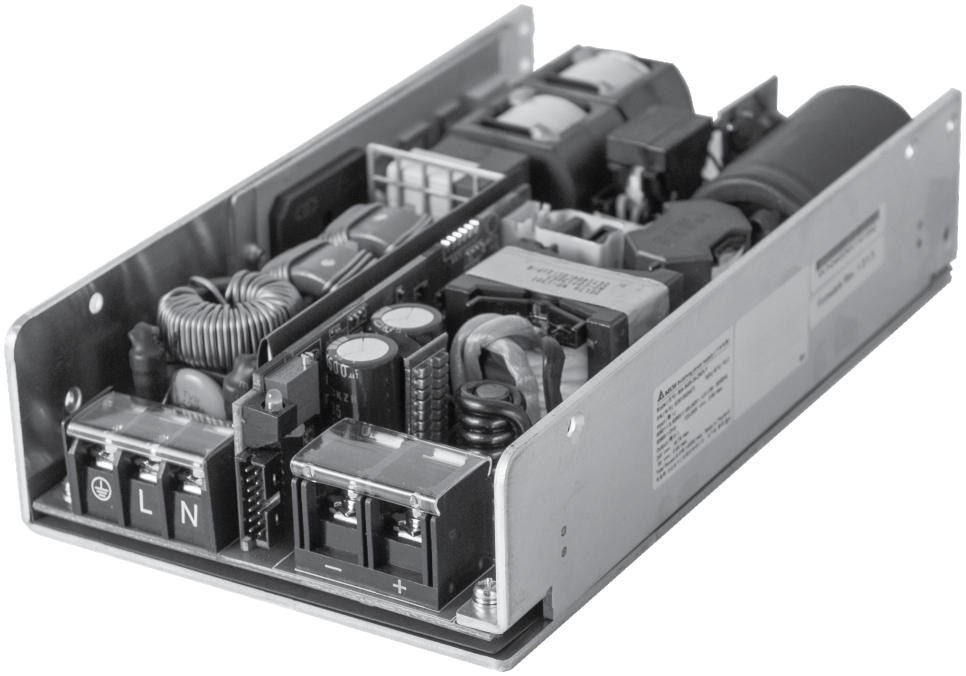



# IMA 400 Watts Power Supply Series

for medical and industrial applications

Product data sheet

Smarter. Greener. Together.

# 400 Watts Power Supply Series

### for medical and industrial applications

## Features

- Safety rated for Medical, Industrial and IT
- Wide operating input voltage range: 80 Vac to 275 Vac or 120 Vdc to 300 Vdc
- Wide adjustable output voltage range (+/- 20%)
- 5 Vdc standby output
- High efficiency: up to 94%
- Size: 4 x 6.96 x 1.6 in (1U design)
- Low acoustic noise level of less than 30 dB(A)
- Active current sharing
- 2 × MOPP
- PMBus™ compatible for control, programming and monitoring
- 500,000 hour MTBF
- Optional conformal coating
- 3 years warranty

## Model variants

| Model number [1] | Input voltage range | | Main DC Output | | Auxiliary DC Output | | Remote ON/OFF standard setting [2] |
|---|---|---|---|---|---|---|---|
| | AC (Vac) | DC (Vdc) | Voltage (Vdc) | Current (A) | Voltage (Vdc) | Current (A) | |
| IMA-x400-12-ZNPLI | 80 to 275 | 120 to 300 | 12 | 33.3 | 5 | 0.5 | OFF |
| IMA-x400-12-ZNPLY | | | | | | | ON |
| IMA-x400-24-ZNPLI | | | 24 | 16.7 | | | OFF |
| IMA-x400-24-ZNPLY | | | | | | | ON |
| IMA-x400-48-ZNPLI | | | 48 | 8.33 | | | OFF |
| IMA-x400-48-ZNPLY | | | | | | | ON |

[1] IMA-x400: x = S for standard version (e.g. IMA-S400-24-ZNPLY),
x = C for conformal coated version (e.g. IMA-C400-24-ZNPLY)

[2] Model ZNPLI and ZNPLY have different settings for Remote ON/OFF, see *"Other features", p. 4*

## AC/DC input (J1)

| | IMA-x400-12 | IMA-x400-24 | IMA-x400-48 |
|---|---|---|---|
| **Nominal input voltage** | 100 Vac to 240 Vac | | |
| **AC operating input voltage range** | 80 Vac to 275 Vac | | |
| **Nominal input frequency** | 50 / 60 Hz | | |
| **Input frequency range** | 47 Hz to 63 Hz | | |
| **DC Input voltage range** | 120 Vdc to 300 Vdc | | |
| **Maximum input current** | 6 A at 80 Vac / 3.8 A at 120 Vdc | | |
| **Efficiency @ 100% load** | see *Fig. 16* to *Fig. 18, page 11* | | |
| @ 230 Vac | 92% | 94% | 94% |
| @ 115 Vac | 90% | 92% | 92% |
| **Max inrush current [1]** | < 20 A | | |
| **Input fuse** | DC input compliant, dual 10 A fuses used | | |
| **Power factor [2]** | 0.9 (typical) | | |

[1] Hot and cold turn on
[2] EN 61000-3-2, Class A compliant

## Main DC output (J2)

| | | IMA-x400-12 | IMA-x400-24 | IMA-x400-48 |
|---|---|---|---|---|
| **Nominal output voltage** | | 12 V | 24 V | 48 V |
| **Output voltage adjustment range** | | 9.6 V to 14.4 V | 19.2 V to 28.8 V | 38.4 V to 56.0 V |
| **Maximum output power** | | 400 W | | |
| **Output voltage regulation** | | | | |
| Total | | 2.25% | | |
| Over line | Full input range, full load | 0.25% | | |
| Over load | Nominal input, full load range | 1% | | |
| Over temperature | Nominal input, full load, full temperature | 1% | | |
| **Maximum output current** | | 33.3 A | 16.7 A | 8.3 A |
| **Maximum output capacitive load** | | 10,000 µF | | |
| **Dynamic load regulation** [1] | | < 5% | | |
| **PARD (20 MHz)** [2] | | < 1% peak to peak | | |
| **Turn on overshoot** | | < 2% | | |
| **Output rising time** | | < 150 ms | | |
| **Hold up time** | | 20 msec nominal | | |
| **Start up time** | | | | |
| AC OFF --> ON | Nominal input, max. load | < 2.5 s | | |
| REMOTE OFF --> ON | Nominal input, max. load | < 150 ms | | |
| **Output over voltage protection** | | YES, latch mode | | |
| | | 15 V to 17.5 V | 30 V to 35 V | 58.5 V to 63 V |
| **Output over current protection** | | YES, at 108% to 140% of nominal output current; auto recovery | | |
| **Short circuit protection** | | YES, auto recovery | | |
| **Over temperature protection** | | YES, auto recovery | | |
| **Remote sense** [3] | Total voltage drop compensation for +V_SENSE and -V_SENSE connections (J3 Pins 13 and 14) to the output load | 200 mV | | |

[1] 50% step from 5% load,1 A/µs, 10 µF Tan and 1µF ceramic capacitor
[2] 10 µF Tan and 1µF ceramic capacitor
[3] Do not short or reversely connect +V_SENSE and -V_SENSE. Doing this can cause damage to the power supply

## Auxiliary DC output (J3)

| | | IMA-x400-xx |
|---|---|---|
| **Connector type** | | Molex, Part number 87833-1420, 14 pin, see *Fig. 19, page 12* |
| **Nominal output voltage** | | 5 V |
| **Output voltage adjustment range** | | – |
| **Output voltage regulation** | | |
| Total | | 2.25% |
| Over line | Full input range, full load | 0.25 % |
| Over load | Nominal input, full load range | 1% |
| Over temperature | Nominal input, full load, full temperature | 1% |
| **Maximum output current** | | 0.5 A |
| **Maximum output capacitive load** | | 1,000 µF |
| **Output over voltage protection** | | Yes, at 5.5 V to 6 V, latch mode |
| **Output over current protection** | | Yes, at 1.0 A to 1.3 A, auto recovery |
| **Short circuit protection** | | YES, auto recovery |
| **Over temperature protection** | | YES, auto recovery |

## Galvanic isolation

| | | IMA-x400-xx |
|---|---|---|
| **Input to Output** | Reinforced | 4000 Vac; 2 x MOPP |
| **Input to Case** | Basic | 1500 Vac; 1 x MOPP |
| **Output to Case** | Basic | 1500 Vac; 1 x MOPP |

## Leakage currents

| | IMA-x400-xx | | | |
|---|---|---|---|---|
| **AC Leakage current from Input to earth ground** | Measured at mains voltage | at 60 Hz | at 63 Hz | |
| Normal condition (low line) | 132 Vac | < 150 µA | < 150 µA | |
| Single fault condition (low line) | 132 Vac | < 250 µA | < 260 µA | |
| Normal condition (high line) | 264 Vac | < 300 µA | < 300 µA | |
| Single fault condition (high line) | 264 Vac | < 500 µA | < 520 µA | |
| **AC Leakage current from Output to earth ground** | Measured at mains voltage | Typical at 60 Hz [1] | Maximum value at 63 Hz [1] | Limit per IEC 60601-1 |
| Normal condition | 264 Vac | 45 µA | < 60 µA | 100 µA |
| Single fault condition (neutral open) | 264 Vac | 45 µA | < 80 µA | 500 µA |
| Single fault condition (ground open) | 264 Vac | 114 µA | < 150 µA | 500 µA |
| AC Backdrive fault | 264 Vac | < 450 µA | < 550 µA | 5000 µA |

[1] Meets IEC 60601-1 BF leakage current limit

## Other features

| | | IMA-x400-xx |
|---|---|---|
| **Current Share Bus Pin** | J3 Pin 11 (CURRENT SHARE_V) | Voltage at *CS* Pin will vary linearly with load current on main output, and will be 6 V at rated load current, when the output voltage is at its rated value. |
| **Power Good Pin** | J3 Pin 9 (PWR_GOOD) | Open collector. As soon as AC input voltage and DC output voltage are in the predefined range, the PWR_GOOD signal is set to HIGH. |
| **Green LED** | | Will turn ON as soon as PWR_GOOD signal is set to HIGH |
| **Derating Guideline** | | Refer to IPC 9592B and Delta Internal Guideline |
| **OR-ing** | | Redundant operation with active circuit sharing, *see Application Note "Redundant operation", p. 10* |
| **SDA, SCL for I2C** | | Internal 10 kΩ pull-up resistor to internal 3.3 V |

| | | IMA-x400-xx-ZNPLI | | IMA-x400-xx-ZNPLY | |
|---|---|---|---|---|---|
| **Remote On/Off Pin [1]** | J3 Pin 10 (REMOTE ON/OFF) | REMOTE ON/OFF (J3 Pin 10) and 5VSB_RTN (J3 Pin 3 or J3 Pin 4 or J3 Pin 7) | Main DC Output | REMOTE ON/OFF (J3 Pin 10) and 5VSB_RTN (J3 Pin 3 or J3 Pin 4 or J3 Pin 7) | Main DC Output |
| | | Shorted | OFF | Shorted | ON |
| | | Open | ON | Open | OFF |

[1] Logic can be switched with PMBus™

## Environmental conditions

| | IMA-x400-12 | IMA-x400-24 | IMA-x400-48 |
|---|---|---|---|
| **Ambient operating temperature range** [1] | -20 °C ... +70 °C (-4°F to +158 °F) (see *Fig. 7* to *Fig. 8, page 10*) | | |
| **Ambient storage temperature range** | -40 °C ... +85 °C (-40 °F to +185 °F) | | |
| **Output power derating** | | | |
| Versus input voltage | When AC input voltage is < 90 Vac, the output power will be reduced by 4 W per 1 V. (see *Fig. 9, page 10*) | | |
| Versus ambient temperature | (see *Fig. 9, page 10*) | (see *Fig. 8, page 10*) | |
| **Output current derating** Versus output voltage | When output voltage is > 12 Vdc, the output current is reduced by 2.292 A per 1 V (see *Fig. 10, page 10*). | When output voltage is > 24 Vdc, the output current is reduced by 0.583 A per 1 V (see *Fig. 11, page 10*). | When output voltage is > 48 Vdc, the output current is reduced by 0.148 A per 1 V (see *Fig. 13, page 11*). |
| **Relative humidity** | < 95% (non-condensing) | | |
| **Operating altitude** [1] [2] | -200 m to 5,000 m (-650 ft to 16,400 ft) | | |
| **Shock test (non-operating)** | IEC 60068-2-27 compliant, 50 g, 11 msec, 3 shocks for each direction | | |
| **Vibration (non-operating)** | IEC 60068-2-6 compliant, 2.09 Grms, 5 Hz to 500 Hz, 20 minutes per side (3 planes) | | |
| **Pollution degree** | 2 | | |

[1] Ambient operating temperature decreases by 1 °C per 305 m (1000 ft) altitude increase
[2] Maximum operating altitude requirements for different types of products, see *"Safety standards and directives 1)", p. 6*

## Reliability

| | IMA-x400-xx |
|---|---|
| **CMTBF** [1] | 500,000 hours |
| **Expected capacitor life time** [2] | 10 years |
| **Warranty** | 3 years |

[1] Telecordia SR-332, Issue 3, 25 °C, 90% confidence level
[2] Nominal input voltage, 45 °C, 80% load

## EMC

| | IMA-x400-xx | |
|---|---|---|
| | Applied standards | Criteria |
| **Radiated emissions** [1] | EN 55011, EN 55022 and FCC, Class B | |
| **Conducted emissions** [1] | EN 55011, EN 55022 and FCC, Class B | |
| **Power line harmonics** | EN 61000-3-2, Class A | |
| **Voltage flicker** | EN 61000-3-3 | |
| **ESD** | EN 61000-4-2, level 4, 8 kV contact, 15 kV air | A |
| **Radiated immunity** | EN 61000-4-3, level 3, 10 V/m | A |
| **Electrical fast transient** | EN 61000-4-4, level 4, ±4 kV | A |
| **Surge immunity** | EN 61000-4-5, level 4, 2 kV DM, 4 kV CM | A |
| **Conducted RF immunity** | EN 61000-4-6, level 3, 10 Vrms | A |
| **Power frequency magnetic field** | EN 61000-4-8, level 3, 10 A/m | A |
| **Voltage dips and sags** | EN 61000-4-11, 30%, 500 ms | A |
| | EN 61000-4-11, 60%, 100 ms | B |
| | EN 61000-4-11,100%, 10 ms | A |
| | EN 60601-1-2, 30%, 500 ms | A |
| | EN 60601-1-2, 60%, 100 ms | B |
| | EN 60601-1-2, 100%, 10 ms | A |
| | EN 60601-1-2, 100%, 5000 ms | B |
| **Ring wave** | EN 61000-4-12, level 3, 1 kV DM, 2 kV CM | A |
| **Voltage fluctuations** | EN 61000-4-14, Class 3 | A |

[1] Power Supply Unit inside a dummy system

## Safety standards and directives [1]

| | IMA-x400-xx |
|---|---|
| **IEC/EN 60950-1, Edition 2 and all national deviations** | UL 60950-1/CSA 22.2 No 60950-1, Edition 2;<br>5,000 m (16,400 ft) altitude, 120 V to 300 Vdc and 100 V to 240 ±10% Vac (UL File E191395) |
| **IEC/EN 60601-1, Edition 3 (tested against Edition 2, too) and all national deviations** | IEC 60601-1(2005), EN60601-1(2006)<br>ANSI/AAMI ES 60601-1(2005)<br>CAN/CSA C22.2 No. 60601-1 (2008);<br>3,000 m (9,800 ft) altitude, 100 V to 240 Vac ±10% (UL File E325662) |
| **Protection class** | I |

[1] Designed to support Type B Applied Part End Product Requirements

## Ecological characteristics

| | IMA-x400-xx |
|---|---|
| **WEEE (Waste Electrical and Electronic Equipment Directive)** | 2012/19/EU |
| **RoHS (Restriction of Hazardous Substances Directive)** | 2011/65/EU |

## Mechanical data

| | IMA-x400-xx |
|---|---|
| **Dimensions (L x W x D)** | 176.8 x 101.6 x 40.6 mm (6.96 x 4 x 1.6 in) |
| **Weight** | 0.960 kg (2.12 lb) |
| **Indicator** | Green LED |
| **Cooling system** | System airflow cooling or natural convection cooling |
| **AC/DC input port** | Block M3.5 x 3 pins |
| **Main DC output port** | Block M5 x 2 pins |
| **Auxialary DC output + signals port** | Connector x 14 pins |
| **Noise** [1)] | < 30 dB(A) |

[1)] At 1 Hz to 20 kHz and a distance of 1 m. Test conditions: 100 Vac, 100% load, ambient temperature 30 °C (86 °F)

## Options

| Model | Main Output voltage | Standby Output | Leakage current | Main Output adjustable | Open frame | U channel | Enclosed | Convection cooling | Fan | Fan, airflow from end to front | Fan, airflow from front to end | Top FAN solution | Active current sharing | Remote ON/OFF | Coated [1)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IMA-S400-12V | 12 V | 5 V/0.5 A | 300 µA | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ● | - |
| IMA-S400-24V | 24 V | 5 V/0.5 A | 300 µA | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ● | - |
| IMA-S400-48V | 48 V | 5 V/0.5 A | 300 µA | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ● | - |
| IMA-C400-12V | 12 V | 5 V/0.5 A | 300 µA | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ● | ● |
| IMA-C400-24V | 24 V | 5 V/0.5 A | 300 µA | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ● | ● |
| IMA-C400-48V | 48 V | 5 V/0.5 A | 300 µA | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ● | ● |

● included
○ on request
- not available

## Mounting orientations

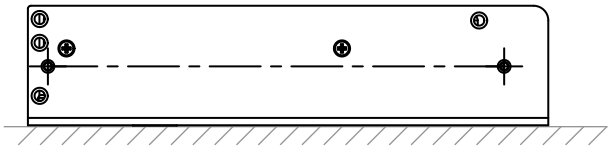


*Fig. 1: Standard mounting orientation*

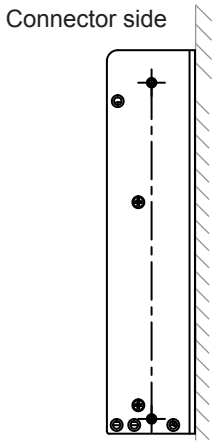



*Fig. 2: Vertical mounting*

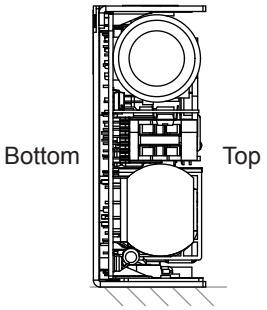



*Fig. 3: Mounting on the left side*

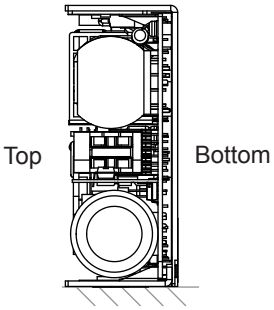
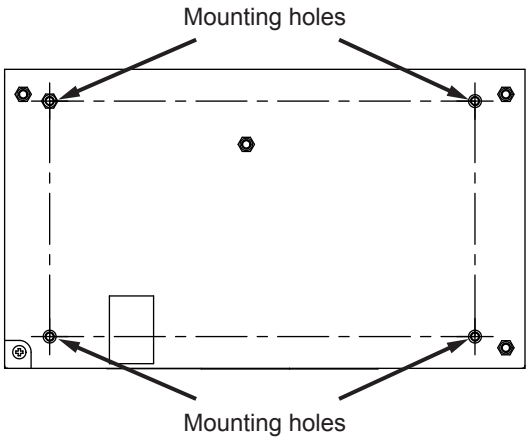



*Fig. 4: Mounting on the right side*

**Bottom view**




**Side view**

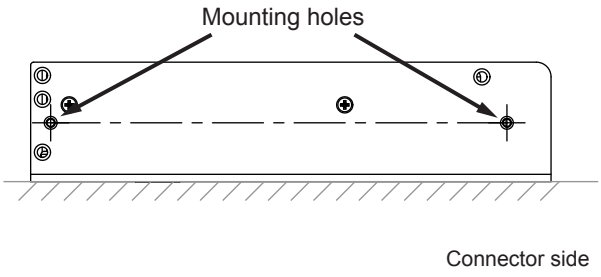



*Fig. 5: Position of the mounting holes*

## Dimensional drawings

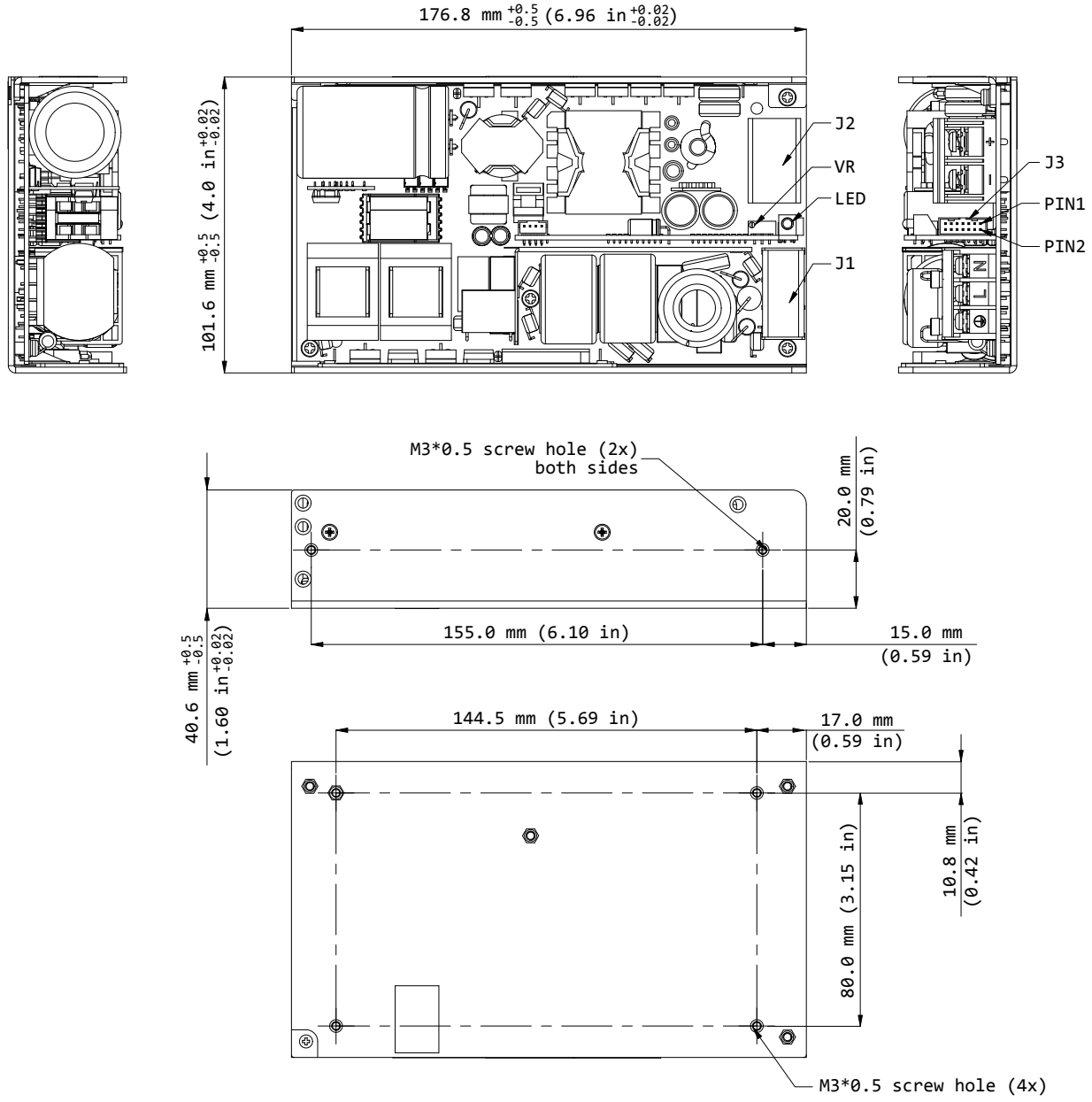



*Fig. 6: Dimensional drawing IMA-x400-xx*

Notes:

- Base plate mounting, M3 thread holes, maximum penetration 4.0 mm (0.16 in) (from outside face of chassis), maximum torque 0.6 Nm (5.31 lb-in)
- (J1) Input terminal block, Switchlab T14-EMII03, M3.5 screw in 3 positions, maximum torque1.3 Nm (11.5 lb-in)
- (J2) Output terminal block, Dinkle DT-7C-B01W-3943-02, M4 screw in 2 positions, maximum torque 1.5 Nm (13.28 lb-in)
- (J3) Signal connector and Auxiliary DC Output, Mating connector for J3 is either Molex, part number 51110-1450 (without locking ramp), or Molex part number 51110-1451 (with locking ramp). The connector is not shipped with the power supply unit.
- General tolerance: ±0.3 mm (0.012 in)

## Curves

**IMA-x400-12**

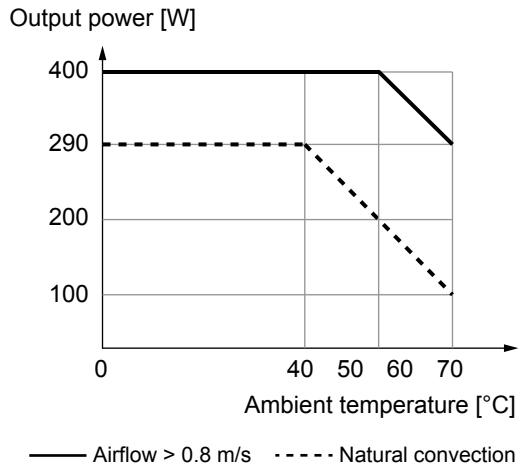



*Fig. 7: Output power versus ambient temperature 12 V*

**IMA-x400-24/48**

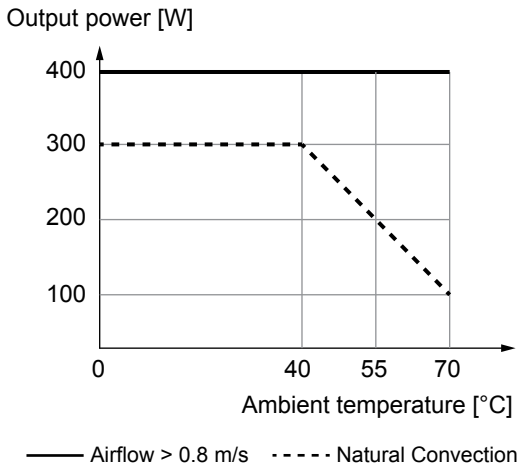



*Fig. 8: Output power versus ambient temperature 24/48 V*

**IMA-x400-xx**

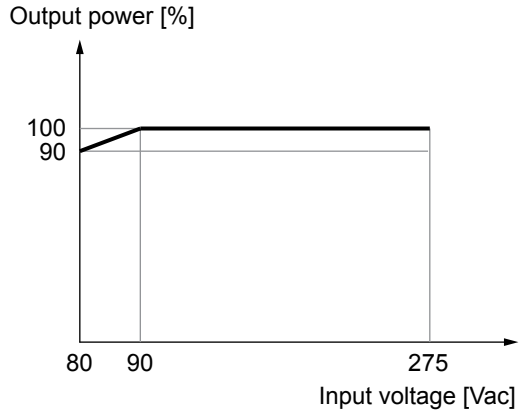



*Fig. 9: Output power versus input voltage*

**IMA-x400-12**

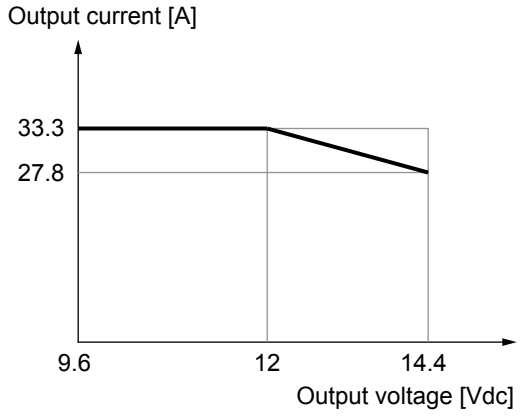



*Fig. 10: Output current versus output voltage 12 V*

**IMA-x400-24**

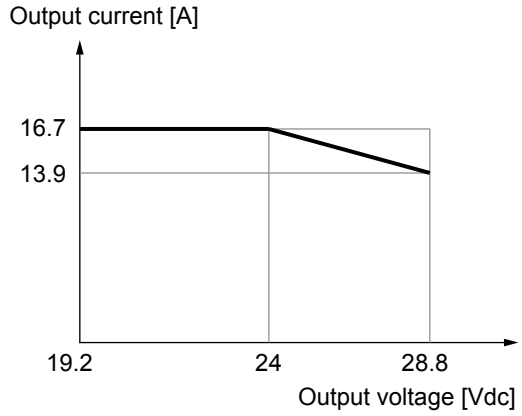



*Fig. 11: Output current versus output voltage 24 V*

**IMA-x400-48**

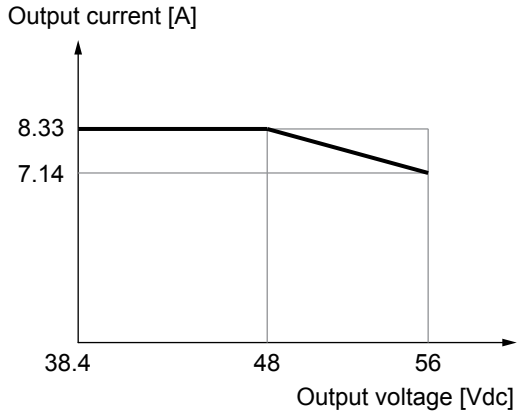



*Fig. 12: Output current versus output voltage 48 V*

## Curves (continued)

**IMA-x400-12**

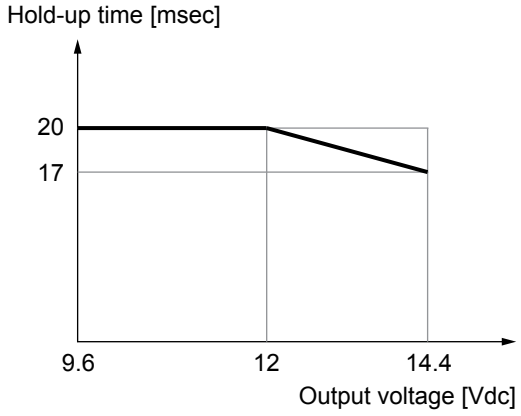



*Fig. 13: Hold-up time versus output voltage 12 V*

**IMA-x400-24**

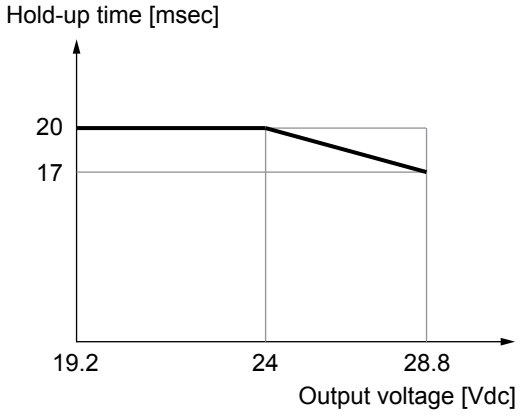



*Fig. 14: Hold-up time versus output voltage 24 V*

**IMA-x400-48**

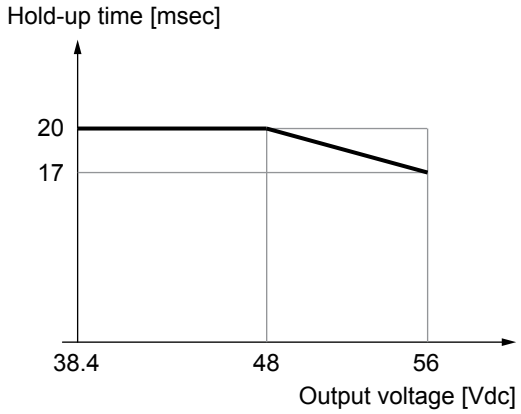



*Fig. 15: Hold-up time versus output voltage 48 V*

**IMA-x400-12**

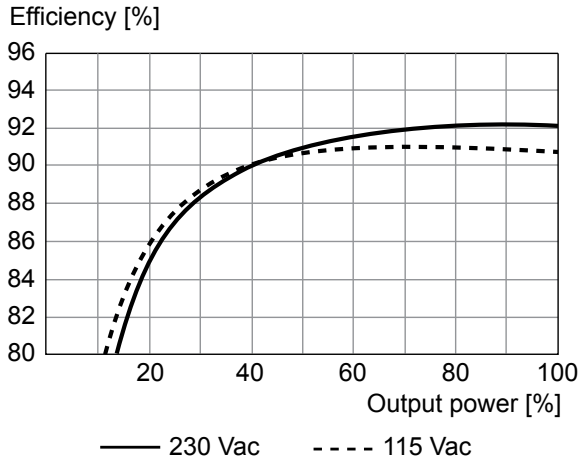



*Fig. 16: Typical efficiency curves 12 V*

**IMA-x400-24**

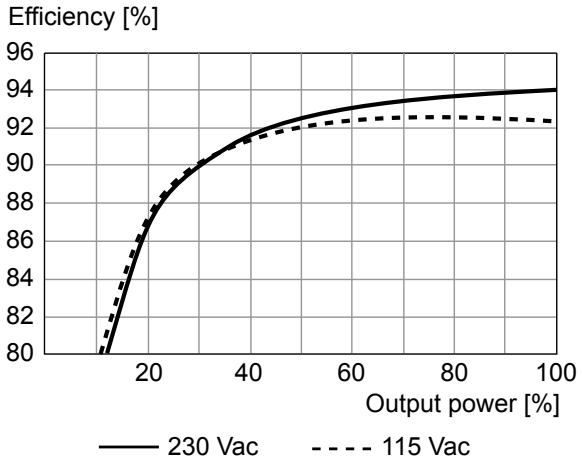



*Fig. 17: Typical efficiency curves 24 V*

**IMA-x400-48**

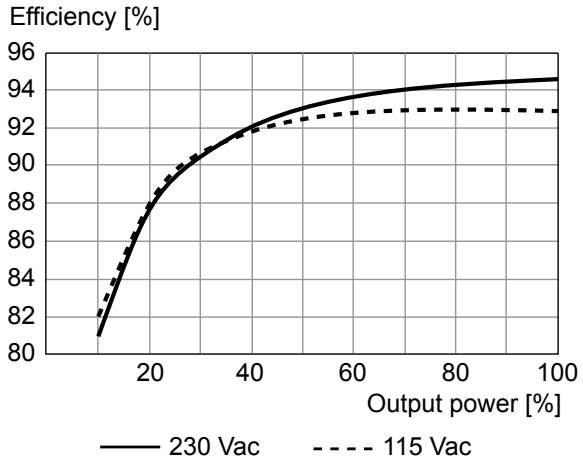



*Fig. 18: Typical efficiency curves 48 V*

## Pin assignment (J3)

**IMA-x400-xx**

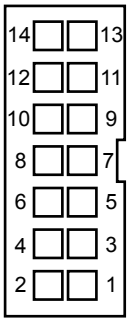



*Fig. 19: Pin assignment J3 terminal block*

| Pin | Assignment | Pin | Assignment |
|---|---|---|---|
| 14 | -V_SENSE | 13 | +V_SENSE |
| 12 | Address | 11 | Current_Share_V |
| 10 | Remote ON/OFF | 9 | PWR_GOOD |
| 8 | +5VSB | 7 | 5VSB_RTN |
| 6 | SDA | 5 | SCL |
| 4 | 5VSB_RTN | 3 | 5VSB_RTN |
| 2 | +5VSB | 1 | +5VSB |

Mating connector type: Molex, Part number 51110-145x

## Circuit diagrams

**IMA-x400-xx**

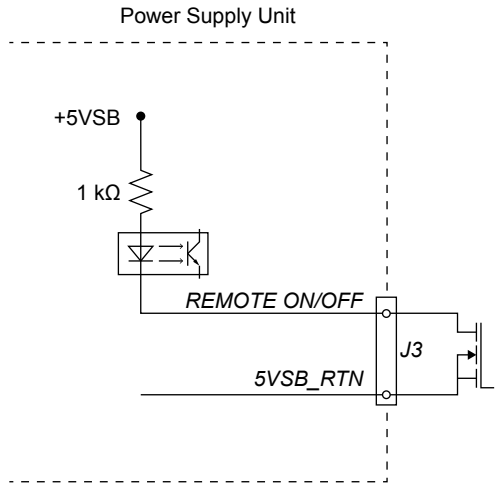



*Fig. 20: Circuit diagram **J3 Pin 10 (REMOTE ON/OFF)***

**IMA-x400-xx**

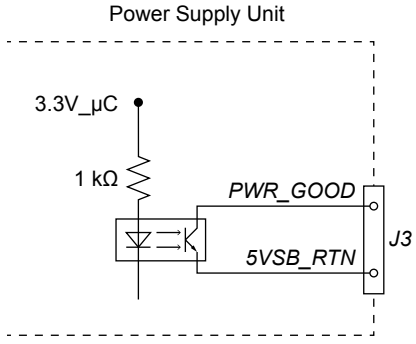



*Fig. 21: Circuit diagram **J3 Pin 9 (PWR_GOOD)***

**IMA-x400-xx**

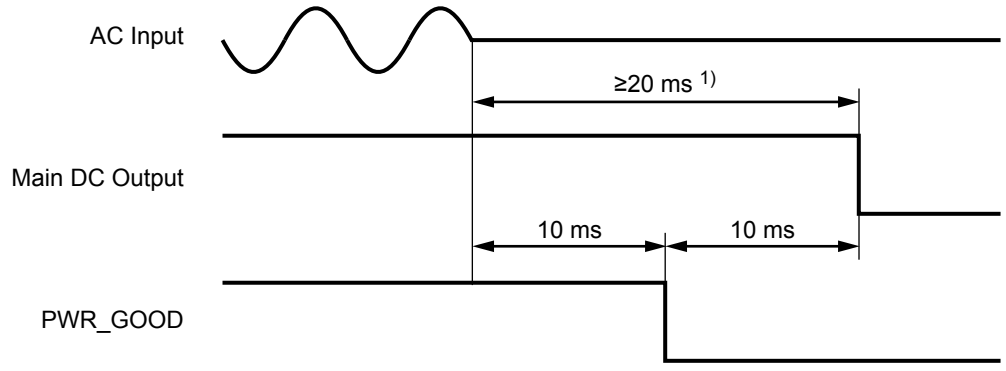



*Fig. 22: Power Good function timing*

[1)] For DC output voltage ≤ Nominal output voltage; will reduce at DC output voltages > Nominal output voltage.

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