

IMA 400 Watts Power Supply Series

for medical and industrial applications

Product data sheet

400 Watts Power Supply Series

for medical and industrial applications

Features

- Safety approval for Medical (IEC 60601-1-2), Industrial (IEC 62368) 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 μ F | | |
| 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/ μ s, 10 μ F Tan and 1 μ F ceramic capacitor

²⁾ 10 μ F Tan and 1 μ F 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) ¹⁾

| | | 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 μ F |
| 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 |

¹⁾ There is no galvanic isolation between 5VSB GND and Main DC Output GND.

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 <i>Application Note "Redundant operation", p. 10</i> |
| 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

This device has been fully tested according to EN 60601-1-2:2015 (4th edition).

| 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 2, 3 Vrms, 6 Vrms in ISM band | A |
| Power frequency magnetic field | EN 61000-4-8, 30 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%, 20 ms | A |
| | EN 60601-1-2:2015 (4 th edition), 30%, 500 ms | A |
| | EN 60601-1-2 :2015 (4 th edition), 60%, 100 ms | B |
| | EN 60601-1-2 :2015 (4 th edition), 100%, 20 ms | A |
| | EN 60601-1-2 :2015 (4 th edition), 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 62368 Edition 2 | IEC 62368-1 (2014) Edition 2 5000 m (16,400 ft) altitude, 120 V to 300 Vdc and 100 V to 240 ±10% Vac |
| IEC/EN 60950-1, Edition 2 and all national deviations | UL 60950-1/CSA 22.2 No 60950-1, Edition 2; 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, EN 60601-1(2006) ANSI/AAMI ES 60601-1(2005) CAN/CSA C22.2 No. 60601-1 (2008); 3,000 m (9,800 ft) altitude, 100 V to 240 Vac ±10% (UL File E325662) |
| IEC 60601-1-2 Edition 4 | IEC 60601-1-2 (2014) |
| 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 |
| Auxiliary 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

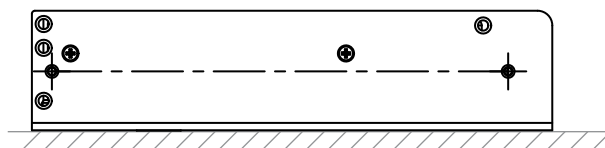


Fig. 1: Standard mounting orientation

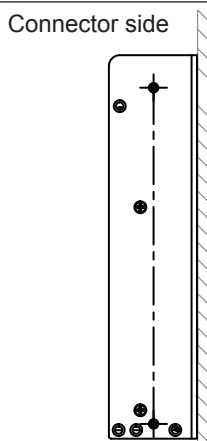


Fig. 2: Vertical mounting

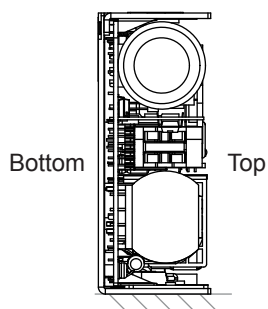


Fig. 3: Mounting on the left side

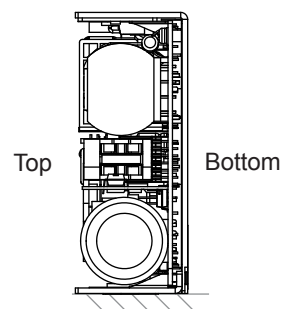


Fig. 4: Mounting on the right side

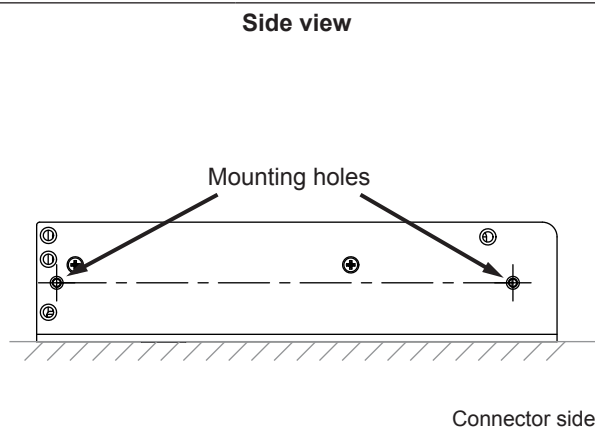
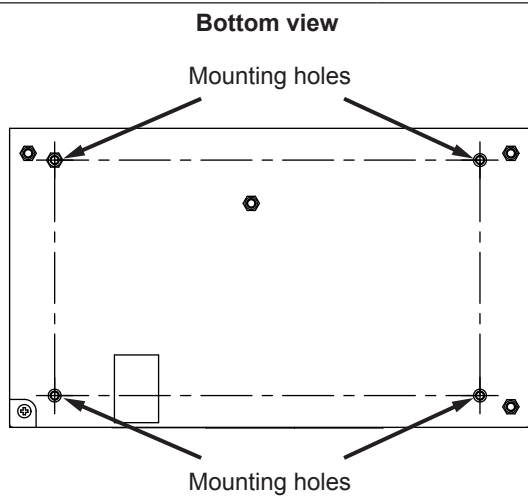


Fig. 5: Position of the mounting holes

Dimensional drawings

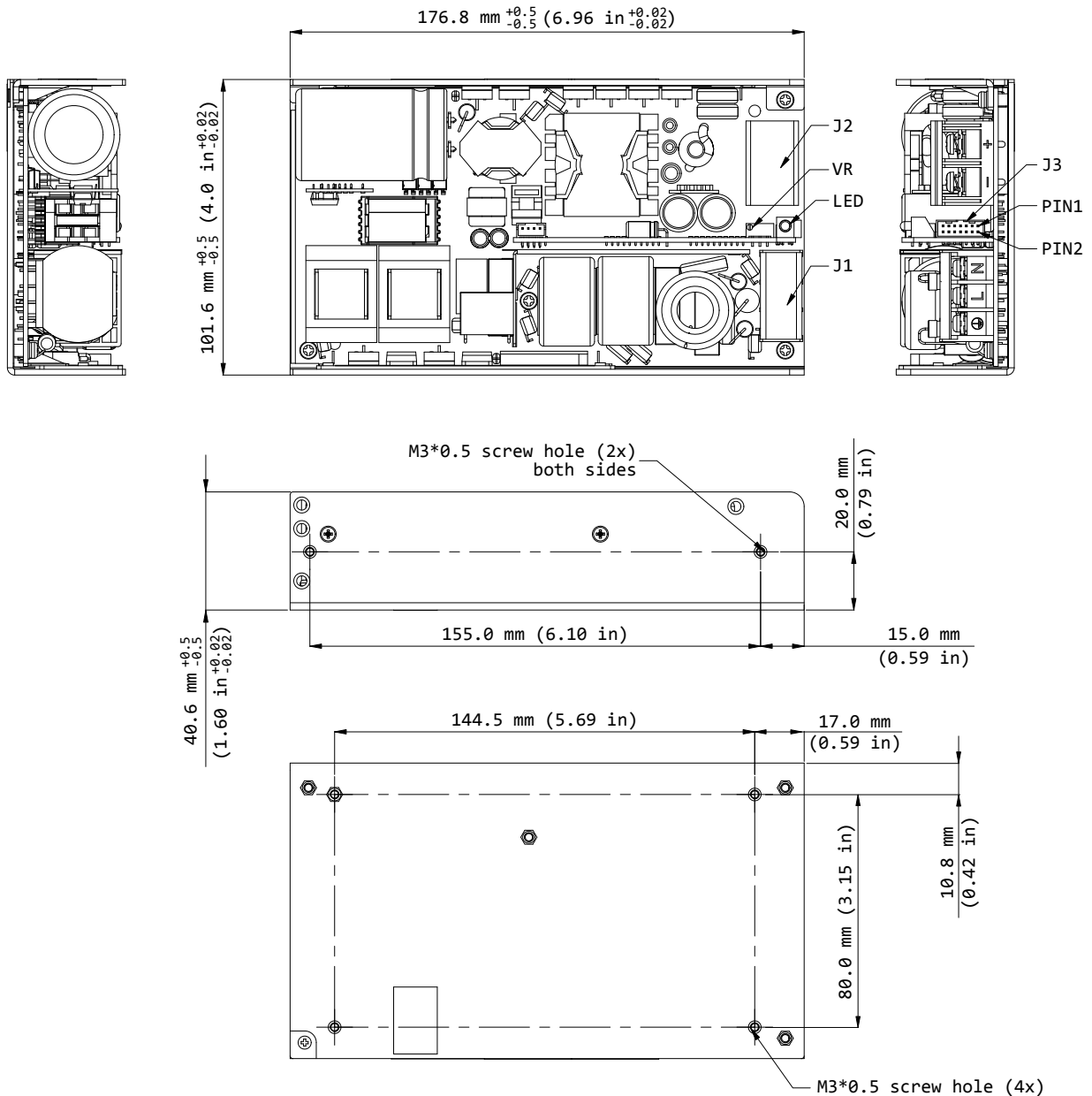


Fig. 6: Dimensional drawing IMA-x400-xx

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 torque 1.3 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

Tested at 90 Vac input

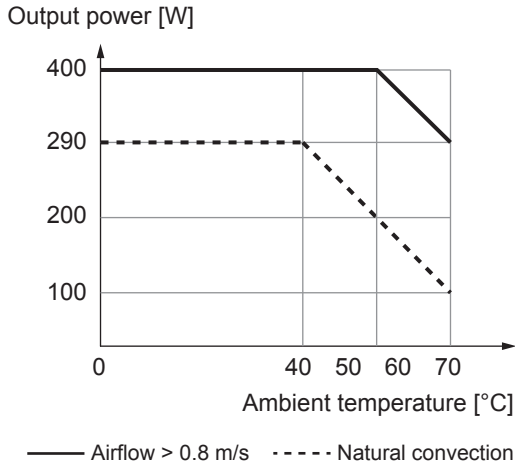


Fig. 7: Output power versus ambient temperature 12 V

IMA-x400-24/48

Tested at 90 Vac input

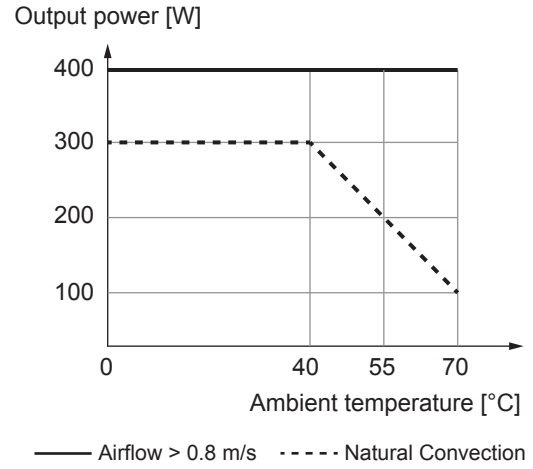


Fig. 8: Output power versus ambient temperature 24/48 V

IMA-x400-xx

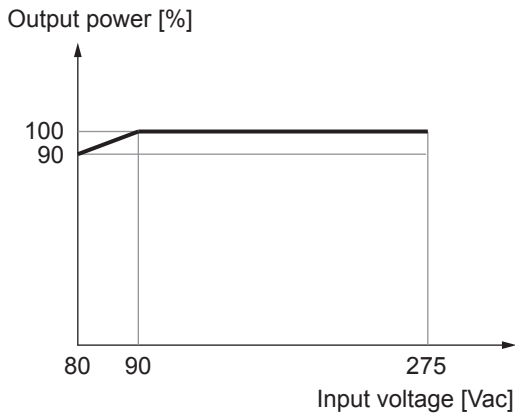


Fig. 9: Output power versus input voltage

IMA-x400-12

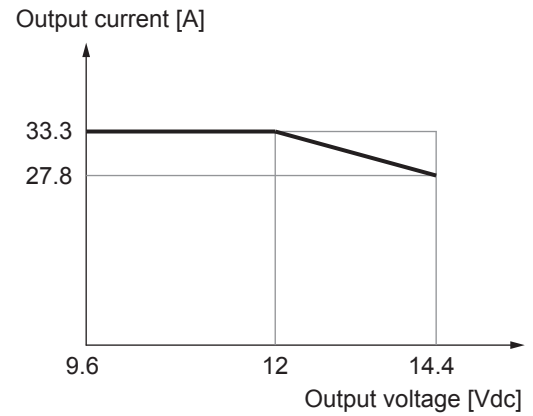


Fig. 10: Output current versus output voltage 12 V

IMA-x400-24

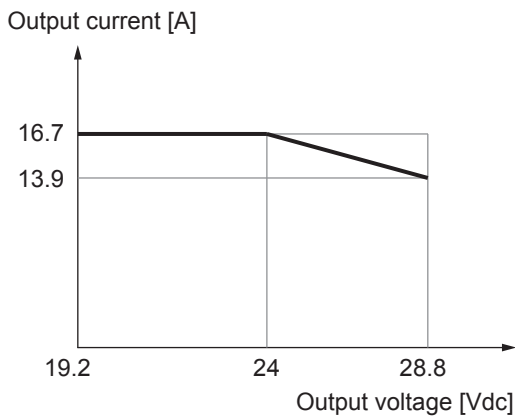


Fig. 11: Output current versus output voltage 24 V

IMA-x400-48

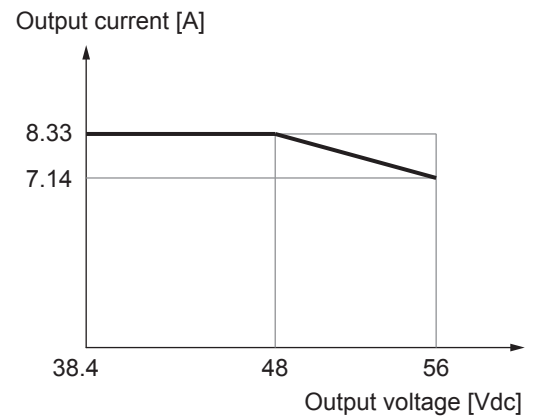


Fig. 12: Output current versus output voltage 48 V

Curves (continued)

IMA-x400-12

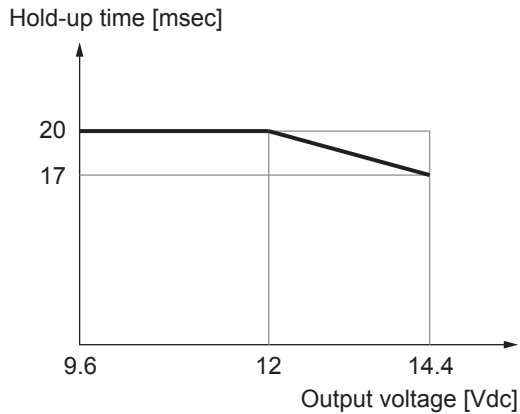


Fig. 13: Hold-up time versus output voltage 12 V

IMA-x400-24

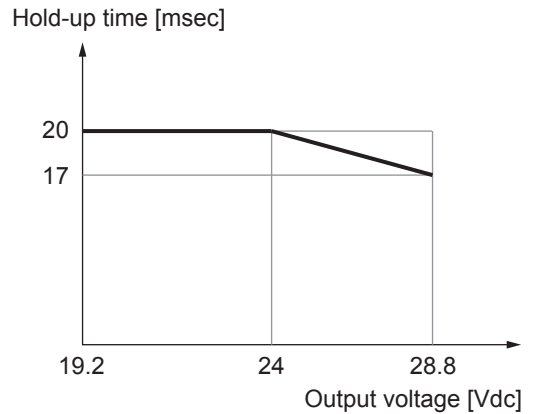


Fig. 14: Hold-up time versus output voltage 24 V

IMA-x400-48

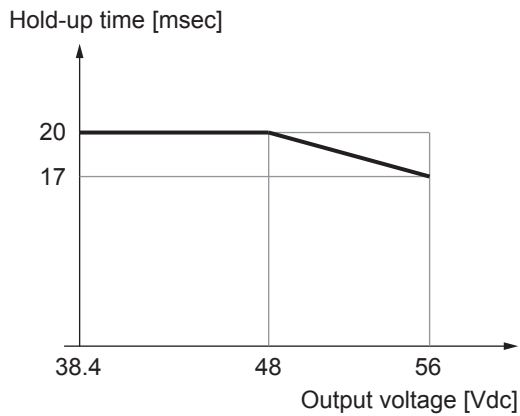


Fig. 15: Hold-up time versus output voltage 48 V

IMA-x400-12

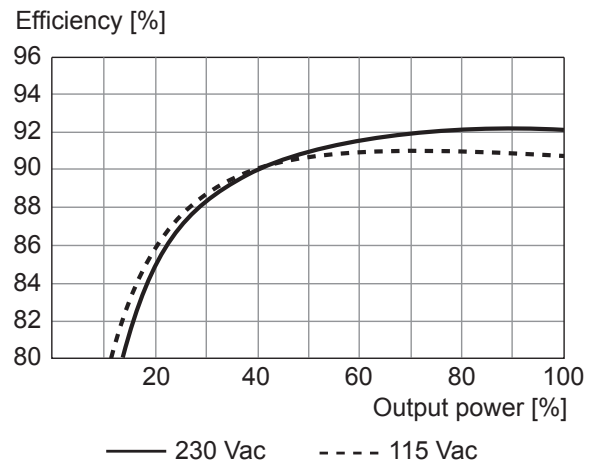


Fig. 16: Typical efficiency curves 12 V

IMA-x400-24

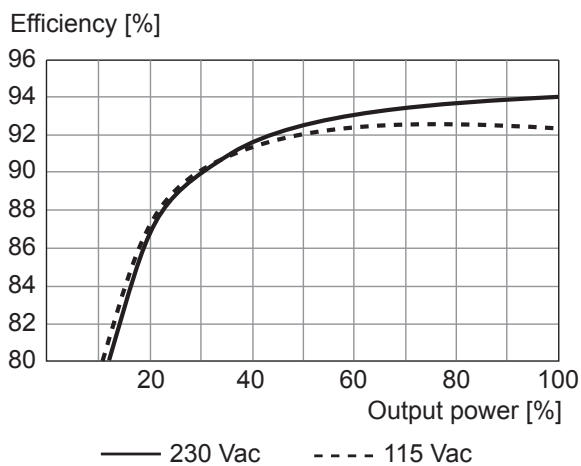


Fig. 17: Typical efficiency curves 24 V

IMA-x400-48

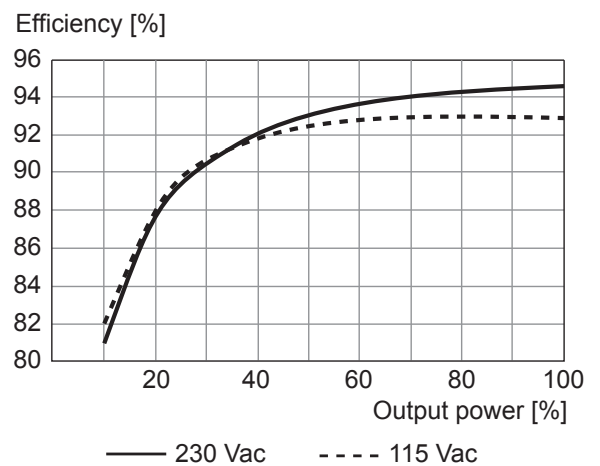


Fig. 18: Typical efficiency curves 48 V

Pin assignment (J3)

| IMA-x400-xx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|-----|-----------------|-----|------------|----|----------|----|----------|----|---------|----|-----------------|----|---------------|---|----------|---|-------|---|----------|---|-----|---|-----|---|----------|---|----------|---|-------|---|-------|--|--|
| | <table border="1"> <thead> <tr> <th>Pin</th> <th>Assignment</th> <th>Pin</th> <th>Assignment</th> </tr> </thead> <tbody> <tr> <td>14</td> <td>-V_SENSE</td> <td>13</td> <td>+V_SENSE</td> </tr> <tr> <td>12</td> <td>Address</td> <td>11</td> <td>Current_Share_V</td> </tr> <tr> <td>10</td> <td>Remote ON/OFF</td> <td>9</td> <td>PWR_GOOD</td> </tr> <tr> <td>8</td> <td>+5VSB</td> <td>7</td> <td>5VSB_RTN</td> </tr> <tr> <td>6</td> <td>SDA</td> <td>5</td> <td>SCL</td> </tr> <tr> <td>4</td> <td>5VSB_RTN</td> <td>3</td> <td>5VSB_RTN</td> </tr> <tr> <td>2</td> <td>+5VSB</td> <td>1</td> <td>+5VSB</td> </tr> </tbody> </table> | 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 | | |
| 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Mating connector type: Molex, Part number 51110-145x</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Fig. 19: Pin assignment J3 terminal block

Circuit diagrams

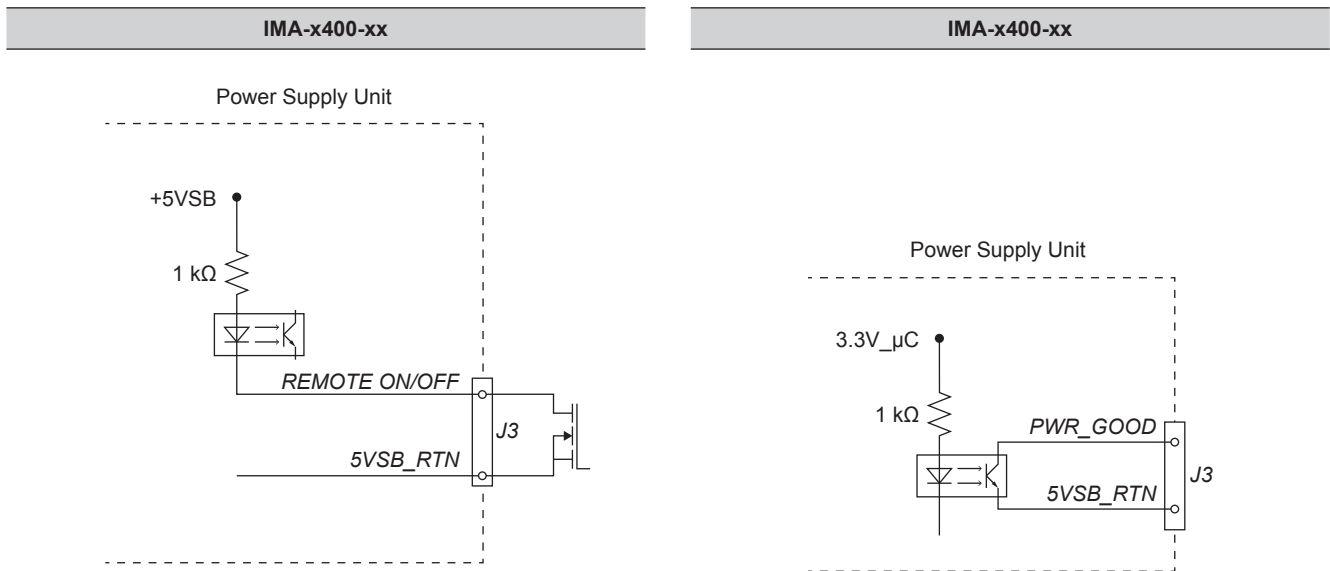


Fig. 20: Circuit diagram J3 Pin 10 (REMOTE ON/OFF)

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

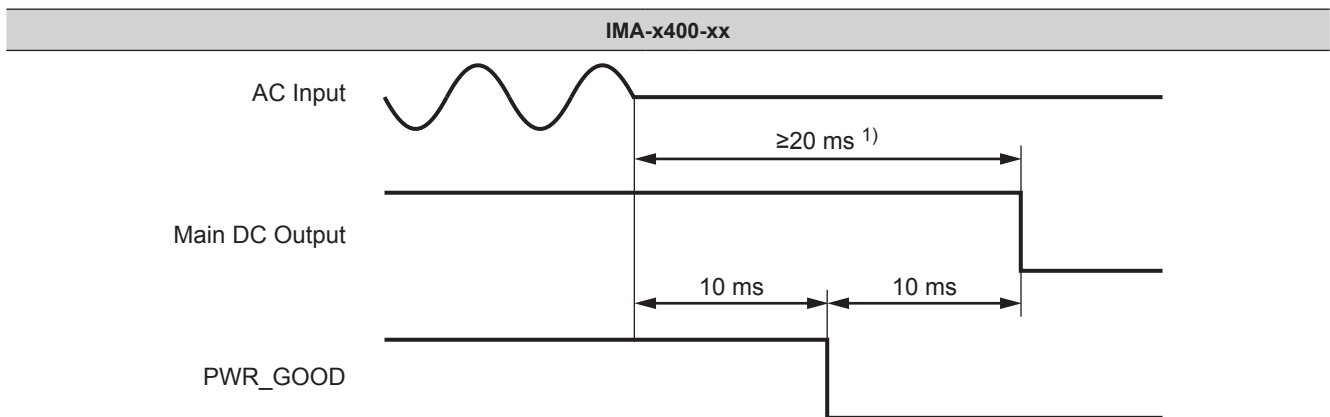


Fig. 22: Power Good function timing

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

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