

RELIABILITY PREDICTION REPORT

Name of Products	Maxicharger DC Wall mount
Model:	Maxicharger DC 40 Wallmount
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Prepared By/Date	Qixueli
Approved By/Date	Liuguiyong

Abstract

This report analyzes the typical configuration of the Maxicharger DC Wall mount Series System. It also calculates the reliability of series system according to the 《Telcordia SR-332 Reliability Prediction Procedure for Electronic Equipment》.

Abbreviations

MTBF : Mean Time Between Failures, usually suitable for reparable Series System.

FITs : Failure in Time, $1\text{FITs} = 10^{-9}/\text{hr}$.

MTTR : Mean Time to Repair

Availability: The probability that the system is in a normal state at any time .

1 Reliability Prediction Methodology

1.1 Units Reliability Prediction Method

In this report, unit reliability is predicted using Method I, Parts Count method of “Telcordia SR-332, Electronic Equipment Reliability Prediction Handbook”, and the failure rates are based on the situation of 40°C operating temperature and 50% electrical stress.

1.1.1 Prediction Method of Component Failure Rate

Component working failure rate is to multiply basic failure rate by corresponding modifying factor, the calculating formula of component working failure rate is:

$$\lambda_{SSi} = \lambda_{Gi} \cdot \pi_{Qi} \cdot \pi_{Si} \cdot \pi_{Ti}$$

λ_{Gi} = basic failure rate of the component

π_{Qi} = quality factor of the component

π_{Si} = stress factor of the component

π_{Ti} = steady temperature factor of the component under normal working temperature.

For Cases 1 and 2, since the temperature and electrical stress factors are $\pi_S = \pi_T = 1.0$ at 40°C and 50% electrical stress for all device types, the formula can be simplified to:

$$\lambda_{SSi} = \lambda_{Gi} \cdot \pi_{Qi}$$

1.1.2 Calculation Method of Unit Failure Rate

Unit failure rate is to multiply the total component failure rates of that unit by environment factor:

$$\lambda_{SSi} = \pi_E \cdot \sum_{i=1}^n N_i \lambda_{SSi}$$

Where:

n = number of different component's types in the unit

N_i = number of the i^{th} component's types

π_E = unit environment factor, for the environment of ground, fixed, controlled, $\pi_E = 1.0$.

1.2 Series System-Level Evaluation Method

Redundant structure in the Series System can be calculated using Markov Chain Model of reparable Series System.

Failure rate of series structure is the total units failure rates.

MTBF is the reciprocal of failure rate: $MTBF = 1/\lambda$

$$A \text{ (Availability)} = MTBF / (MTBF + MTTR)$$

$$\text{Downtime} = 525600 \times (1 - A) \text{ mins/yr}$$

1.3 Determination of Other Related Parameters

The MTTRs in this report only include the field repairing time, not include the time for the maintenance personnel's journey and the logistic management.

In this report, the MTTR of each unit and equipment is determined to be 1.0 hour, according to the engineering experience and field data.

2 Typical Configuration and Reliability Models for the Maxicharger DC Wall mount

2.1 Typical Configuration

The typical configuration of Maxicharger DC Wall mount Series System is shown as following diagram:

Unit	Number	Unit	Number
MiniTCU board	1	Charging gun	2
ECU board	1	RCD	1
CCU board	2	DC Contactor	6
Power Module	2	AC Contactor	1
LCD Screen	1	AC Breaker	1
Auxiliary power Supply	2	FAN	4
Heater	2	Electric Meter	2

Table1 Maxicharger DC Wall mount Series System Typical Configuration Diagram

2.2 Reliability Models

The Maxicharger DC Wall mount Series System-level reliability model diagram is shown as following diagram, which is build according to the above configuration. The whole Series System Configuration will change according to number of power module.

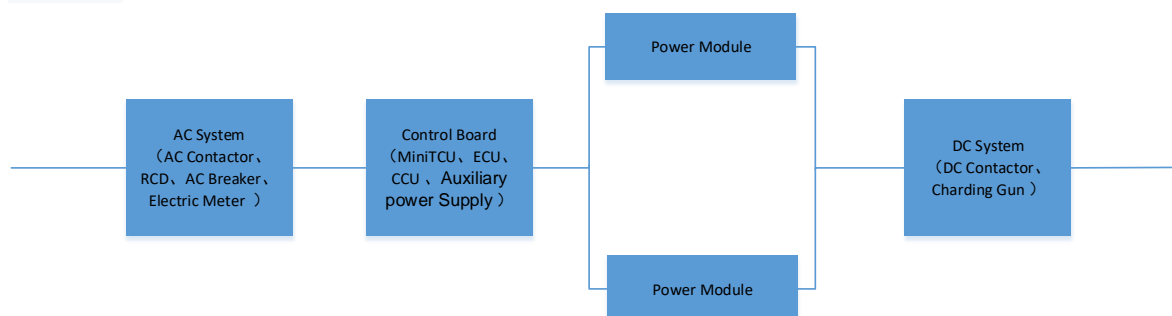


Figure1 Maxicharger DC Wall mount Series System-level Reliability Model Diagram

3 Reliability Prediction for the Maxicharger DC Wall mount Series System

3.1 Units Reliability Prediction

According to the above prediction methods, the units reliability can be calculated as follows:

Unit	Failure Rate(FITs)	MTBF(yrs)
MINITCU board	896	127.4

ECU board	2184	52.3
CCU board	4693	24.3
Power Module	114	1001.4
LCD Screen	1410	81.0
Auxiliary power Supply	58	1968.2
Heater	100	1141.6
Charging gun	25	4566.2
RCD	140	815.4
DC Contactor	140	815.4
AC Contactor	140	815.4
AC Breaker	50	2283.1
FAN	300	380.5
Electric meter	150	761.0

Table2 Reliability Prediction Results for Units

3.2 Maxicharger DC Wall mount Series System Reliability Prediction

According to the above prediction methods, we can calculate the availability and reliability for Maxicharger DC Wall mount Series System:

Series	Availability	MTBF(yrs)	Downtime(mins/yr)
Maxicharger DC 40 Wallmount	0.9999829	6.7	9.0

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