**DATASHEET**

# CC12500H3C380TEZ-GM High-Efficiency Water-Cooled Rectifier

3ϕ, 3-Wire 400/480$V_{AC}$ Input; Default Output: 380$V_{DC}$ (±190V) @ 12,500W, 12$V_{DC}$ @ 1.8A

RoHS Compliant

The CC12500H3C380TEZ-GM is a high efficiency, true 3 phase, 3 wire (Delta) AC input, 380Vdc HVDC output, liquid 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, >96%, 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. The width allows two rectifiers to be mounted side by side in standard 19 inch racks.

## Applications

- Supercomputers
- 380Vdc data centers
- Telecom central offices
- Industrial systems

## Targeted countries

Australia, Canada, European Union, India, Japan, New Zealand, South Korea, Taiwan, USA

## Features

- Efficiency 96.0% peak typical
- Compact form factor with 24W/in$^3$ density
- Nominal Dimensions 60.3 x 203.2 x 711.2 mm (2.4 x 8.0 x 28.0in)
- AC Input 3-wire, 3Φ-400/480Vac, 12,500W Rated Output
- Power factor correction (meets EN/IEC 61000-3-2 and EN 60555-2 requirements)
- High Resistance Mid-Point Ground (HRMG) ±190$V_{DC}$ Output with Internal HRMG Fault detector circuit
- RS-485 Communication Protocol
- Output voltage programmable from 360-400$V_{DC}$
- Output overvoltage and overload protection
- AC Input overvoltage and undervoltage protection
- Over-temperature warning and protection
- Redundant, parallel operation with droop load sharing
- Redundant +12$V_{DC}$ @ 1.8A Aux power
- Remote ON/OFF
- Integrated liquid-cooled cold plate
- Hot insertion/removal (hot plug)
- Redundant DC output Interlock
- Three front panel LED indicators
- ANSI/UL* 62368-1 and CAN/CSA† C22.2 No. 62368-1 Recognized, DIN VDE‡ 0868-1/A11:2017 (EN62368-1:2014/A11:2017)
- CE mark§
- Meets FCC part 15 subpart B, EN55032 Class B standards
- Meets EN61000 immunity and transient standards
- Shock & vibration: Meets IPC 9592 Class II standards
- Dripless Liquid Quick Connects Designed for Electronics Applications

* *UL* is a registered trademark of Underwriters Laboratories, Inc.
† *CSA* is a registered trademark of Canadian Standards Association.
‡ *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.)
** ISO is a registered trademark of the International Organization of Standards

# 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 Voltage: Continuous | $V_{IN}$ | 0 | 528 | $V_{AC}$ |
| Storage Temperature (ensure that all liquid has been removed from cooling | $T_{stg}$ | -40 | 85 | °C |
| I/O Isolation voltage to Frame (100% factory Hi-Pot tested) | | | 2121 | $V_{AC}$ |

## Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, $V_o$=380$V_{DC}$, resistive load, and temperature conditions. To meet measurement accuracy a warm up time of 1hr may be required

**INPUT**

| Parameter | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Voltage Range (3Φ delta with safety frame ground) | | $V_{IN}$ | 360 | 400/480 | 509 | $V_{AC}$ |
| Frequency | | $F_{IN}$ | 47 | | 63 | Hz |
| Input current per phase (maximum at Vin 360$V_{AC}$, $W_{OUT}$ 11700W) | | $I_{IN}$ | | | 20 | $A_{rms}$ |
| Input current phase unbalance [load > 50% of FL] | | | | | 2 | % |
| Inrush Transient (per Φ at 480$V_{RMS}$, 25°C, excluding X-Capacitor charging) | | $I_{IN}$ | | 75 | 80 | $A_{pk}$ |
| Leakage Current (per Φ, 530$V_{AC}$, 60Hz) | | $I_{IN}$ | | | 5[1] | % |
| Power Factor (50 – 100% load) | | PF | 0.98 | 0.995 | | |
| Total Harmonic Distortion (50 – 100% load) | | THD | | | 5[2] | % |
| Efficiency (480$V_{AC}$ @ 25°C) | 10% load<br>20% load<br>50% load<br>100% load | η | | 90%<br>94%<br>96%<br>95% | | % |
| Holdup time ($V_{in}$ = 360$V_{rms}$, $V_{out}$ ≥ 320$V_{DC}$, 75% constant power load) | | T | 20 | 24 | | ms |
| Isolation (per EN62368) | Input – Output<br>Input-Chassis/Signals | V | 3000<br>2000 | | | $V_{ac}$<br>$V_{ac}$ |

[1]Leakage current shall not exceed 5% of the nominal input current per phase under testing. Appropriate marking requirements of ANSI/UL* 62368-1 and CAN/CSA† C22.2 No. 62368-1 Recognized, DIN VDE‡ 0868-1/A11:2017 (EN62368-1:2014/A11:2017)

[2]Total harmonic distortion <6.5% when $T_{water\text{-}inlet}$ <5°C.

**380$V_{DC}$ MAIN OUTPUT**

| Parameter | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output Power | ( 360 – 432$V_{AC}$ – 3Φ, $T_{INLET}$ = 2–50°C ) | $W_{OUT}$ | | | 10,417 | $W_{DC}$ |
| | ( 432 – 509$V_{AC}$ – 3Φ, $T_{INLET}$ = 2–50°C ) | | | | 12,500 | $W_{DC}$ |
| Output Voltage Factory Setpoint (480 Vac in, no load, 25°C) | | $V_{OUT}$ | | 385 | | $V_{DC}$ |
| Output Voltage Programming Range (no load) | | | 365 | 0.5 | 400 | $V_{DC}$ |
| Resolution | | | | | | $V_{DC}$ |
| Output Regulation | | | | 0.303 | | V/A |
| Load (programmed droop) | | | | | | |
| Line, temperature & aging | | | -0.5 | | +0.5 | % |
| Output Current (Vac=480, $T_{INLET}$ = 45°C) | $V_{OUT}$ = 360$V_{DC}$ | $I_{Out}$ | 1 | | 34.7 | $A_{DC}$ |
| (all 12,500W) | $V_{OUT}$ = 380$V_{DC}$ | | | | 33 | |
| | $V_{OUT}$ = 400$V_{DC}$ | | | | 31.3 | |
| Output Ripple | RMS (5Hz to 20MHz) | $V_{OUT}$ | | | 90 | $mV_{rms}$ |
| ( 20MHz bandwidth, load > 1A) | Peak-to-Peak (5Hz to 20MHz) | | | | 800 | $mV_{p\text{-}p}$ |

# Technical Specifications (continued)

## Electrical Specifications (continued)

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Turn-On (monotonic from 30–100% of Vnom) | | | | | |
| Delay | T | | 5 | | s |
| Rise Time | | | 90 | | ms |
| Output Overshoot | $V_{OUT}$ | | | 2 | % |
| Load Step Response | | | | | |
| ΔI [$V_{IN}$ = 400-480$V_{AC}$, 25°C, load step 50% ↔ 100%, di/dt = 1A/µs ] | $I_{OUT}$ | -4 | | 50 | %FL |
| ΔV | $V_{OUT}$ | | | 4 | % |
| Settling Time to normal regulation | T | | | 1 | ms |
| Overload Protection | | | | | |
| Current Limit (constant-current regulation) ($V_{IN}$ = 432-509 Vac) | $I_{OUT}$ | | 37.4 | | $A_{DC}$ |
| ($V_{IN}$ = 360-432 Vac) | | | 35.0 | | |
| Fast Power Limit[3] ($V_{IN}$ = 480 Vac) | $W_{OUT}$ | | 13,500 | | $W_{DC}$ |
| Slow Power Limit[3] ($V_{IN}$ = 480 Vac) | | | 12,500 | | |
| Undervoltage Shutdown[4] (after a 2 second delay) | $V_{OUT}$ | 250 | | 320 | $V_{DC}$ |
| Severe Undervoltage Shutdown[4] (after a 0.5 second delay) | | 0 | | 250 | |
| Short-circuit protection | No damage | | | | |
| Startup delay | Upon startup, overload shutdown is delayed for 20 seconds to allow the insertion and startup of multiple modules within a system. | | | | |
| Overvoltage Shutdown — 200ms delayed shutdown | $V_{OUT}$ | 410 | 420 | 430 | $V_{DC}$ |
| (default) Immediate shutdown | | > 440 | | | |
| Programmable range | | 380 | | 420 | |
| Latched shutdown | After 3 restart attempts within a 30 sec window, unit latches OFF | | | | |
| Restart delay | | 3.5 | 4 | 5 | sec |
| Over-Temperature Power Reduction[3] | | | | | |
| Inception | $T_{INTERNAL}$ | | 90 (rising) | | °C |
| Recovery | | | 80 (falling) | | |
| Typical Control Range | $V_{OUT}$ | 320 | | 400 | $V_{DC}$ |
| Rate of Change | $W_{OUT}$ | | ±10 | | W/sec |
| Over-Temperature Warning (OTW) LED indication - see Table 5) | $T_{COMPONENT}$ | | >90 | | °C |
| Over-Temperature Shutdown | $T_{COMPONENT}$ | | 100 (rising) | | °C |
| Restart | | | 70 (falling) | | |
| Restart/Reset conditions | Loss of input > 100ms or Output OFF followed by ON command | | | | |

[3]In Power Limit/Reduction mode, the output-voltage setpoint is lowered until the target output power is achieved.

[4]with one soft-start attempt after 10 seconds

### 12$V_{DC}$ Auxiliary output[5]

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Output Voltage Setpoint | $V_{OUT}$ | | 12 | | $V_{DC}$ |
| Overall Regulation | | -10 | | +10 | % |
| Output Current | | 0 | | 1.8 | A |
| Over-voltage Clamp | | | 15 | 16.5 | $V_{DC}$ |
| Over-current Limit | | 105 | | 135 | %FL |

[5]12$V_{DC}$ auxiliary output will recover after over-current limit shutdown only if the load is less than 0.8A and output external capacitance is 500uF max. With high load and output capacitance, the input power must be recycled to get 12$V_{DC}$ auxiliary output recovery.

# Technical Specifications (continued)

## General Specifications

| Parameter | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|
| Unpacked Weight | | | 13<br>(28) | Kgs<br>(Lbs) | |

## Environmental Specifications

| Parameter | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|
| Coolant Water Inlet Temperature[6,7] | 2 | | 50 | °C | |
| Operating Ambient Air Temperature | 2 | | 50 | °C | |
| Cooling Flow Rate | 0.26<br>1.0 | | 0.5<br>2 | Gpm<br>L/min | Optional inlet orifice is available to provide minimum flow rate |
| Cold Plate Inlet Pressure | | | 100 | psi | |
| Cold Plate Pressure Drop | | 10 | | psi | at the minimum flow rate |
| Operating Altitude | | | 3000 / 10k | m / ft | |
| Non-operating Altitude | | | 9000 /30k | m / ft | |
| Shock and Vibration Operational | Meets IPC 9592 Class II, Section 5 and GR-63_CORE, Level 3 requirements | | | | |
| Earthquake Rating | 4 | | | Zone | Meets GR-63_CORE requirements[8] |

[6]Coolant must remain free of algae and corrosion products. The use of suitable inhibitors in the coolant is recommended, compatible with copper tubing. Full-rated output power is available up to 50°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.
[8]When installed in a Zone 4 rated cabinet.

# Technical Specifications (continued)

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

| Parameter | Function | Standard | Level | Criteria | Test |
|---|---|---|---|---|---|
| AC input | Conducted emissions[9] | EN55032, FCC part 15 | A | | 0.15 – 30MHz |
| | | EN61000-3-2 | | | 0 – 2 KHz |
| | | Telcordia GR1089-CORE | | | |
| | Radiated emissions[9] | EN55032/CISPR32, FCC part 15 Subpart B, ICES-003, KN22, CNS 13438 | B – 3dB margin | | 30 – 10000MHz |
| | Input Harmonics | EN61000-3-2 | A | | |
| AC Input Immunity | Line sags and interruptions | EN61000-4-11 | Class 3 | A | -30% (from 400Vac) for 10ms |
| | | Output will stay above $320V_{DC}$ @ 75% load | | A | 25% sag from nominal (400Vac) for 0.5 sec |
| | | | | A | 1 cycle interruption |
| | Lightning surge | EN61000-4-5, Level 4, 1.2/50µs – error free | | A | 4kV L-E |
| | | | | A | 2kV L-L |
| | | ANSI C62.41-2002 100kHz ring wave | 3, Category B | B, Table 2 | 6kV/0.5kA |
| | | ANSI C62.41-2002 1.2/50µs-8/20µs | 3, Category B | B, Table 3 | 6kV, 3kA |
| | | ANSI C62.41-2002 5/50ns EFT burst | | B, Table 6 | 2kV, severity II |
| | Fast transients | EN61000-4-4 | 3 | A | 5/50ns, 2kV (common mode) |
| Enclosure immunity | Conducted RF fields | EN61000-4-6 | 3 | A | 130dBµV, 0.15-80MHz, 80% AM |
| | Radiated RF fields | EN61000-4-3 | 3 | A | 10V/m, 80-1000MHz, 80% AM |
| | Power Frequency Magnetic Fields | EN61000-4-8 | | A | 30A/m |
| | ESD | EN61000-4-2 | 4 | A | 8kV contact, 15kV air |

[9]Tested with ABB shelf, external AC input filter, and shielded DC output cables.

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

# Technical Specifications (continued)

## Feature Descriptions

Hot swap: The rectifier is equipped with an interlock switch which operates in a redundant scheme with the Interlock short connector pin to ensure output voltage is not present on the output connector while removing or inserting the rectifier into the shelf.

Power limiting: There are three distinct mechanisms which trigger power limiting, in which the output voltage is lowered below the programmed value only as much as necessary to achieve the target output power. The purpose of power limiting is to protect the rectifier while giving the larger system time to reduce the load and avoid the disruption of a rectifier shutdown.

The first two mechanisms described below are for overload---above the rectifier rating---while the third occurs below the rectifier rating to prevent overheating. In each case if the load is reduced, the output voltage is raised until it returns to its normal programmed value, ending power limiting. The Over -Power Warning signal described in the next section is asserted for the first two limits below.

1. Fast Power Limit reduces output power as quickly as possible to the threshold value, essentially clamping output power.
2. Slow Power Limit is triggered by a training-average power calculation, to allow short overloads that are below the fast power limit while preventing extended operation above the rectifier rating. Depending on the severity of the overload & prior load, this limit acts after approximately 2-3 seconds, reducing output power to the rated value over a few more seconds. When in Slow Power limit, the rectifier has a one minute on-time followed by a two minute off-time. This cycle repeats until output current is reduced below the slow power limit threshold.
3. Over-Temperature Power Reduction to below the rectifier power rating occurs when the rectifier internal temperature approaches its operating limit. Output voltage is lowered gradually until the internal temperature falls below the inception threshold. The output voltage is regulated at this level until the internal temperature then falls below the “recovery” threshold. In recovery, the output voltage is gradually raised back to the programmed value, unless the “inception” threshold is exceeded again. If the OT power reduction fails to arrest the temperature rise, e.g. for a total loss of cooling, an over-temperature shutdown is triggered.

## Control and Status

The Rectifier provides two means for monitor/ control, analog and the ABB RS-485 protocol.

## Analog Control Signals

Rectifier Enable: Controls the main 380$V_{DC}$ output. This pin must be pulled low to LGND to turn ON the power supply. The power supply will turn OFF if either Rectifier Enable or Interlock are released.

Interlock Feature: The rectifier operates a redundant interlock scheme using a handle-actuated switch and an interlock pin. Opening the handle turns off 12V and communications will be lost. The interlock pin is a short signal pin that shuts down the rectifier completely upon extraction. The interlock pin must be connected to SEC_RTN on the system side. The interlock features work in conjunction to ensure that no arcing or connector contact damage occurs to the connector during the hot insertion/extraction process.

Slot Identification: Up to 10 different units are selectable by connecting a resistor between SLOT_ID and SEC_RTN. Internally this pin is pulled up to 3.3V (±3%) by a 10 kOhm (±1%) resistor. The full tolerance range of the chosen resistor should fall between the minimum and maximum values of Rs listed below to ensure the correct slot number is identified.

# Technical Specifications (continued)

| Slot_ID | Min $V_S$ | Max $V_S$ | Min $R_S$ (KΩ) | Max$R_S$ (KΩ) | Std 1% (KΩ) |
|---|---|---|---|---|---|
| Invalid | 0 | 0.300 | 0 | 1.00 | 0 |
| 0 | 3.192 | 3.195 | 295.56 | 304.29 | 301 |
| 1 | 3.269 | 3.326 | OPEN | OPEN | OPEN |
| 2 | 1.231 | 1.256 | 5.95 | 6.14 | 6.04 |
| 3 | 1.953 | 1.991 | 14.50 | 15.21 | 14.7 |
| 4 | 0.798 | 0.816 | 3.19 | 3.29 | 3.2 |
| 5 | 1.736 | 1.775 | 11.10 | 11.64 | 11.4 |
| 6 | 0.939 | 0.956 | 3.98 | 4.08 | 4.02 |
| 7 | 1.482 | 1.511 | 8.15 | 8.45 | 8.25 |
| 8 | 2.544 | 2.583 | 33.65 | 36.03 | 34.8 |
| 9 | 2.844 | 2.894 | 62.37 | 71.28 | 66.5 |

### Analog Status Signals

Module Present: This signal is used as an OUTPUT signal by the power supply to notify the system controller that a power supply is physically present in the slot. This signal pin is pulled down to LGND by the power supply.

Over-Power Warning (OPW):This signal is HI during normal operation but asserted LO during operation at output power greater than the rectifier rating. This enables load power to be reduced before the Slow Power Limit acts.

If the overload is less than the rectifier Fast Power Limit, OPW is asserted after some delay to allow for short overloads without disruption. OPW is triggered by a training-average power calculation, which shortens the delay for higher loads during and/or before the overload. For example, a repeating 2 seconds of 13.1 kW load followed by 0.8 second of 6.65 kW will NOT trigger OPW, but lengthening the overload pulse to 2.3 seconds WILL trigger OPW intermittently after a few cycles.

If the overload is greater than the Fast Power Limit, OPW is asserted immediately and power is reduced to the fast threshold without warning.

### ABB RS-485 protocol

ABB will provide separate application notes on the RS-485 based protocol physical, data, and link layers for users to interface to the rectifier. Contact your local ABB representative for details.

Application Layer: The controller interacts with the system devices using the READ, WRITE, and READ RESPONSE packets. Each packet carries a unique body that details the variables and values of interest in the system device. A READ packet transmits the variable name to the system device, which then returns a value to the controller with the READ RESPONSE packet. The WRITE packet transmits a variable name and new value to a system device, which records it. The WRITE packet is also used to cause specific actions to occur within the device. The variable names and commands that are found in the packet bodies define the Galaxy Power System application. The tables following this section will detail the specific packet body contents. First described are the basic data types used widely in the application. Generic variables that all devices must support are then described followed by the unique variables associated with specific devices.

## Table 1 - Basic Data Types

| Data Types | Data Type Definition |
|---|---|
| null | no value |
| uint8_t | 8-bit unsigned integer |
| uint16_t | 16-bit unsigned integer |
| int16_t | 16-bit signed integer |
| uint32_t | 32-bit unsigned integer |
| int32_t | 32-bit signed integer |

Note: All multi-byte integer data types are BIG ENDIAN format (MSB, LSB)
Signed numbers are in two's complement format.

## Table 2 - Device Group Number Definitions

| Variable Name | Group | Description |
|---|---|---|
| MASTER_ADDR | 00h | Plant controller |
| BROADCAST | FFh | Broadcast address to all devices |
| RECTIFIER_ADDR | E8h | High voltage rectifier |

# Technical Specifications (continued)

## Table 3 - Variable Allocation

| Variable Range | Description |
|---|---|
| 00h to 0Ah | Common variables (0Ah read is not common, just write) |
| 0Bh to 9F | Group specific variables, common within a given group |
| 0Ah to AFh | Upgrade related commands |
| 0Bh to DFh | Group specific variables |
| 0Eh to FFh | Device specific commands typically for lab and debugging. May not be common within a group |

Scaling: Analog quantities are scaled (multiplied) by the following factors, then truncated to an integer:

- DC voltage and current 64
- AC voltage 100
- AC current 200
- Temperature in °C 1
- Watts 1

## Table 4 – RS-485 Variable List

| Variable Name | Num | Len | Data Type | Description |
|---|---|---|---|---|
| DUMMY_RW | 00h | 00h | null | Used to exercise the protocol for test purposes. |
| SERIAL_NUMBER_RW | 01h | 12h | uint8_t[18] | Serial number as an array of 18 ASCII characters.<br>(e.g. LBGEPE16KZ00000000) |
| GROUP_ADDRESS_RW | 02h | 01h | uint8_t | Rectifier group address E8h (multi-cast address) |
| COMCODE_RW | 03h | 0Bh | uint8_t[11] | Internal part number up to 11 ASCII characters:<br>(e.g. 150047061) |
| PROTOCOL_CONTROL_W | 04h | 01h | uint8_t | 01h – forces devices to drop the link |
| STATION_TYPE_R | 05h | 14h | uint8_t[20] | Product code, up to 20 ASCII characters<br>(e.g. CC12500H3C380TEZ-GM) |
| SERIES_RW | 06h | 07h | uint8_t[7] | Series identifier, up to 7 ASCII characters (e.g. 1:0) |
| APPLICATION_VERSION_R | 07h | | | Software version: |
| Argument: | | 01h | uint8_t | 70h returns PFC version, 73h returns DCDC version |
| Response: | | 07h | uint8_t[7] | Format: major,minor,month,day, year,hours, minutes<br>Note: If no argument then DCDC version is returned |
| reserved | 08h | | | Reserved |
| TIMEOUT_SCALE_RW | 09h | 01h | unit8_t | No-activity link timeout in seconds. Default: 10 |
| LAMP_TEST_W | 0Ah | 00h | null | Lamp Test command |
| I_R | 0Ah | 02h | uint16_t | Total output current of rectifier |
| T_INTERNAL_R | 0Bh | 01h | unit8_t | Most critical temperature |
| STATUS_R | 0Ch | 02h | uint16_t | Device status |
| ORFET_FAIL_STAT | | | | 0001h: 1= ORing FET failure detected |
| ACF_STAT | | | | 0002h: 1 = AC out of range |
| VOUT_UNBALANCE | | | | 0004h: 1 = Vout unbalance warning |
| TA_STAT | | | | 0008h: 1 = Over temperature shutdown |
| RFA_STAT | | | | 0010h: 1 = Rectifier failure detected |
| AC_LOW_LINE_STAT | | | | 0020h: 1 = low input-voltage range (< 432 Vac; power limited) |
| ------ | | | | 0040h: Reserved |
| ------ | | | | 0080h: Reserved |
| INTERLOCK_STAT | | | | 0100h: 1 = interlock is open |
| TRH_STAT | | | | 0200h: 1 = Standby from controller requested |
| HVSD_STAT | | | | 0400h: 1 = Over voltage shutdown (requires restart) |
| ON_STAT | | | | 0800h: 1 = On and producing power |

# Technical Specifications (continued)

| | | | | |
|---|---|---|---|---|
| ------ | | | | 1000h: Reserved |
| ID_CHANGED_STAT | | | | 2000h: Reserved |
| ------ | | | | 4000h: Reserved |
| CL_STAT | | | | 8000h: 1 = in current limit or power limit |
| VSET_RW | 0Eh | 02h | uint16_t | Power up default voltage set-point |
| CMD_W | 0Fh | 02h | uint16_t | Device control |
| STANDBY_CMD | | | | 0001h: Place rectifier into Standby |
| ON_CMD | | | | 0002h: Release rectifier from Standby |
| ------ | | | | 0004h: Reserved |
| ------ | | | | 0008h: Reserved |
| ------ | | | | 0010h: Reserved |
| RESTART_CMD | | | | 0020h: Restart after over voltage or over current |
| LAMPTEST_CMD | | | | 0040h: Lamp test |
| ------ | | | | 0080h: Reserved |
| FAULT_LED_ON | | | | 0100h: Request fault LED ON |
| FAULT_LED_OFF | | | | 0200h: Request fault LED OFF |
| ------ | | | | 0400h: Not used |
| ------ | | | | 0800h: Not Used |
| ------ | | | | 1000h: Not Used |
| ------ | | | | 2000h: Not Used |
| ------ | | | | 4000h: Not Used |
| RESET_ENERGY_CMD | | | | 8000h: Reset energy counter |
| CAPACITY_R | 11h | 02h | uint16_t | Nominal current capacity of rectifier (Idc x 64) |
| VCMD_RW | 13h | 02h | uint16_t | Present output voltage setting |
| VOP_R | 20h | 02h | uint16_t | Output voltage measurement |
| VACIN_RMS_R | 29h | 06h | | Line-to-line AC RMS voltage measurements |
| | | | uint16_t | Vab |
| | | | uint16_t | Vbc |
| | | | uint16_t | Vca |
| IACIN_RMS_R | 2Ah | 06h | | AC RMS phase current measurements |
| | | | uint16_t | Phase A |
| | | | uint16_t | Phase B |
| | | | uint16_t | Phase C |
| AC_POWER_R | 37h | 02h | uint16_t | AC input power in Watts |
| ON_TIME_R | 39h | 04h | uint32_t | Hours on and producing power |
| BLOCK_READ_R | 73h | 0Bh | | Block read |
| | | | Uint16_t | Status word |
| | | | uint16_t | Vout measurement |
| | | | Uint32_t | Accumulated energy in J |
| | | | Uint16_t | Instantaneous Output Power in Watts |
| | | | Int8_t | Temperature in C |

# Technical Specifications (continued)

## Table 5: Alarm and LED state summary

| Condition | Power Supply LED State | | |
|---|---|---|---|
| | AC OK<br>Green | Fault<br>Red | DC OK<br>Green |
| OK | 1 | 0 | 1 |
| Over-Temperature Warning (OTW) 5°C before shutdown) | 1 | Blinks | 1 |
| Thermal Shutdown | 1 | 1 | 0 |
| Blown AC Fuse in Unit | Blinks | 1 | 0 |
| AC Present but not within limits | Blinks | 0 | 0 |
| AC Lost (indicated for 0.5-1 min) | Yellow | 0 | 0 |
| Boost Stage Failure | 1 | 1 | 0 |
| Over Voltage Latched Shutdown | 1 | 1 | 0 |
| Over Current | 1 | 0 | Blinks |
| Non-catastrophic Internal Failure | 1 | 1 | 1 |
| Standby (remote) | 1 | 0 | 0 |
| Output Unbalance | 1 | 0 | Blinks Yel / Grn |
| Boot Block Mode | 0 | Blinks | 0 |

## Table 6: Signal Definitions

| Pin | Function | Label | Type | Description |
|---|---|---|---|---|
| 2A | Interlock | INTERLOCK | Input | Short pin that must be connected to SEC_RTN externally to enable the output. This signal provides the last-to-make and first-to-break function to prevent arcing during hot plug and hot disengagement. |
| 2B | Slot identification | SLOT_ID | Input | Set to one of 10 levels by an external resistor to SEC_RTN. |
| 2C | Secondary return | SEC_RTN | Reference | Filtered connection to Vout–. |
| (Signals above are referenced to SEC_RTN; signals below are referenced to LGND) | | | | |
| 5B | Over-Power Warning | OPW | Output | Open-drain FET; normally open |
| 5D, 6D | Standby power | 12V_AUX | Output | 12V @ 1.8A provided for external use; return is LGND. This output is always ON and OR'ed for paralleling. |
| 6B | RS485 A signal | RS485_A | I/O | RS485 "+" or non-inverting signal line. |
| 6C | RS485 B signal | RS485_B | I/O | RS485 "–" or inverting signal line. |
| 7A | Rectifier Enable | ENABLE | Input | When shorted to LGND, turns ON the main output |
| 7B | Module Present | MOD_PRES | Output | Short pin connected to LGND, notifies the system that this module is present, |
| 7C, 7D | Logic Ground | LGND | Reference | Isolated from the main output & SEC_RTN. |

# Technical Specifications (continued)

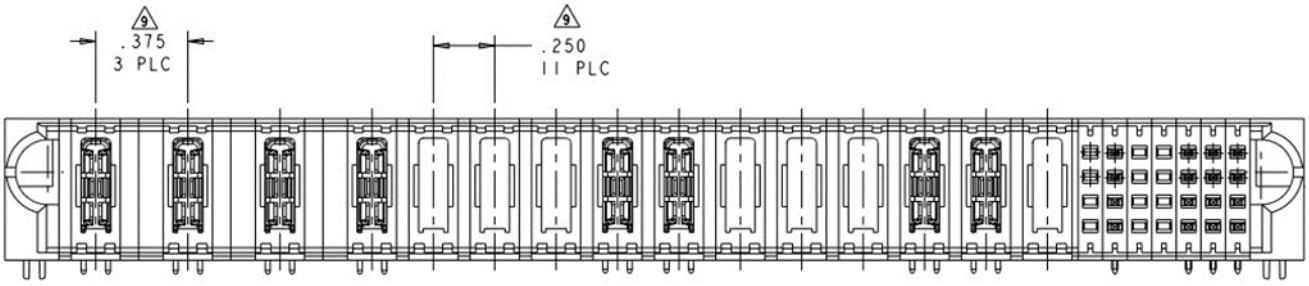
## Connector

Installed in rectifier: TE 4-6450832-7 (pictured below)

- Example mate: 1 ea. TE 1-1892903-9 housing + 8 ea. TE 1600903-1 power receptacles + 7 ea. TE 1600902-1 four-position signal inserts

| PART NUMBER | ROWS | | POWER | | | | | | | | | | | | | | SIGNAL | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4-6450832-7 | D | HD | TM | TM | TM | TM | - | - | - | TM | TM | - | - | - | TM | TM | - | - | J | - | - | J | J | J |
| | C | | | | | | | | | | | | | | | | | - | K | - | - | K | K | K |
| | B | | | | | | | | | | | | | | | | | - | G | - | - | G | G | G |
| | A | | | | | | | | | | | | | | | | | - | H | - | - | H | H | H |
| 15P + 28S | | | | | | | | | | | | | | | | | | | | | | | | HD |

- NO CONTACTS LOADED




Facing rear of module

| AC INPUT | | | | | | DC OUTPUT | | | | | | | | | SIGNALS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| L1 | L2 | L3 | Frame Gnd | Empty | Empty | Empty | Vout + | Vout + | Empty | Empty | Empty | Vout - | Vout - | Empty | Empty | RESERVED | Empty | Empty | 12V_AUX | 12V_AUX | LGND | D |
| | | | | | | | | | | | | | | | Empty | SEC_RTN | Empty | Empty | RESERVED (RACK_ID) | RS485_B | LGND | C |
| | | | | | | | | | | | | | | | Empty | SLOT_ID | Empty | Empty | OPW | RS485_A | MOD_PRES | B |
| | | | | | | | | | | | | | | | Empty | INTERLOCK | Empty | Empty | RESERVED (DCOK) | | ENABLE | A |
| PWB | | | | | | | | | | | | | | | | | | | | | | |

= Short Pin
= System side mating connector must have its Frame GRD pin the longest to ensure that it is mating first.

Connected Internally:
P8 & P9
P13 & P14
D5 & D6
C7 & D7

# Technical Specifications (continued)

## Cable Assembly

For convenient connection without a shelf (see photo under “Accessories”).

Connectors:

AC Installed: Molex 42818-0412 4-circuit single-row 10mm-pitch Mini-Fit Sr.™ housing + crimp terminals Molex 42817-0032 (ground) & 3 ea. Molex 42817-0012:

- Example mate: Molex 42816-0412 Receptacle Housing + 4 ea. Molex 42815-0012 - female crimp terminals, 12-10 AWG

DC Installed: 4 ea. TE 640907-2 female Fast-on

Signal installed: Molex 43025-1400 Micro-Fit 3.0™ housing + 12 ea. Molex 43030-0002 female crimp terminals

- Example mate: Molex 43045-1413 Vertical Header, Dual Row, 14 circuits

| Pin | Function | Name | Rectifier |
|---|---|---|---|
| 1 | RS485 signal B (inverting) | RS485_B | 6C |
| 2 | Logic Ground (signal return) | LGND | 7D |
| 3 | 12V+ | 12V_AUX | 6D |
| 4 | Module present | MOD_PRES | 7B |
| 5 | Enable | ENABLE | 7A |
| 6 | rsvd blank | | |
| 7 | Secondary Return | SEC_RTN | 2C |
| 8 | RS485 signal A (non-inverting) | RS485_A | 6B |
| 9 | Logic Ground (signal return) | LGND | 7C |
| 10 | 12V+ | 12V_AUX | 5D |
| 11 | Over Power Warning | OPW | 5B |
| 12 | rsvd blank | | |
| 13 | Slot ID | SLOT_ID | 2B |
| 14 | Interlock | INTERLOCK | 2A |

INTERLOCK (pin 14) must be connected to SEC_RTN (pin 7) to enable the rectifier.

Rectifier signals not available from harness:

- DC_OK (5A)
- RACK_ID (5C)

### Coolant Dripless Fittings

For convenient connection of coolant delivery hoses.

**CC12500H3C380TEZ-GM:**

The chiller plate is equipped with two dripless plugs: LQ2D4604BLU (CPC).
Recommended mating sockets can be purchased from CPC (Colder Products Company).

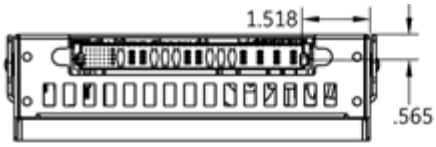
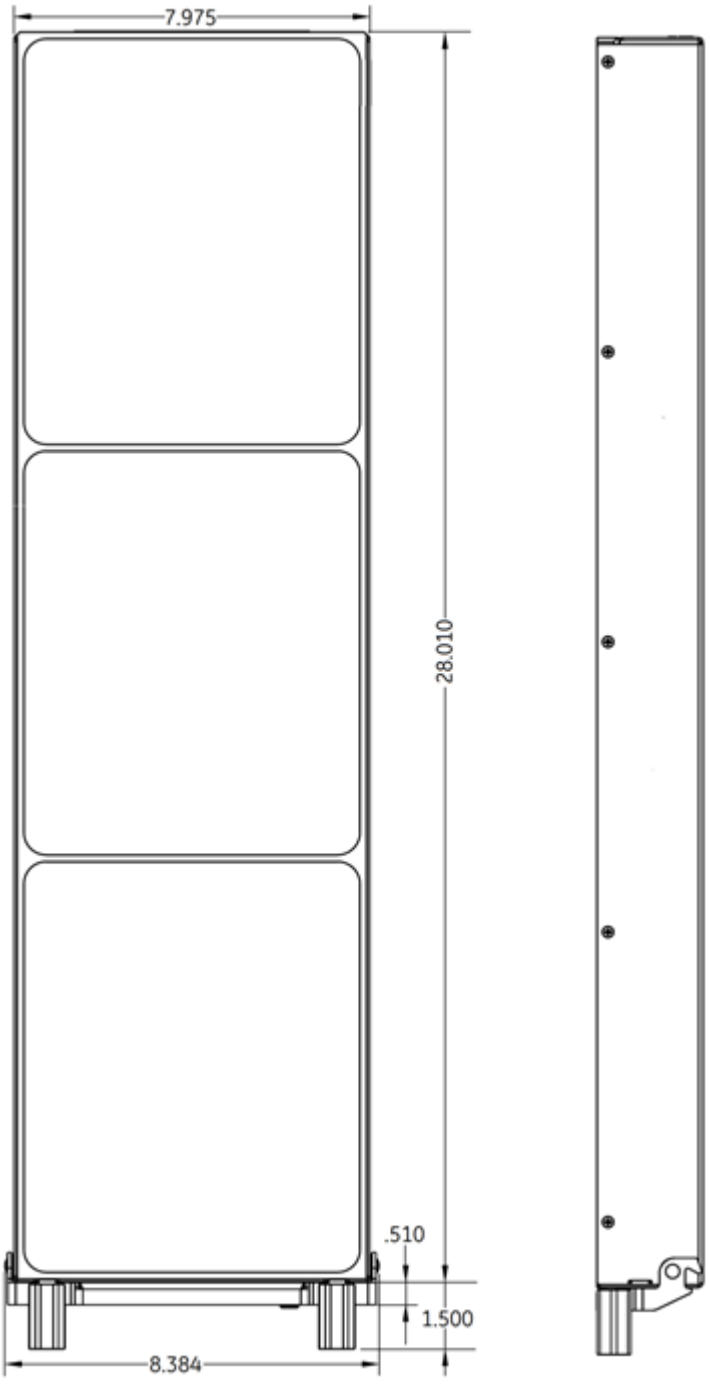
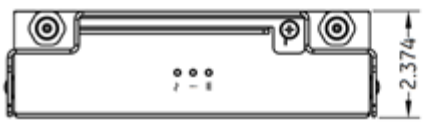
**CC12500H3C380TEZ-LN:**

The chiller plate is equipped with the following dripless plugs:

- SCG03.7150/JE/KB/FS – BLUE plug for Inlet
- SCG03.7150/JE/KR/FS – RED plug for Outlet

Recommended mating sockets SCG03.1150/JE/KB/FS and SCG03.1150/JE/KR/FS can be purchased from Staubli Corporation.

# Technical Specifications (continued)

| Mechanical Outline | |
|---|---|
| Rear View |  |
| Top/Side View<br><br>Note: Cold plate quick disconnects not shown. Liquid connection fitted with SAE -4 thread (7/16-20) coupling. |  |
| Front View |  |

# Technical Specifications (continued)

## Accessories

| Item | Description | Ordering code |
|---|---|---|
|  | Single-unit cable assembly that mates with rectifier Blind -Mate connector for bench-top testing. (sold as a component; equipment containing this harness requires safety certification) | 8600164177P |
|  | Two Slot Shelf Chassis J2015001L003 | 150046616 |

## Ordering Information

Please contact your ABB Sales Representative for pricing, availability and optional features.

| Item | Description | Ordering code |
|---|---|---|
| CC12500H3C380TEZ-GM | 12.5kW 400/480Vac-to-380VDC Rectifier with CPC LQ2 quick disconnects for coolant | 150047061 |
| CC12500H3C380TEZ-LN | 12.5kW 400/480Vac-to-380VDC Rectifier with Staubli SCG03 quick disconnects for coolant | 1600312237A |

# Change History (excludes grammar & clarifications)

| Version | Date | Description of the change |
|---|---|---|
| 5.4 | 12/21/2021 | Updated as per template, Upgraded safety standards and Changed Maximum value of cooling flow rate in Environmental spec. table. |
| 5.5 | 04/04/2022 | Updated text on page 6. |

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