# CC7500L3B86TEZ-AM/CC7500H3B86TEZ-AM
# High-Efficiency Water-Cooled Rectifier

## 3Ø, 3-Wire Input; 7500W Capable, Wide output range: 70-88$V_{DC}$

## L3B version 200-240$V_{AC}$, H3B version 380-480$V_{AC}$

RoHS Complaint




The OmniOn Power™ CC7500x3B86TEZ-AM [x = L (Low-line) or H (High-line)] is a high efficiency, true 3-phase, 3-wire (Delta) AC input, 70-88$V_{DC}$ output, liquid or conduction cooled rectifier power supply. The true three phase input eliminates any neutral connection and ensures tight phase current balancing. The rectifier achieves very high efficiency, reducing the cooling demands and providing beneficial OpEx savings. The rectifier meets world-wide safety, environmental, and regulatory requirements. The physical package is designed to allow very flexible positioning into system cabinets, or racks. The rectifier can be mounted in both horizontal and vertical orientations, and its thin profile allows for minimal width when mounted vertically along cabinet's sides, or maximum stacking density when mounted horizontally in equipment racks.

(Differences between these versions & the standard versions (no -AM) are listed on Pg.7.)

## Applications

- Laser
- Industrial systems

## Features

- Efficiency
  - Low Line - 95% peak
  - High Line - ~96% peak
- Compact form factor with 23.6W/in³ density
- Compact dimensions 218 x 54.3 x 448 mm (liquid cooled version)
- AC Input 3-wire, 3Ø, 7500W Rated Output
- Power factor correction (meets EN/IEC 61000-3-12 and EN 60555-2 requirements)
- Output voltage programmable from 70-88$V_{DC}$
- Redundant, parallel operation with active load sharing
- ModBus Communication Protocol
- Field remote upgrade
- Output overvoltage and overload protection
- AC Input overvoltage and undervoltage protection
- Over-temperature warning and protection
- Redundant +5$V_{DC}$ @ 0.75A Standby power
- Remote ON/OFF and redundancy interlock
- Integrated liquid-cooled cold plate (option)
- Conduction cooled (option)
- Three front panel LED indicators
- UL recognized (UL1012)
- CE mark (with EN62477-1/IEC61207-1)
- Meets FCC part 15 subpart A, EN55032 Class A standards
- Meets EN61000 immunity and transient standards
- Dripless Liquid Quick Connects Designed for


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# CC7500x3B86TEZ-AM Technical Specifications

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Input<br>Low line unit<br>High line unit<br>No damage Continuous | $V_{IN}$ | 0 | 300<br>600 | $V_{AC}$ |
| Current into Enable or Intlock pin<br>(internal circuit is 5.9kohm + 1.1V LED) | $I_{EN}$ | 0 | 7 | mA |
| Voltage from Enable or Intlock pin to LGND | $V_{EN}$ | -5 | 27 | V |
| External voltage applied to pull up open-collector output signals | VCC_ext | | 30 | $V_{DC}$ |
| Storage Temperature (ensure that all liquid has been removed from cooling pipes for storage temperatures < 2°C) | $T_{stg}$ | -40 | 85 | °C |
| Isolation voltage, Input to GND (chassis), Output and all signals (100% factory Hi-Pot tested) | | | 2121 | $V_{DC}$ |

## Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. To meet measurement accuracy a warm up time of 1hr may be required.

| **INPUT Low Line Unit (200-240$V_{AC}$)** | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Min** | **Typ** | **Max** | **Unit** |
| Operating Voltage Range (3Φ delta with safety frame ground) | | $V_{IN}$ | 176[1] | 200/208<br>220/240 | 275 | $V_{AC}$ |
| Frequency | | $F_{IN}$ | 47 | | 63 | Hz |
| Input current per phase (maximum at $V_{IN}$ = 195$_{AC}$, $W_{OUT}$ = 7500W) | | $I_{IN}$ | | | 27 | $A_{rms}$ |
| Input low voltage<br>Turn off<br>Turn on<br>Hysteresis | | $V_{IN}$ | | <br><br>5 | 171<br>176 | $V_{AC}$ |
| Input high voltage<br>Turn off<br>Turn on<br>Hysteresis | | $V_{IN}$ | 280<br>275 | <br><br>5 | | $V_{AC}$ |
| Input current phase unbalance | [load > 50% of FL] | | | | 2 | % |
| Inrush Transient<br>(per Φ at 240$V_{RMS}$, 25°C, excluding X-Capacitor charging) | | $I_{IN}$ | | | 10 | $A_{pk}$ |
| Leakage Current (per Φ, 240$V_{AC}$, 60Hz) | | $I_{IN}$ | | | 5[2] | % |
| Input voltage unbalance | | $V_{IN}$ | -15 | 1 | +10 | % |
| Power Factor (50 – 100% load) | | PF | 0.98 | 0.995 | | |
| Total Harmonic Distortion (50 – 100% load) | | THD | | | 5[3] | % |
| Efficiency<br>(200/208$V_{AC}$ @ 25°C,<br>86$V_{DC}$ output) | 50% FL | η | | 95 | | % |
| Ride through ($V_{IN}$ = 200$V_{rms}$, 100% FL) | | T | 10 | | | ms |
| Isolation | Input – Output<br>Input – Chassis (GND)/All Signals<br>Output – Chassis (GND)<br>LGND – Chassis (GND) | V | 2000<br>2000<br>1500<br>100 | | | $V_{DC}$ |

[1]Power derating at $V_{IN}$<195$V_{AC}$.
[2]Leakage current shall not exceed 5% of the nominal input current per phase under testing. Appropriate marking requirements of UL 1950, CSA 950, and IEC/EN 60950 should be applied.
[3]Total harmonic distortion <6.5% when $T_{water\text{-}inlet}$ <5°C.



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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Electrical Specifications (continued)

| INPUT High Line Unit (380-480$V_{AC}$) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Min** | **Typ** | **Max** | **Unit** |
| Operating Voltage Range (3Φ delta with safety frame ground) | | $V_{IN}$ | 320 | 380-480 | 530 | $V_{AC}$ |
| Frequency | | $F_{IN}$ | 47 | | 63 | Hz |
| Input current per phase (maximum at $V_{IN}$ = 320$V_{AC}$, $W_{OUT}$ = 7500W) | | $I_{IN}$ | | | 17 | $A_{rms}$ |
| Input low voltage | Turn off<br>Turn on<br>Hysteresis | $V_{IN}$ | | <br><br>5 | 315<br>320 | $V_{AC}$ |
| Input high voltage | Turn off<br>Turn on<br>Hysteresis | $V_{IN}$ | 535<br>530 | <br><br>5 | | $V_{AC}$ |
| Input current phase unbalance | [load > 50% of FL] | | | | 2 | % |
| Inrush Transient<br>(per Φ at 480$V_{RMS}$ , 25°C, excluding X-Capacitor charging) | | $I_{IN}$ | | | 30 | $A_{pk}$ |
| Leakage Current (per Φ, 530$V_{AC}$, 60Hz) | | $I_{IN}$ | | | 13<br><5 | mArms<br>% |
| Input voltage unbalance | | $V_{IN}$ | -15 | | +10 | % |
| Power Factor (50 – 100% load) | | PF | 0.96 | 0.99 | | |
| Total Harmonic Distortion (50 – 100% load) | | THD | | | 5[3] | % |
| Efficiency<br>(480$V_{AC}$ @ 25°C, 84$V_{DC}$ output) | 50% Load<br>75% Load<br>100% Load | η | | 96.1<br>96.2<br>96.2 | | % |
| Holdup Time ($V_{IN}$= 480, $V_{OUT}$ = 84$V_{DC}$ 100% FL) | | T | 10 | | | ms |
| Isolation | Input – Output<br>Input – Chassis (GND)/All Signals<br>Output – Chassis (GND)<br>LGND – Chassis (GND) | V | 2750<br>2750<br>1500<br>100 | | | $V_{DC}$ |

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‡ VDE is a trademark of Verband Deutscher Elektrotechniker e.V.

§ This product is intended for integration into end-user equipment. All CE marking procedures of end-user equipment should be followed. (The CE mark is placed on selected products.)

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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Electrical Specifications (continued)

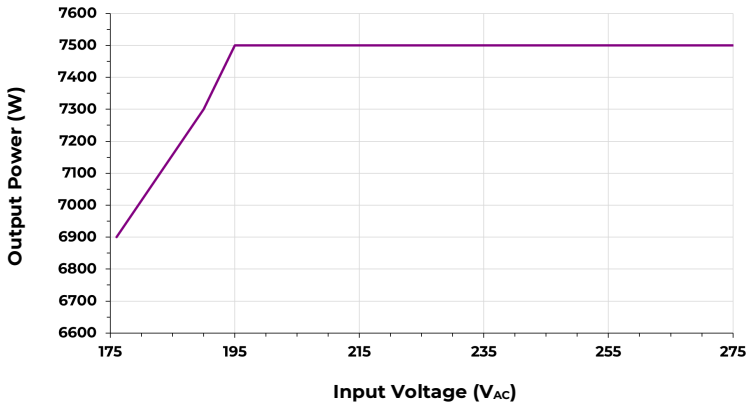
| MAIN OUTPUT (common) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Min** | **Typ** | **Max** | **Unit** |
| Output Power ($T_{INLET/CASE}$ = 2-30°C , $V_{IN}$≥195$V_{AC}$ , $V_{OUT}$≥80$V_{DC}$)<br>320$V_{AC}$ ≤ $V_{IN\ (High-line)}$ ≤ 530$V_{AC}$<br>195$V_{AC}$ ≤ $V_{IN\ (Low-line)}$ ≤ 275$V_{AC}$, power derating[4] | | $W_{OUT}$ | | | 7500<br>7500 | W<br>W |
| Output Voltage Factory Setpoint | | $V_{OUT}$ | | 84 | | $V_{DC}$ |
| Output Voltage Programming Range<br>Low Line<br>High Line | | | 70 | | 88 | $V_{DC}$ |
| Resolution | | | | 5 | | $mV_{DC}$ |
| Overall Output Regulation (single and paralleling operation)<br>Tinlet/case = 25°C<br>Tinlet/case = 2-30°C | | | -0.5<br>-1% | | +0.5<br>+1% | V |
| Output Current ($T_{INLET/case}$ = 2-30°C)<br>$V_{IN(Low-line)}$ ≥195$V_{AC}$[4]<br>$V_{OUT}$ = 88$V_{DC}$<br>$V_{OUT}$ = 84$V_{DC}$<br>$V_{OUT}$ = 80$V_{DC}$<br>$V_{OUT\ (High-line)}$ = 70$V_{DC}$<br>$V_{OUT\ (Low-line)}$ = 70$V_{DC}$ | | $I_{OUT}$ | <br><br>0<br>0<br>0<br>0<br>0 | | <br><br>85.2<br>89.3<br>93.8<br>75<br>93.8 | $A_{DC}$ |
| Output Ripple<br>RMS (5Hz to 20MHz)(20MHz bandwidth)<br>Peak-to-Peak (5Hz to 20MHz) | | $V_{OUT}$ | 0 | | 93.8<br>120<br>500 | <br>$mV_{rms}$<br>$mV_{p-p}$ |
| Current share (>50% FL) | | | -5 | | +5 | %FL |
| External Bulk Load Capacitance | | | 0 | | 22,750 | µF |
| Turn-On (monotonic from 30-100% of $V_{nom}$)<br>AC input turn on Delay<br>Remote enable turn on delay<br>Rise Time | | T | | 5<br>50<br>100 | | S<br>ms<br>ms |
| Output Overshoot | | $V_{OUT}$ | | | 3.5 | % |
| Pulse load response, $C_O$=6720µF, 25°C, no shutdown/damage happen<br>Load frequency<br>Duty<br>Load step | | <br>F<br>Duty<br>$I_{OUT}$ | <br>1<br>1<br>1 | | <br>10<br>100<br>100 | <br>KHz<br>%<br>% FL |
| Power limit, $V_o$ from 80-88$V_{DC}$ | | $W_{OUT}$ | 7500 | | | W |
| Current limit, $V_o$ from 70-88$V_{DC}$ | | $I_{OUT}$ | 105 | | | % |
| Undervoltage Shutdown | | $V_{OUT}$ | | 67 | | $V_{DC}$ |
| Behavior | | One restart attempt, then latches OFF | | | | |
| Short-circuit protection | | No damage | | | | |
| Overvoltage Shutdown (dynamic) | 200ms delayed shutdown<br>(default) Immediate shutdown<br>Programmable range | $V_{OUT}$ | | $V_{o,set}$ +5 | | $V_{DC}$ |
| | Latched shutdown | After 3 restart attempts within a 30 sec window, unit latches OFF | | | | |
| | Restart delay | | 3.5 | 4 | 5 | sec |
| Over-temperature Warning<br><br>Over-temperature Shutdown<br>Restart | | $T_{COMPONENT}$ | | 5°C below shut down<br>20<br>20 | | °C |
| Restart/Reset conditions | | Loss of input > 1 sec or Output OFF followed by ON command | | | | |
| Isolation voltage to Chassis/signals | | 1500 $V_{DC}$ | | | | |

[4]See curve below of Output Power Derating vs. $V_{IN}$.



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# CC7500x3B86TEZ-AM Technical Specifications (continued)




**Output Power Derating vs $V_{IN}$ (low-line module)**

| **$5V_{DC}$ Auxiliary output** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Min** | **Typ** | **Max** | **Unit** |
| Output Voltage Setpoint (return is LGND) | $V_{OUT}$ | | 5 | | $V_{DC}$ |
| Overall Regulation | | -10 | | +10 | % |
| Output Current | | 0 | | 0.75 | A |
| Over - voltage Clamp | | | 5.5 | | $V_{DC}$ |
| Over - current Limit | | | 250 | | %FL |
| Isolation voltage to main output | | 1500 | | | $V_{DC}$ |
| Isolation voltage to grounding/chassis | | 100 | | | $V_{DC}$ |

## General Specifications

| Parameter | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|
| Unpacked Weight (conduction cooled) | | 7.68 (16.9) | | Kgs (Lbs) | |
| Packed weight (conduction cooled) | | 9.14 (20.1) | | | |
| Unpacked Weight (liquid cooled) | | 7.91 (17.4) | | | |
| Packed weight (liquid cooled) | | 9.36 (20.6) | | | |
| Reliability Calculated | | 560,000 | | Hours | Full load, 25°C case; MTBF per Telecordia SR232 Reliability protection for electronic equipment, issue 3, method I, case III. |
| Service life | | 10 | | years | Case temperature, 25°C, 80% load |


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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Signal Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. Signals are referenced to LGND unless noted otherwise. See the Signal Definitions table for additional information.

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Remote ON/OFF** (by Enable pin; return is LGND) | | | | | |
| main output OFF | $V_{EN}$ | 0 | – | 0.8 | V |
| main output ON (current into pin)* | $I_{EN}$ | 3 | – | 6 | mA |
| **Vprog** | | | | | $V_{DC}$ |
| Voltage control range | $V_{control}$ | 0 | | 3.3 | $V_{DC}$ |
| Programmed output voltage range | $V_{OUT}$ | 70 | | 88 | $V_{DC}$ |
| Voltage adjustment resolution (12-bit A/D) | $V_{control}$ | | 7.2 | | mV |
| Output configured to $84V_{DC}$[5] | $V_{control}$ | 3.1 | | 3.3 | $V_{DC}$ |
| Output configured to $70V_{DC}$ | $V_{control}$ | 0 | | 0.1 | $V_{DC}$ |
| **Fault** (open collector output, pulled up with a 5kohm resistor inside, 24V need to be sourced externally) | | | | | |
| Logic HI (No fault is present) | V | | – | 30 | $V_{DC}$ |
| Sink current | I | – | – | 6 | mA |
| Logic LO (Fault is present) | V | 0 | – | 0.4 | $V_{DC}$ |
| **Power Good** (Open collector output, pulled up with a 5kohm resistor inside, 24V need to be sourced externally) | | | | | |
| Logic HI (Vo in regulation – normal) | V | | | 30 | $V_{DC}$ |
| Sink current | I | | | 6 | mA |
| Logic LO (Alert is set) | V | 0 | | 0.4 | $V_{DC}$ |
| **EMG** (Open collector output, pulled up with a 5kohm resistor inside to VCC_ext which needs to be sourced externally) | | | | | |
| Logic HI (either Interlock open = OFF) | V | | | 30 | $V_{DC}$ |
| Sink current | I | | | 6 | mA |
| Logic LO (normal) | V | 0 | | 0.4 | $V_{DC}$ |
| **Interlock 1** (Opto-coupler input, internal 5.9K ohm resistor + ~1.1V LED) Conduction current to turn on | | 3 | | 6 | mA |
| **Interlock 2** (Opto-coupler input, internal 5.9K ohm resistor + ~1.1V LED) Conduction current to turn on | | 3 | | 6 | mA |

[5]default setting can be changed through Modbus command by user, and stored into non-volatile memory.

*Interlocks must also be ON to turn the output ON. Internal circuit is 5.9K ohm in series with ~1.1V (used to calculate current).

## Environmental Specifications

| Parameter | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|
| Coolant Water Inlet Temperature[6,7] | 2 | | 30 | °C | |
| Operating Ambient Air Temperature | 2 | | 50 | °C | |
| Cooling Flow Rate | 0.2<br>0.76 | | 0.66<br>2.5 | GPM<br>L/min | |
| Cold Plate Inlet Pressure | 30 | | 100 | psi | |
| Cold Plate Pressure Drop | | 10 | | psi | at the minimum flow rate |
| Conduction cold-plate temperature | 2 | | 30 | °C | |
| Operating Altitude | | | 3000 / 10k | m / ft | |
| Non-operating Altitude | | | 9000 / 30k | m / ft | |
| Relative Humidity | The product should be operated under controlled temperature and humidity conditions with ambient below 50°C and below 60% Relative Humidity. | | | | |
| Shock Operational | IEC 60068-2-27 | | | | |
| Vibration Operational | IEC 60068-2-64 | | | | |

[6]Coolant must remain free of algae and corrosion products. The use of suitable inhibitors in the coolant is recommended and compatible with copper tubing. Full-rated output power is available up to 30°C inlet water temperature (lower for coolants other than water).

[7]Water connections are indicated by color on faceplate (blue – cool inlet, red – warm exit). Water delivery method should include strain relief feature to mitigate the risk of water leak in the end product. Leak detection and protection mechanisms should be used to mitigate the effect of water leaks. Care must be taken to prevent water clogs that could reduce the water pressure or restrict flow.



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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## EMC[#]

| Parameter | Function | Standard | Level | Criteria | Test |
|---|---|---|---|---|---|
| AC input | Conducted emissions | EN55032, FCC part 15 | A - 3dB margin | | 0.15 – 30MHz |
| | Radiated emissions[8] | EN55032/CISPR32, FCC part 15 Subpart A, | | | 30 – 10000MHz |
| | Input Harmonics | IEC61000-3-12 THD | A<br>5% | | |
| AC Input Immunity | Line DIP and Short interruptions | IEC61000-4-34 Dip | Class 3 | B<br>B | -30% (from nominal) for 25/30 cycles<br>-100%, 1 cycle |
| | | IEC61000-4-34 short interruption | Class 3 | B | 25% sag from nominal for 250/300 cycles |
| | | | | A | 1/2 cycle -100% interruption |
| | Lightning surge | EN61000-4-5, Level 4, 1.2/50µs – error free | | A | 4kV L-E |
| | | | | A | 2kV L-L |
| | Fast transients | EN61000-4-4 | 3 | A | 5/50ns, 2kV (common mode) |
| Enclosure immunity | Conducted RF fields | EN61000-4-6 | 3 | A | 140dBµV, 0.15-80MHz, 80% AM |
| | Radiated RF fields | EN61000-4-3 | 3 | A | 10V/m, 80-1000MHz, 80% AM |
| | ESD | EN61000-4-2 | 4 | A | 8kV contact, 15kV air |
| | Magnetic Field Immunity | EN61000-4-8 | 4 | A | |

| Criteria | Performance |
|---|---|
| A | No performance degradation |
| B | Temporary loss of function or degradation not requiring manual intervention |
| C | Temporary loss of function or degradation that may require manual intervention |
| D | Loss of function with possible permanent damage |

[#]Surges and sags applied one Φ at a time and all 3Φ's simultaneously; phase angles 0°, 90°, 270°.

[8]Test with system. OmniOn Power™ assumed a ferrite core is used in the AC input line. The core used by OmniOn Power™ is PN 2631626202 from Fair-Rite.

## Differences between the -AM and Standard (no -AM) versions

- Coolant connections are opposite the electrical connections vs. on the same side in the standard versions
  - Therefore no rubber boot is present to protect the ac connector
- Output connections are threaded studs (compatible with paralleling busbars on Pg. 13) vs. cable connectors
- Default $V_{OUT}$ setpoint is $84V_{DC}$ vs. $86V_{DC}$
- Absolute maximum Voltage from Enable or Intlock pin to LGND is 27V vs. 8V


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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Control and Status

The Rectifier provides two methods for monitor and control, analog and the Modbus protocol.

## Signal Reference

Unless otherwise noted, all signals, the standby output, and Modbus communications are referenced to Logic Ground (LGND). See the Signal Definitions Table at the end of this document for further description of all the signals.

LGND is capacitively coupled to the chassis which is connected inside the rectifier to the safety GND lead. The maximum voltage differential between LGND and Chassis (GND) should be less than $100V_{DC}$. It is assumed that the end user will connect LGND to the digital ground reference in the system.

LGND is isolated from the main output of the rectifier.

## Control Signals

**Interlock 1 & 2:** These two pins provide redundant emergency stop function. Either interlock pin open (low) will turn off main output immediately. To turn ON the main output, each Interlock pin & the Enable pin must be driven high by injecting between 3mA (min) & 6mA (max) into each. The internal circuit for each pin is an opto-isolator diode (~1.1V) with 5.9kohm in series to LGND.

LED/analog signals/communication can report status correctly when interlock is open.

Interlock is top priority no matter Enable/Modbus command status.

**Enable:** Remote on/off for the main output with system control. Logic high to turn ON the main output and Logic low (open) to turn OFF in < 200ms. To drive the pin high, between 3mA (min) & 6mA (max) must be driven into the pin as described above for Interlock 1 & 2.

Refer the on/off logic table combined interlock and Enable.

| | | | | | | |
|---|---|---|---|---|---|---|
| Input | Interlock 1 | Low/ Open | High | Low/ Open | High | High |
| | Interlock 2 | Low/ Open | Low/ Open | High | High | High |
| | Enable | Low/ Open | Low/ Open | Low/ Open | High | Low/ Open |

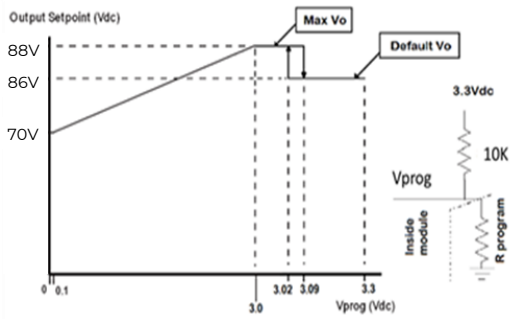
| | | | | | | |
|---|---|---|---|---|---|---|
| Output | EMG | High | High | High | Low | Low |
| | PG | Low | Low | Low | High | Low |
| | Output Voltage | Off | Off | Off | ON | Off |

**Voltage programming ($V_{prog}$):** Hardware voltage programming controls the output voltage until a software command to change the output voltage is executed. Software voltage programming permanently overrides the hardware margin setting and the rectifier no longer listens to any hardware margin settings until power to the controller is interrupted, for example if input power or bias power is recycled.

When bias power is recycled to the controller the controller restarts into its default configuration, programmed to set the output as instructed by the $V_{prog}$ pin. Again, subsequent software commanded settings permanently override the margin setting. As an example, applying a voltage between $V_{prog}$ and LGND is an effective way of changing the factory set point of the rectifier to whatever voltage level is desired by the user during initial start-up.

The $V_{prog}$ pin level should be set by a divider from $3.3V_{DC}$ to LGND external to the rectifier as shown in the graph. Programming can be accomplished either by a resistor divider or by a voltage source injecting a precision voltage level into the $V_{prog}$ pin. Above $3V_{DC}$ the rectifier sets the output to its default state.

If $V_{prog}$ feature is not used, keep this pin open. this signal is pulled up to 3.3V with a resistor inside, therefore output voltage is default factory setting.



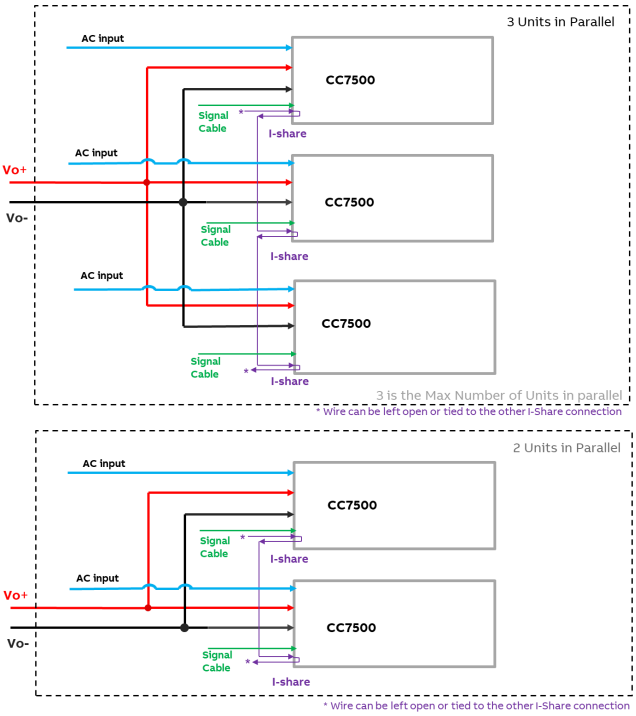


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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## I_share (after P0 stage)

**Load share (Ishare):** This is a single wire analog signal that is generated and acted upon automatically by rectifiers connected in parallel. Ishare pins should be connected to each other for rectifiers, if active current share among the rectifiers is desired. No resistors or capacitors should get connected to this pin. I_share refers Vo- as ground.




## Status Signals

**EMG:** This signal represents the status of interlocks input. This signal is pulled up with a 5kohm resistor inside, VCC_ext needs to be sourced outside the rectifier. When either interlock input is open this signal will be HI.

**PG:** This signal is HI when the main output is delivered and goes LO if the main output is out of regulation. This signal is pulled up with a 5kohm resistor inside, 24V needs to be sourced outside the rectifier.

## Fault Signals

**Fault_1 (Pin 13):** This signal representing whether a Fault occurred (see table p.11). This signal is pulled up with a 5kohm resistor to VCC_ext, where 24V needs to be sourced outside the rectifier. This signal goes LO when the unit needs attention.

**Fault_0 (Pin 11):** Indicates inability to provide power according to the table on p.11. These signals are pulled up with an internal 5 kohm resistor to VCC_ext, where 24V needs to be sourced outside the rectifier.

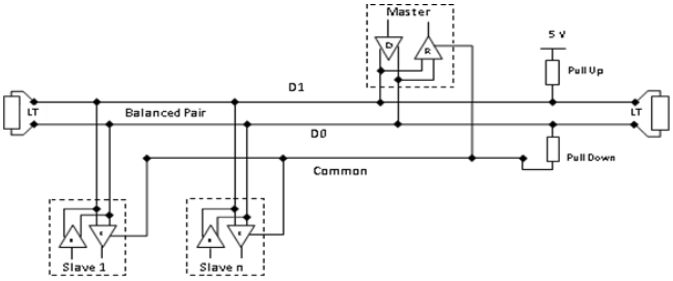
## Communication

CC7500X3B86TEZ-AM supports Modbus communication to control and monitor the device. It also supports firmware remote upgrade and black box.

Refer to the Modbus Communication Protocol Feature Document Issue 0.1 for details.

**Modbus Physical layer:**

Modbus over a serial line should implement an electrical interface in accordance with EIA/TIA-485 standard (also known as RS485 standard). This standard allows point to point and multipoint systems, in a “two-wire configuration”.




Hardware signal pin named “Modbus+” is presented as “D1” and “Modbus-” as “D0”.

**Modbus mode**

Supports RTU mode

The format (11 bits) for each byte in RTU mode is:

- Coding System: 8-bit binary
- Per Byte: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit
- Parity: Default is even parity
- Baud: Default is 19200

**Modbus Addressing**

The Modbus addressing space comprises of 256 different addresses.


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# CC7500x3B86TEZ-AM Technical Specifications (continued)

| 0 | From 1 to 247 | From 248 to 255 |
|---|---|---|
| Broadcast address | Slave individual addresses | Reserved |

The Address 0 is reserved as the broadcast address. All slave nodes must recognize the broadcast address. The Modbus Master node has no specific address, only the slave nodes must have an address. This address must be unique on a Modbus serial bus. As slave, CC7500X3B86TEZ-AM supports 1-99 addresses setting through addr_0, addr_1.

**Addr_0 to Addr_1**

Treat the Addr_0 pin as a ones place and Addr_1 as a tens place to make up the unit's address. Each address pin is pulled up to an internal 3.3V through a 10K ohm resistor. The external resistor, Rs, connected to LGND changes the voltage level to configure the address according to the table below.

Addr_1 is to set tens place for the address, and Addr_0 is to set one place.

| Tens or one place | Voltage level | $R_S$ (± 0.1%) |
|---|---|---|
| 1 | 3.30 | open |
| 2 | 2.67 | 45.3k |
| 3 | 2.34 | 24.9k |
| 4 | 2.01 | 15.4k |
| 5 | 1.68 | 10.5k |
| 6 | 1.35 | 7.15k |
| 7 | 1.02 | 4.99k |
| 8 | 0.69 | 2.49k |
| 9 | 0.36 | 1.27k |
| 0 | 0 | 0 |

For example, if address 0x10d required, the Addr_1 with 0ohm resistor for 0 and the Addr_0 pin open for 1. Unit will keep default address 0x11d when all address pins are open.

**Black Box**

Contents of the black box and more detailed information about the specifics of the feature are described in a separate document. The intent here is to provide a high-level summary. This feature includes the following.

1. A rolling event Recorder
2. Operational Use Statistics

**Remote upgrade**

CC7500X3B86TEZ-AM supports to upgrade firmware on live through Modbus.

## LEDs

Three LEDs are located on the front faceplate of the device. The AC_OK LED provides visual indication of the INPUT signal function. When the LED is ON and GREEN, the rectifier input is within normal design limits.

The second LED is the DC_OK LED. When it is GREEN, the DC output is present. When 'blinking', a power limit or overload condition exists. When it is OFF, the output is not present.

The third LED is the FAULT LED. A continuous RED condition indicates that a fault exists and the rectifier has been shut down. A 'blinking' RED LED indicates an over-temperature warning.

Both FAULT LED and DC_OK LED 'blinking' indicates an interlock is OPEN.

A communication fail alert is enabled after communications is established. If during power up, communications is not sensed, then the communication fail alert can not be asserted. If at any time during operation there is communications established, then the communication fail alert can occur if communication is lost.

There is a communication fail alert timeout default of 30 seconds, where if communications has been established and the device does not communicate for 30 seconds, the communication fail alert will assert. This timeout can be changed via a Modbus register. The communication fail alert feature can also be enabled/disabled via a Modbus register, if you do not want a timeout/comm fail to be detected.


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## Alarm and LED state summary

| | Power Supply LED State | | | Signals State | | | |
|---|---|---|---|---|---|---|---|
| **Condition** | **AC OK Green** | **Fault Red** | **DC OK Green** | **Fault_1 (Pin 13)** | **Fault_0 (Pin 11)** | **PG** | **EMG** |
| OK | 1 | 0 | 1 | High | High | High | LOW |
| Over-Temperature Warning (OTW) 5°C before shutdown) | 1 | Blinks | 1 | LOW | High | High | LOW |
| Over temperature Shutdown | 1 | 1 | 0 | LOW | LOW | LOW | LOW |
| AC Present but not within limits | Blinks | 0 | 0 | High | LOW | LOW | LOW |
| Boost Stage Failure | 1 | 1 | 0 | LOW | LOW | LOW | LOW |
| Over Voltage Latched Shutdown | 1 | 1 | 0 | LOW | LOW | LOW | LOW |
| Over Current | 1 | 0 | Blinks | High | LOW | Pulse | LOW |
| Non-catastrophic Internal Failure | 1 | 1 | 1 | LOW | High | High | LOW |
| Standby (remote enable/ communication command) | 1 | 0 | 0 | High | High | LOW | LOW |
| Emergency stop (either interlock open) | 1 | Blinks | Blinks | High | High | LOW | High |
| Comm. Fail (loss of Comm.) | 1 | Blinks | 1 | High | High | High | LOW |

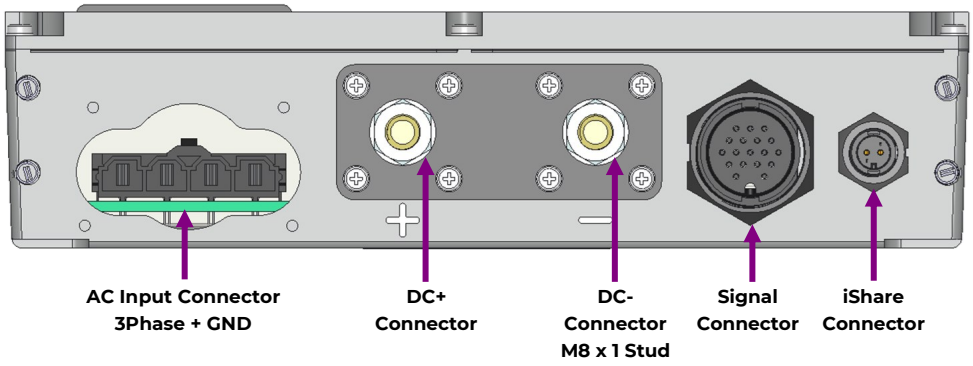

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# CC7500x3B86TEZ-AM Technical Specifications (continued)

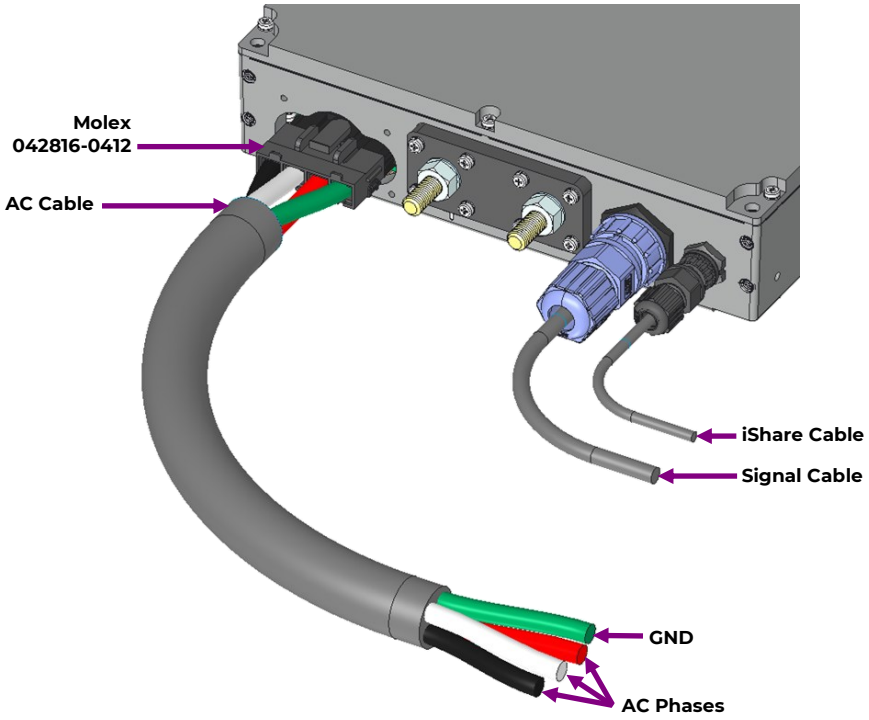
## Front view




## Rear view




**Connectors without mated pairs, covers and cables**




**Connectors with mated pairs, covers and cables**


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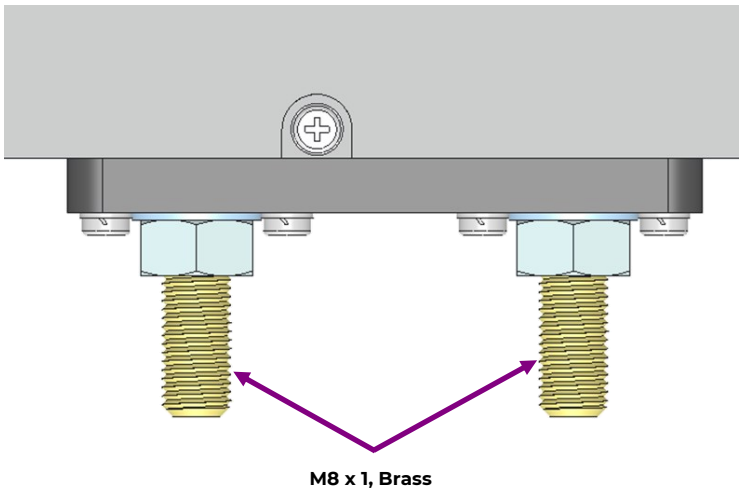
# CC7500x3B86TEZ-AM Technical Specifications (continued)

## DC Output Connector

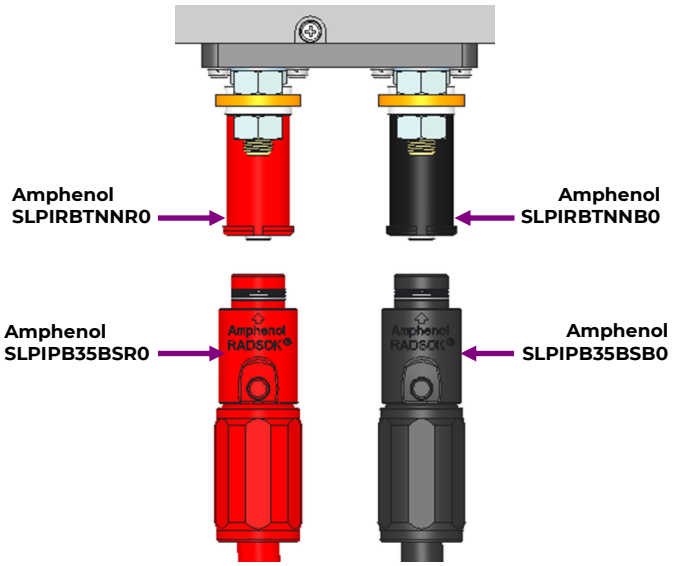
DC connectors on rectifier are brass, M8 x 1 mm threaded studs.

A separate busbar kit is available to connect 2 units in parallel with one output connection.

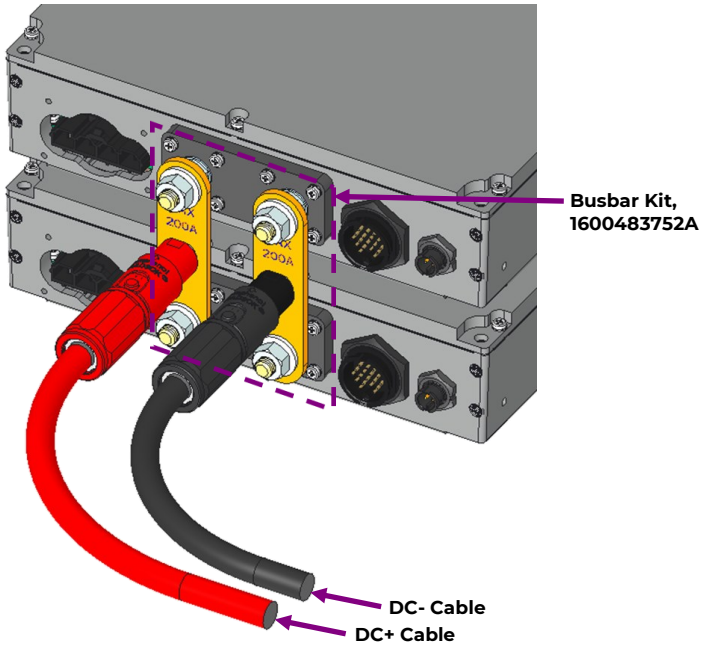
The busbar kit uses Amphenol Surlok waterproof connectors, SLPIRBTNNR0, Red, 90deg key, and SLPIRBTNNB0, Black, 90deg key. Mating connectors are Amphenol SLPIPB35BSR0, Red, 90deg key, and SLPIPB35BSB0, Black, 90deg key. They support 2 AWG wire field termination using standard crimping tools.




**Rectifier output connectors**




**Rectifier output connectors with busbar kit assembled (cables not included)**

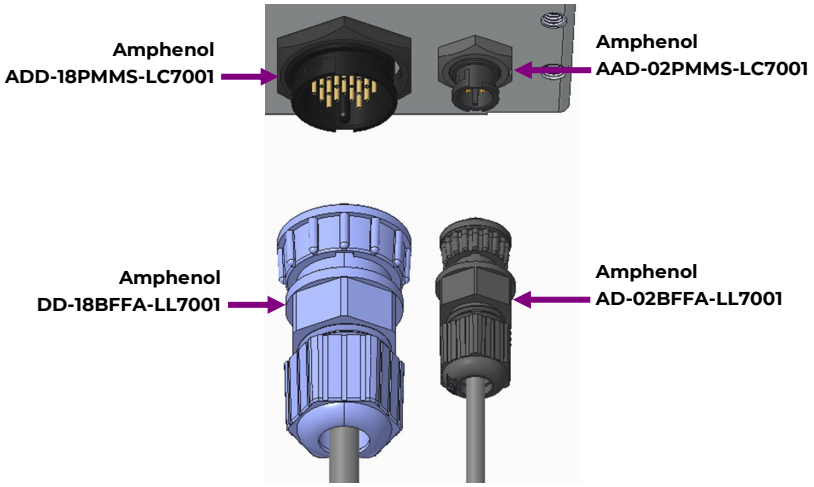


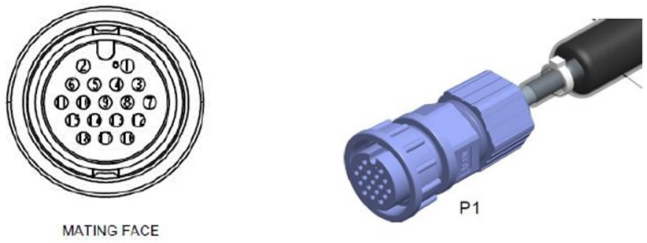

**Connectors with mated pairs, covers, cables, busbar kit**


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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Signal & Current-Share Connectors

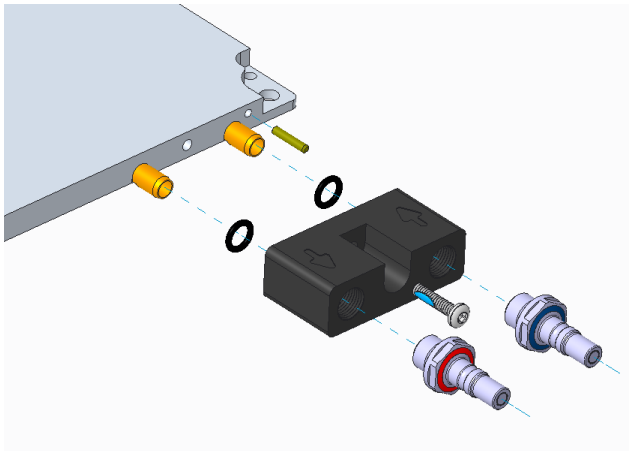


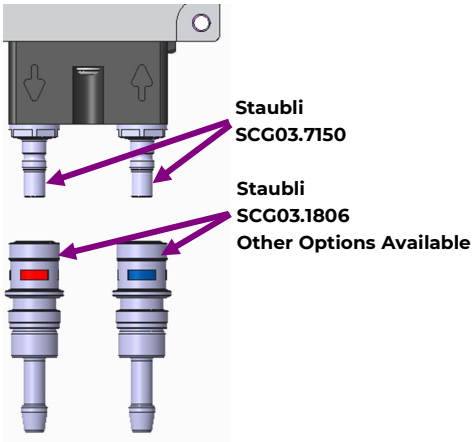




**Signal cable (Ordering code: 1600447136A)**

## Water connections

The rectifier uses dripless liquid quick-connects for the cold plate connections. They are Staubli SCG03.7150 plugs (with G 1/8 threads) that will mate with any Staubli SCG03 socket.







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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Signal table

| Connector | Pin | Label | Type | Description |
|---|---|---|---|---|
| Signal | 1 | Modbus+ | | Modbus communication wire D1, refer to LGND |
| | 2 | Modbus- | | Modbus communication wire D0, refer to LGND |
| | 3 | LGND | Reference ground | Isolated from the main output & SEC_RTN. |
| | 4 | 5Vstby | Output | 5V @ 0.75A provided for external use; return is LGND.<br>This output is always ON. |
| | 5 | Vprog | Input | Vo programing |
| | 6 | Addr_0 | Input | Address setting |
| | 7 | Addr_1 | Input | Address setting |
| | 8 | Intlock_1 | Input | Emergency stop to turn OFF the main output within 50ms. Open (not connected) turns OFF; 3mA (min) to 6mA (max) into the pin turns ON. The internal circuit is an opto-isolator diode (~1.1V) with 5900 ohms in series to LGND, so supplying an external voltage of 24V turns ON. |
| | 9 | Intlock_2 | Input | Emergency stop to turn OFF the main output within 50ms. Open (not connected) turns OFF; 3mA (min) to 6mA (max) into the pin turns ON. The internal circuit is an opto-isolator diode (~1.1V) with 5900 ohms in series to LGND, so supplying an external voltage of 24V turns ON. |
| | 10 | Enable | Input | Turns the main output ON/OFF. Open (not connected) turns OFF; 3mA (min) to 6mA (max) into the pin turns ON. The internal circuit is an opto-isolator diode (~1.1V) with 5900 ohms in series to LGND, so supplying an external voltage of 24V turns ON. |
| | 11 | Fault_0 | Output | Indicates inability to provide power - see table p.11. Open-collector type, pulled up internally to VCC_ext. Sink current is 5mA max. Normal is logic High. |
| | 12 | PG | Output | $V_O$ is in regulation Open-collector type, pulled up internally to VCC_ext. Sink current is 5mA max. max voltage is VCC_ext. Normal is logic Hi. |
| | 13 | Fault_1 | Output | Internal fault - see table p.11. Open-collector type, pulled up internally to VCC_ext. Sink current is 5mA max, max voltage is VCC_ext. Normal is logic High; goes low when unit needs attention. |
| | 14 | EMG | Output | “Emergency” interlock status: Logic Low when both interlocks are satisfied (= ON = powered). Pulled up internally to VCC_ext. |
| | 15 | VCC_ext | Input | External pull-up voltage for output signals, referred to LGND and connected to internal 5K pull-up resistors. Set less than the maximum input voltage of connected devices, and < 30V abs max. |
| | 16 | – | – | |
| | 17 | – | – | |
| | 18 | – | – | |
| I-Share | 1 | ISHARE | – | A single wire active-current-share interconnect between rectifiers<br>Ref: Vout (-) |
| | 2 | ISHARE | – | Same signal as above, for daisy-chaining. |



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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Modbus Registers

All registers in this document are 0-based. Holding register 40001 is addressed as 0001 in a Modbus message.

| Reg Address | Reg length (word) | Register Name | R/W | Reg type | Note |
|---|---|---|---|---|---|
| 1 | 18 | SERIAL_NUMBER | R/W | STR18 | |
| 19 | 1 | GROUP_ADDRESS | R/W | INT | |
| 20 | 11 | COMCODE | R/W | STR11 | |
| 31 | 20 | STATION_TYPE_R | R | STR20 | |
| 51 | 7 | SERIES | R/W | STR7 | XX: YYZ, XX YY is 0-9, Z is A-Z |
| 58 | 7 | SEC_APPLICATION_VERSION | R | STR7 | VERmaj, VERmin, Month, Day, Year, Hour, Minutes |
| 65 | 7 | PRI_APPLICATION_VERSION | R | STR7 | VERmaj, VERmin, Month, Day, Year, Hour, Minutes |
| 72 | 10 | CLEI_NUMBER | R | STR10 | |
| 82 | 1 | CAPACITY | R | INT | Current capacity of rectifier (A x 10) |
| 84 | 2 | ON_TIME | R | INT | In hours |
| 301 | 1 | RECT_STATUS | R | | Device Status<br>0001h: 1 = oring FET failed<br>0002h: 1 = AC input failure<br>0004h: Not Used<br>0008h: 1 = Rectifier shutdown due to thermal alarm<br>0010h: 1 = Rectifier failure<br>0020h: Not Used<br>0040h: 1 = Load share imbalance<br>0080h: 1 = Participating in load share (Enabled)<br>0100h: Manual Off, 1 = Manually OFF<br>0200h:1 = Standby from controller requested<br>0400h: 1 = Rectifier shutdown due to high voltage<br>0800h: Rectifier Power Status, 1 = On and producing power<br>1000h: 1 = Ready to participate in load share<br>2000h: 1 = ID # has changed (cleared when read)<br>4000h: 1 = Fan failed<br>8000h: 1 = Rectifier is in current limit/ Power Limit |
| 500 | 1 | VIN_RMS_A | R | INT | Input voltage phase A in VIN_RSU |
| 501 | 1 | VIN_RMS_B | R | INT | Input voltage phase B in VIN_RSU |
| 502 | 1 | VIN_RMS_C | R | INT | Input voltage phase C in VIN_RSU |
| 503 | 1 | IIN_RMS_A | R | INT | Input current phase A in IIN_RSU |
| 504 | 1 | IIN_RMS_B | R | INT | Input current phase B in IIN_RSU |
| 505 | 1 | IIN_RMS_C | R | INT | Input current phase C in IIN_RSU |
| 506 | 1 | AC_POWER_ALL | R | INT | Input power all phases in PIN_RSU |
| 523 | 1 | VCATHODE (volts) | R | INT | Output voltage in VOUT_RSU |
| 524 | 1 | VANODE (volts) | R | INT | Output voltage in VOUT_RSU |
| 527 | 1 | OUTPUT CURRENT | R | INT | Output current in IOUT_RSU |
| 529 | 1 | OUTPUT POWER | R | INT | Output Power in Watts |



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# CC7500x3B86TEZ-AM Technical Specifications (continued)

## Modbus Registers (continued)

| Reg Address | Reg length (word) | Register Name | R/W | Reg type | Note |
|---|---|---|---|---|---|
| 531 | 1 | TEMP_INTERNAL (hottest) | R | INT | Hottest Temperature in TEMP_RSU (Celsius) |
| 532 | 1 | TEMP_DCDC | R | INT | Temperature in TEMP_RSU (Celsius) |
| 533 | 1 | TEMP_PFC | R | INT | Temperature in TEMP_RSU (Celsius) |
| 534 | 1 | TEMP_SYNC | R | INT | Temperature in TEMP_RSU (Celsius) |
| 535 | 1 | TEMP_ORFET | R | INT | Temperature in TEMP_RSU (Celsius) |
| 536 | 1 | TEMP_AMBIENT | R | INT | Temperature in TEMP_RSU (Celsius) |
| 803 | 1 | CMD_ALL | R/W | | 00 01h Standby<br>00 02h Unit On<br>00 04h HV Shutdown<br>00 08h Loadshare On<br>00 10h Loadshare Off<br>00 20h Restart<br>00 40h Lamp Test<br>00 80h<br>01 00h Fault LED On<br>02 00h Fault LED Off<br>04 00h Oring FET Test<br>08 00h<br>10 00h<br>20 00h<br>40 00h<br>80 00h |
| 850 | 1 | VIN_RSU_R | R | | Readback scaling factor for input voltage |
| 851 | 1 | IIN_RSU_R | R | | Readback scaling factor for input current |
| 852 | 1 | PIN_RSU_R | R | | Readback scaling factor for input power |
| 853 | 1 | FIN_RSU_R | R | | Readback scaling factor for input frequency |
| 854 | 1 | VBUS_RSU_R | R | | Readback scaling factor for bus voltage |
| 860 | 1 | VOUT_RSU_R | R | | Readback scaling factor for output voltage |
| 861 | 1 | IOUT_RSU_R | R | | Readback scaling factor for output current |
| 862 | 1 | POUT_RSU_R | R | | Readback scaling factor for output power |
| 870 | 1 | TEMP_RSU_R | R | | Readback scaling factor for temperature |
| 904 | 1 | VSET | R/W | INT | Vout set-point (non-volatile memory) in VOUT_RSU |
| 905 | 1 | VCMD | R/W | INT | Vout set-point (volatile memory) in VOUT_RSU |
| 920 | 1 | CL_PERCENT | R/W | INT | Current limit set point in % of rectifier capacity. Configurable from 30 to 100. |
| 922 | 1 | ISHVSD | R/W | INT | Individual selective high voltage shutdown in VOUT_RSU |
| 1100 | 1 | COMM_LOSS TIMEOUT_VALUE | R/W | UINT | In seconds |
| 1101 | 1 | COMM_LOSS TIMEOUT_DISABLE | R/W | INT | Write 1 to disable, write 0 to enable (default is enabled) |


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## Byte format

The format (11 bits) for each byte in RTU mode is:

**Coding System:** 8-bit binary

**Bits per Byte:** 1 start bit, 8 data bits, 1 parity bit, 1 stop bit

**Parity:** even

**Baud:** 19200

## Supported Function Codes

0x03: Read Holding Registers

0x06: Write Single Holding Register

0x10: Write Multi Holding Register

## References

1. OmniOn “Galaxy Communication Protocol Feature Document”（99ESSS001）Ver 2.19 Team
2. Modbus application protocol V1.1b3
3. Modbus Serial Line Protocol and Implementation Guide V1.02
4. OmniOn ACS510 low voltage AC drivers User manual
5. OmniOn AC500 PLC user manual

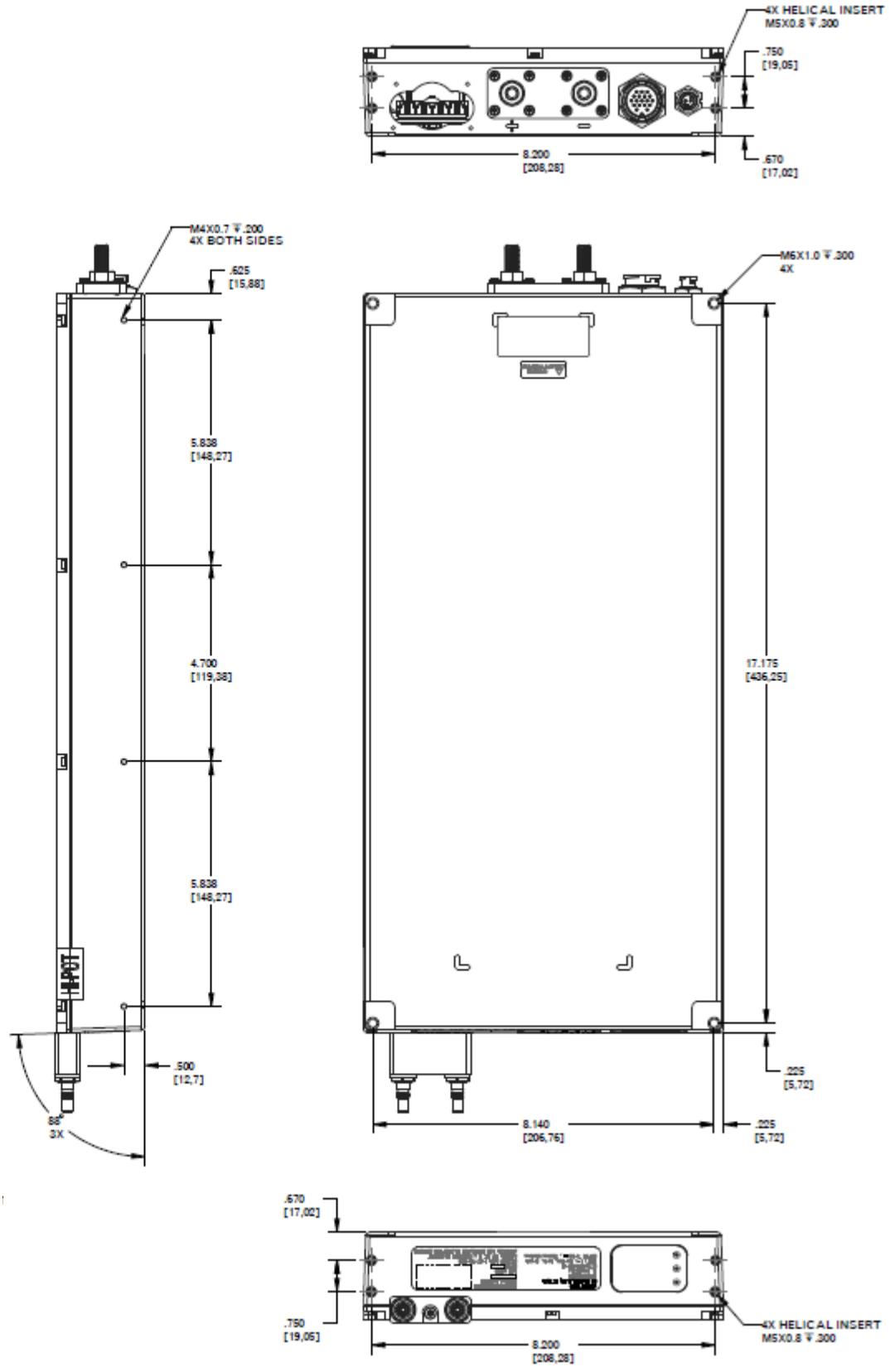
## Standard Modbus Exception Codes

| Code | Name | Description |
|---|---|---|
| 1 | Illegal Function | The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program |
| 2 | Illegal Data Address | The data address received in the query is not an allowable address for the slave. |
| 3 | Illegal Data Value | A value contained in the query data field is not an allowable value for the slave. |


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# CC7500x3B86TEZ-AM Mechanical Specifications

## Mechanical Drawing

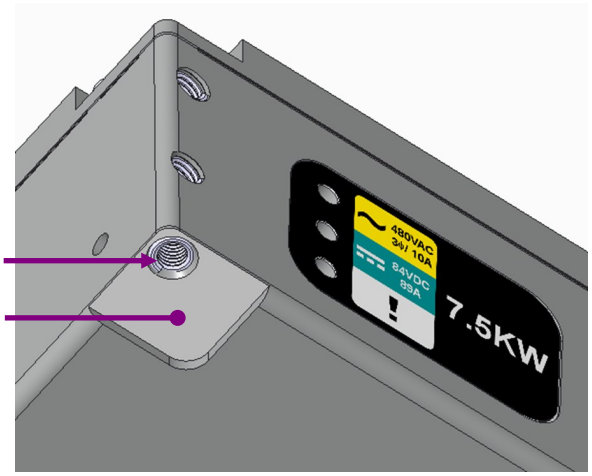


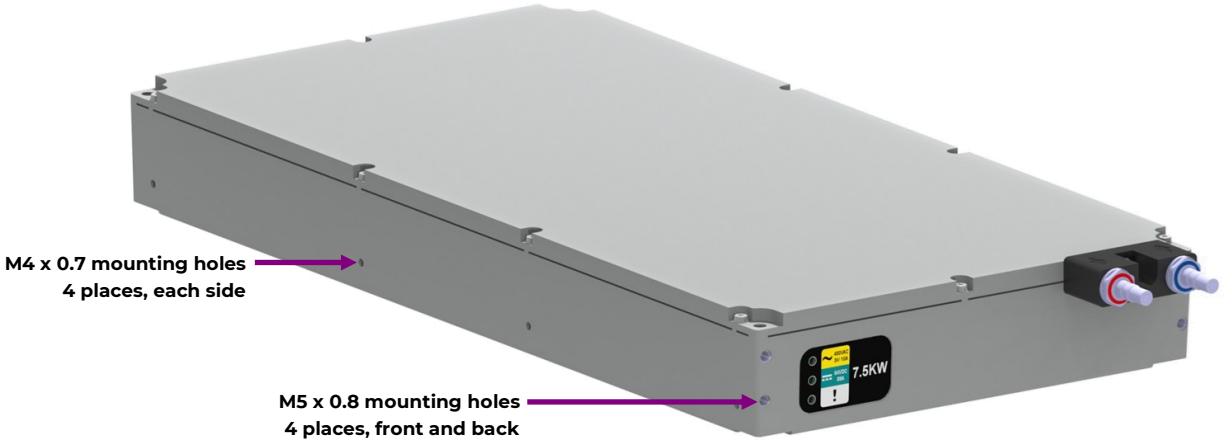


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## Mounting Instruction

### Bracket Landings



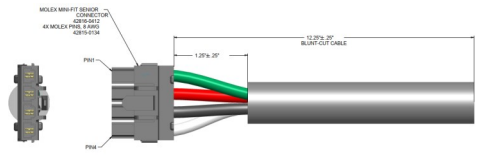
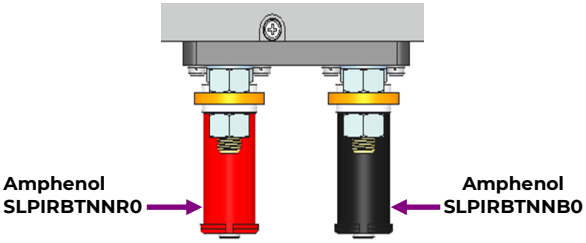
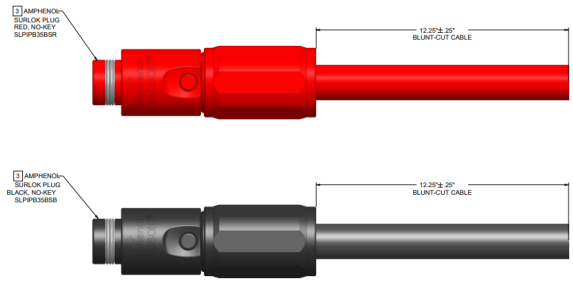
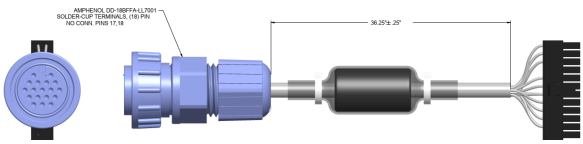
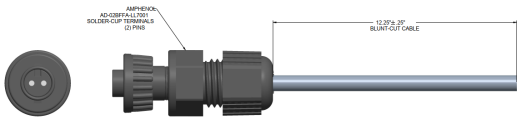
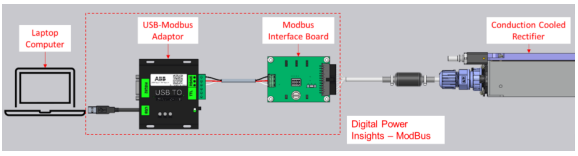





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# CC7500x3B86TEZ-AM Ordering Information

## Accessories

| Picture | Item | Description | Ordering code |
|---|---|---|---|
|  | AC Cable | 3ph Delta with Ground, 8AWG, 311mm | 1600447138A |
|  | Busbar Kit | Red/Black pair with Amphenol Surlock connectors | 1600483752A |
|  | DC Cable | Surlok, Red/Black pair, 2AWG, 311mm | 1600447137A |
|  | Signal Cable | ModBus and Alarms, 412mm, 24AWG, with Integrated EMI filter | 1600447136A |
|  | Share Cable | Load Share, 311mm, 22AWG | 1600447322A |
|  | Digital Power Insights – ModBus Developers Toolkit | ModBus Adaptor, Interface Board, Downloadable GUI and Instructions (Requires Signal Cable 1600447136A Purchased separately) | 1600464989A |

Please contact your OmniOn Power™ Sales Representative for pricing, availability and optional features.

| Item | Description | Ordering code |
|---|---|---|
| CC7500L3B86TEZ-AM | 7500W 200-240$V_{AC}$ to 84$V_{DC}$ Rectifier, water cooled | 1600481549A |
| CC7500H3B86TEZ-AM | 7500W 380-480$V_{AC}$ to 84$V_{DC}$ Rectifier, water cooled | 1600481751A |


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## Change History (excludes grammar & clarifications)

| Revision | Date | Description of the change |
|---|---|---|
| 1.0 | 07/25/2024 | Initial Release |
| 1.1 | 09/24/2024 | Added Relative Humidity to the Environment Specification table |
| 1.2 | 06/24/2025 | Updated product name on cover page, Added description for high line version in ordering table, Added busbar kit in accessories |
| 1.3 | 09/08/2025 | Updated image of water connections |


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601 Shiloh Rd.
Plano, TX USA

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