**Product guide specification**

**Cyberex® Power Distribution Unit**

**PDU 350 – 800kVA**

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# General

## Summary and scope

The following technical specification describes the requirements of the power conditioning/distribution module for distribution of computer grade power to the data processing equipment and other critical loads. The system shall be known as a Power Distribution Unit (PDU).

## Standards

The PDU shall be designed, tested (or certified) and manufactured to the following standards:

* ETL listed to UL 60950-1
* ETL listed to UL 891
* cETL listed to CAN/CSA C22.2 No. 60950-1

## Definitions

The following definitions shall apply throughout this specification:

* Owner, User or Buyer – the owner; or the owner’s designated representative(s).
* Manufacturer – the firm or corporation who will manufacture and deliver the DSTS equipment specified herein.
* Specifications – the technical instructions described or portions of standards referenced herein, and any addenda thereto.

## System description

### Environmental requirements

The PDU shall be capable of withstanding any combinations of the following environmental conditions without mechanical or electrical damage or degradation of operation.

* Operating ambient temperature: 0 to 40°C.
* Non-operating storage temperature: -40 to 60°C.
* Relative humidity: 10 to 95% non-condensing.
* Maximum operating altitude without de-rating:
  + 1000m (3300ft) above sea level.
  + De-rating factor for altitudes greater than 1000m shall be 0.3% for every 100m above 1000m.
* Non-operating altitude: 15,000m

### Electrical characteristics

* The PDU shall have a full load continuous capacity of [350] [400] [500] [600] [750] [800] kVA.
* The input voltage to the PDU shall be 480 VAC, three (3) phase, three (3) wire plus ground @ 60 Hz.
* The output voltage from the PDU shall be [208/120 VAC] [415/240 VAC] wye, three (3) phase, four (4) wire plus ground @ 60 Hz.

## Warranty

The PDU manufacturer shall guarantee the entire system against defective material and workmanship for a period of one (1) year from date of shipment.

With purchase of factory start-up services and used in the continental United States, the manufacturer shall include labor and expenses for a period of one (1) year from date of the factory start-up, not to exceed eighteen (18) months from date of factory shipment.

# Product

## Manufactured units

2.1.1 PDU manufacturers: Subject to compliance with requirements, provide products by ABB (Cyberex®).

## Components

### Cabinet construction: Main transformer cabinet

The PDU cabinet shall have the following features and capabilities.

* The PDU main transformer cabinet enclosure shall be designed for placement on the computer room raised floor or outside the computer room in the general facility environment and shall not exceed 52"W, 38"D, and 84"H.
* The main transformer cabinet enclosure shall be based on four C-channels running from the front to the rear.
* The main transformer cabinet enclosure shall be a single bay vertical cabinet using convection for cooling purposes.
* The cabinet enclosure shall be designed to allow all routine service, including compensation tap changes, to be made via FRONT ACCESS. Access to the compensation taps may require removal of distribution components.
* The cabinet enclosure shall be designed to accept a variety of distribution options. Output breakers with output amperages ranging from 225A to 800A will be available. The output distribution system may be contained within the overall cabinet of the high-density PDU system. See Section 2.2.2 for additional distribution side car options.
* The standard cabinet enclosure color shall be black. The paint shall be applied using industry-accept methods that ensure high durability.

### Cabinet construction: Distribution side cars

The PDU shall provide two (2) side car options to provide extended distribution options beyond the distribution provided in the main transformer cabinet.

* 12” deep side-facing side car to accept the same distribution options offered in the main cabinet (see Section 2.2.7 for output distribution options). The side-facing side car shall also accommodate an optional main input for a dual feed configuration.
* 34” wide front-facing side car shall accommodate an optional main input for a dual feed configuration.

### Cabinet construction: General

* The PDU cabinet enclosures shall contain four (4) stabilizing feet for stability purposes.
* The PDU cabinet enclosures shall be painted standard Cyberex® black to complement the data processing equipment in this facility. The paint shall be applied using powder coating methods and shall be heat treated and matte finished to help protect the surface of the PDU.

### Cabinet access

Cabinet access shall be as follows:

* Front access required for operation.
* Side access required for operation of the side-facing side car.
* Left, right, or rear access required for servicing the main transformer cabinet. If side cars are placed on both sides of the main transformer cabinet, then rear access is required for service.
* Bottom cable entrance/exit for main transformer cabinet.
* Top or bottom exit for distribution side cars.

### Input main circuit breaker

* The PDU shall include an input main circuit breaker to provide both system protection and a means of disconnecting power from the system.
* The system's input main circuit breaker(s) shall be a 600V rated, 3-pole [thermal magnetic] [electronic trip] molded case circuit breaker, sized for 125% of the PDU full load current rating.
* The system's input main circuit breaker shall contain an internal 24 VDC shunt trip mechanism which shall be interfaced to the local Emergency Power-Off (EPO) pushbutton on the PDU as well as remote EPO pushbutton connections for all remote needs. Customer shall provide dry contacts for remote EPO.
* The system's input main circuit breaker(s) shall have a standard interrupt rating of 65kAIC at 480V.
* The PDU shall include the capability for multiple input main circuit breakers to provide both system protection and a means of disconnecting power from the system. The second input breaker shall be mounted in a side-facing 12” side car.
* Dual input designs shall accommodate assurance designs including lock-out or Kirk-key design.
* Input connections land to bus bar with NEMA 2-hole connections.

### Isolation transformer

The PDU shall contain an isolation, electro-statically shielded transformer for voltage step-down, isolation, and grounding purposes. The transformer shall be constructed using all copper windings and shall employ six (6), 2 1/2% full load compensation taps (two [2] above and four [4] below nominal).

The PDU isolation transformer shall have the following electrical and construction characteristics:

* Rated kVA [350] [400] [450] [500] [600] [750] [800] kVA
* Primary voltage 480VAC, 3 PH, 3 W + Ground
* Secondary voltage [415/240VAC] [208/120VAC], 3 PH, 4W + Ground
* Input/output frequency 60Hz
* Voltage THD (added) 1% max.
* Full load efficiency DOE 2016
* Insulation class Class 220
* Temperature rise 150°C, optional 115°C
* Audible noise NEMA ST20
* K-rating 13, (optional 20, 9, 4)

The neutral of the isolation transformer shall be rated 2 times the system full load amps rating. This is a strict requirement of the specification due to the anticipated high nonlinear loads associated with this project.

The transformer shall contain two (2) NO thermostats per coil to monitor temperature. The first thermal device shall operate at 190°C. The second thermal device shall operate at 220°C. In the event of a 220°C temperature condition, the thermal overload protection device shall close a set of contacts and initiate an automatic shutdown event.

The transformer shall be cooled via natural convection.

### Output distribution options

The high-density PDU shall have the ability to accommodate the following output distribution options:

* Option 2: Fixed mount, buss-fed distribution with specified 52”W X 38”D X 84”H cabinet with breaker capacity as follows:
  + 12 Qty 225A
  + 9 Qty 400A
  + 6 Qty 600A

## Monitoring system

The PDU shall be equipped with the Cyberex® PowerView Monitoring System, which interfaces with both the local color, touchscreen GUI and/or Building Management System (BMS).

### Local display

The PDU shall be equipped with an industrial use, long life, color touchscreen, liquid crystal display (LCD) for the graphical user interface (GUI). The LCD shall measure at least 6.5 inches. The display shall contain all normal operating controls, metering and status indication via an integrated LED ring-light. Additionally, the GUI shall also be able to display an event log containing the condition/alarm, time, and date of the event.

### The display panel shall become an integral part of the PDU and shall indicate the following system information:

* Serial number
* Software version
* Modbus ID
* Board temperature
* Date of last upgrade
* Date of last service
* Date of initial installation

The monitoring panel shall employ an audible alarm to annunciate fault conditions that require acknowledgment such as transformer over-temperature. The alarm shall be silenced by acknowledging the condition on the display panel.

The PDU shall continuously monitor the temperature of the main isolation transformer. The transformer shall be equipped with two (2) thermal sensors per coil, one (1) to annunciate a "High Temperature" condition and the other to automatically shut down the PDU upon a hazardous temperature condition (220°C).

The PDU shall log the “Excess Temperature Warning Threshold” event in the event log as an alarm as well as sound the audible alarm.

The PDU monitoring panel shall contain a fully-guarded, red illuminated “Emergency Power Off” pushbutton assembly. This control circuit shall be interconnected to the internal 24 VDC shunt trip mechanism and shall allow the user to open the PDU main breaker.

### Cyberex® PowerView PDU system monitoring

The following shall be metered:

* True RMS output voltages (3-phase, L-L, and L-N)
* True RMS input voltages (3-phase, L-L)
* True RMS output currents (3-phase)
* True RMS neutral current
* Frequency
* Output power (kW, kVA, kVAR)
* Output power factor
* Energy consumption (kWh, kVAh)
* Max energy demand (kWh periodic max)
* Percentage load
* Voltage THD in %
* Current THD in %
* Crest factor for load

The PowerView shall continuously monitor for the following alarm/warning conditions in the PDU system:

* Output under/over voltages (L-N)
* Output over currents (3-phase)
* Output over neutral and ground currents (Amps)
* Input under/over voltage (L-L)
* Under/over frequency

### User Interface Board (UIB)

The PDU shall contain a user interface board which allows the local installing electrical contractor to interconnect remote emergency power off pushbutton stations to the EPO control circuit, as well as any other customer monitoring connections.

Upon any alarm condition the system shall produce an event in the event log describing the alarm/warning condition. The system has the ability to output up to four (6) SPDT (Form C) relay contacts. The function of these relays is given below:

* Relay 1: Summary Alarm
* Relay 2: Unacknowledged Events
* Relay 3: Factory-Programmable Alarm Output
* Relay 4: Factory-Programmable Alarm Output
* Relay 5: Factory-Programmable Alarm Output
* Relay 6: Factory-Programmable Alarm Output

In addition to the above monitoring features, the system shall have the ability to accept normally open contacts from up to four (4) building interface points. The PDU monitor panel shall also allow those points to be configured as latching or non-latching (i.e. to change status back to “normal” when the normal condition returns).

### Monitoring options

* Cyberex® PowerView [Core] [Pro] Sub-feed Circuit Monitoring (SFCM) for sub-feeds

## Communications and connectivity

The PDU shall provide industry standard communications connectivity and protocols to interface with the user’s Building Management System (BMS), local network and portable devices using the following methods. The manufacturer shall provide comprehensive documentation (e.g. Modbus register maps) to facilitate the interface with the user’s systems. All communications connections shall incorporate industry standard connectors and terminal strips for user’s connections located at a central user demarcation point in the PDU.

All remote communications with the PDU using Internet, Modbus or serial protocols shall be strictly limited to monitoring and or changing alarm thresholds. There shall be no provision that allows the PDU to be remotely operated in such a way that could cause a load drop.

### Modbus over RTU (via RS 485)

The PDU shall provide serial (2 wire or 4 wire) standard Modbus connectivity over RS 485. The PDU shall be designated as “slave” and assigned a single Modbus ID. For configurations equipped with additional circuit monitoring modules (BCM or SFCM), each module will have its’ own unique Modbus ID.

### Modbus over TCP, via Ethernet

The PDU shall provide Modbus TCP over Ethernet.

### Serial service port, via USB

The PDU shall provide a dedicated USB service port for use by authorized field service personnel for the purposes of performing maintenance tasks including diagnostics and software upgrades. The USB service port shall also facilitate software upgrades via a USB storage device, as well as, alarm/warning and metering/configuration data downloads.

### Remote software upgrade

The PDU shall provide the following functions for communicating the status via the Internet or Intranet:

* TFTP – The PDU shall provide means for authorized field service personnel to performing remote software upgrade.

## Equipment options

Available as options, the PDU shall contain following:

* Surge arrestor
* Sub feed Circuit Monitoring (SFCM) with energy metering (Specifier’s note: See Cyberex® PowerView guide specification)
* Local EPO pushbutton assembly
* Floorstand (Seismic)
* Kick plates

# Execution

## Overview

Factory start-up and user training, preventive maintenance service, and full service for the above specified system shall be included upon request. The manufacturer shall nationally employ service organizations of factory-trained field service personnel dedicated to the start-up, maintenance, and repair of the manufacturer’s power equipment.

The manufacturer shall maintain (24 hours per day, 365 days per year) an answering service to facilitate in providing technical support and emergency service dispatching.

### Installation, inspection and factory authorized start-up

Installation and start up shall include the following:

* Ensure removal of temporary shipping bracing.
* Verify all electrical connections for tightness as specified.
* Verify input voltage and phase rotation are within specifications.
* Review the field assembly and connection of components.
* Inspect accessible components for cleanliness, for mechanical and electrical integrity, and for evidence of damage or deterioration.
* Pretest and adjust monitoring and/or control parameters as required.
* Correct all deficiencies before proceeding with tests. Correct deficiencies identified by tests and retests.
* If applicable, adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout the normal operation cycle of the facility.
* Record circuit monitors set-ups, if applicable.
* Measure output voltage of branch circuit panel board, if applicable. Verify proper operation of equipment, including circuit monitor and input and output control circuits.
* Submit test reports.

### Training (optional)

Concurrent with factory authorized system startup the manufacturer’s field service engineer shall train the owner’s operating personnel in the proper operation of the system. Training shall last a minimum of two hours and shall include:

* Safety precautions
* Features and construction of project equipment
* Voltage adjustment procedures, if applicable
* Routine inspection and test procedures
* Routine cleaning
* Interpretation of reading of warnings and alarms

**End of specification**