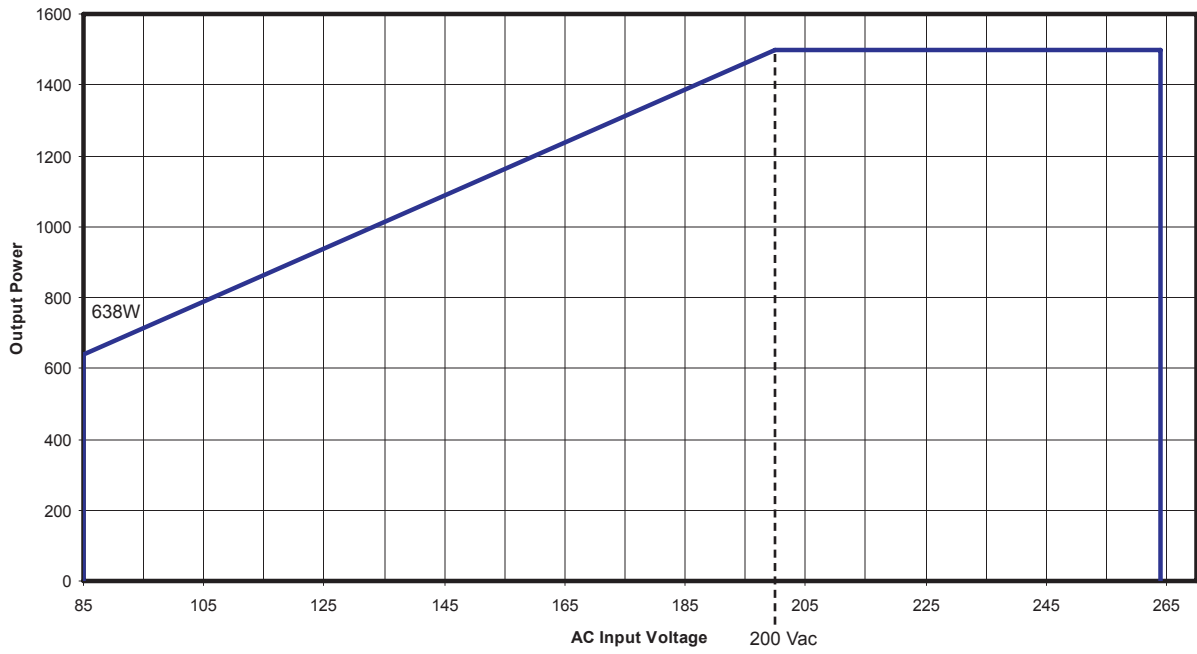
Special 7 Output PFC Mini-EL

A special 7 output PFC Mini-EL is available in four models. See table below for more information.

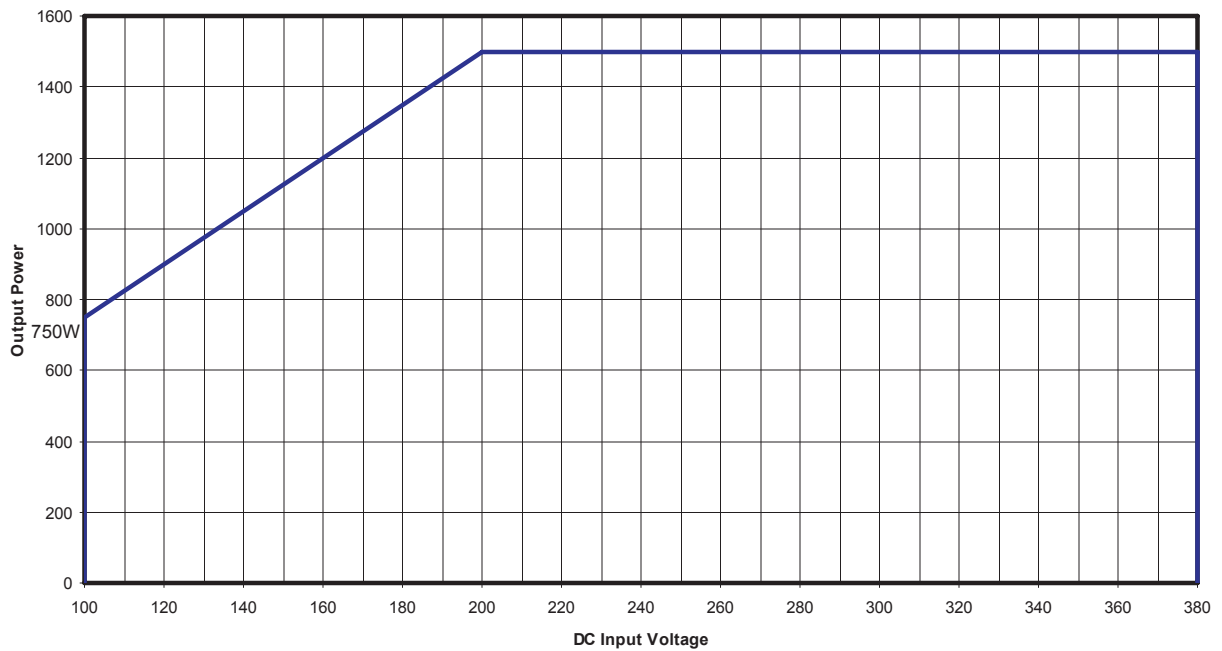
		PM7-43-01-EL	PM7-25-02-EL	PM7-25-03-EL	PM7-07-04-EL
		MAXIMUM CURRENT			
OUTPUT VOLTAGE	- 2.0	3	3	3	3
	-5.2	16	16	16	16
	± 5.0	40	40	40	40
	± 12.0	8.3	8.3	20.8	20.8
	± 12.0	8.3	8.3	20.8	20.8
	± 24.0	4.2	10.4	4.2	10.4
	± 24.0	4.2	10.4	4.2	10.4
	Maximum Output Power	690W	790W	990W	1,290W

PFC Mini-EL Output Power vs. Input Voltage

Output Power vs. AC Input Voltage



Output Power vs. DC Input Voltage



OUTPUT (CONT'D.)**2nd Generation Modules (Maxi and Mini modules only)**

Parameter	MIN.	TYP.	MAX.	UNITS	NOTES
Setpoint Accuracy*		±0.5	±1	% of V _{NOM}	
Load Regulation		±0.1		% of V _{NOM}	See module design guide for exact specifications.
Temperature Regulation		0.002	0.005	%/°C	-20 to 100°C
Long Term Drift		0.02		%/K hours	
Output Ripple and noise:					
15V and below			50	mV p-p	
> 15V to 24V			150	mV p-p	
>24V			1.0	% V _{out}	
Voltage Trim Range					
2nd Gen Slots		10-110		% V _{out}	Preload may be required.
Total Remote Sense Compensation	0.5			Volts	Autosense. See pg.6 & 11
OVP Set Point	112		135	% of V _{out}	Recycle power
Current Limit		115	135	% of I _{max}	Auto Recovery
Overtemperature Limiting	100	115			2nd Gen OTL is non-latching

* For special, adjustable voltages and 48Vdc outputs, maximum setpoint accuracy is 2% of V_{nom}.

Note: See individual module datasheets for specific module specifications.

ENVIRONMENTAL

Storage Temperature	-40°C to +85°C
Operating Temperature	
Full Power	-20 to +45°C*
Half Power	-20 to +65°C

* 45°C is the maximum operating temperature. If one is using a 2nd Gen module less than 24V output and more than 500 Watts, the maximum operating temperature is 40°C.

Specific temperature data on all module configurations can be obtained by contacting Applications Engineering.

Altitude	Derate 2.6% total output power for each 1,000 ft to a maximum operating altitude of 15,000 ft. Non-operating storage maximum altitude is 40K. 75% maximum load
Humidity	0 to 95% non condensing
Product Weight	6.0 lbs. (2,7 kg)
Dimensions	1.72" H (43,6mm) x 6.0" W (152,4mm) x 13.2" L (335,3mm)
Warranty*	2 years limited warranty. See vicorpower.com for complete warranty statement.

* Opening, repairing or modifying the unit will void the warranty. If you have any problem with the power supply, please contact Customer Service at 1-800-797-5678. If the unit needs to be returned for inspection/analysis, an RMA number will be issued. All units must have a RMA number prior to return.

CURRENT SHARE BOARD - Optional Feature

"Current sharing" also known as Load Sharing, is the ability to divide the output current evenly across all active power supplies. This greatly reduces stresses on each power supply and allows them to run cooler, resulting in higher reliability. Standard "current sharing" techniques typically utilize shunt resistors or Hall Effect devices to measure the current from each power supply. Power shunt resistors continually dissipate power and require cooling especially when dealing with high output currents of >100Amps. Hall Effect devices measure magnetic fields generated by current flowing through a conductor and, although they dissipate no power, they tend to be large and expensive.

First developed by Westcor Engineering for paralleling MegaPAC supplies, the Box-to-Box Current Share Board or CSB allows two or more Vicor power supplies to current share by utilizing the inherent voltage drop produced in the negative output return cable. This eliminates the need for additional shunt resistors or expensive Hall Effect devices and provides a simple 5 wire connection method to achieve a +/-1mV accuracy between the Negative Output power rails. This accuracy translates to a 1% current sharing if there is a total of 100mV conduction voltage drop in the negative return path.

Constructed as a current source to drive the Trim pin of a Vicor module, the design uses an accurate comparator circuit to monitor the power returns. In addition, the circuit is unidirectional and can only trim an output voltage up. The benefit is that only the supply that is supporting less current is adjusted up. This action balances the currents to the load by matching the output voltages of the supplies. In the case of one supply failing, the circuit will attempt to trim the failed supply only. This will leave the remaining functional supply alone to provide power to the load at its nominal voltage. Thus the circuit also offers simple redundancy. In addition, because CSB functions as a current source, the Trim outputs (T1 and T2) of the CSB can be placed in parallel to create a summing node. This allows current sharing between more than two supplies by paralleling the T2 output of one CSB circuit with the T1 output of the next CSB.

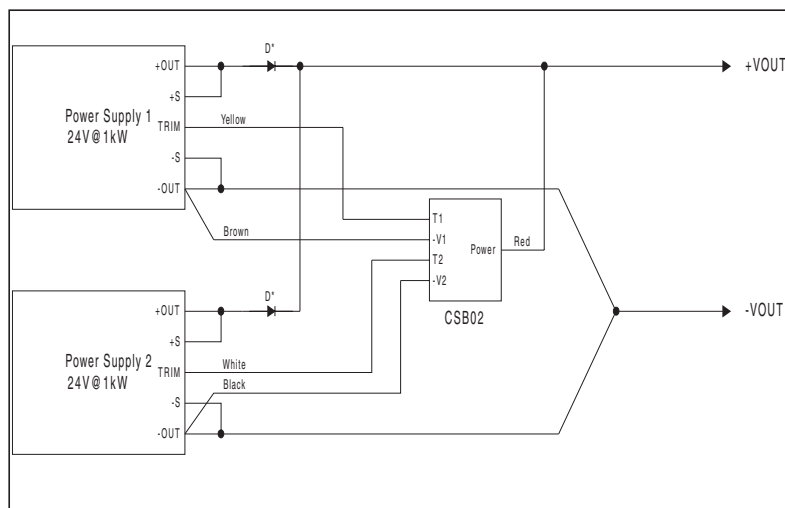


Figure 1. CSB Interconnect Example

Please note: The CSB is not intended for use in Hotswap Applications.

Requirements:

1. For proper operation, the power supplies being paralleled should be enabled at the same time.
2. -Out conductors must be of equal length and wire gauge. Separate -Out conductors must be used from each supply to the load, or the use of a "Y" connection to a common point must be used as shown in figure 1. Each leg of the "Y" must have a minimum of a few millivolts of drop in order for proper operation. 50mV to 100mV of drop will provide from 5% to 1% accuracy.
3. -V1 and -V2 for all Box-to-Box circuits must be connected directly at the negative output power studs or terminals to achieve accurate current sharing.
4. D* can be added if redundancy is needed. If redundancy is not required, D* can be replaced with direct wire connections.
5. When using D*, the Power input should be connected on the cathode side of the paralleling diodes as shown above.
6. Terminate Sense Leads either locally or remotely as shown in figure 1.
7. For paralleling more than 2 supplies consult factory for assistance.

CURRENT SHARE BOARD - Optional Feature (contd)

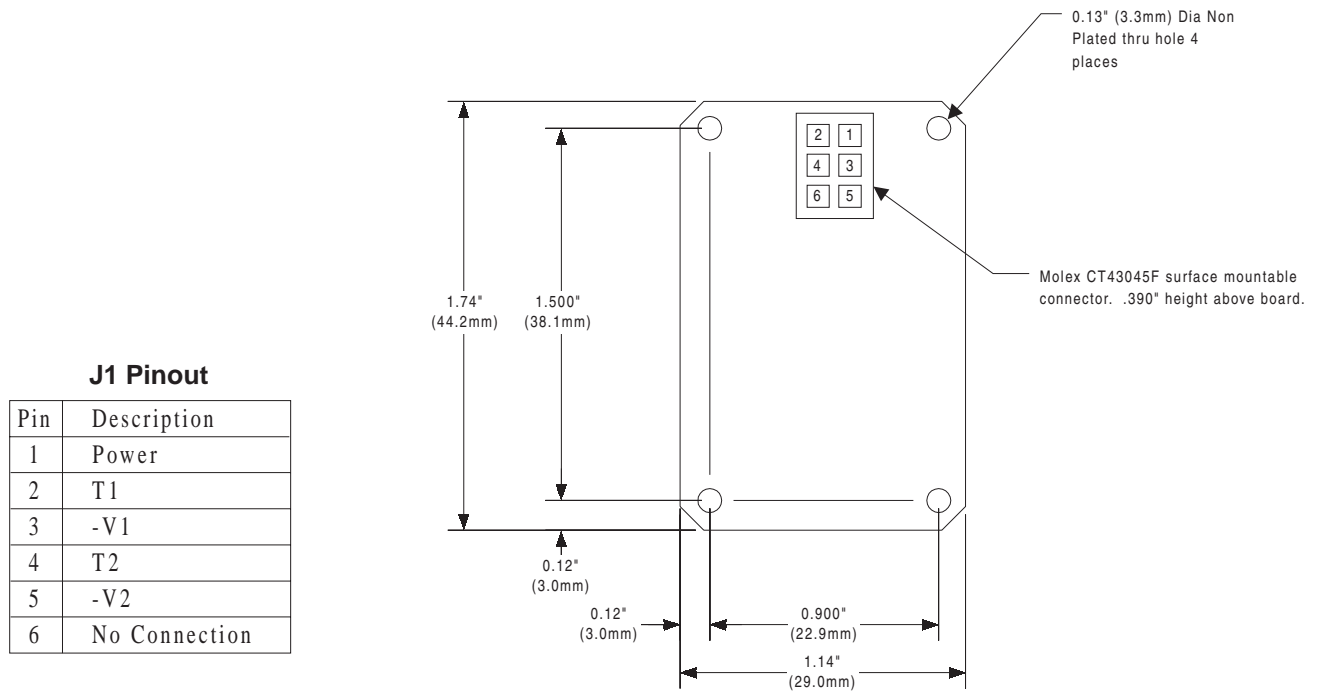


Figure 2. Mechanical Drawing



Figure 3. Cable Drawing

Specifications:

1. Power: 2-50Vdc at 5mA maximum.
2. Accuracy: +/- 1mV between -Vout connections.
3. Output current when not trimming up: +/- 1uA (VI-200/J00), +/-5uA (2nd Generation).
4. Use 4 non-plated through holes with standoffs for mounting.
5. CSB01 MUST be used for current sharing 1st Generation converters (VI-200/J00).
6. CSB02 MUST be used for current sharing 2nd Generation converters (Maxi, Mini and Micros).

*****PLEASE NOTE, THE CSB IS NOT INTENDED FOR HOTSWAP APPLICATIONS*****

Contact your Regional Applications Engineer at 1-800-927-9474 for additional information.

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For more information about this or other Vicor products, or for assistance with component-based power system design, contact the Vicor office nearest you. Vicor's comprehensive line of power solutions includes modular, high-density DC-DC converters and accessory components, configurable power supplies, and custom power systems. Westcor, a division of Vicor, designs and builds, configurable power supplies incorporating Vicor's high density DC-DC converters and accessory components. **Westcor's product line includes:**

LOPAC FAMILY:

- PFC MicroS
- PFC Micro
- PFC Mini
- PFC Mini-EL

MEGAPAC FAMILY:

- PFC MegaPAC
- PFC MegaPAC (Low Noise/High Power)
- 4kW MegaPAC
- PFC MegaPAC-EL (Low Noise)
- Mini MegaPAC
- 4kW MegaPAC-EL (Low Noise)
- PFC MegaPAC (High Power)
- Autoranging MegaPAC
- ConverterPACs

OTHERS:

- FlatPAC-EN

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