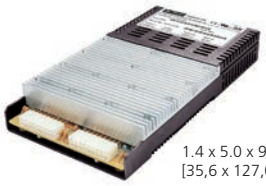
# FlatPAC-EN™ MI



1.4 x 5.0 x 9.2in
[35,6 x 127,0 x 233,7mm]

## Rugged COTS Autoranging Switcher

### Features & Benefits

- EN61000-3-2 harmonic-current compliance
- Low-profile package (1.4in [35,6mm])
- Output power to 500W (425W for EN compliance)
- Up to four user-specifiable outputs
- "Autosense" feature
- Meets MIL-STD-810 for shock and vibration
- RS-232 microcontroller interface
- Safety agency approvals: CE Marked, cTÜVus
- –40°C operation
- Optional conformal coating

### Product Description

With a power density greater than 7W/in$^3$, the Vicor FlatPAC-EN MI is an ultra-low-profile, compact, EN-compliant autoranging AC-DC switcher. It is capable of providing up to 500 Watts from up to four isolated outputs.

For maximum versatility and flexibility, the FlatPAC-EN MI can be configured with standard Vicor DC-DC converter modules: full-, half- and quarter-brick sizes. These modules cover the entire range of outputs from 1 to 100$V_{DC}$ and 25 to 500 Watts, as well as an array of non-standard voltages. The optimum FlatPAC-EN MI solution can be factory-configured based on your exact voltage and power requirements.

For conducted EMI the FlatPAC-EN MI conforms with FCC Class A and B; and EN55022 Class A. Compliance with 55022 B and MIL-STD-461 are configuration-dependent. Consult factory.

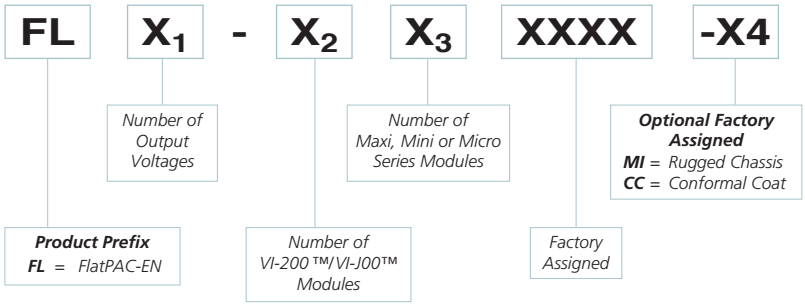
The supplies are also compliant with all EN61000-6-1 requirements for conducted and radiated immunity, as well as EN61000-3-2 for harmonic current emissions and EN61000-3-3 for voltage flicker.

For compliance to EN61000-3-2, do not exceed input currents of 3.33A @ 230$V_{AC}$, 59Hz.

### Autosense Feature [a]

This is a feature implemented in all converter slots in the FlatPAC-EN MI. If remote-sense connections are not needed or are inadvertently not made, no local-sense connections are necessary. Simply connect the output(s) to the load and the converter(s) will automatically operate in the local-sense mode. If remote sense connections are made, the unit will operate in remote sense mode.

### Part Numbering




[a] Applies to outputs utilizing full- or half-size converters.

## DC Output Selections

The tables below show a sampling of some of the most popular standard outputs that can be configured into the FlatPAC-EN MI.

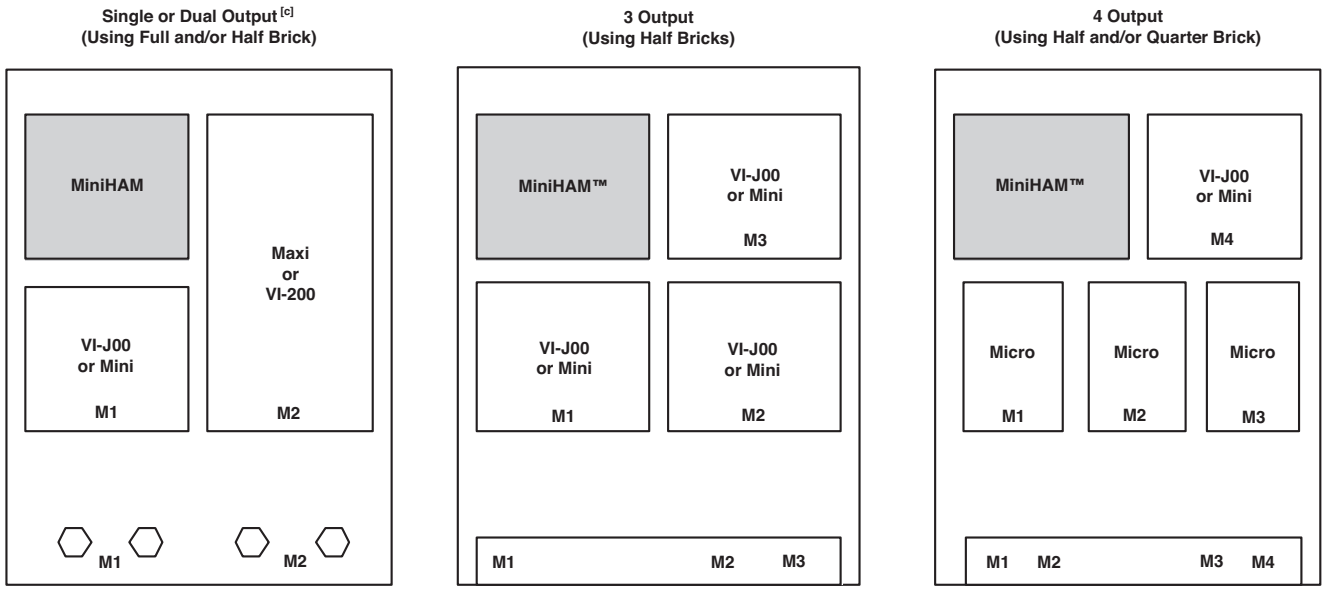
| Output Voltage ($V_{DC}$) | Available Power (W) per Package Size | | | | | | |
|---|---|---|---|---|---|---|---|
| | Full Brick | | | Half Brick | | | Quarter Brick |
| | Maxi | VI-200™ | | Mini | VI-J00™ | | Micro |
| 2 | 160 | 80 | 60 | 100 | 40 | 30 | 50 |
| 3.3 | 264 | 132 | 99 | 150 | 66 | 50 | 75 |
| 5 | 400 | 200 | 150 | 200 | 100 | 75 | 100 |
| 12 | 500 | 200 | 150 | 250 | 100 | 75 | 150 |
| 15 | 500 | 200 | 150 | 250 | 100 | 75 | 150 |
| 24 | 500 | 200 | 150 | 250 | 100 | 75 | 150 |
| 28 | 500 | 200 | 150 | 250 | 100 | 75 | 150 |
| 48 | 500 | 200 | 150 | 250 | 100 | 75 | 150 |

## FlatPAC-EN Configurations

Vicor DC–DC converter modules are used to populate the FlatPAC-EN MI. There are several configurations available depending on module size, power limitation and location of the MiniHAM.[b]

The two-output FlatPAC-EN MI contains one full brick and one half brick. The three-output FlatPAC-EN MI contains three half bricks. The four-output FlatPAC-EN MI contains one half brick and three quarter bricks. See below.

**FlatPAC-EN MI Configurations[d]**
**Maximum Total Output Power = 500W (425W for EN61000-3-2 Compliance)**




**Note:** The FlatPAC-EN is limited to a maximum output power of 500W regardless of the module capability. For example, if three Mini modules are used, the maximum output power for the FlatPAC-EN is still 500W irrespective of the maximum output power of the modules. For EN61000-3-2 harmonic current compliance, input current of $3.33A_{RMS}$ should not be exceeded.

[b] The MiniHAM is a passive harmonic attenuator specifically designed for EN compliance. Unlike active PFC solutions, the MiniHAM generates no EMI, greatly simplifying and reducing system noise filtering requirements. It is also considerably smaller and more efficient than active alternatives and improves the unit's MTBF. It will provide harmonic current compliance at $230V_{AC}$ input at up to 425W of output power.
[c] For a single-output configuration either M1 or M2 is used.
[d] Please note that the output connector is configuration-dependent.

## Performance Specifications

The following are typical performance specifications at room ambient temperature, nominal line voltage (115 / 230$V_{AC}$) and 75% load on all outputs, unless specified otherwise. For detail specifications, consult the FlatPAC-EN MI Design Guide available online at vicorpower.com.

### Input Characteristics

| Parameter | Typ | Units | Notes |
|---|---|---|---|
| AC Input | | | |
| Voltage | 90 – 132 / 180 – 264 | $V_{AC}$ | Derates to 260W @ 90$V_{AC}$, 400W @ 180$V_{AC}$ |
| Frequency | 47 – 63 | Hz | |
| DC Input | 250 – 380 | $V_{DC}$ | |
| Line Regulation | 0.2 | % | From low line to high line |
| Inrush Current | | | |
| @ 115$V_{AC}$ | 8 | $A_{RMS}$ | |
| @ 230$V_{AC}$ | 8 | $A_{RMS}$ | |
| Ride-Through Time | | | |
| @ 115$V_{AC}$ | 12 / 15 | ms | |
| @ 230$V_{AC}$ | 16 / 18 | ms | |
| @ Load | 500 / 400 | W | |
| Conducted EMI / RFI | FCC Class A, EN55022 Class A | | |
| | FCC Class B, EN55022 Class B | | For EN55022 B and MIL-STD 461, contact factory |
| Power Factor | >0.70 | | >75% load |
| Harmonic Current Limits | EN61000-3-2/A14 | | Input current of 3.33$A_{RMS}$ max. at 230$V_{AC}$, 50Hz |
| Transient Burst Immunity | EN61000-4-4 | | Criteria B |
| Surge Immunity | EN61000-4-5 | | Installation Class 3, performance Criterea B, Class 4 performance configuration dependent - contact factory |
| Voltage Dips | EN61000-4-11 | | Criteria B |
| Dielectric Withstand | | | |
| Primary to Chassis GND | 1,500 | $V_{RMS}$ | |
| Primary to Secondary | 3,000 | $V_{RMS}$ | |
| Secondary to Chassis GND | 500 | $V_{RMS}$ | |

## Performance Specifications (Cont.)

The following are typical performance specifications at room ambient temperature, nominal line voltage (115 / 230$V_{AC}$) and 75% load on all outputs, unless specified otherwise. For detail specifications, consult the FlatPAC-EN Design Guide available online at vicorpower.com.

### Output Characteristics

| Parameter | Typ | Units | Notes |
|---|---|---|---|
| Setpoint Accuracy | 0.5 | % | Of $V_{NOM}$ |
| Load Regulation | 0.2 | % | No Load to full load |
| Temperature Regulation | 0.005 | % / °C | –40 to +65°C |
| Long Term Drift | 0.02 | % / khr | |
| Output Ripple & Noise | | | |
| ≤10$V_{OUT}$ | 100 | mV | 20MHz band width |
| >10$V_{OUT}$ | 1.0 | % | 20MHz band width |
| Voltage Trim Range | | | |
| VI-200™ / VI-J00™ modules | 50 – 110 | %$V_{OUT}$ | ±10% on 10 – 15$V_{OUT}$ |
| Maxi, Mini, Micro modules | 10 – 110 | %$V_{OUT}$ | Preload may be required |
| Remote-Sense Compensation | 0.5 | $V_{DC}$ | Autosense (See page 1) |
| OVP Set Point | 125 | %$V_{OUT}$ | Not available on VI-200 / VI-J00 Modules |
| Current Limit | 115 | %$I_{MAX}$ | Autorecovery |

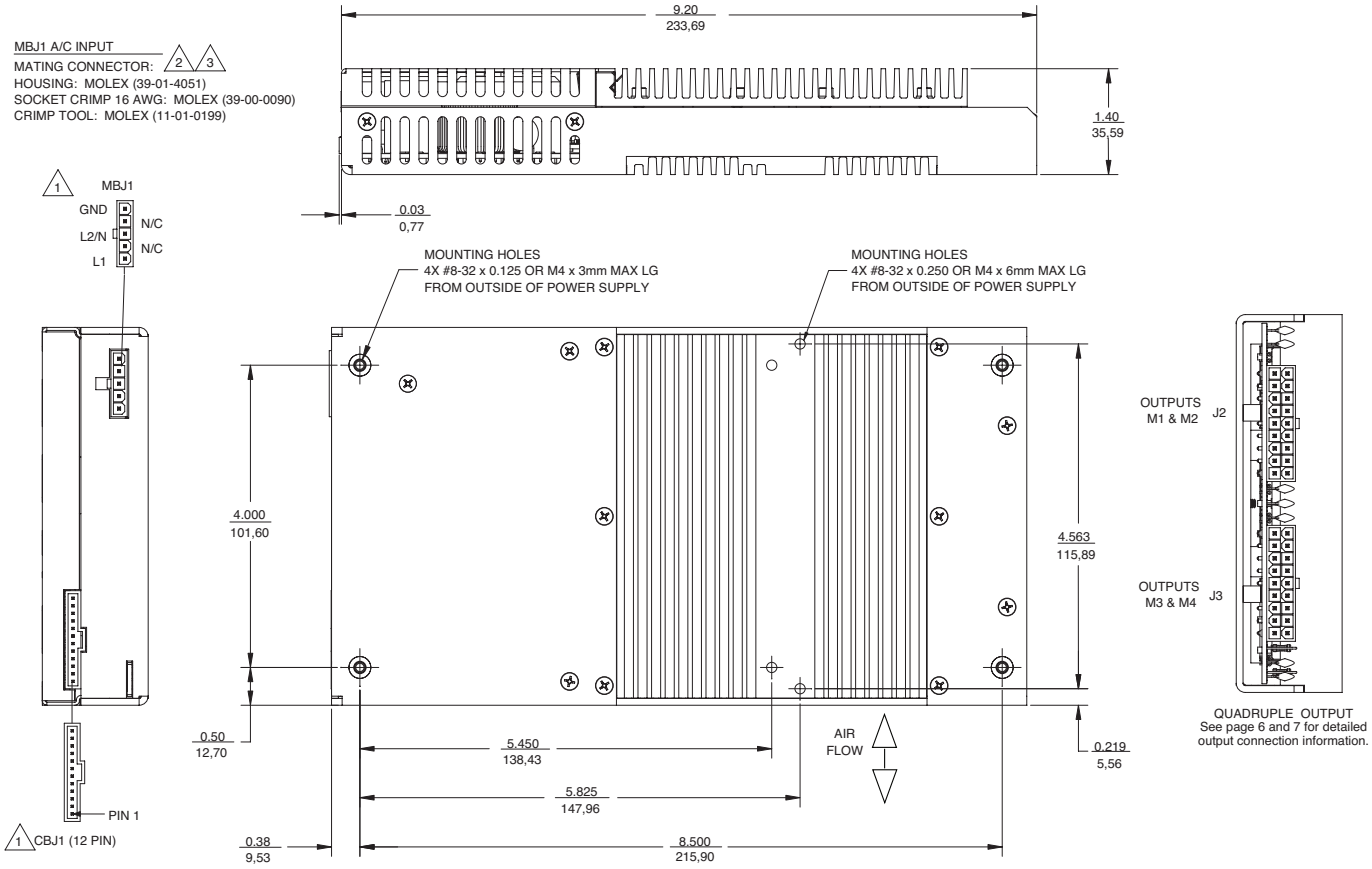
### Environmental Characteristics

| Parameter | Typ | Units | Notes |
|---|---|---|---|
| Storage Temperature | –40 to +100 | °C | Standard version |
| Operating Temperature | | | |
| Ambient Air | –40 to +70 | °C | See de-rating curves in Design Guide |
| Case Temperature | –40 to +90 | °C | 75° for VI-200 modules |
| Shock and Vibration | | | MIL-STD-810 |
| Safety Approvals | cTÜVus, CE Marked | | |

### Mechanical Characteristics

| Parameter | Typ | Units | Notes |
|---|---|---|---|
| Weight | 3.4 [1.5] | lbs [kg] | |
| Overall Dimensions | 9.2 x 5.0 x 1.4<br>[233,7 x 127,0 x 35,6] | in<br>[mm] | L x W x H |

## Mechanical Drawings




| PIN | REF | DESCRIPTION |
|---|---|---|
| CBJ1 | SGND | SIGNAL GROUND |
| CBJ2 | N/C | N/C |
| CBJ3 | ACOK | AC POWER OK |
| CBJ4 | TX | TRANSMIT 4 |
| CBJ5 | RX | RECEIVE |
| CBJ6 | E/D-4 | ENABLE/DISABLE |
| CBJ7 | E/D-3 | ENABLE/DISABLE |
| CBJ8 | E/D-2 | ENABLE/DISABLE |
| CBJ9 | E/D-1 | ENABLE/DISABLE |
| CBJ10 | GSD | GENERAL SHUTDOWN |
| CBJ11 | N/C | N/C |
| CBJ12 | +5VS | +5V @ 300mA |

CBJ1 E/D INTERFACE CONNECTOR

MATING CONNECTOR: 2 3
HOUSING: MOLEX (50-57-9412)
SOCKET CRIMP 24-30 AWG: MOLEX (16-02-0097)
CRIMP TOOL: MOLEX (11-01-0209)

### NOTES: UNLESS OTHERWISE SPECIFIED

1

| REFERENCE | DESIGNATION |
|---|---|
| MB | MOTHER BOARD |
| CB | CONTROL BOARD |

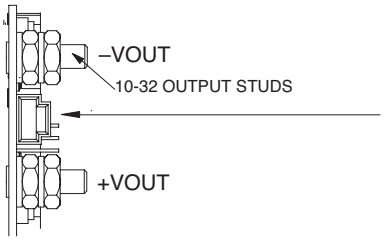
2 CONNECTOR PART NUMBERS SPECIFIED ARE MOLEX OR EQUIVALENT

3 A COMPLETE SET OF MATING CONNECTORS CAN BE PURCHASED FROM WESTCOR BY SPECIFYING CONNECTOR KIT P/N 19-130044

4 CBJ4 AND CBJ5 ARE PART OF THE RS-232 MICROCONTROLLER FUNCTIONS. SEE FLATPAC-EN DESIGN GUIDE (AVAILABLE ONLINE AT VICORPOWER.COM) FOR DETAILED INFORMATION.

## FlatPAC-EN MI Output Connectors

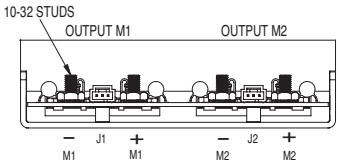
**A. STUD OUTPUT CONNECTORS** (When populated with full- and/or half-brick modules)




J1/J2 SENSE/TRIM PIN CONNECTOR

| | |
|---|---|
| 1 | TRIM |
| 2 | +SENSE |
| 3 | –SENSE |

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

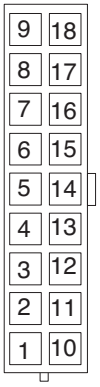



SINGLE OR DUAL OUTPUT

**B. 18 PIN MOLEX CONNECTOR** (When populated with half-brick modules)

**Output M1 (using 1 half-brick)**

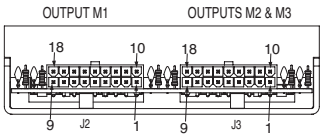
J2




J2 (18 PIN OUTPUT, SENSE AND TRIM PIN CONNECTOR)

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | N/C | 10 | N/C |
| 2 | N/C | 11 | N/C |
| 3 | N/C | 12 | N/C |
| 4 | N/C | 13 | +SENSE M1 |
| 5 | N/C | 14 | N/C |
| 6 | TRIM M1 | 15 | –SENSE M1 |
| 7 | +VOUT M1 | 16 | +VOUT M1 |
| 8 | +VOUT M1 | 17 | –VOUT M1 |
| 9 | –VOUT M1 | 18 | –VOUT M1 |

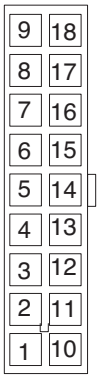
MATING CONNECTOR:
18 PIN HOUSING: MOLEX (39-01-2180)
TERMINAL FEM CRIMP 18-24 AWG: MOLEX (39-00-0039)
USE CRIMP TOOL: MOLEX (11-01-0197)




TRIPLE OUTPUT

**Outputs M2 and M3 (Using 2 half bricks)**

J3




J3 (18 PIN OUTPUT, SENSE AND TRIM PIN CONNECTOR)

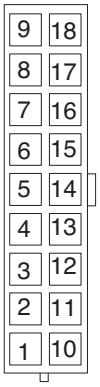
| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | +VOUT M3 | 10 | +VOUT M3 |
| 2 | –VOUT M3 | 11 | +VOUT M3 |
| 3 | –VOUT M3 | 12 | –VOUT M3 |
| 4 | +SENSE M3 | 13 | +SENSE M2 |
| 5 | –SENSE M3 | 14 | TRIM M3 |
| 6 | TRIM M2 | 15 | -SENSE M2 |
| 7 | +VOUT M2 | 16 | +VOUT M2 |
| 8 | +VOUT M2 | 17 | –VOUT M2 |
| 9 | –VOUT M2 | 18 | –VOUT M2 |

## FlatPAC-EN MI Output Connectors (Cont.)

**C. 18 PIN CONNECTOR** (When populated with half- and/or quarter-brick modules)

### Outputs M1 and M2 (Using 2 quarter bricks)

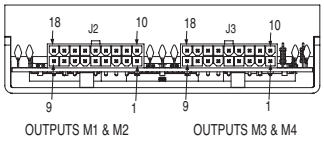
J2




J2 (18 PIN OUTPUT, SENSE AND TRIM PIN CONNECTOR)

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | +VOUT M2 | 10 | +VOUT M2 |
| 2 | –VOUT M2 | 11 | +VOUT M2 |
| 3 | –VOUT M2 | 12 | –VOUT M2 |
| 4 | +VOUT M2 | 13 | +VOUT M1 |
| 5 | –VOUT M2 | 14 | TRIM M2 |
| 6 | TRIM M1 | 15 | –VOUT M1 |
| 7 | +VOUT M1 | 16 | +VOUT M1 |
| 8 | +VOUT M1 | 17 | –VOUT M1 |
| 9 | –VOUT M1 | 18 | –VOUT M1 |

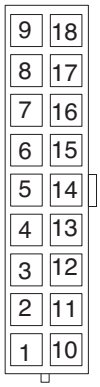
MATING CONNECTOR:
18 PIN HOUSING: MOLEX (39-01-2180)
TERMINAL FEM CRIMP 18-24 AWG: MOLEX (39-00-0039)
USE CRIMP TOOL: MOLEX (11-01-0197)




QUADRUPLE OUTPUT

### Outputs M3 and M4 (Using 1 quarter brick and 1 mini brick)

J3




J3 (18 PIN OUTPUT, SENSE AND TRIM PIN CONNECTOR)

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | +VOUT M4 | 10 | +VOUT M4 |
| 2 | –VOUT M4 | 11 | +VOUT M4 |
| 3 | –VOUT M4 | 12 | –VOUT M4 |
| 4 | +SENSE M4 | 13 | +VOUT M3 |
| 5 | –SENSE M4 | 14 | TRIM M4 |
| 6 | TRIM M3 | 15 | –VOUT M3 |
| 7 | +VOUT M3 | 16 | +VOUT M3 |
| 8 | +VOUT M3 | 17 | –VOUT M3 |
| 9 | –VOUT M3 | 18 | –VOUT M3 |

Note: Additional technical information including temperature derating curves, installation instructions, mounting holes, RS-232 microcontroller features covered in the FlatPAC-EN Design Guide available online at vicorpower.com.

## FlatPAC-EN MI Accessories

The following accessories are available for the FlatPAC-EN MI:

**Connector Kits**

- FlatPAC-EN MI 19-130044

**Current-Share Boards**

Used for increased output power or redundancy

- FlatPAC-EN MIs with VI-200™/VI-J00™ Modules CSB01
- FlatPAC-EN MIs with Maxi/Mini/Micro Modules CSB02

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Visit http://www.vicorpower.com/mil-cots-power-systems/flatpacen_mi for the latest product information.

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