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# Rectifier User Manual

Version: 1.2

Model: BR483000-M

HF Rectifier module 48V/ 50A

# Catalogue

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## 1. Electrical Specifications

### 1.1 Input

Input	Single-phase two-wire
Input Voltage	90Vac to 290Vac, 90Vdc to 400Vdc
Rate input Voltage	220Vac
Frequency Range	45Hz-65Hz
Max input Current	18.5A±10%@155Vac/50A
surge current	Compliant standard : ETSI300132-3
Efficiency	≥95%@220Vac 100% Load
PF	≥0.99@220Vac/50A
Leakage current	<3.5mA@264Vac
Rate capacity	2900W(154Vac~290Vac)(215Vdc-400Vdc) 1200W(90Vac~154Vac)(90Vdc-215Vdc)
Input Protection	L line ,Fuse 25A
Max Input Voltage	320Vac(Power cannot be damaged)

Note: If the system consisting of this module uses three-phase input power, please ensure that the system N line is connected reliably, otherwise the module may be damaged!

### 1.2 Output

#### 1.2.1 Output voltage current regulation

Output Voltage	+53.5Vdc
Output Default Voltage	+53.5±0.1Vdc
Output Voltage adjust range	+43Vdc~+58Vdc
Efficiency	≥96.8%@220Vac 50-100% Load ≥95.5%@peak value
Load sharing (50%~100% Loading)	≤±5%
Line Regulation	±0.1%
Load Regulation	±0.5%
Voltage Regulated Accuracy	±0.6%
Min- Current	0A
Rate Current	50A
Peaking Current	≤55A
Tempe. coefficient (1/°C)	≤±0.02%

Note: The rectifier module output current regulation and communication interruption are as follows:

1) The output current of the rectifier module can be adjusted according to the current command. The adjustment range is 1A~50A.

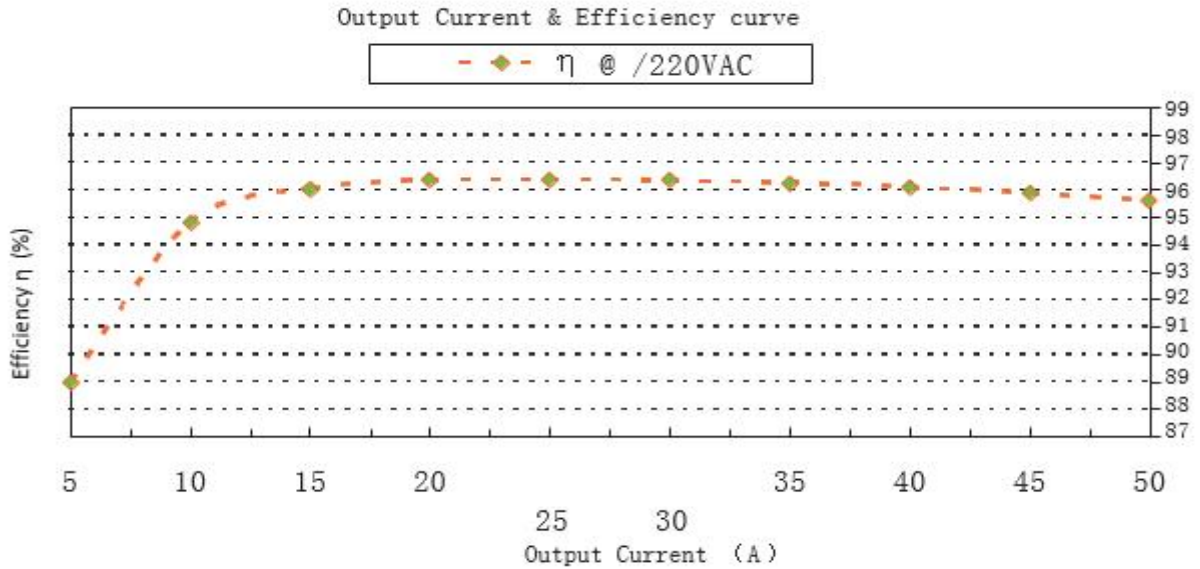
2) Communication fault more than 1 minute (Rectifier and Control monitor), A .Rectifier module output Voltage automatic recovery default Voltage 53.5V and limited current function not

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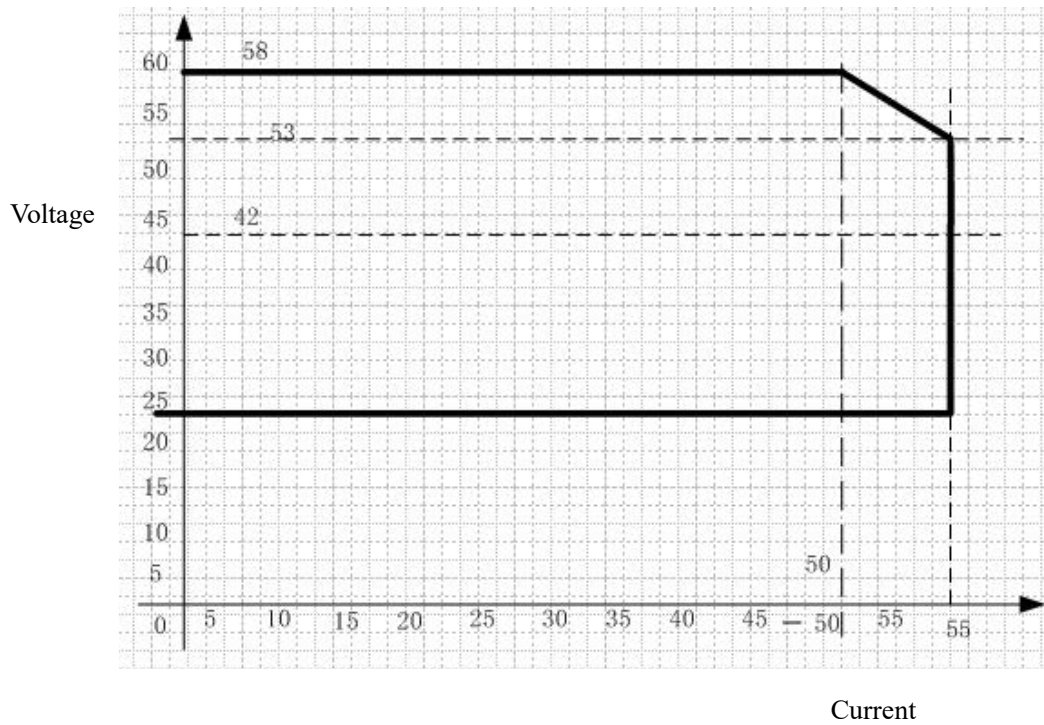
working; b. if the rectifier modules are controller by monitor and Power off, then rectifier system will power on (if the rectifier fault, it can not be turned on again)

### 1.2.2 Efficiency Figure

Input 220VAC, Output 53.5V



### 1.2.3 Output Current & Voltage



### 1.2.4 Output ripple and noise

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Output Voltage	Ripple and Noise (peak-to-peak)
+53.5Vdc	200mVp-p@ 25°C

Note : 1) Ripple and Noise testing : Ripple and noise Default as 20 MHz.

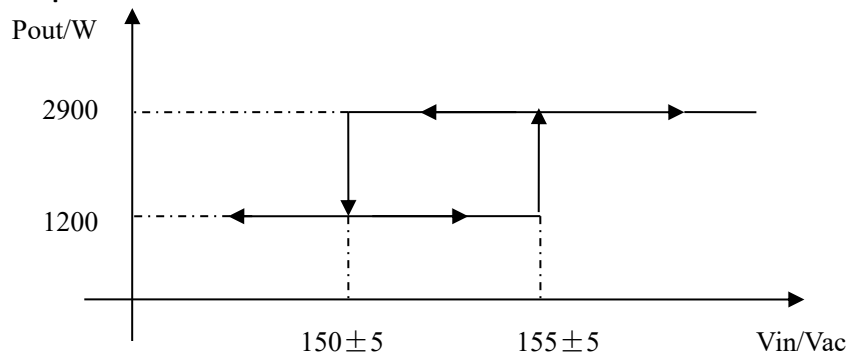
### 1.2.5 Output dynamic response

Voltage overshoot	Load	Recover time
+53.5V±5%	25% ~ 50% load 50%~ 75% load	≤200us

### 1.2.6 Output Overshoot

Output Voltage	Overshoot Voltage	
	Power on	Power Off
+53.5V	≤5%	≤5%

### 1.2.7 Power Switch point



### 1.2.8 Power on output delay time

Output Voltage	220Vac@25°C
+53.5V	3S~10S

Note: The power-on delay time is the time from AC power-on to output voltage (to 46VDC)

### 1.2.9 LED Indicator

The power LED is installed on the power panel side and the output status is shown in the table below.

Indicator	LED Color	Normal	abnormal	Abnormal Reasons

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		Status	status	
Power running indicators	Green	<b>On</b>	off	Mains fault ( No AC input, AC input under voltage ) ,Rectifier not working
Protect indicators	Yellow	Off	<b>on</b>	Temperature per-alarm (working temperature more than 65 °C ,then over temperature shutdown); Sleep shutdown (the module only lights the protection indicator when the system is shut down, and the module does not report alarm).
Fault Indicator	Red	Off	<b>on</b>	Output Over voltage power off、 Fan fault 、 Over-Temp. Power off 、 Rectifier module inner fault。

### 1.2.10 Standby power consumption

Note: 220Vac input , Full load; Testing input Capacity

### 1.2.11 Noise voltage

Noise voltage	Max	Note
Phone noise weighting Voltage	≤2mV	
broadband noise Voltage	≤50mV	3.4~150KHz
	≤20mV	150~30000KHz
Radio interference noise, or radio frequency noise	≤5mV	3.4~150KHz
	≤3mV	150~200KHz
	≤2mV	200~500KHz
	≤1mV	500~30000KHz

### 1.2.12 Rectifier module and monitor module communication function

RS485 communication mode (half-duplex, double-line) is adopted between the rectifier module and the monitoring module.

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The RS485 interface in the rectifier module needs to be isolated. The RS485 power supply is +5Vdc (regulation accuracy  $\pm 5\%$ ), which is provided by the monitoring module.

The main monitoring information of the rectifier module is:

1) Adjust Voltage and Current function: meet the requirements of battery floating charge and meet the adjust voltage requirements;

2) Single module switch machine control;

3) Alarm information:

Mains failure: mains failure (AC input over voltage);

Module protection: temperature pre-alarm;

Module failure: Output over voltage shutdown, fan failure, over temperature shutdown or no output caused by internal causes of other modules; (module is in: sleep shutdown state, mains failure does not report module failure).

### 1.3 Protection function

#### 1.3.1 Output Limited Current Protection

Output Voltage	Limited Current point	Note
+53.5V	105%~110%	Limited current output

#### 1.3.2 Output short circuit Protection

Output Voltage	Note
+53.5V	Restart after protection

#### 1.3.3 Output Over voltage Protection

Output Voltage	Protection Point
+53.5V	60 $\pm$ 1V. (Lock)

Note: After entering the lock protection state, you need to disconnect the AC power first, and then re-power on, the rectifier module can be re-operated.

#### 1.3.4 Input Over Voltage Protection

Input Voltage	Note
310 $\pm$ 10Vac	Output off, Self-recovery after normal voltage
	output recovery point backlash>10V

Note: Input overvoltage protection should be tested at 50A rated load.

#### 1.3.5 Input Under voltage protection



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Input Voltage	Note
80±5Vac	Output is off, self-recovery after normal voltage
	output recovery point backlash>5V

Note: Input overvoltage protection should be tested at 50A rated load.

### 1.3.6 Input high voltage LVD Protection

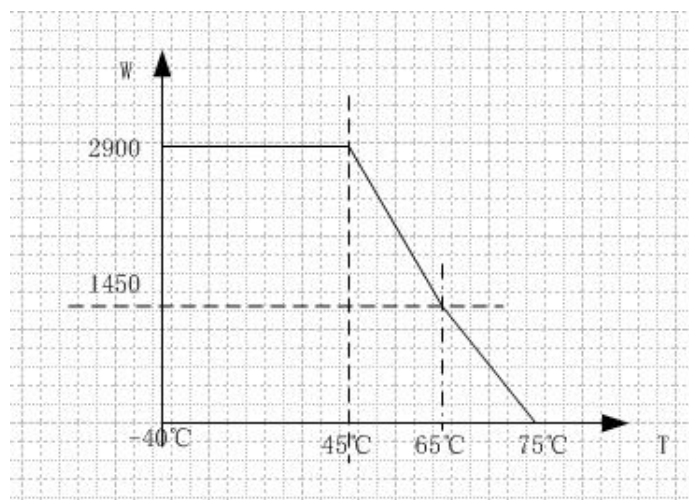
PFC busbar Voltage	Note
450VDC	Module disconnect input relay,

Note: Input overvoltage protection should be tested at 50A rated load.

### 1.3.7 Over-temp. Protection

Temp.	Note
≤55℃	With maximum output Capacity ability , without over-temperature protection and the module is running normally.
55℃~65℃	The module can be automatically derate to ensure long-term stable output of at least 50% of rated power
>65℃	Power off , After power off,Recovery temperature difference >10℃

### 1.3.8 Output Capacity& Temperature Figure



Output Capacity& Temperature Figure

## 2. Insulation Performance

### 2.1 Insulation resistance

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Input & output	Testing voltage 500VDC, Insulation Resistance $\geq 10M$ (normal atmospheric pressure, normal temperature, relative humidity $< 90\%$ , no condensation)
Input & ground	
Output & ground	

### 2.2 Isolation Voltage

Input & output	Valid Value 3000Vac 50Hz or Equivalent DC voltage 4240Vdc 1minute $\leq 1mA$
Input & ground	Valid Value 1500Vac 50Hz or Equivalent DC voltage 2120Vdc 1minute $\leq 1mA$
Output & ground	Valid Value 500Vac 50Hz or Equivalent DC voltage 710Vdc 1minute $\leq 1mA$

## 3. Safety standard

Power supply safety meets the following standards:

GB4943-2001

## 4. EMC

### 4.1 EMI

EMI compliance with the below standard:

**1) conducted interference**

\*EN55022, CLASS A

**2) Radio Frequency Interface**

\*EN55022, CLASS A

**3) Output Conducted interference**

\*EN300386, CLASS A

### 4.2 (EMS)

Power EMS Meet the below standards:

**1) ESD**

\*GB17626.2-1998/IEC61000-4-2

a, the shell, the parts that the hand can touch during normal operation: contact discharge  $\pm 6KV$ ; air discharge  $\pm 8KV$

Criterion B (power on test)

b, the shell, the parts that the hand can touch during normal operation: contact discharge  $\pm 8KV$ ; air discharge  $\pm 10KV$

Criterion R (not powered during test)

c, signal interface inner conductor: contact discharge  $\pm 2KV$

Criterion R; (power on test, no test on address line and current line)

**2) EFT**

\*GB17626.4-1998/IEC61000-4-4                      Level 3      A

**2) SURGE**

\*GB17626.5-1998/IEC61000-4-5                      Level 4      B

**4) DIP**

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\*GB17626.11-1998/IEC61000-4-11

Power DIP test sheet as below (22Vac)

Drop	Drop Phase	Drop time	Standard
0%Ut	0°/45°/90°/135°/180°/225°/270°/315°	10ms	B
40%Ut	0°/45°/90°/135°/180°/225°/270°/315°	20ms	B
70%Ut	0°/45°/90°/135°/180°/225°/270°/315°	100ms	B

### 5) Harmonic current

\*IEC 61000-3-2 [6] CLASS A

### 6) Voltage fluctuations and flicker

\*IEC 61000-3-3

$P_{st} \leq 1.0$ ;  $P_{1t} \leq 0.65$ ;  $d_c \leq 3\%$ ;  $d_{max} \leq 4\%$ ;  $d(t)$  Value more than 3% times  $\leq 200$ ms

### 7) Lightning strike

In the system application, the AC input terminal can withstand the common mode no less than 5kA, 8/20us impulse current waveform, plus or minus 5 times, each interval of 1 minute (see standard: YD 5098-2001). B

### 8) Conducted immunity

\*IEC61000-4-6 Level 3 A

### 9) Radiation immunity

\*IEC61000-4-3 Level 3 A

### Standard:

A: The power supply did not have any degradation in performance throughout the test, and it was completely the same as the specifications specified in the power supply specification.

B: During the test, the performance of the power supply is allowed to temporarily decrease, but it can be restored after the test is over.

C: A short-term loss of function is allowed, but the end of the test can be restored automatically or manually.

D: Damage to other devices other than the fuse device is not allowed during the test.

## 5. Working temperature

### 5.1 Environment Temperature

\*Working Temp.:  $-10^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$ . ( $-40^{\circ}\text{C}$  Normal Working)

\*storage Temp.:  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ .

\*Transport Temp.:  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ .

### 5.2 Relative Humidity

\*Working RH: 5%~95% No condensation)

\*Storage RH: 5%~95% No condensation)

### 5.3 Altitude

\*working Altitude: 0~4000M, based 3000m, For every 200 m increase in altitude, the temperature drops by  $1^{\circ}\text{C}$

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\*Storage Altitude : 0~4000M, based 3000m, For every 200 m increase in altitude, the temperature drops by 1°C

### 5.4 cooling

The rectifier module with fan, forced air cooling, air is sent out after the wind is coming forward, the fan is placed in the front, and the fan has temperature control speed regulation function.

### 5.5 vibrate tolerance

\*Working environment: sinusoidal vibration: 5~9Hz: amplitude 3.5mm; 9~200Hz: acceleration 10m/s<sup>2</sup>; 3 axial direction, sweeping vibration 5 times in each direction, 1OCT/min (1 octave/min).

\* Transportation environment: random vibration: 2~10Hz: 10m<sup>2</sup>/s<sup>3</sup>; 10~200Hz: 3m<sup>2</sup>/s<sup>3</sup>; 200~500Hz: 1m<sup>2</sup>/s<sup>3</sup>;

3 axial, 30min in each direction.

(Reference standard: ETS300019-2)

### 5.6 Impact tolerance

\*Working environment: acceleration 250m / s<sup>2</sup>; pulse width 6ms; 3 axes 6 to each collision 500 times.

\* Transportation environment: acceleration 400m / s<sup>2</sup>; pulse width 6ms; 3 axes 6 to each collision 500 times.

(Reference standard: ETS300019-2)

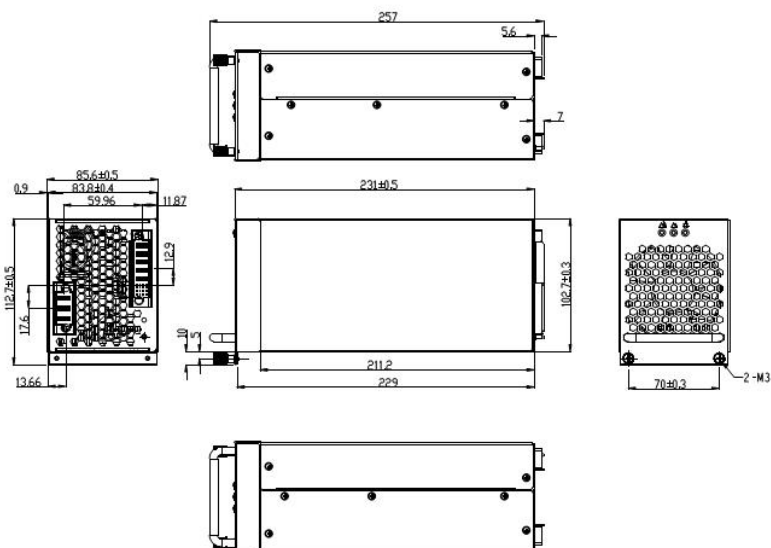
### 5.7 drop

\* Transportation environment: drop height 1m; bottom surface 1 time.

(Reference standard: ETS300019-2)

## 6. Size

	Rectifier module	Package size	Note
H	83.8 mm	155mm	/
W	112mm	167mm	/
D	257mm	317mm	/



## 7. Weight

<2.5kg

## 8. Case IP protection rating

IP20 (User normal maintenance operation surface)

## 9. Transportation and storage

The product should be placed in a warehouse that is affected by dry, ventilated and non-corrosive gases with a temperature of -10 ° C to 40 ° C and a relative humidity of not more than 80%.

The product has a strong packaging when transported. The outside of the box complies with the relevant national standards and should have signs such as “careful handling” and “moisture proof”. The box containing the product is allowed to be transported by any means of transport. Direct rain and snow strikes and mechanical impacts should be avoided during transportation.

## 10. Other requirements

Item	Requirement	Note
noise	Less than 55dBa	
odor	not produce odor and harmful odor	
Components	All devices meet the derating	
Hot swap	Rectifier module for hot swap	
Failure isolation	After the rectifier module fails, it can be reliably separated from the system.	

## 11. MTBF

1\*10<sup>5</sup>h: 25°C, Rated input and full load output.

## 12. Connector pin definition

	Pin	Signal	Remark	Contact sequence
AC input	1	Rectifier module AC input	L	2
	2	Rectifier module protection Ground	PE	1
	3	Rectifier module AC input	N	2
DC output and Signal	1	Rectifier module address wire	ADDRESS0	3
	2	Rectifier module address wire	ADDRESS1	3
	3	Rectifier module share current wire	LOADSHARE +	3

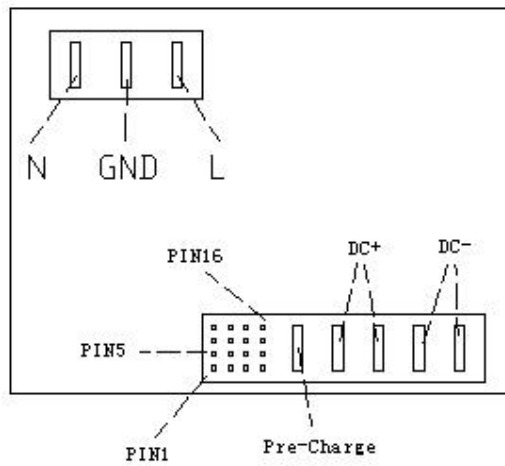
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4	NC	NC	3
5	NC	NC	3
6	NC	NC	3
7	Rectifier module address wire	ADDRESS2	3
8	Rectifier module address wire	ADDRESS3	3
9	Rectifier module hare current wire	LOAD SHARE-	3
10	RS485 Power+	+3.3V/+5V	3
11	RS485Power-	+3.3V/+5V GND	3
12	Rectifier module Communication wire	RS485-	3
13	Rectifier module address Wire	ADDRESS4	3
14	NC	NC	3
15	Rectifier module Communication wire	RS485+	3
16	Address wire GND	ADDR_GND	3
As Figure	Pre-Charge	Pre-Charge	1
As Figure	Rectifier module output 48V+	DC+	2
As Figure	Rectifier module output 48V+	DC+	2
As Figure	Rectifier module output 48V-	DC-	1
As Figure	Rectifier module output 48V-	DC-	1

(1) The description of the pin is as follows:

Block address definition: The module internally pulls up the address line. ADDRESS0~4 can be left floating outside the module or shorted to the address line GND. Shorting means "1", floating means "0", such as ADDRESS0 external and address If the line GND is shorted and the other address lines are left floating, the rectifier module address is 1. The address range of the rectifier module is 0 to 31.。

(2) Pre-Charge pin is used to pre-charge the output capacitor inside the rectifier module when the rectifier module is hot swapped.。



### 13. Product Maintenance

#### 13.1 Product free maintenance time

The free maintenance level of this product is Class B, and the free maintenance period (warranty period) is 1 year.

#### 13.2 On-site maintenance

The power module has a hot swap function, and the on-site repair mode is module replacement.