

### 400 Watts

- 400 W Convection-cooled
- Conduction Cooling For Higher Ambient Operation
- 94% Efficiency
- 85 VAC to 264 VAC Input
- 5V Standby
- <1W Standby Power
- IT & Medical Safety Approvals
- Power Fail & Inhibit Signals
- 3 Year Warranty



The universal AC input CCL400 provides 400W of convection cooled output power over the temperature range -40°C to +50°C with derating to +70°C. The temperature range can be extended by the use of conduction cooling to the full 400W at +70°C. Approved for IT and Medical and with a feature set including a 5V standby output, <0.5W standby power, power fail and inhibit signals the CCL400 is ideal for a wide range of applications where fan cooling is not desirable.

#### Dimensions:

##### CCL400:

7.00 x 3.95 x 1.57" (178 x 100 x 40 mm)

##### CCL400-C:

7.39 x 4.04 x 1.92" (189.9 x 107.3 x 48.9 mm)

### Models & Ratings

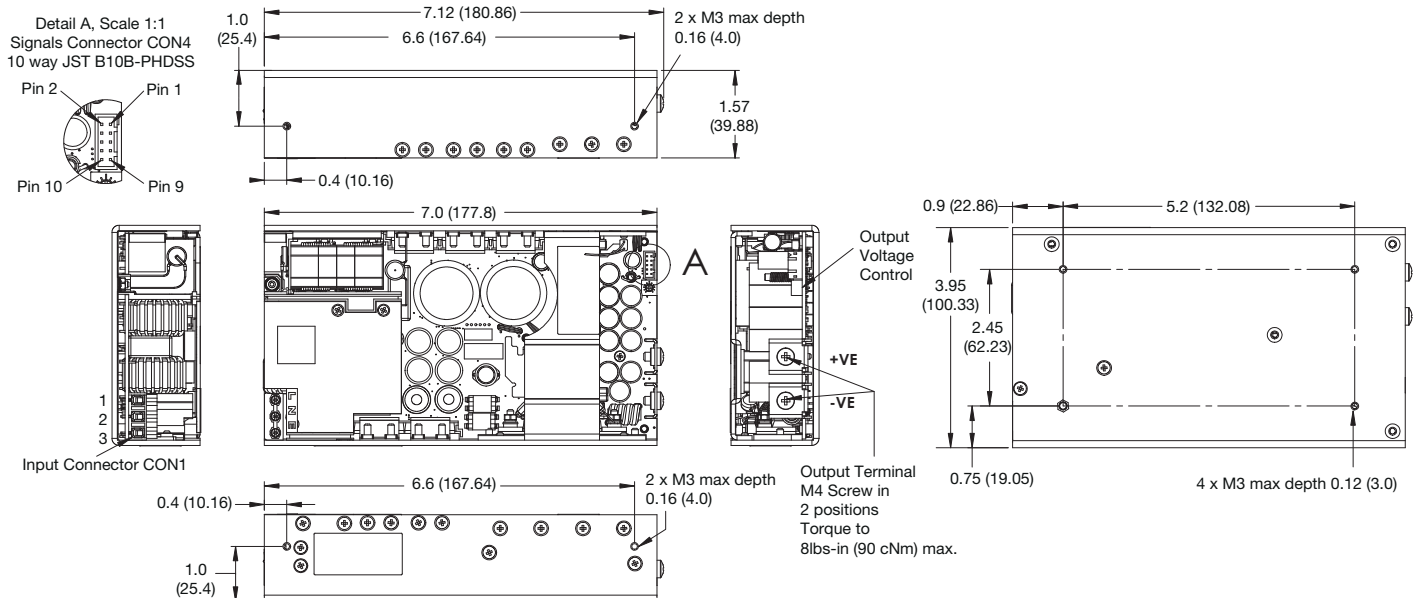
| Output Voltage 1 | Output Current V1 | Standby Supply V2 | Output Power | Model Number <sup>(1,2)</sup> |
|------------------|-------------------|-------------------|--------------|-------------------------------|
| 12 V             | 33.3 A            | 5.0 V / 0.5 A     | 400 W        | CCL400PS12                    |
| 24 V             | 16.6 A            | 5.0 V / 0.5 A     | 400 W        | CCL400PS24                    |
| 30 V             | 13.3 A            | 5.0 V / 0.5 A     | 400 W        | CCL400PS30                    |
| 48 V             | 8.3 A             | 5.0 V / 0.5 A     | 400 W        | CCL400PS48                    |

### Notes

1. Add suffix '-C' for cover version e.g. CCL400PS24-C

2. Add suffix '-S' for a right angled input screw terminal connector e.g. CCL400PS24-S or CCL400PS24-CS.

### Mechanical Details

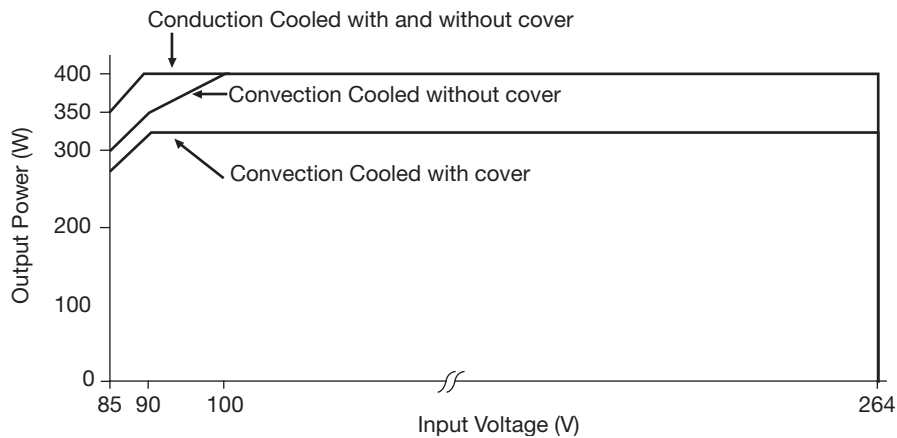


### Input

| Characteristic                  | Minimum                                      | Typical | Maximum | Units | Notes & Conditions   |
|---------------------------------|--|---------|---------|-------|--|
| Input Voltage - Operating       | 85   | 115/230 | 264     | VAC   | Derate output power < 100 VAC for convection cooling or <90 VAC for conduction cooling. See fig. 1 |
| Input Voltage - Fault Condition |  |         | 300     | VAC   | 5 seconds max  |
| Input Frequency                 | 47   | 50/60   | 63      | Hz    | Agency approval, 47-63 Hz  |
| Power Factor                    |  | >0.95   |         |       | EN61000-3-2 class A compliant<br>EN61000-3-2 class C for loads ≥10%                                |
| Input Current - Full Load       |  | 3.8/1.9 |         | A     | 115/230 VAC  |
| No Load Input Power             |  |         | 1       | W     | All models, when inhibit activated   |
| Inrush Current                  |  | 35      | 60      | A     | 230 VAC  |
| Earth Leakage Current           |  | 90/180  | 250     | µA    | Typ. 115/230 VAC 50 Hz, Max 264 VAC 60 Hz  |
| Input Protection                | F10.0 A 250 V internal fuse in both AC lines |         |         |       |  |

### Input Voltage Derating

Figure 1



### Output

| Characteristic             | Minimum | Typical | Maximum | Units   | Notes & Conditions  |
|----------------------------|---------|---------|---------|---------|---|
| Output Voltage             | 12      |         | 48      | VDC     | See Models and Ratings table  |
| Initial Set Accuracy       |         |         | ±0.5    | %       | 50% load, 115/230 VAC   |
| Output Voltage Adjustment  |         |         | ±3      | %       |   |
| Minimum Load               | 0       |         |         | A       |   |
| Start Up Delay             |         | 1.5     | 2.0     | s       | 115/230 VAC full load from input AC turn on                         |
| Hold Up Time               |         | 30      |         | ms      |   |
| Drift                      |         |         | ±0.2    | %       | After 20 min warm up  |
| Line Regulation            |         |         | 0.5     | %       |   |
| Load Regulation            |         |         | 0.5     | %       |   |
| Transient Response         |         |         | <4      | %       | Recovery within 1% in less than 500 µs for a 50-75%-50% load change |
| Ripple & Noise             |         |         | 1       | % pk-pk | 20 MHz bandwidth  |
| Overvoltage Protection     | 115     |         | 140     | %       | Vnom DC. Output 1, recycle input to reset                           |
| Overload Protection        | 110     |         | 150     | %       | Trip & Restart characteristic V1                                    |
| Short Circuit Protection   |         |         |         |         | Shutdown and auto recovery  |
| Temperature Coefficient    |         |         | 0.05    | %/°C    |   |
| Overtemperature Protection |         |         |         |         | Shutdown and auto recovery  |

### General

| Characteristic  | Minimum | Typical     | Maximum | Units             | Notes & Conditions                |
|---|---------|-------------|---------|-------------------|-----------------------------------|
| Efficiency  |         | 93-94       |         | %                 | 230 VAC full load                 |
| Isolation: Input to Output<br>Input to Ground<br>Output to Ground | 4000    |             |         | VAC               | 2 x MOPP                          |
|   | 1500    |             |         | VAC               | 1 X MOPP                          |
|   | 500     |             |         | VDC               |                                   |
| Switching Frequency   | 60      |             | 300     | kHz               | PFC                               |
|   |         | 75          |         | kHz               | Main converter                    |
|   |         | 70          |         | kHz               | Standby                           |
| Power Density   |         |             | 9.1     | W/in <sup>3</sup> |                                   |
| Mean Time Between Failure   |         | 172         |         | kHrs              | MIL-HDBK-217F, Notice 2 +25 °C GB |
| Weight  |         | 2.12 (960)  |         | lb (g)            | CCL400PSxx                        |
|   |         | 2.46 (1115) |         |                   | CCL400PSxx-C                      |

### Efficiency Vs Load

Figure 2  
12 V Models

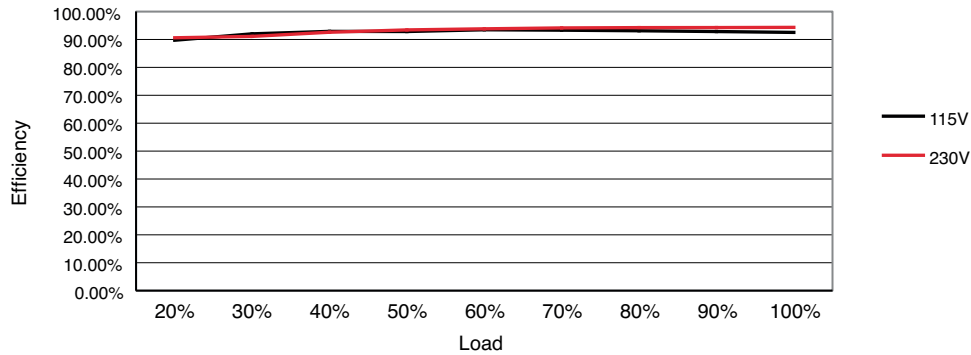


Figure 3  
24 V Models

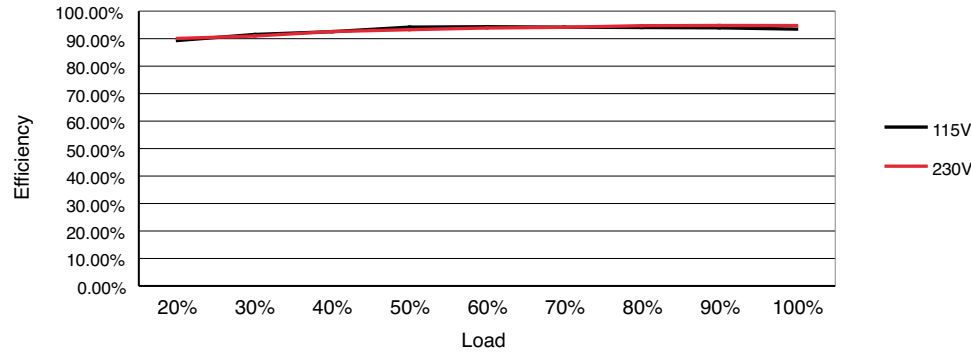
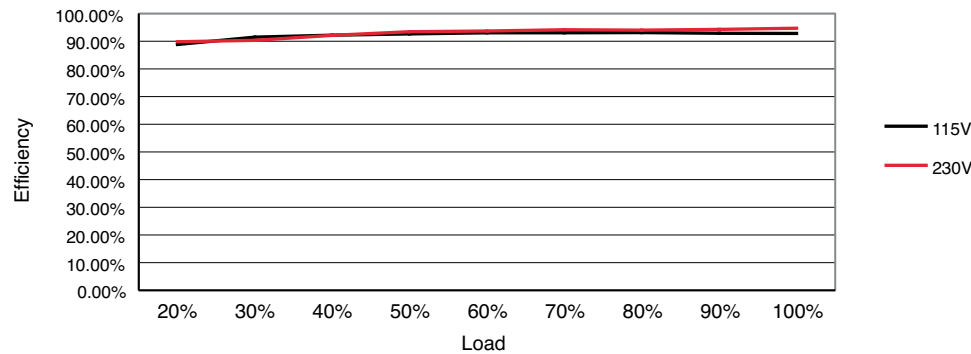


Figure 4  
48 V Models

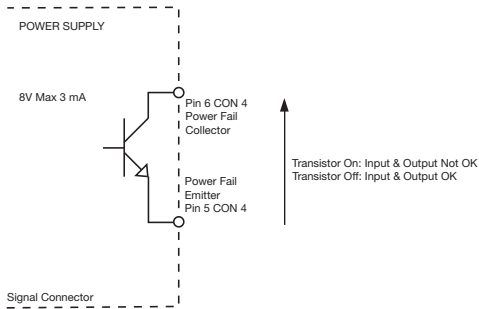


### Signals & Controls

| Characteristic     | Notes & Conditions  |
|--------------------|---|
| Power Fail (AC-OK) | Uncommitted opto isolated transistor, normally off when AC is good (see fig.5)<br>Provides 5 - 15ms warning of loss of output from AC failure off when AC is healthy. |
| Inhibit            | Uncommitted isolated optocoupler diode, powered diode inhibits the supply (see fig.6 & 7)   |
| Standby Supply     | 5V/0.5A Isolated supply present when AC applied.  |
| Remote Sense       | Compensates for 0.25V per lead, 0.5V total drop.  |

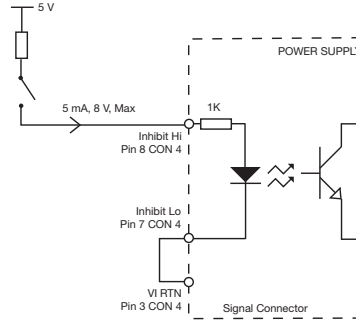
#### Power Fail

Figure 5



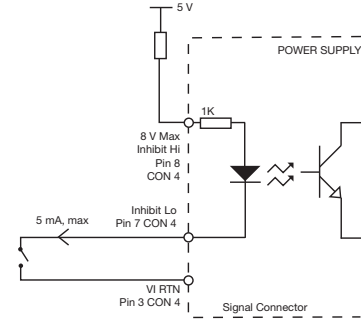
#### Inhibit (High)

Figure 6



#### Inhibit (Low)

Figure 7



### Environmental

| Characteristic        | Minimum   | Typical | Maximum | Units | Notes & Conditions   |
|-----------------------|---|---------|---------|-------|--|
| Operating Temperature | -40   |         | +70     | °C    | See derating curve, fig.8. and Thermal Considerations on page 8. |
| Storage Temperature   | -40   |         | +85     | °C    |  |
| Cooling               |   |         |         |       | Convection or conduction-cooled with 0.5 °C/W or better heatsink |
| Humidity              |   |         | 95      | %RH   | Non-condensing   |
| Operating Altitude    |   |         | 5000    | m     |  |
| Shock                 | ±3 x 30g shocks in each plane, total 18 shocks. 30g = 11ms (±0.5msec), half sine. Conforms to EN60068-2-27 & EN60068-2-47 |         |         |       |  |
| Vibration             | Single axis 10 - 500 Hz at 2g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6                   |         |         |       |  |

#### Temperature Derating Curve

Figure 8 - No Cover Fitted

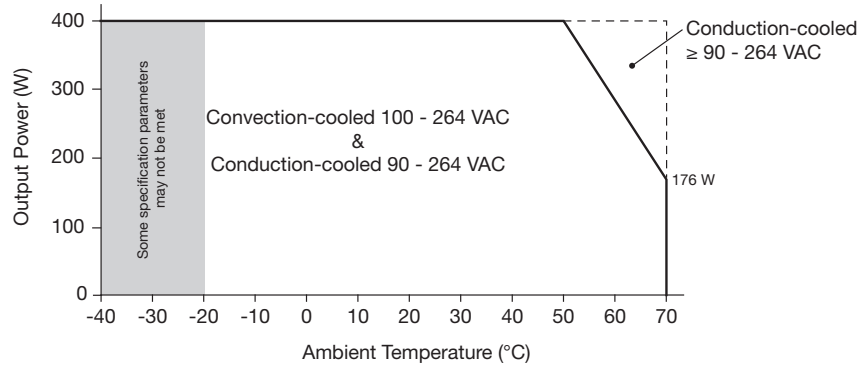
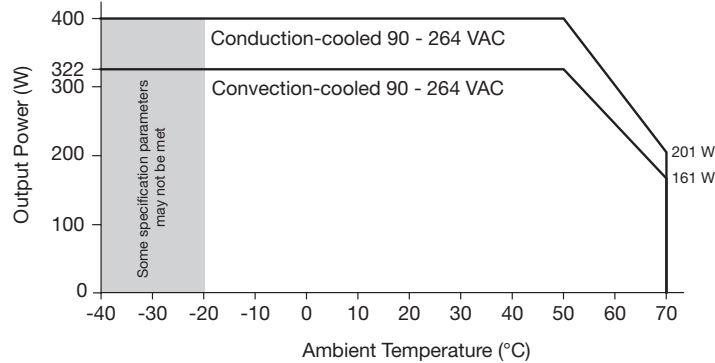


Figure 9 - Cover Fitted



### EMC: Emissions

| Phenomenon       | Standard    | Test Level | Notes & Conditions   |
|------------------|-------------|------------|--|
| Conducted        | EN55022/11  | Class B    |  |
| Radiated         | EN55022/11  | Class A    | With 1 turn Würth 742-700-81 core or similar on all 3 conductors of input lead and 2 turns Kitagawa R1-18-28-10 core or similar on both conductors of output lead. |
|                  |             | Class B    |  |
| Harmonic Current | EN61000-3-2 | Class A    |  |

### EMC: Immunity

| Phenomenon             | Standard              | Test Level               | Criteria | Notes & Conditions           |
|------------------------|-----------------------|--------------------------|----------|------------------------------|
| Low Voltage PSU EMC    | EN61204-3             | High severity level      | as below |                              |
| Harmonic Current       | EN61000-3-2           | Class A                  |          | All models                   |
|                        |                       | Class C                  |          | >40 W                        |
| Radiated               | EN61000-4-3           | 3                        | A        |                              |
| EFT                    | EN61000-4-4           | 3                        | A        |                              |
| Surges                 | EN61000-4-5           | Installation class 3     | A        |                              |
| Conducted              | EN61000-4-6           | 3                        | A        |                              |
| Dips and Interruptions | EN55024 (100 VAC)     | Dip >95% (0 VAC), 8.3ms  | A        |                              |
|                        |                       | Dip 30% (70 VAC), 416ms  | B        |                              |
|                        |                       | Dip >95% (0 VAC), 4160ms | B        |                              |
|                        | EN55024 (240 VAC)     | Dip >95% (0 VAC), 10.0ms | A        |                              |
|                        |                       | Dip 30% (168 VAC), 500ms | A        |                              |
|                        |                       | Dip >95% (0 VAC), 5000ms | B        |                              |
|                        | EN60601-1-2 (100 VAC) | Dip >95% (0 VAC), 10.0ms | A        |                              |
|                        |                       | Dip 60% (40 VAC), 100ms  | A        | Derate output power to 200 W |
|                        |                       | Dip 30% (70 VAC), 500ms  | A        | Derate output power to 200 W |
|                        |                       | Dip >95% (0 VAC), 5000ms | B        |                              |
|                        | EN60601-1-2 (240 VAC) | Dip >95% (0 VAC), 10.0ms | A        |                              |
|                        |                       | Dip 60% (96 VAC), 100ms  | A        |                              |
|                        |                       | Dip 30% (168 VAC), 500ms | A        |                              |
|                        |                       | Dip >95% (0 VAC), 5000ms | B        |                              |
| SEMI F47               |                       |                          |          | Compliant                    |

### Safety Approvals

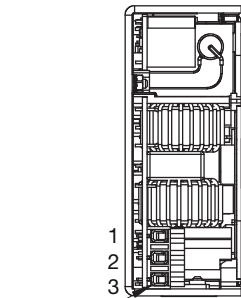
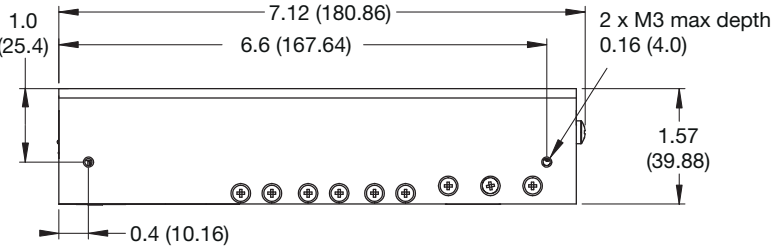
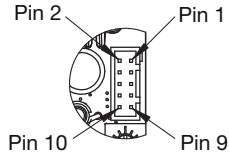
| Safety Agency              | Safety Standard                                | Notes & Conditions  |
|----------------------------|--|---|
| CB Report                  | IEC60950-1 Ed 2                                | Information Technology                                    |
|                            | IEC60601-1 Ed 3.1 Including Risk Management    | Medical   |
| UL                         | UL60950-1, CSA 22.2 No.60950-1-1:08            | Information Technology                                    |
|                            | ANSI/AAMI ES60601-1 & CSA C22.2, No.60601-1:08 | Medical   |
| TUV                        | EN60950-1:2006                                 | Information Technology                                    |
|                            | EN60601-1/A12:2006                             | Medical   |
| CE                         | LVD & RoHS                                     |   |
| Equipment Protection Class | Class I  | See safety agency conditions of acceptability for details |

|                      | Means of Protection                    | Category          |
|----------------------|--|-------------------|
| Primary to Secondary | 2 x MOPP (Means of Patient Protection) | IEC60601-1 Ed 3.1 |
| Primary to Earth     | 1 x MOPP (Means of Patient Protection) |                   |

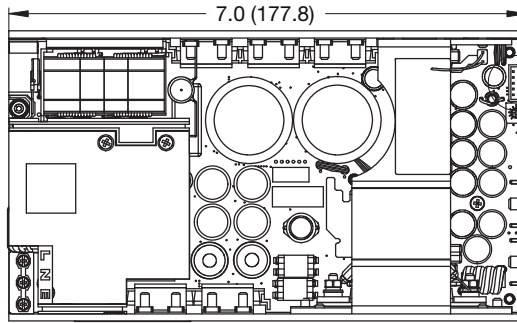
### Mechanical Details

#### CCL400

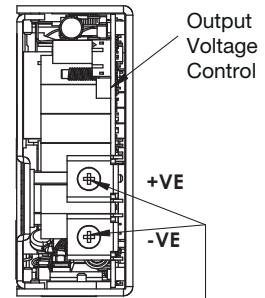
Detail A, Scale 1:1  
Signals Connector CON4  
10 way JST B10B-PHDSS



Input Connector CON1



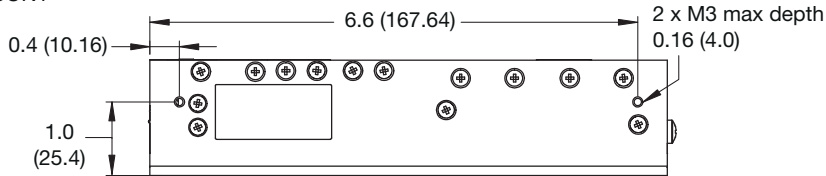
A



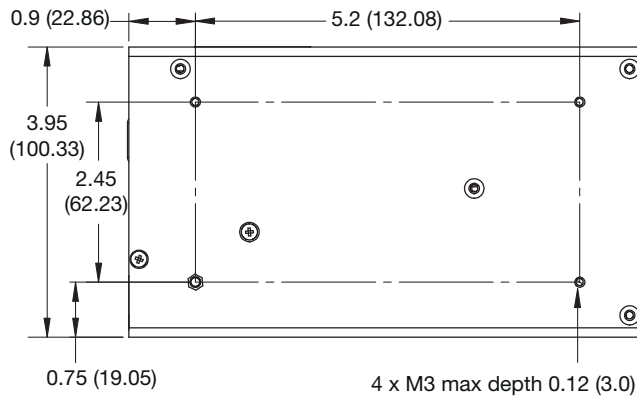
Output Voltage Control

+VE

-VE



Output Terminal  
M4 Screw in  
2 positions  
Torque to  
8lbs-in (90 cNm) max.



| CON1 Input Connector<br>(Dinkle 166-03P3) |          |
|---|----------|
| Pin                                       | Function |
| 1   | Line     |
| 2   | Neutral  |
| 3   | Earth    |

| Output Connector |          |
|------------------|----------|
| Pin              | Function |
| 1                | +V1      |
| 2                | +V1 RTN  |

| CON4 Signals Connector<br>(JST B10B-PHDSS) |                        |
|--|------------------------|
| Pin  | Function               |
| 1  | + Standby              |
| 2  | + Standby              |
| 3  | - Standby              |
| 4  | - Standby              |
| 5  | Power Fail (Emitter)   |
| 6  | Power Fail (Collector) |
| 7  | Inhibit (Cathode)      |
| 8  | Inhibit (Anode)        |
| 9  | - Sense                |
| 10   | + Sense                |

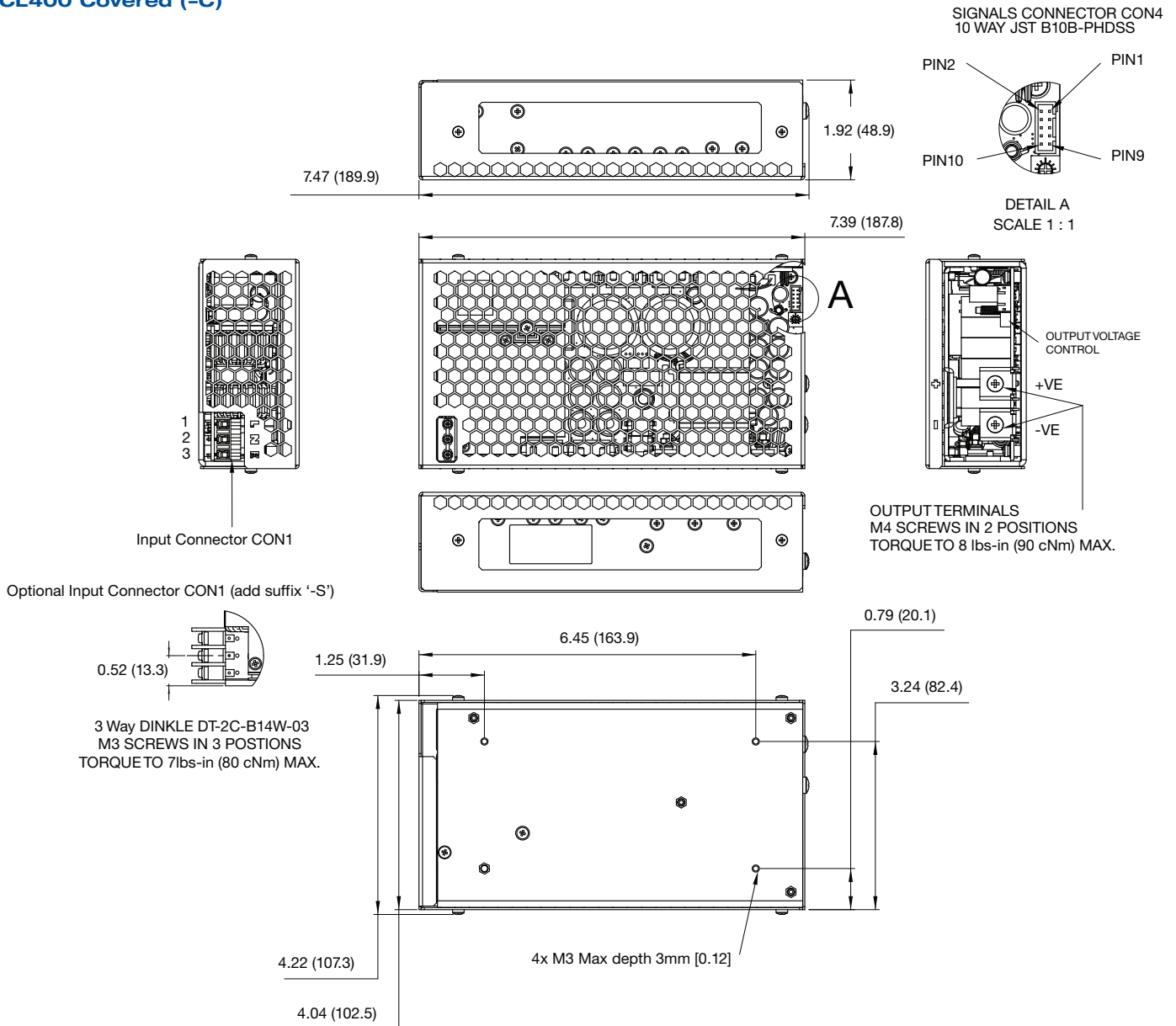
#### Notes

- Dimensions shown in inches (mm).
- CON4 Mating Plug: JST-PHDR-10VS  
Contact: 26-22-AWG (JST-SPHD-001T-P0.5)

- For optional screw terminal input connector, add suffix '-S' to the model number. i.e. CCL400PS12-S (contact sales for availability).

### Mechanical Details

#### CCL400 Covered (-C)



| CON1 Input Connector<br>(Dinkle 166-03P3) |          |
|---|----------|
| Pin                                       | Function |
| 1   | Line     |
| 2   | Neutral  |
| 3   | Earth    |

| Output Connector |          |
|------------------|----------|
| Pin              | Function |
| 1                | +V1      |
| 2                | +V1 RTN  |

| CON4 Signals Connector<br>(JST B10B-PHDSS) |                        |
|--|------------------------|
| Pin  | Function               |
| 1  | + Standby              |
| 2  | + Standby              |
| 3  | - Standby              |
| 4  | - Standby              |
| 5  | Power Fail (Emitter)   |
| 6  | Power Fail (Collector) |
| 7  | Inhibit (Cathode)      |
| 8  | Inhibit (Anode)        |
| 9  | - Sense                |
| 10   | + Sense                |

#### Notes

- Dimensions shown in inches (mm).
- CON4 Mating Plug: JST-PHDR-10VS  
Contact: 26-22-AWG (JST-SPHD-001T-P0.5)
- For optional screw terminal input connector, add suffix '-S' to the model number. i.e. CCL400PS12-S (contact sales for availability).

### Thermal Considerations

In order to ensure safe operation of the PSU in the end-use equipment, the temperature of the components listed in the table below must not be exceeded. Temperature should be monitored using K type thermocouples placed on the hottest part of the component (out of direct air flow). See below for component locations.

| Temperature Measurements (At Ambient 50 °C) |                    |
|---|--------------------|
| Component                                   | Max Temperature °C |
| L2 Coil                                     | 120 °C             |
| TR28 Body                                   | 120 °C             |
| C64   | 105 °C             |
| C39   | 105 °C             |

### Service Life

The estimated service life of the CCL400 Series is determined by the cooling arrangements and load conditions experienced in the end application. Due to the uncertain nature of the end application this estimated service life is based on the actual measured temperature of a key capacitors with in the product when installed by the end application. The worst case of the two figures should be taken as the indicative service life in 24/7 operation.

The graph below expresses the estimated lifetime of a given component temperature and assumes continuous operation at this temperature.

#### Estimated Service Life vs Component Temperature

