

Delta Rectifier Module Maintenance Manual - Official Technical Overview & Hardware Datasheet

DELTA RECTIFIER MODULE MAINTENANCE MANUAL

OFFICIAL TECHNICAL OVERVIEW & HARDWARE DATASHEET

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EXECUTIVE SUMMARY

The Delta Rectifier Module (DRM) series represents a paradigm shift in telecom power conversion, delivering carrier-grade reliability and efficiency for next-generation network infrastructures. Designed as a fully hot-swappable, high-density power conversion unit, the DRM is engineered to meet the rigorous demands of 5G aggregation sites, central offices, and edge computing nodes. This document provides a comprehensive technical overview, detailing the architectural innovations, operational parameters, and maintenance protocols that ensure uninterrupted service delivery. With a peak efficiency of 98%, intelligent digital control, and a modular form factor, the DRM series drastically reduces total cost of ownership while enhancing grid stability and battery life. The platform supports both AC and DC input configurations, offering a versatile, future-proof solution for global telecom operators.

transitioning to green energy initiatives.



ARCHITECTURE & CHASSIS DESIGN

The Delta Rectifier Module is built upon a robust mechanical and electrical architecture that prioritizes thermal efficiency and ease of maintenance. The 1RU high, 19-inch rack-mountable chassis houses up to three independent rectifier modules, each operating as a self-contained power conversion unit. The backplane utilizes a low-impedance, high-current busbar system that minimizes power loss and ensures balanced load sharing. A dedicated communication interface, compliant with the CANbus and Modbus standards, facilitates real-time monitoring and firmware updates via the centralized Site Management Controller (SMC).

Key mechanical design features include:

- * ****Front-to-Back Cooling Airflow:**** Optimized for high-density rack environments, ensuring consistent thermal dissipation across all modules without hot spot formation.
- * ****Advanced Material Composition:**** The chassis utilizes galvanized steel with a compliant anti-corrosion coating, meeting IEC 60721-3-3 standards for stationary use in polluted atmospheres.
- * ****Color-Coded Connectors:**** All primary (AC/DC) and secondary (Control) connectors are color-coded and keyed to prevent misinsertion, facilitating rapid field replacement.
- * ****Integrated EMC Filtering:**** Built-in class B EMI filters on the input stage ensure compliance with EN 55022, allowing deployment in sensitive electronic environments.

HARDWARE FEATURES

The DRM boasts a suite of advanced hardware features designed to optimize power delivery and ensure system longevity. The core of the module leverages Gallium Nitride (GaN) technology, enabling higher switching frequencies and reduced core losses. This translates directly to a wider operational temperature range (-40°C to +75°C) and a form factor that delivers up to 3000W per module.

Core hardware components and features include:

- * ****Digital Signal Processor (DSP) Control:**** High-precision DSP management for voltage regulation with an accuracy of $\pm 0.5\%$ in constant voltage (CV) and constant current (CC) modes.
- * ****Adaptive Load Sharing:**** Active digital current sharing ensures that load is distributed equally among paralleled modules, preventing individual unit overstress and extending Mean Time Between Failures (MTBF).
- * ****Battery Recharge Management:**** A specialized algorithm supports three-stage (Bulk, Absorption, Float) charging profiles for VRLA and Li-Ion batteries, automatically compensating for temperature variances via an external temperature sensor probe.
- * ****Hot-Swap Capability:**** The floating connector system supports live insertion and removal without interruption to the load, a critical feature for non-disruptive maintenance.
- * ****Comprehensive Protection:**** Full protection suite includes Output Overvoltage Protection (OVP), Overcurrent Protection (OCP), Short Circuit Protection (SCP), Input Undervoltage/Overvoltage (UVLO/OVLO), and Overtemperature Protection (OTP) with automatic recovery upon fault clearance.

Parameter	Specification
Form Factor	1RU Modular Chassis (Supports up to 3x 3000W Rectifiers)
AC Input Voltage (Range)	85 - 300 VAC (Auto-ranging)
DC Output Voltage (Range)	-40 to -58 VDC (Software Adjustable)
Maximum Output Power	3000W (Continuous) / 3600W (Peak, 1ms)
Power Efficiency	Up to 98% (Peak Efficiency)
Communication Interface	CANbus / Modbus (via SMC)
Operating Temperature	-40°C to +75°C (Derating above 55°C)

TECHNICAL SPECIFICATIONS

- * **AC Input Voltage:** 85-300 VAC (Nominal: 220 VAC) or 176-300 VDC (Nominal: 240 VDC) - Auto-ranging.
- * **Input Frequency:** 45-66 Hz.
- * **Power Factor:** > 0.99 at 50% load.
- * **Total Harmonic Distortion (THD):** < 5% at full load.
- * **DC Output Voltage:** -40 to -58 VDC (Adjustable via software).
- * **Nominal Output Power:** 3000W (Rated), 3600W (Short-term peak, 1ms).
- * **Peak Efficiency:** 98% (Typical).

- * **Regulation (Line & Load):** $\pm 0.5\%$ for Voltage; $\pm 1\%$ for Current.
- * **Hold-up Time:** $> 8\text{ms}$ (at full load).
- * **Standby Power Consumption:** $< 3\text{W}$.
- * **Operating Temperature (Ambient):** -40°C to $+75^{\circ}\text{C}$ (Power derating for temperatures $> 55^{\circ}\text{C}$).
- * **Storage Temperature:** -45°C to $+85^{\circ}\text{C}$.
- * **Relative Humidity:** $0\% - 95\%$ (Non-condensing).
- * **Altitude:** Up to 3000m (Derating applicable above 2000m).
- * **Audible Noise:** $< 40\text{ dBA}$.

COMPLIANCE & STANDARDS

The Delta Rectifier Module has been rigorously tested and certified to meet the following global standards:

- * **Safety:** IEC/EN 62368-1, UL 62368-1, CSA C22.2 No. 62368-1.
- * **EMC:** EN 55032 (Class A), EN 55035, FCC Part 15 (Class A), ICES-003.
- * **Environmental:** RoHS 2011/65/EU, REACH, WEEE compliant.
- * **Telecom Immunity:** GR-1089-CORE, ETSI EN 300 386.
- * **Efficiency:** Compliant with 80 PLUS Titanium (80% load) and EU CoC Tier

ORDERING OPTIONS

The DRM platform offers versatile ordering configurations to suit diverse deployment scenarios. The base chassis (DRM-C-01) is ordered separately from the rectifier modules to allow for flexible scaling. Below are the primary orderable items:

- * ****DRM-C-01:**** Empty 1RU Chassis with Integrated Backplane and SMC mounting slot.
- * ****DRM-3000W-AC:**** Rectifier Module, 3000W, AC Input (85-300VAC).
- * ****DRM-3000W-DC:**** Rectifier Module, 3000W, DC Input (176-300VDC).
- * ****DRM-SMC:**** Site Management Controller Module (required for system monitoring).
- * ****DRM-ETEMP:**** External Battery Temperature Sensor (accessory).

