

Three hexagonal images arranged in a triangular pattern. The top hexagon shows a row of white wind turbines on a blue sea under a clear sky. The bottom-left hexagon shows a close-up of a black mechanical component with a brass-colored base and a small drill bit. The bottom-right hexagon shows a close-up of two interlocking blue gears.

Modular UPS from INVT

- Invt power system



HT33060X = 60K cabinet+ PM30*2

HT33090 X = 120K cabinet +PM30*3

HT33120 X = 120K cabinet +PM30*4

HT31040 X = 3140 cabinet +PM30*2 (also can do 3120)

HT33080X = HT33090X

HT33100X = HT33120X

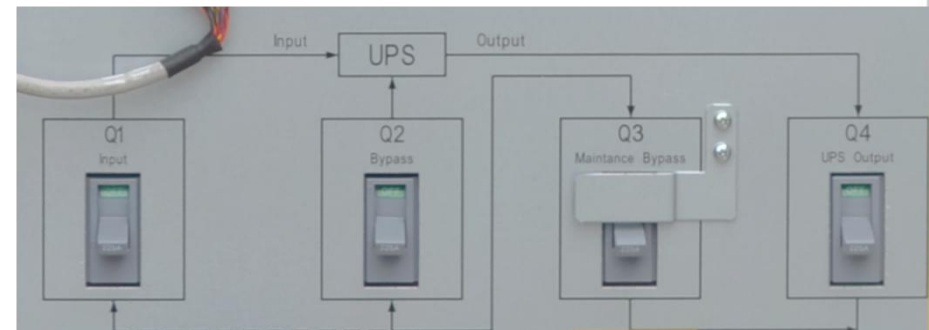
Appearance



Front View



Hot swappable power module



Simple maintenance bypass



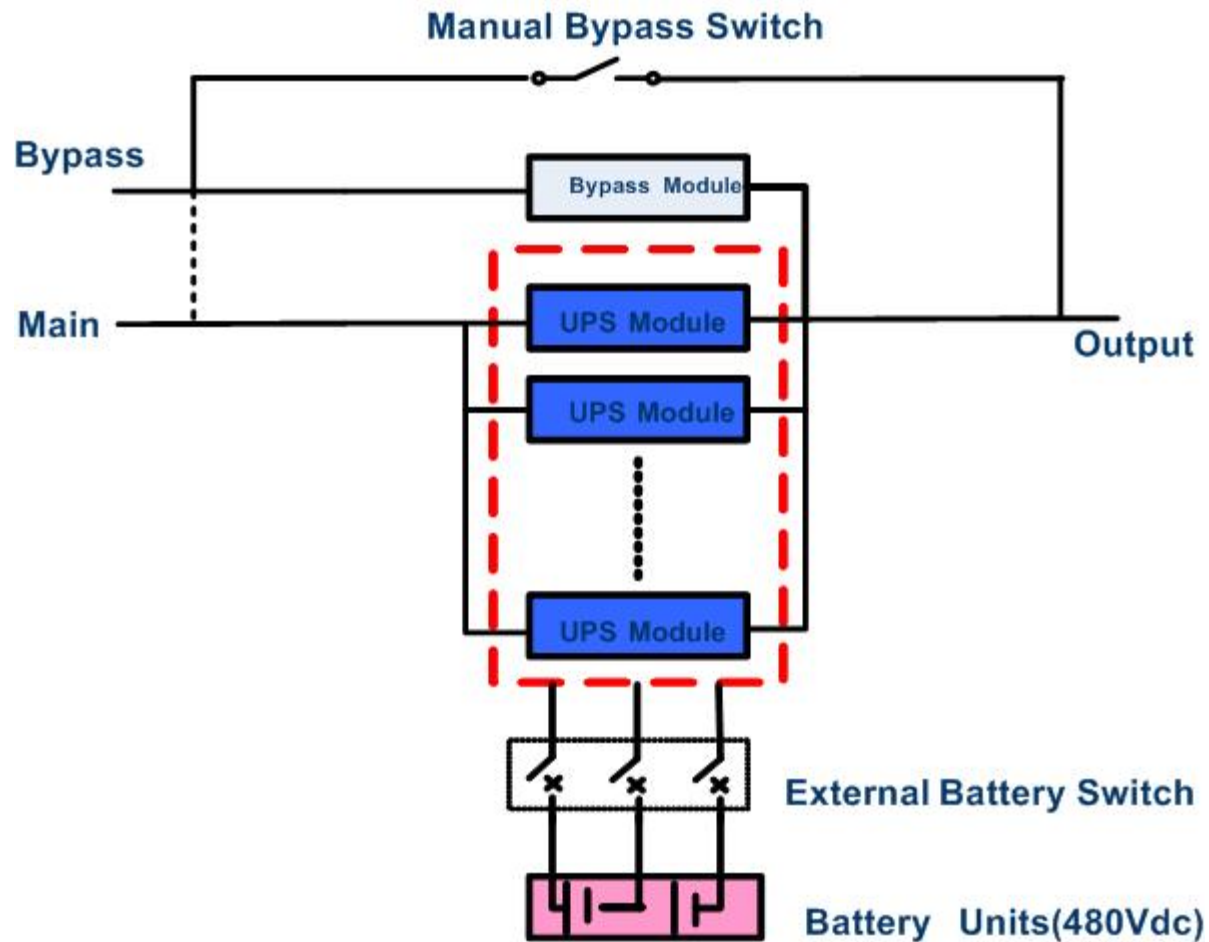
New functional improvement

- Duct design independent
- The overall temperature detection and protection
- Fault recording function
- Self aging function
- Programmable dry contact
- Compatibility of lithium battery

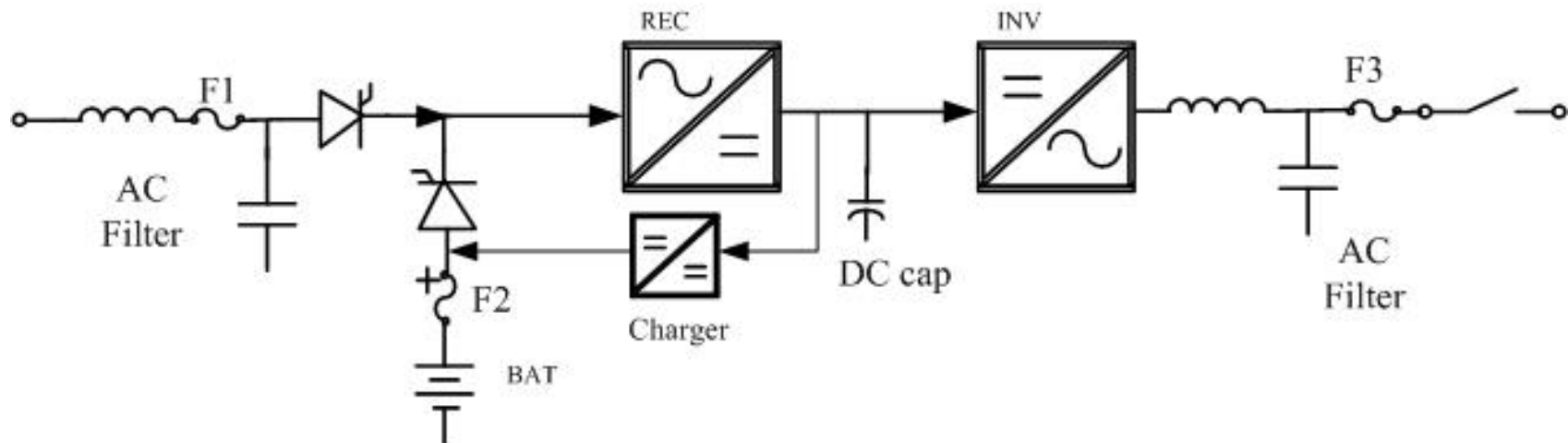
Content

- ◆ **System diagram**
- ◆ **Power module design**
- ◆ **Performance**
- ◆ **Power module test verification**
- ◆ **System design**
- ◆ **Special Functions**
- ◆ **Parallel and LBS system**

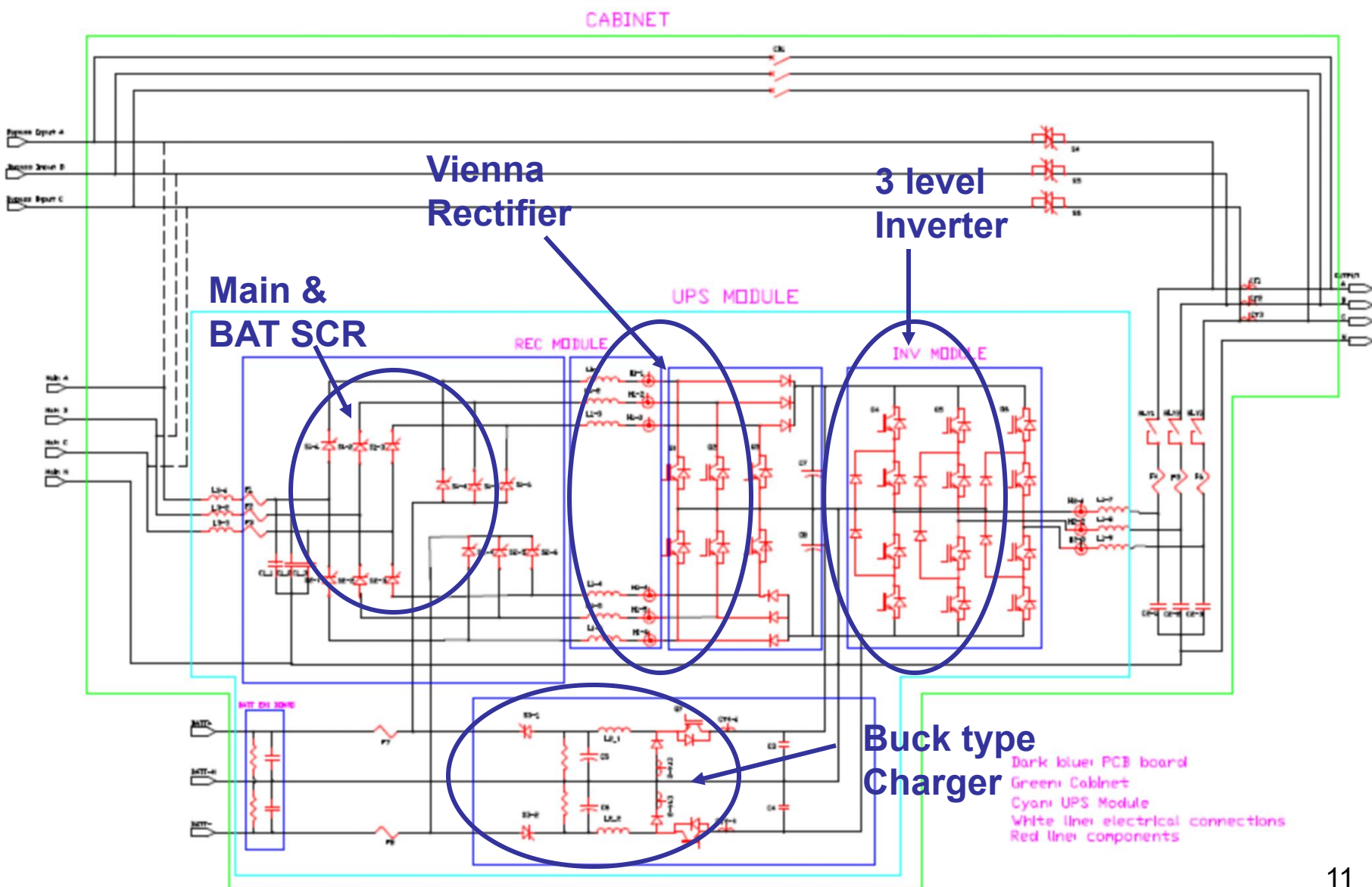
System diagram (2-4 slots)

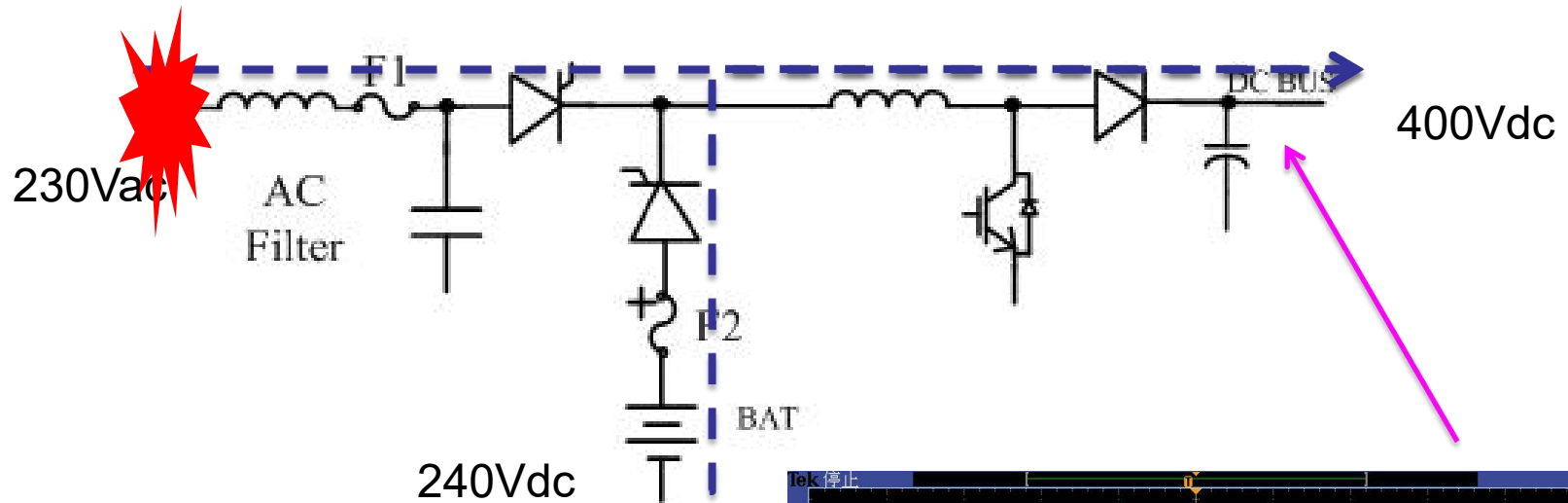


Single line diagram of module

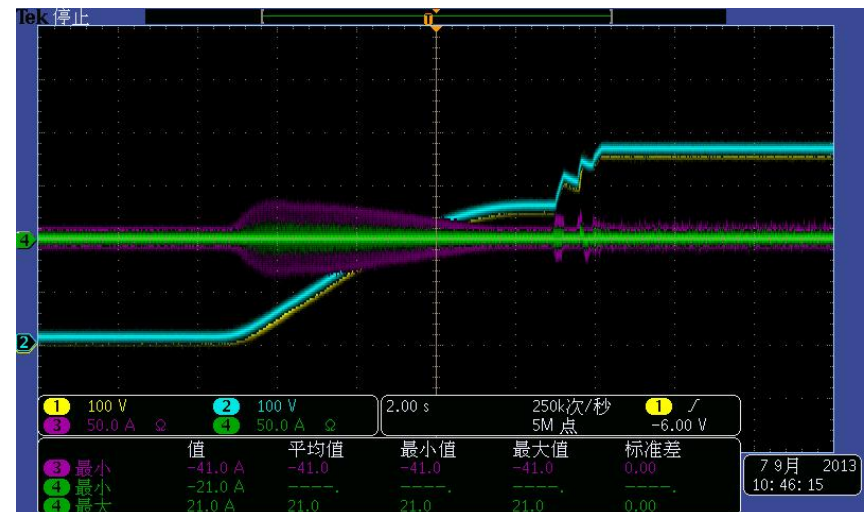


System topology





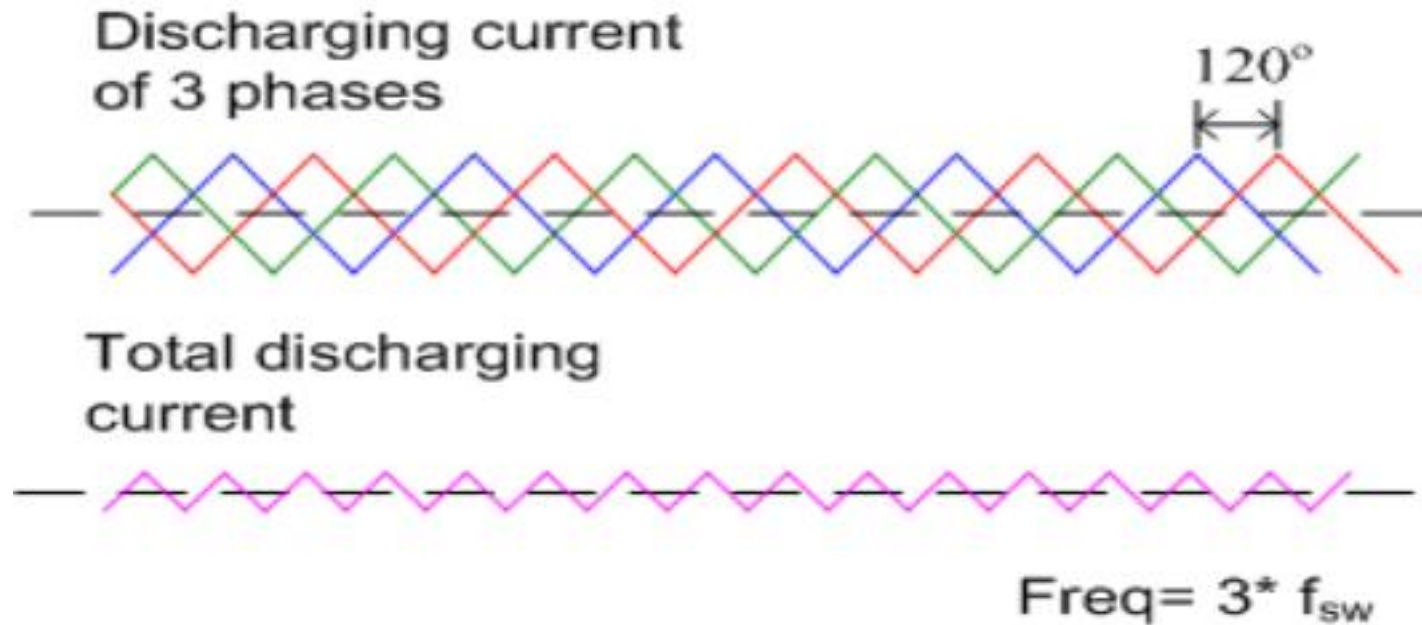
DC soft start



About Rectifier

- Boost type PFC
- No balance circuit needed
- Unit power factor, THDi<3%
- Battery discharge through rectifier
- No current flow between Utility and battery, more reliable

Interleave control of discharge

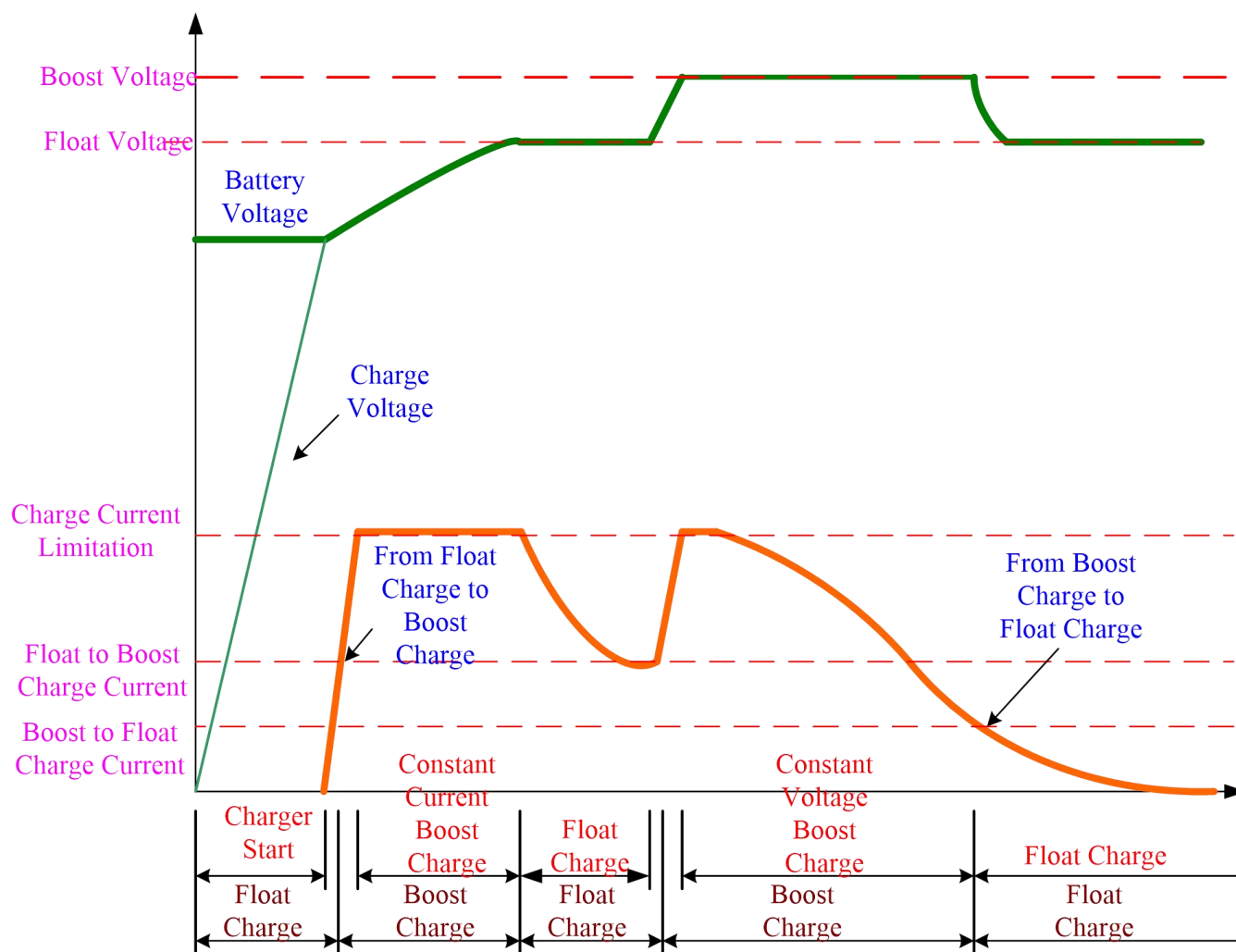


The current ripple is reduced by a factor of 3

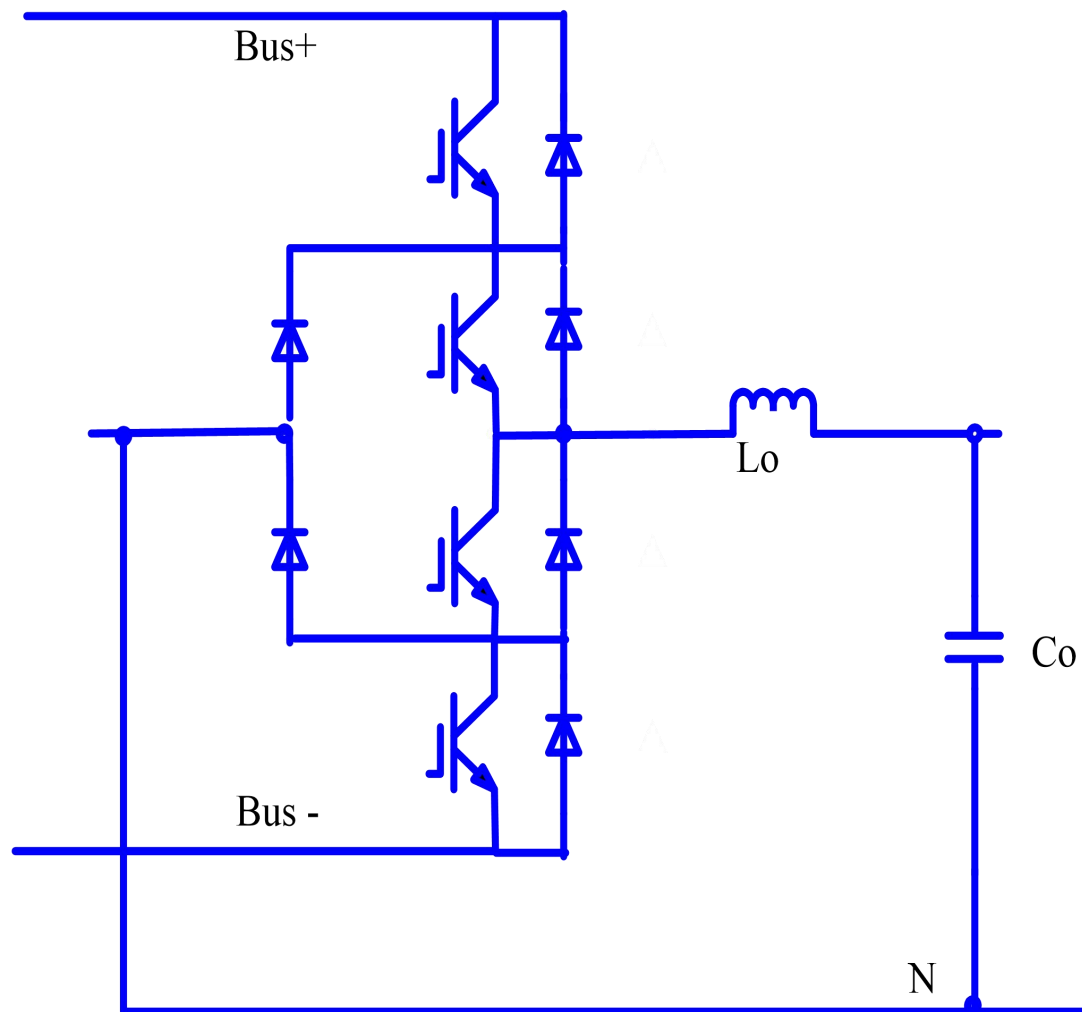


Triple frequency of the ripple current, smaller filter is needed.

Charging procedure analysis



Inverter topology



Diode-clamped 3 level Inverter

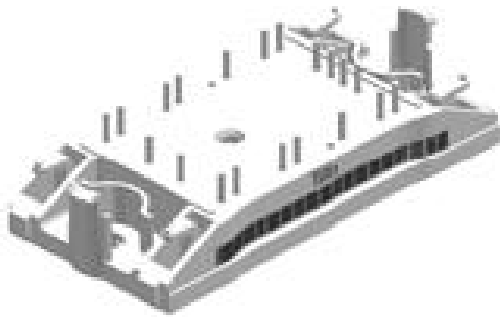
Integrated IGBT module

High efficiency

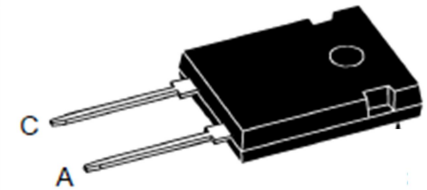
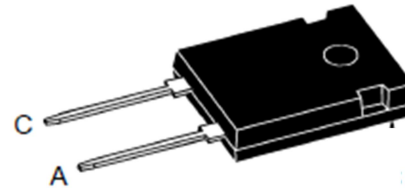
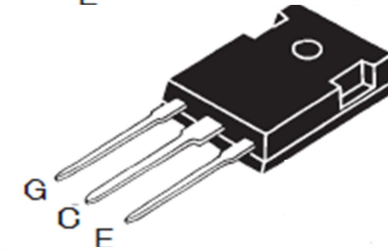
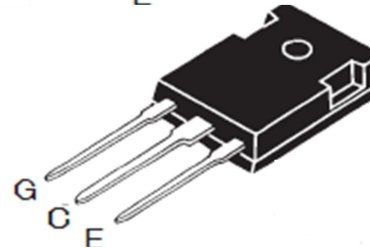
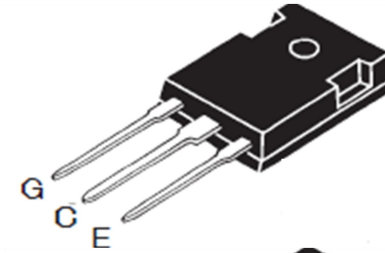
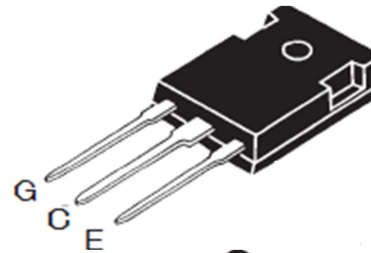
Small passive filter

Lower Noise

Integrated IGBT module



=



**Best performance on
electric and thermal**



**Lower loss, higher
efficiency**

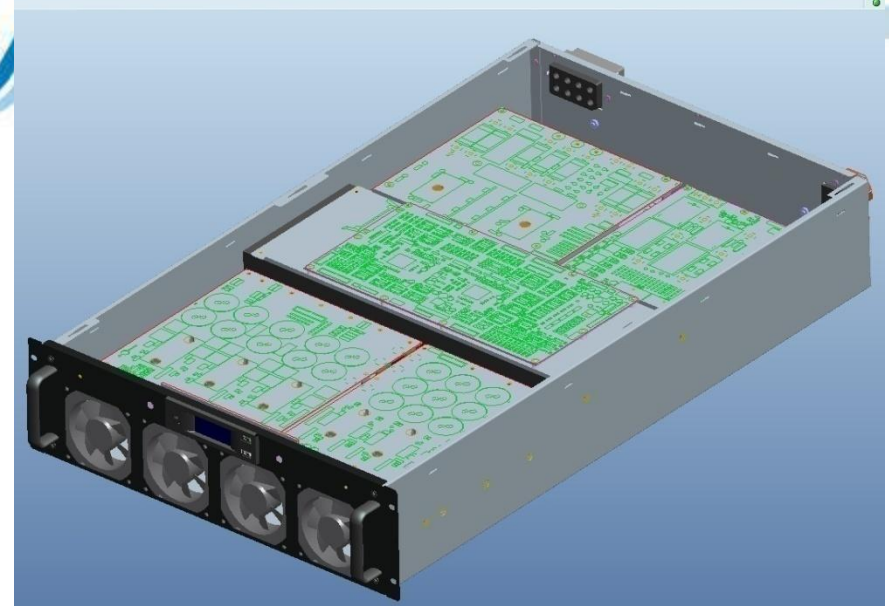


Easy for manufacturing

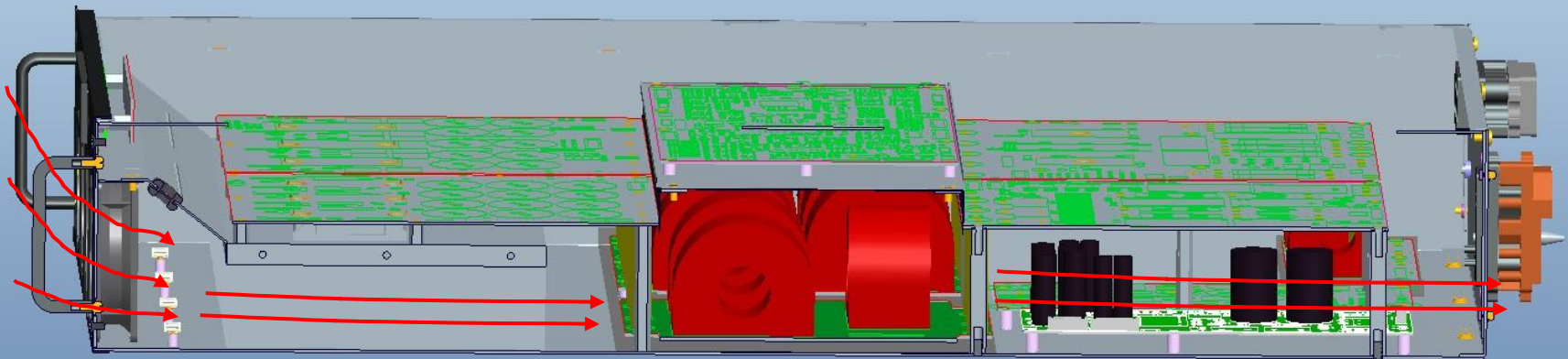


Improve reliability

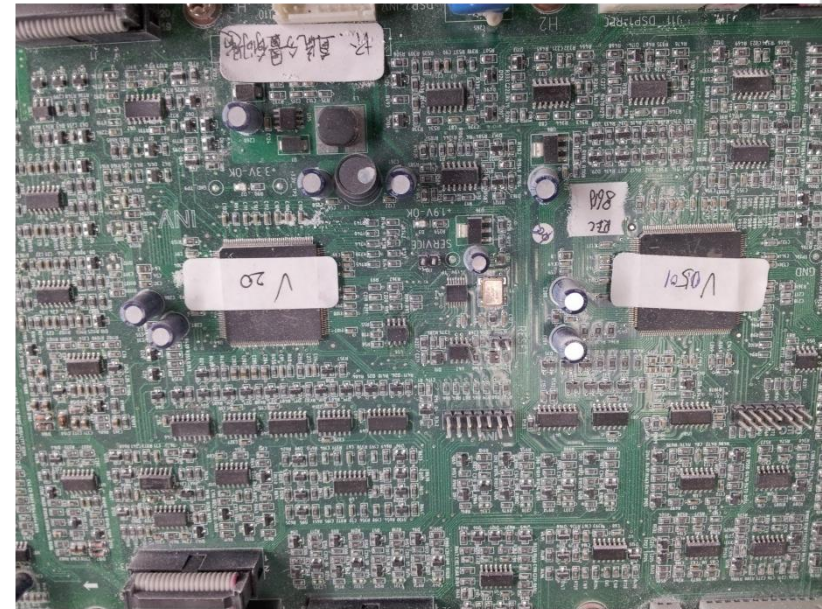
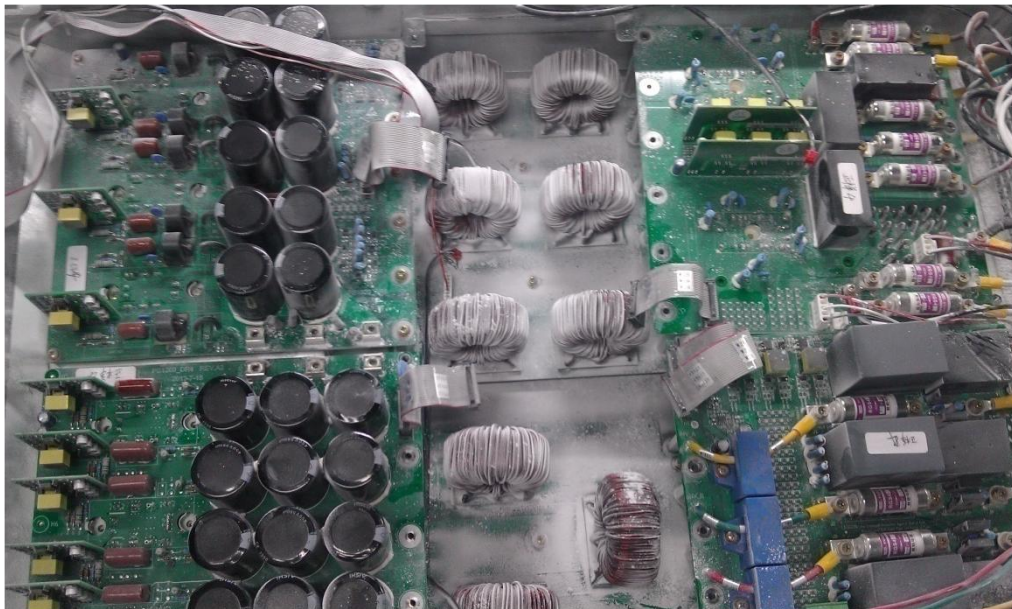
Isolated Air Flow



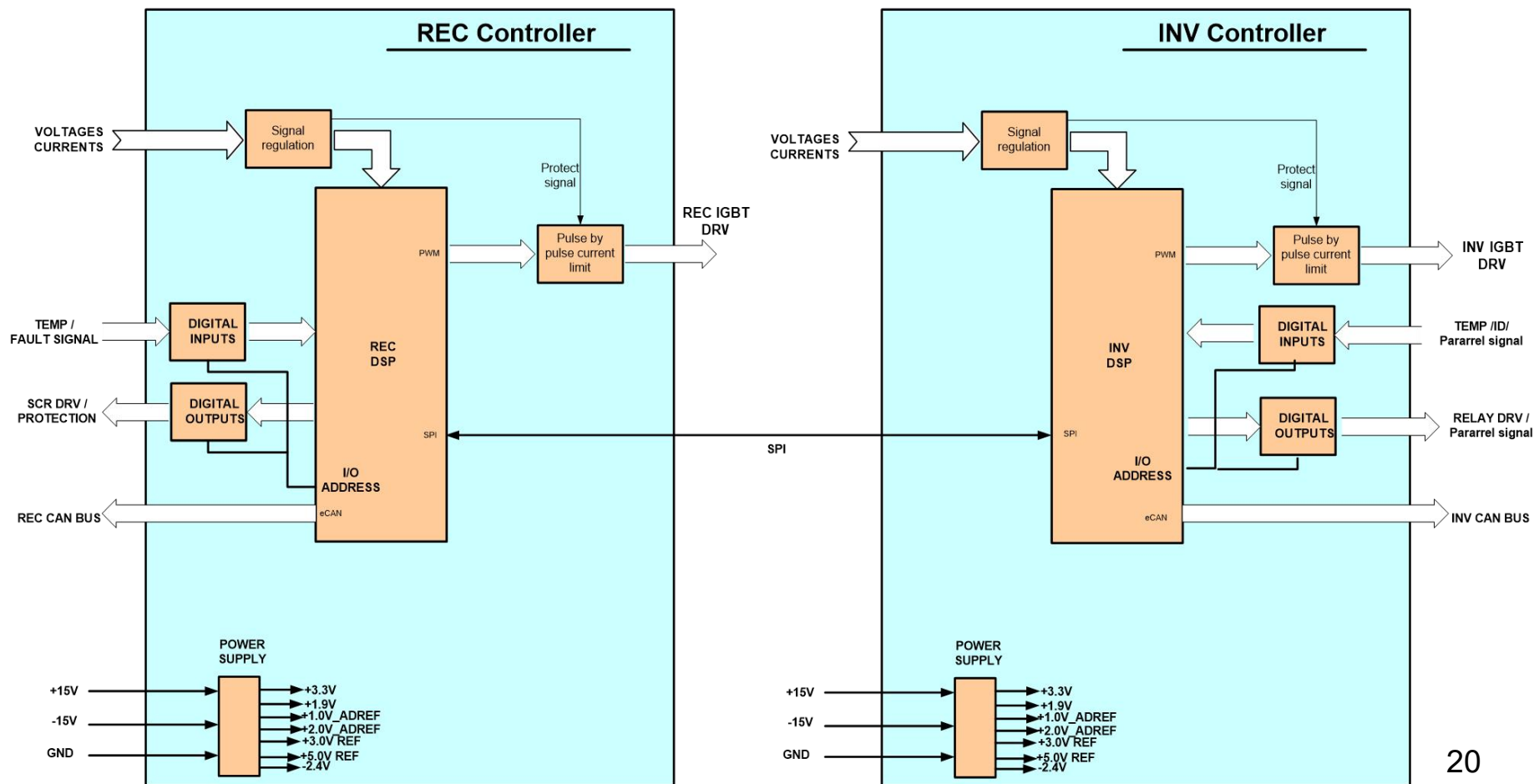
No dust through IGBT & Major PCBs



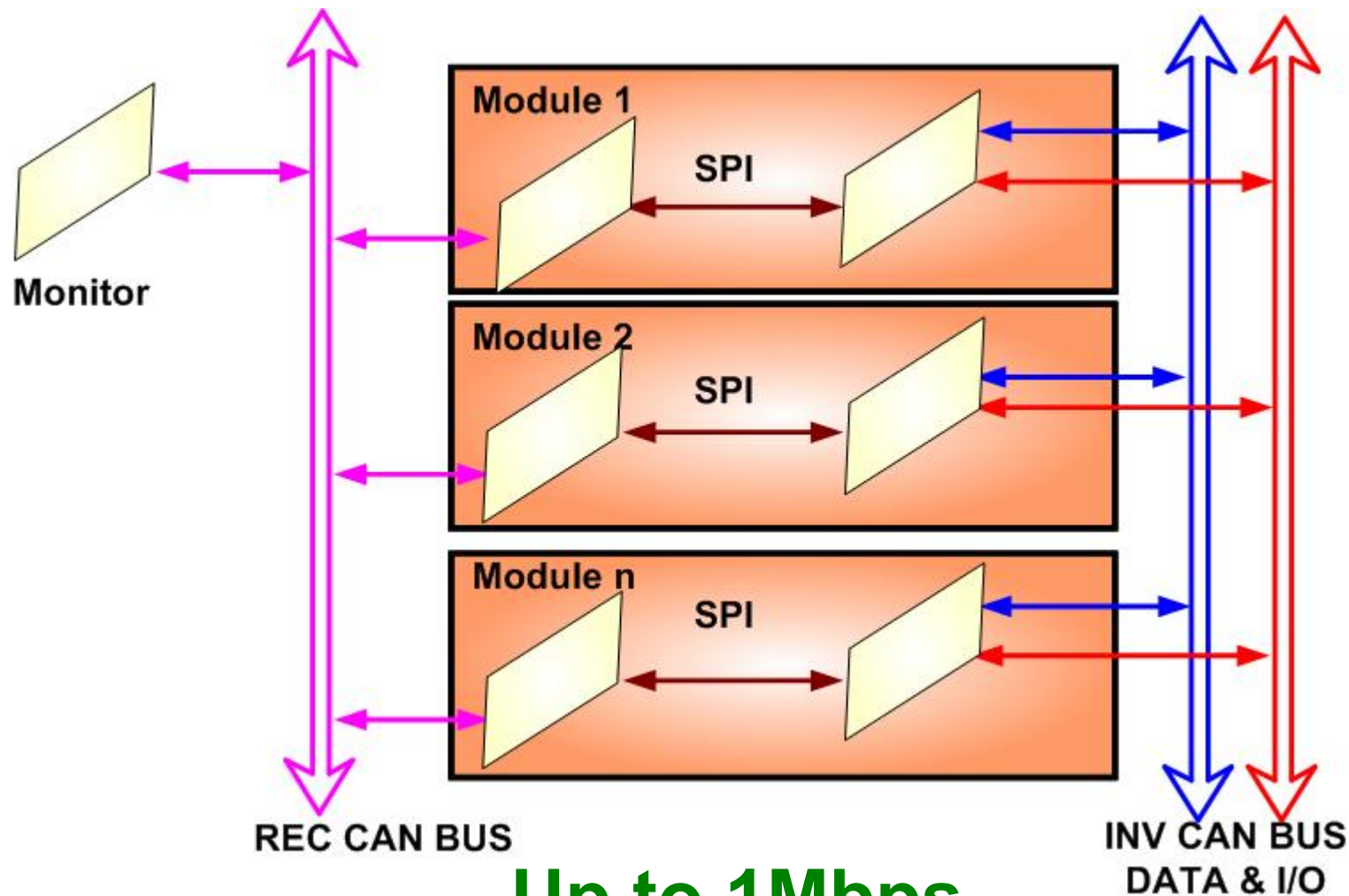
Dust Test



Control diagram of module



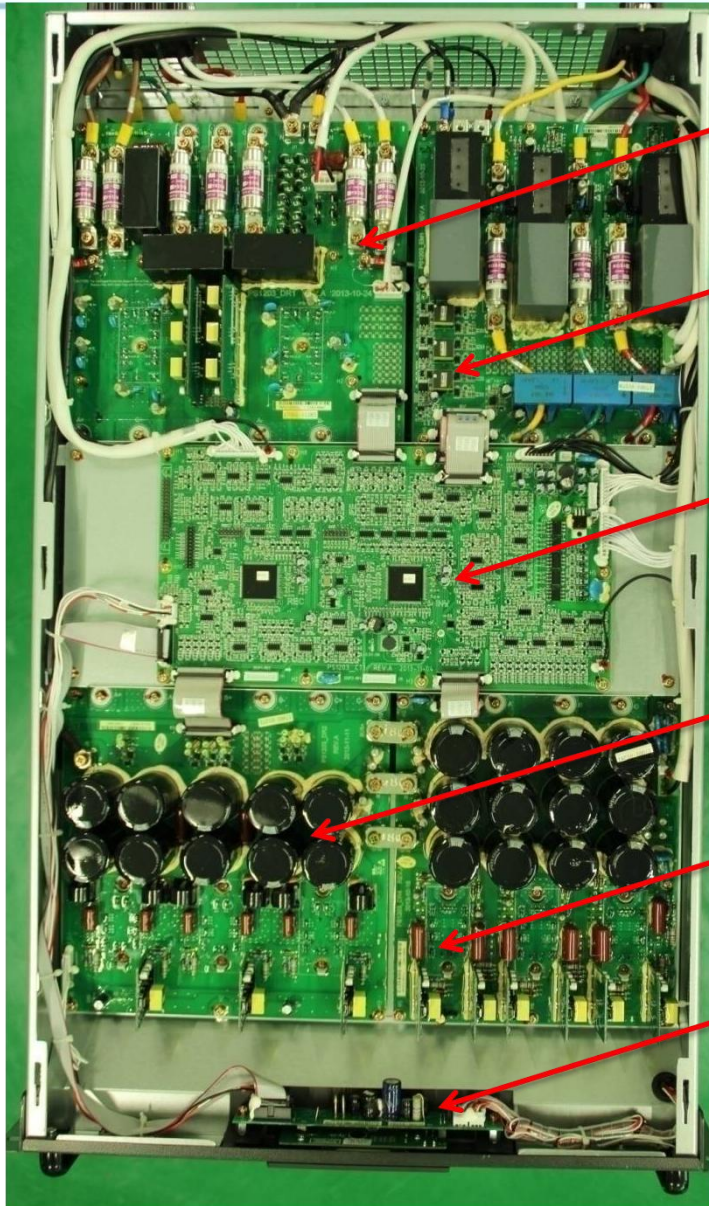
Communication diagram



PCB list--module

Part Number	Description	Quantity
17001-01274	REC INDUCTOR BOARD;ASY01_PS1203_CP2	1
17001-01275	REC POWER BOARD;ASY01_PS1203_DR2	1
17001-01276	INV POWER INDUCTOR;ASY01_PS1203_CP3	1
17001-01277	CHARGER BOARD;ASY01_PS1203_PW2	1
17001-01278	OUTPUT POWER BOARD;ASY01_PS1203_EM1	1
17001-01279	INPUT INDUCTOR BOARD;ASY01_PS1203_CP4	1
17001-01280	CONTROL BOARD;ASY01_PS1203_CT1	1
17001-01281	INV POWER BOARD;ASY01_PS1203_DR4	1
17001-01282	FAN POWER SUPPLY BOARD;ASY01_PS1203_PW1	1
17001-01283	INPUT SCR BOARD;ASY01_PS1203_DR1	1
17001-01322	AUX POWER SUPPLY;ASY01_PS1203_PW3	1

Power module PCB



Input SCR Board

Output power board

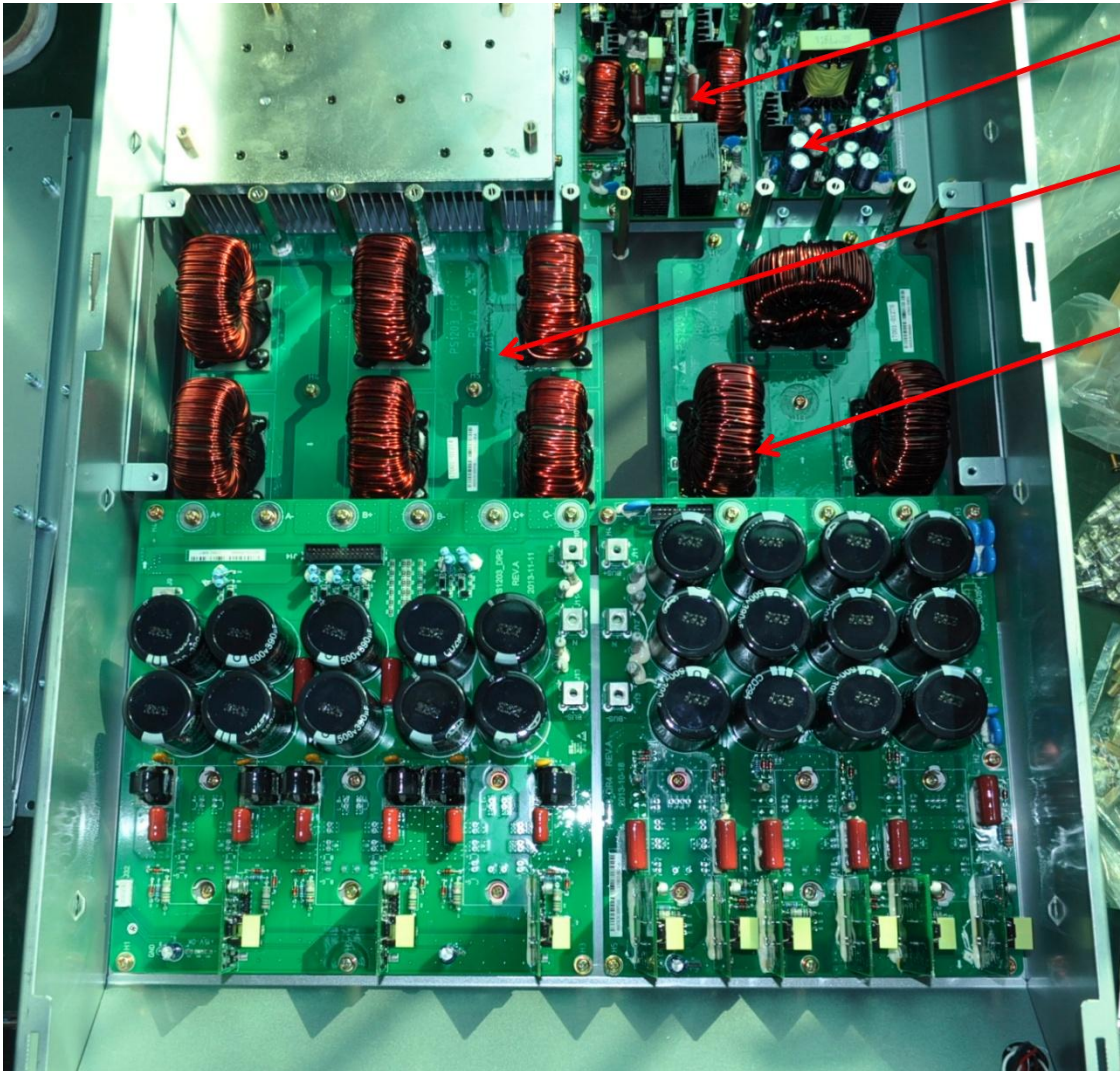
Control board

Rec power board

Inverter power board

Fan PS & LCD

Power module PCB



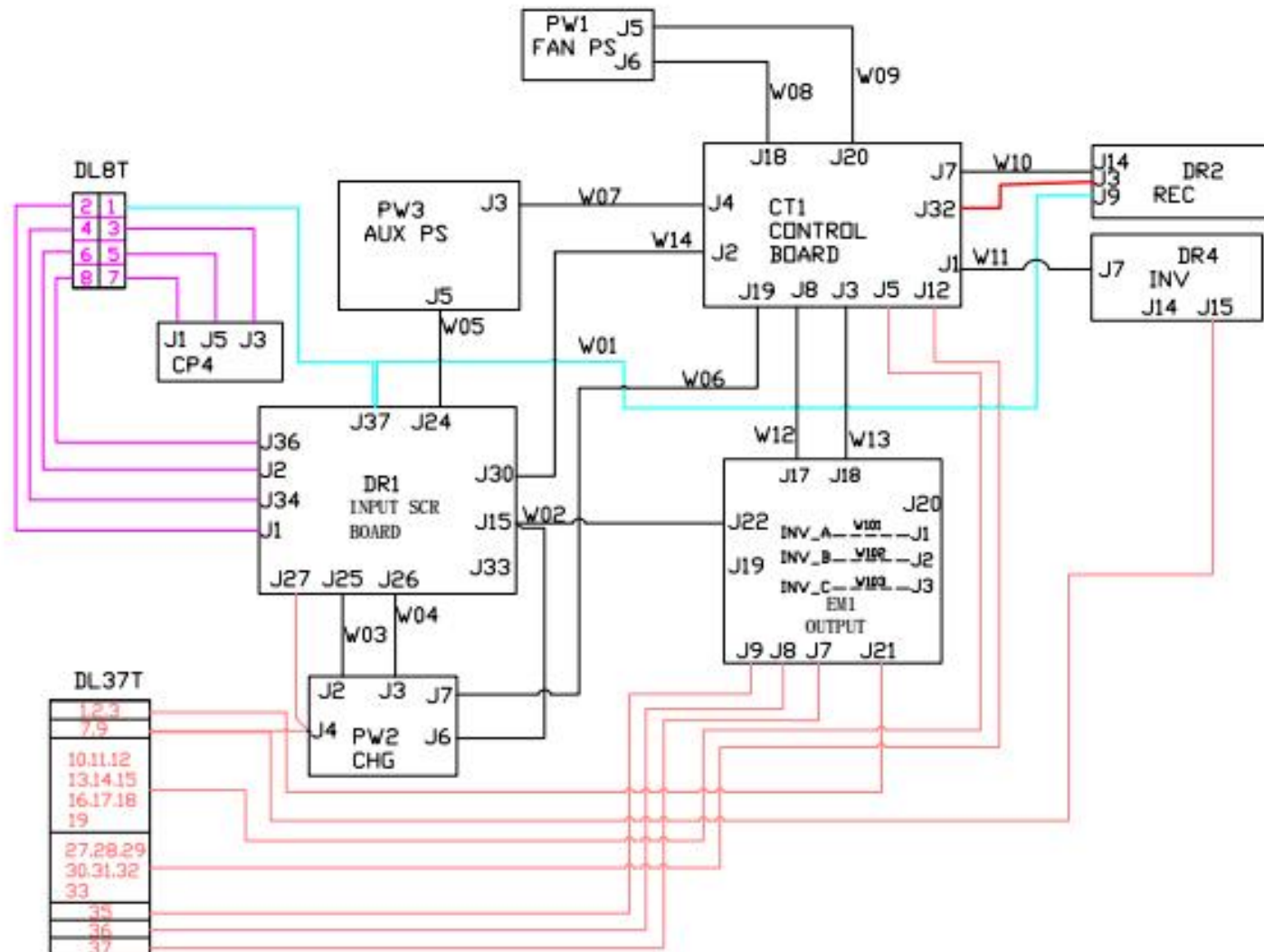
Charger board

AUX PS

Rec inductor board

Inv inductor board

Wiring diagram-- module

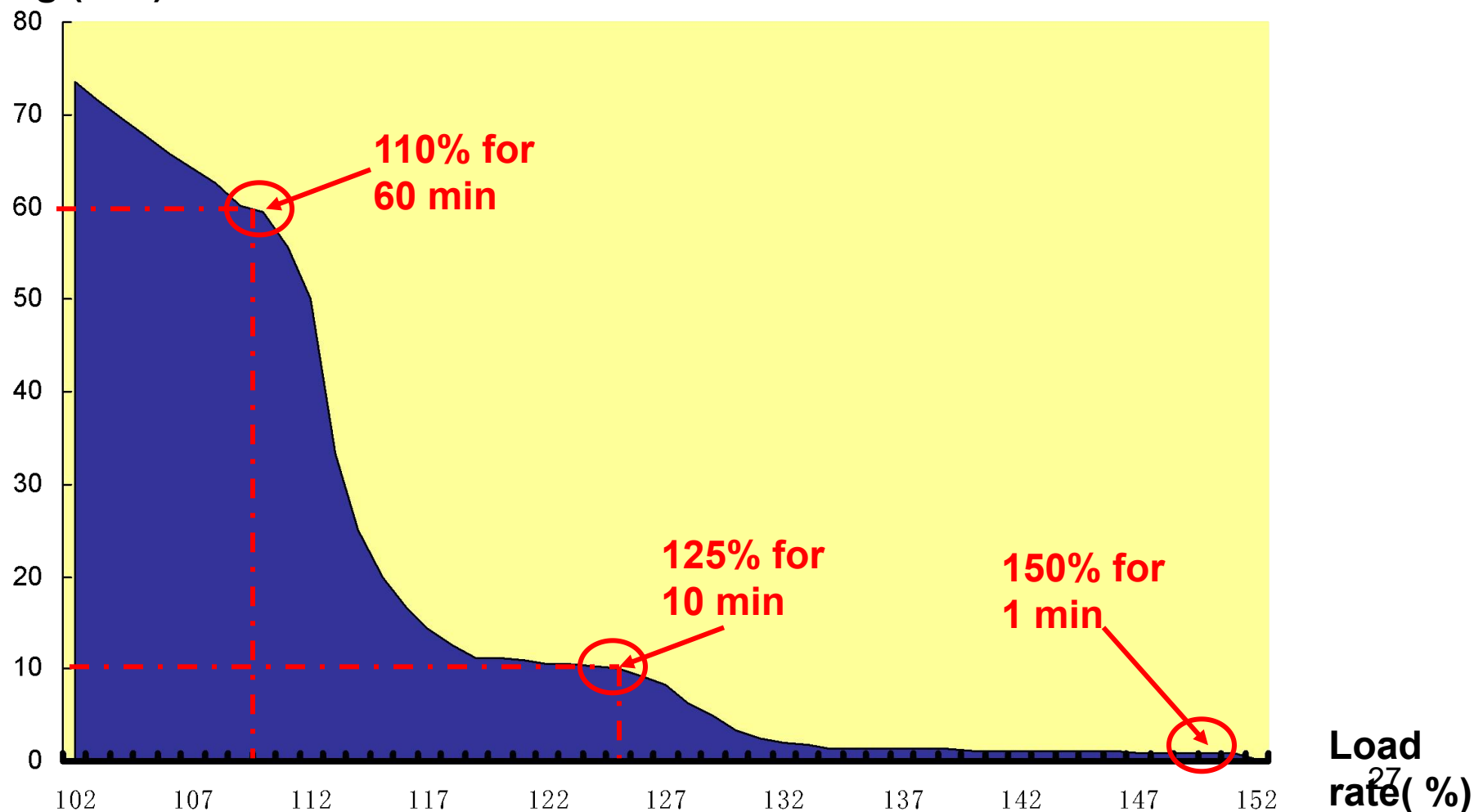


Performance-- Efficiency



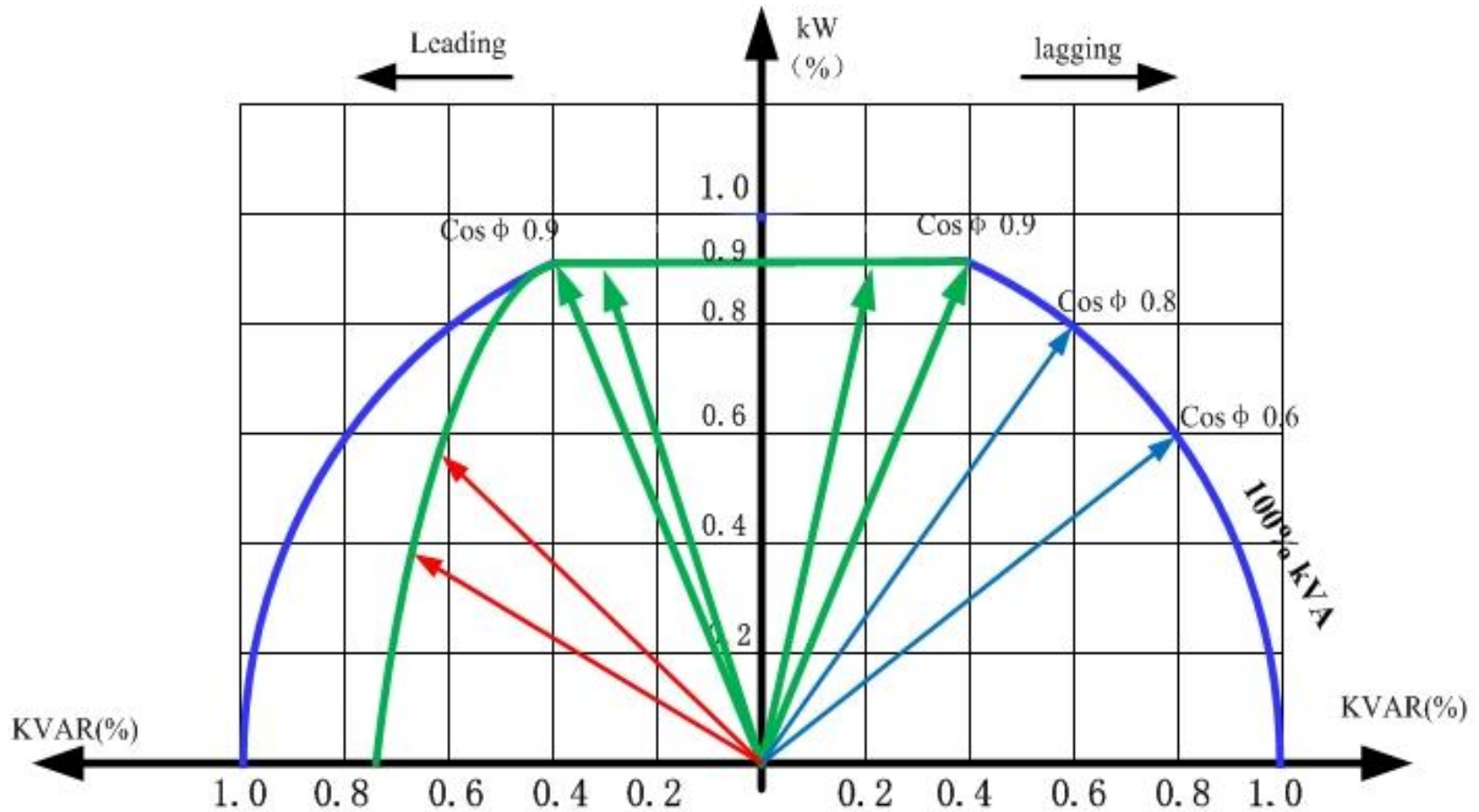
Performance--- Overload

Overload
timing (min)



Load
rate(%)

Load Adaptability



For $0.9_{\text{lagging}} < \text{Cos } \phi < 0.9_{\text{leading}}$ **No derating for active power**

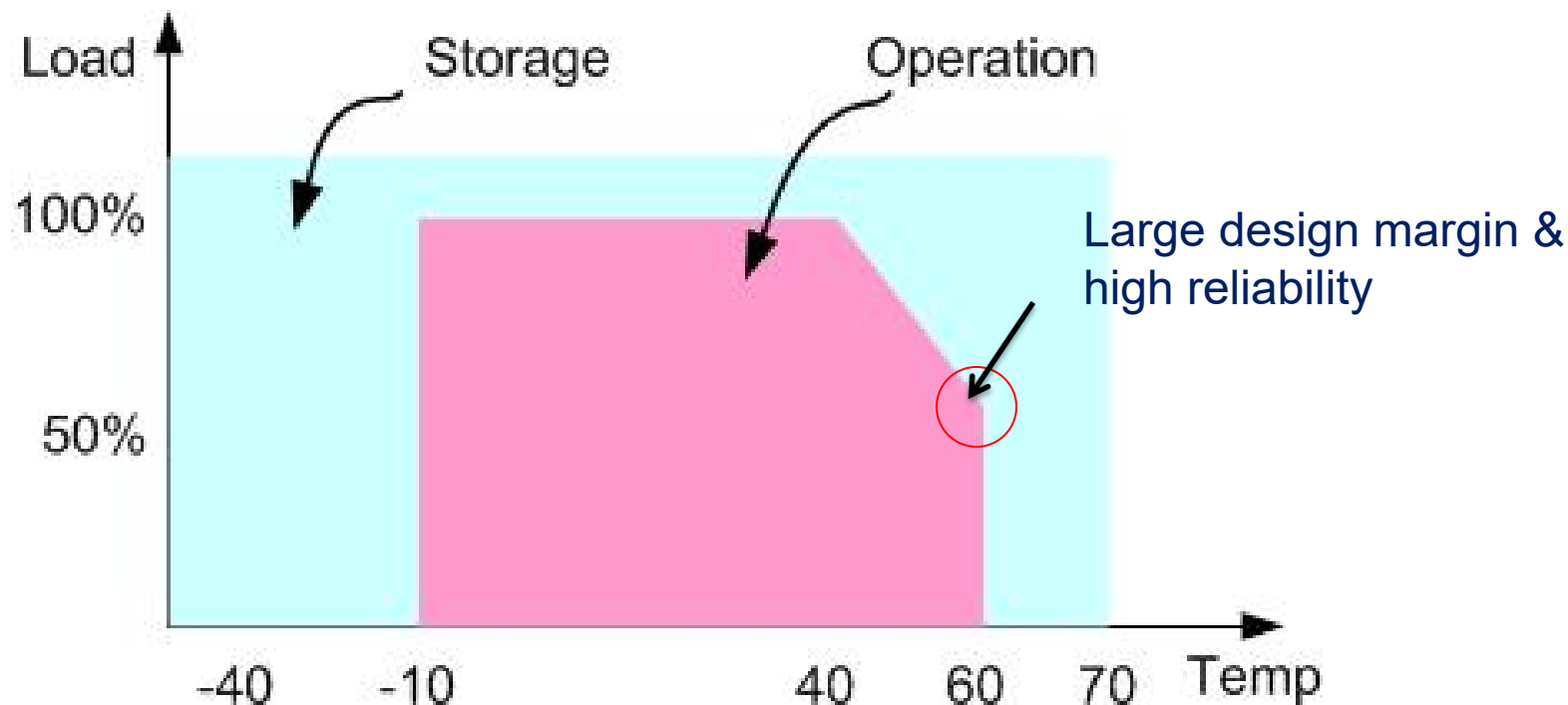
Test Items--Environment

Storage: -40-70°C

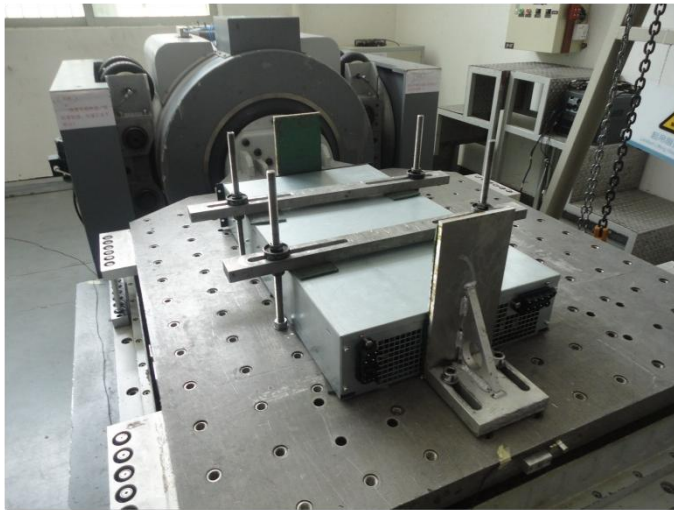
Operation: -10°C@full load

40°C, 95%RH@full load

60°C, 95%RH@50% load



Reliability & EMC Test



PM30 power module -- Design



**LCD to show the
Module status.**

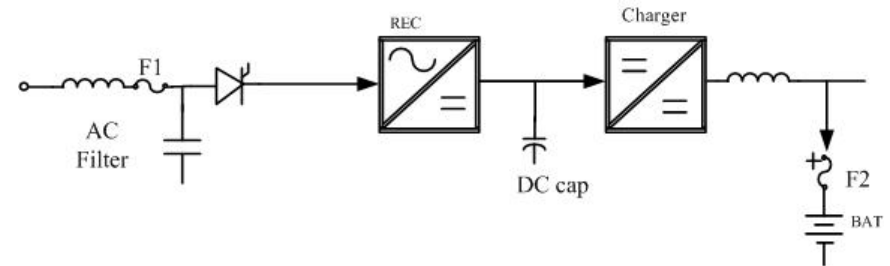
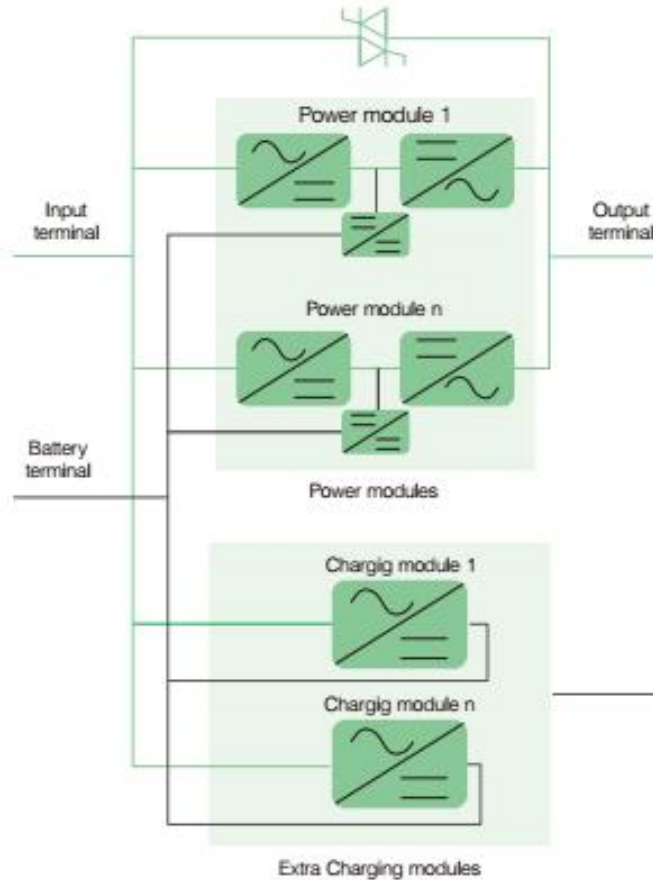


Alarm code table

CODE	Possible fault
16	Utility fail
18	Byp sequence fail
20	Byp voltage abnormal
28	Byp frequency out of syn window
30	Transfer times limit in one hour
32	Output shorted
34	Battery end of discharge(EOD)
38	Battery test fail
41	Battery maintenance fail
47	Rec fail
49	Inv fail
51	Rec over temperature
53	Fan fail
55	Output overload
57	Output overload time is out
59	Inv over temperature
61	Inhibit to transfer to inverter
65	Battery voltage low

CODE	Possible fault
67	Battery connection reversed
69	Inverter protected
71	Input Neutral lost
74	Manual shut down of module
81	Battery or charger fail
83	Redundancy lost alarm
85	Inhibit output after EOD
93	I/O CAN fail
95	DATA CAN fail
97	Power sharing fail
99	Syn signal fail
109	Inverter fail
111	Outlet temperature alarm
113	Input current unbalance
115	DC bus over voltage
117	Rec soft start fail
119	Inv relay open
121	Inv relay shorted
123	PWM syn signal fail
125	Sleep mode
127	Manual transfer to inverter

Charger module



Max 50A charging current -
- settable



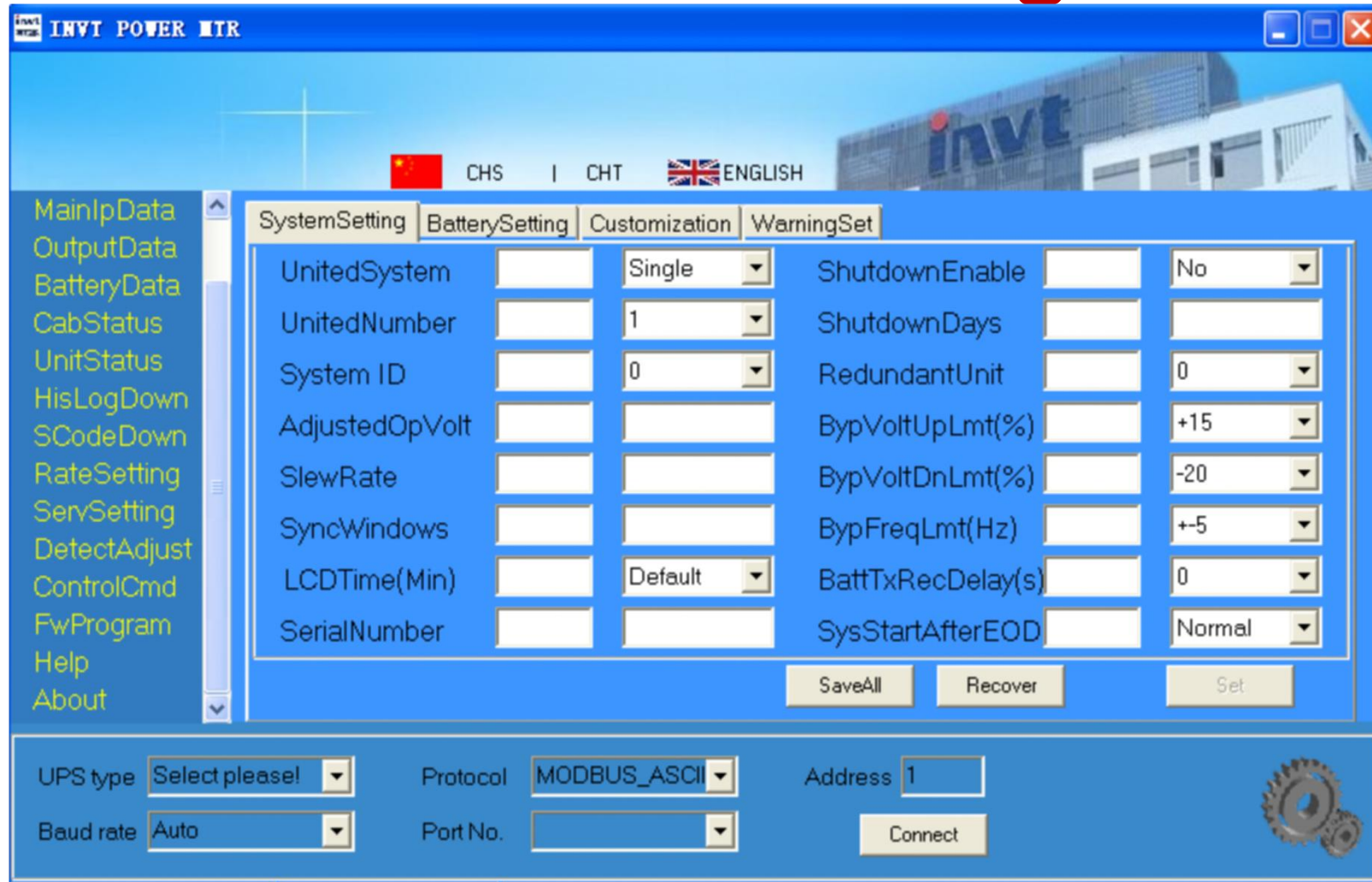
How to calculate the charging current

- For power module, the max charger power is 20% of output power.

$$I_{\text{chg_PM}} = P_{\text{chg}} / U_{\text{boost}}$$
$$= (0 \sim 20)\% * P_{\text{out}} / (2.35 * 6 * \text{Battery number})$$

- For charger module , set the demanded current $I_{\text{chg_module}}$, (0-50A).
- $I_{\text{chg_PM}} + I_{\text{chg_module}} < 0.2 * \text{Battery AH}$

INVT Monitoring software



INVT POWER MTR

CHS | CHT | ENGLISH

MainIpData
OutputData
BatteryData
CabStatus
UnitStatus
HisLogDown
SCodeDown
RateSetting
ServSetting
DetectAdjust
ControlCmd
FwProgram
Help
About

SystemSetting | BatterySetting | Customization | WarningSet

UnitedSystem		Single	ShutdownEnable		No
UnitedNumber		1	ShutdownDays		
System ID		0	RedundantUnit		0
AdjustedOpVolt			BypVoltUpLmt(%)		+15
SlewRate			BypVoltDnLmt(%)		-20
SyncWindows			BypFreqLmt(Hz)		+-5
LCDTime(Min)		Default	BattTxRecDelay(s)		0
SerialNumber			SysStartAfterEOD		Normal

SaveAll Recover Set

UPS type Select please! Protocol MODBUS_ASCII Address 1

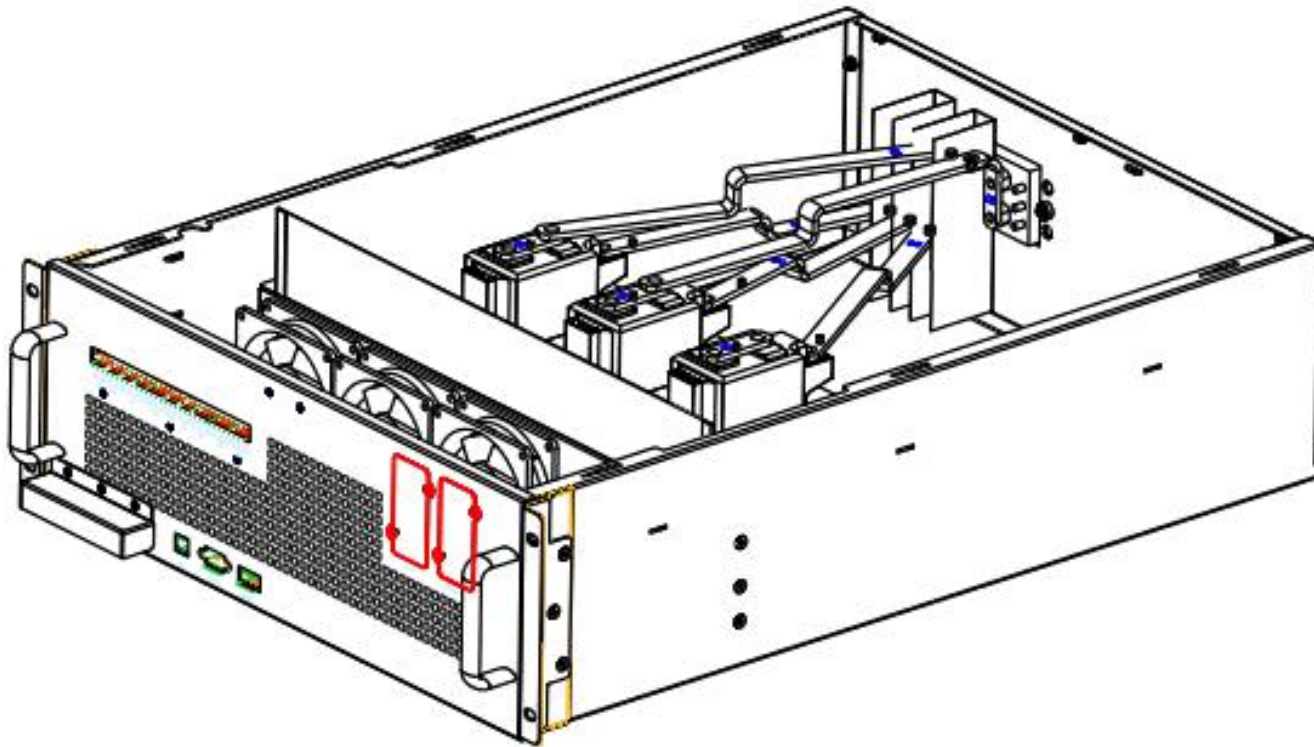
Baud rate Auto Port No. Connect

All INVT products share the same monitoring software.

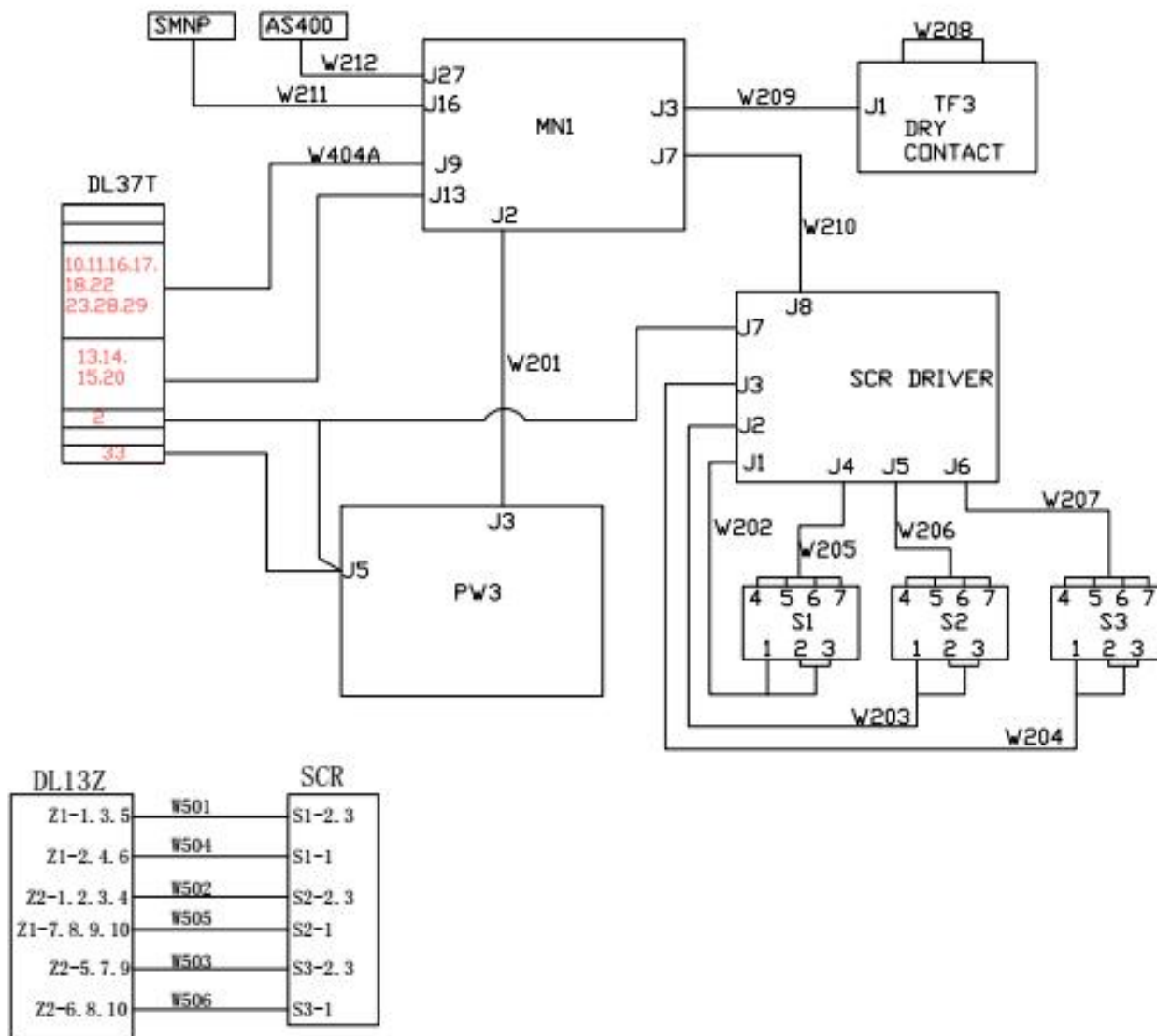
Available frame



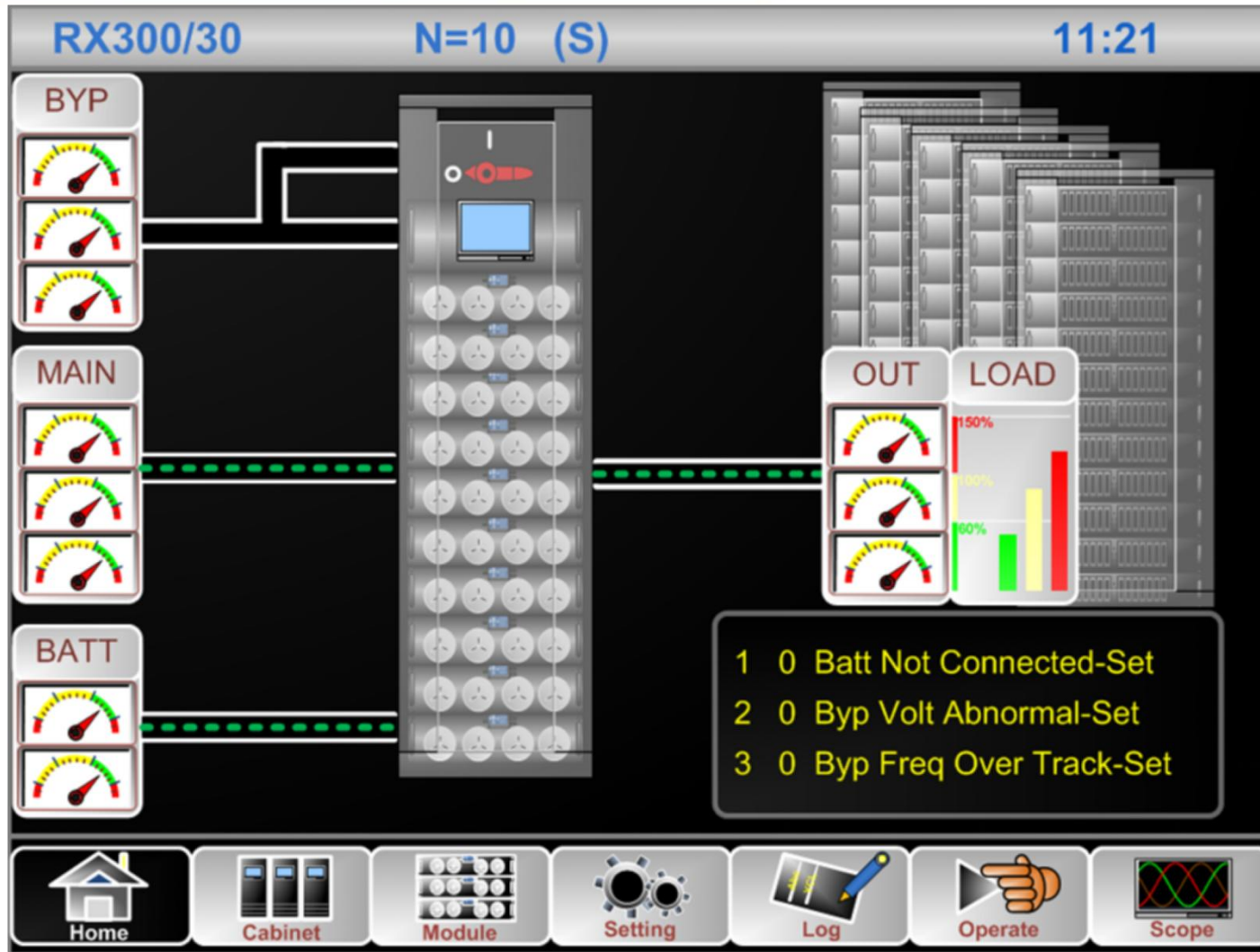
Monitoring module—3 slots



Monitoring module wiring



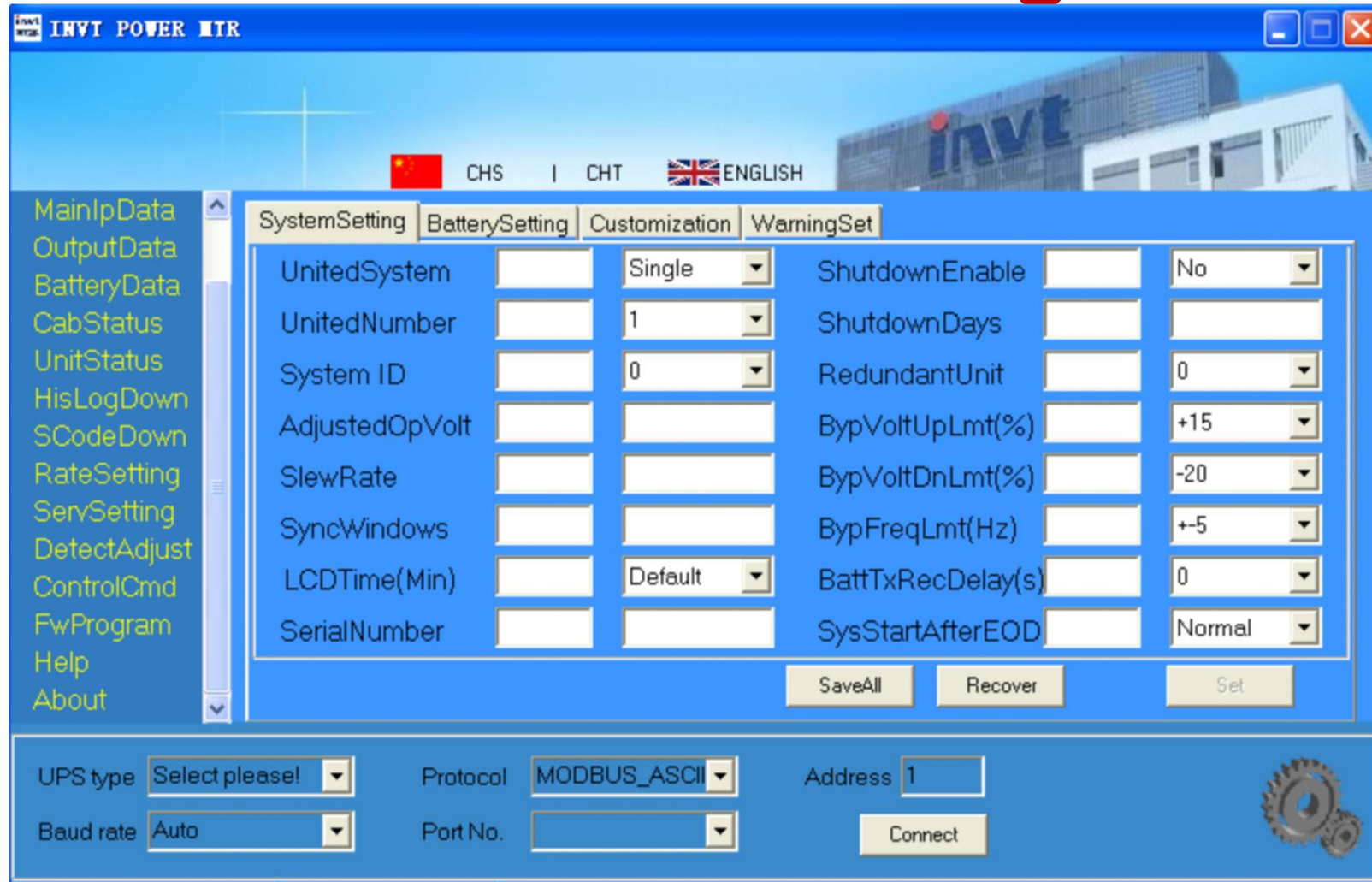
HMI



Interface

- **Standard:**
RS232, RS485, USB, Dry contact,
- **Option:**
SNMP, Parallel, Expansion Dry Contact card, Remote Monitor, LBS

INVT Monitoring software



INVT POWER MTR

CHS | CHT | ENGLISH

MainIpData
OutputData
BatteryData
CabStatus
UnitStatus
HisLogDown
SCodeDown
RateSetting
ServSetting
DetectAdjust
ControlCmd
FwProgram
Help
About

SystemSetting | BatterySetting | Customization | WarningSet

UnitedSystem		Single	ShutdownEnable		No
UnitedNumber		1	ShutdownDays		
System ID		0	RedundantUnit		0
AdjustedOpVolt			BypVoltUpLmt(%)		+15
SlewRate			BypVoltDnLmt(%)		-20
SyncWindows			BypFreqLmt(Hz)		+-5
LCDTime(Min)		Default	BattTxRecDelay(s)		0
SerialNumber			SysStartAfterEOD		Normal

SaveAll Recover Set

UPS type Select please! Protocol MODBUS_ASCII Address 1

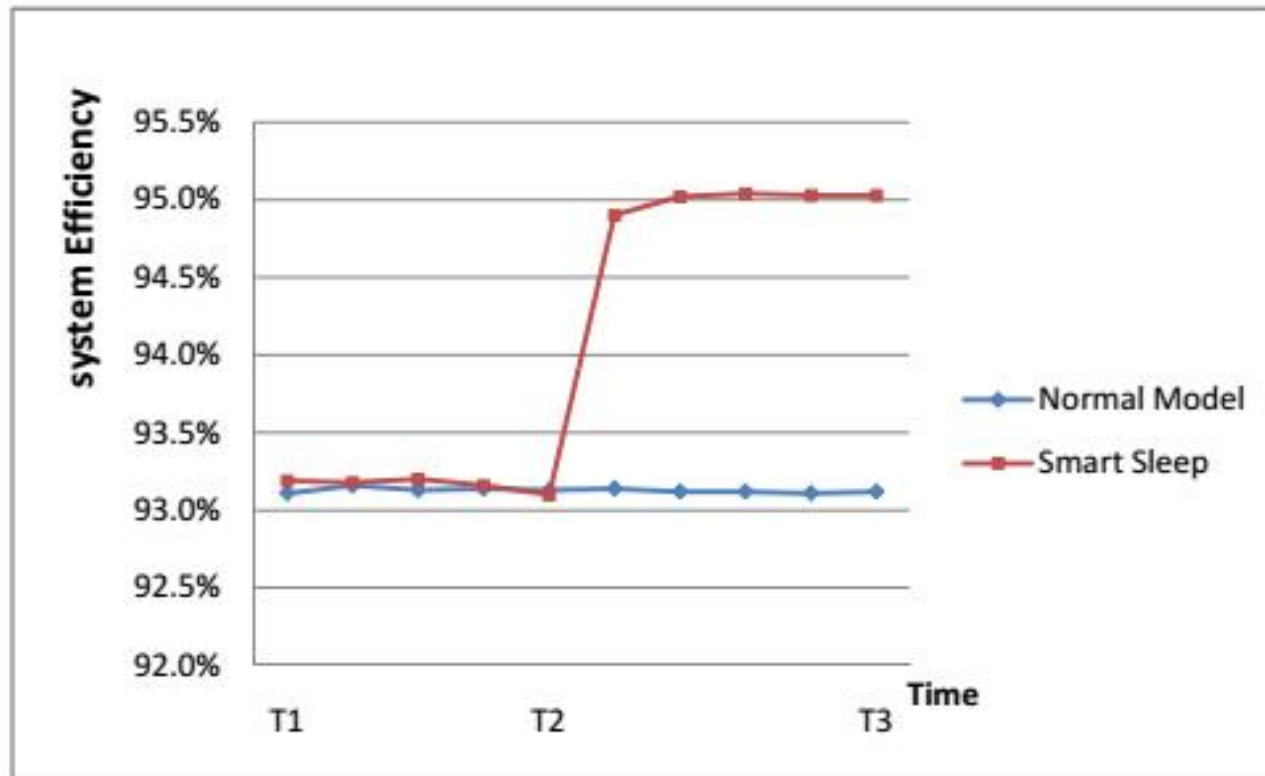
Baud rate Auto Port No. Connect

All INVT products share the same monitoring software.

Special Functions

- Intelligent Sleep mode
- Self Aging---test without load
- Complete Temperature sensing, to improve the reliability
- Store the critical waveforms when fault happens
- Online Programmable Dry Contact

Intelligent Sleep mode



Providing high efficiency for full range of load rate
Normal Sleep mode & Deep Sleep mode
Module rotation automatically

Sleep mode setting

CHS ENGLISH

System Setting Battery Setting Customization WarningSet DryContactSet

Home
BypassData
MainIpData
OutputData
BatteryData
CabStatus
UnitStatus
HisLogDown
SCodeDown
RateSetting
ServSetting
DetectAdjust
ControlCmd
FwProgram

CustomCode

☐ Tx2InvIntEnable(0)	☐ Reserved(9)
☐ ModOnOffEnable(1)	☐ Reserved(A)
☒ SleepEnable(2) 1	☐ Reserved(B)
☒ DeepSleepEnable(3) 2	☐ Reserved(C)
☐ Reserved(4)	☐ Reserved(D)
☐ SciLcdEnable(5)	☐ Reserved(E)
☐ InletOvTmpAlmEn(6)	☐ Reserved(F)
☐ ForbidTx2Byp(7)	
☐ Reserved(8)	

SleepLoadLevel(%) 60

SleepRotationT(Months) 3

Set

UPS type 3/3X(10-600kVA) Protocol MODBUS_ASCII Address 1

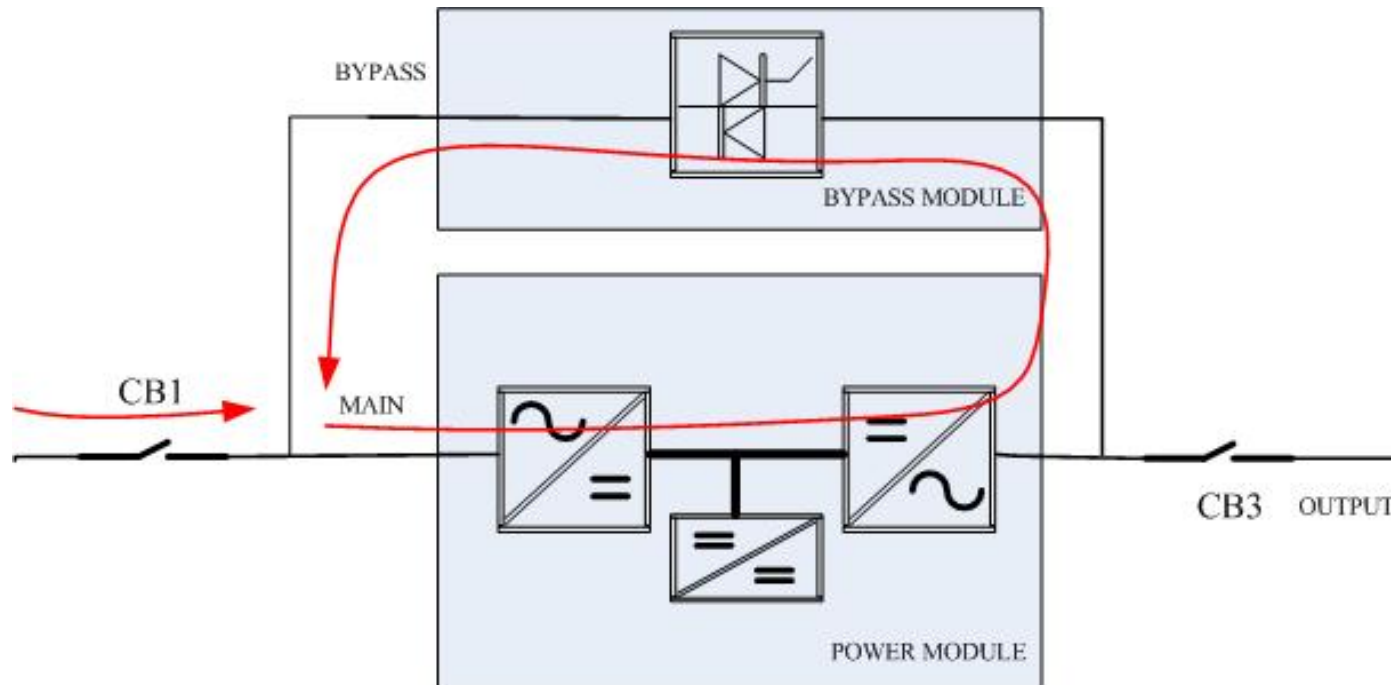
How to calculate

- For a setting of load rate of a%, the number of working modules N should be calculated by,

$$\frac{\text{Load}}{a\% * P_{\text{module}}} < N < \frac{\text{Load}}{a\% * P_{\text{module}}} + 1$$

- For example, the load is 65kVA for 300kVA cabinet ,the setting load level is 40%, then the required number of modules is 6, then 4 modules should be in sleep mode.

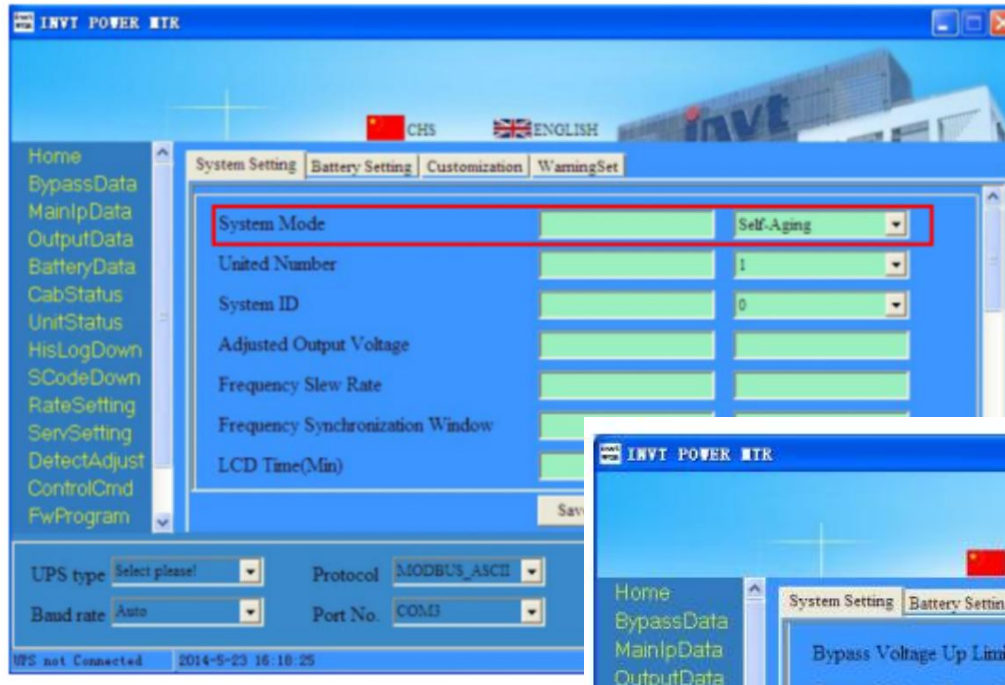
Self Aging



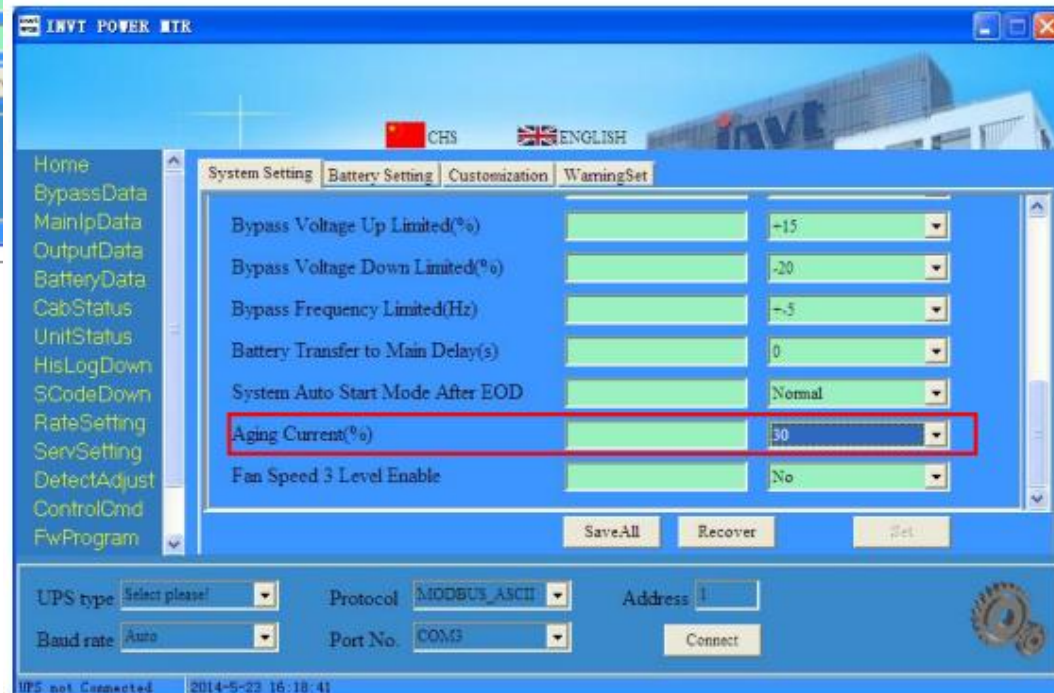
**Aging without load connected;
Reduce the power consumption up to 90%;
Only by software setting , no hardware change;
For factory test or customers' reception.**

Self aging setting

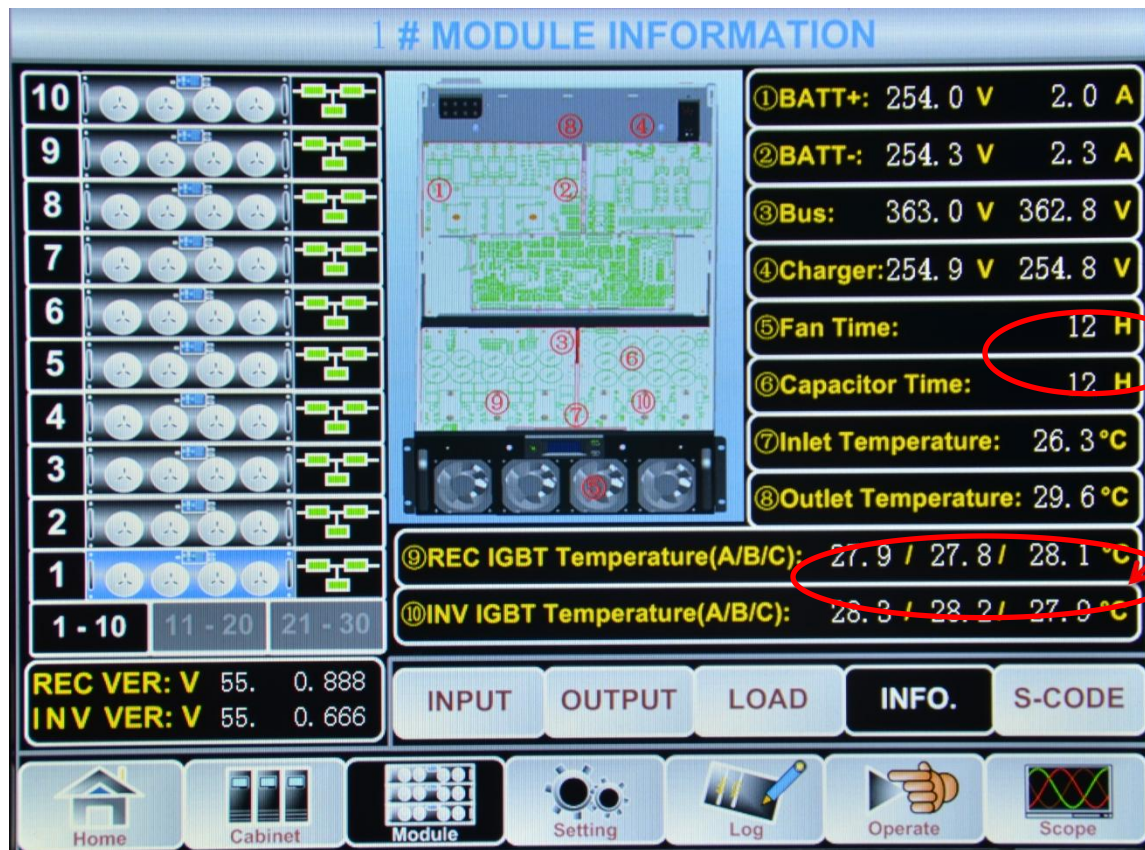
Enable self aging mode



Set the self aging level



Monitoring of critical components



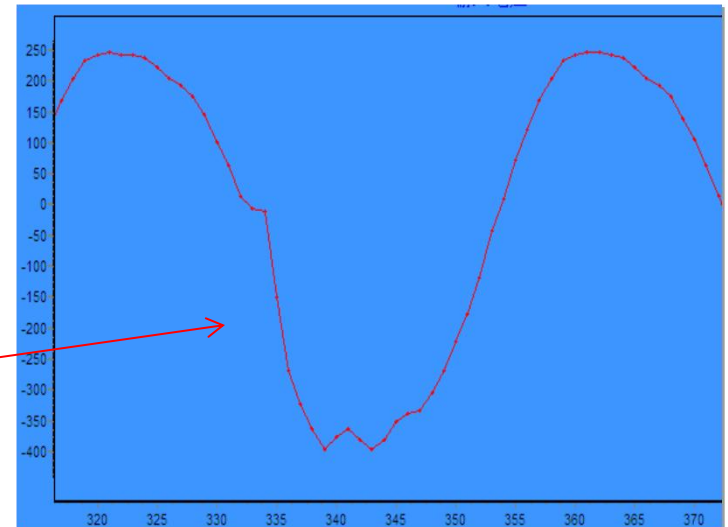
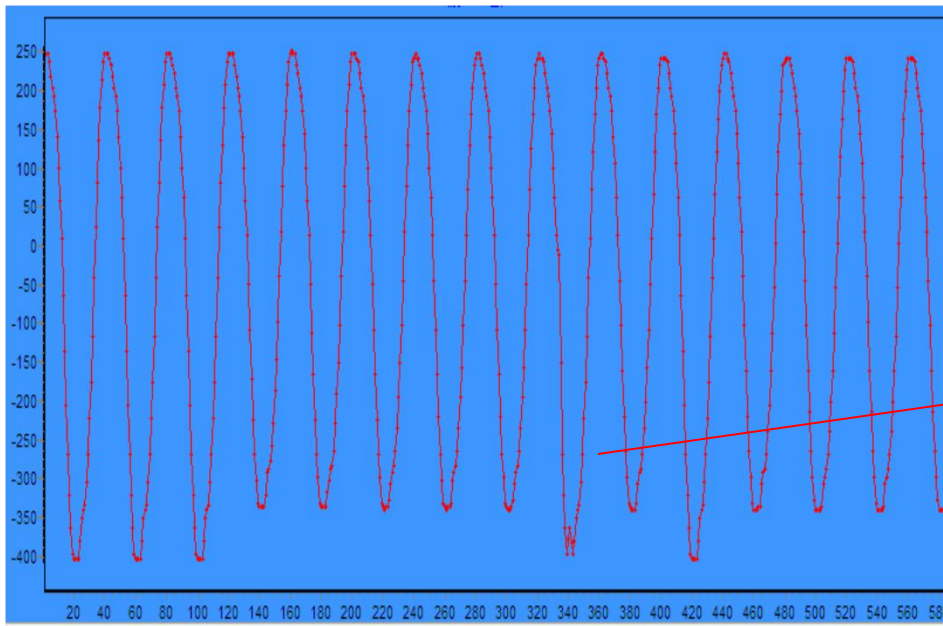
The run time of fan and caps

The temp of all IGBT components

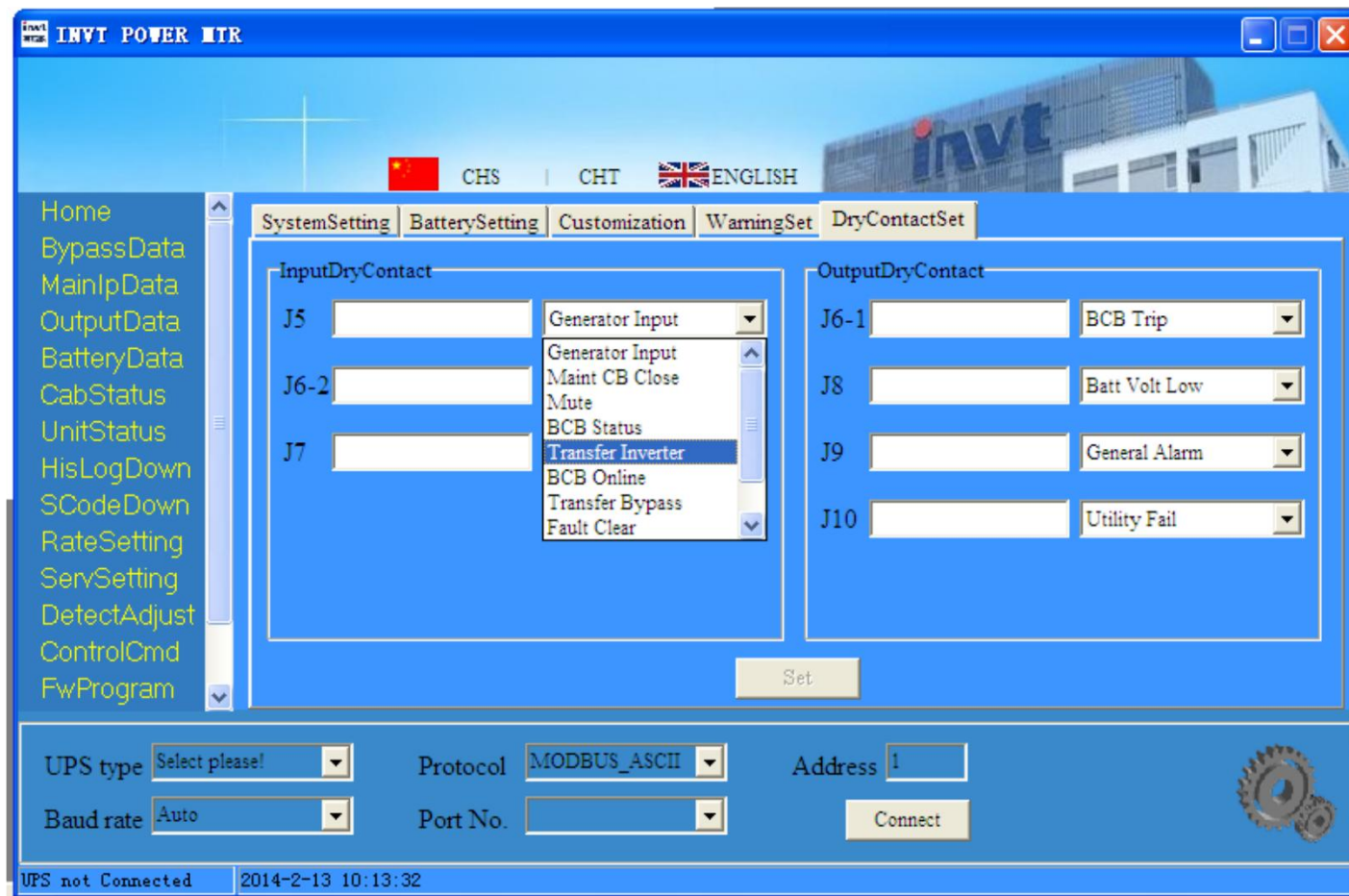
- ◆ **Monitor the running time of fans and capacitors for service purpose.**
- ◆ **Temperature sensing includes: 6 IGBT modules, inlet & outlet temperature, heat sink temperature.**
- ◆ **Flexible & reliable over temperature protection--normal mode & fault mode.**
- ◆ **Ensure the manufacturing quality – to identify the fault in the factory.**

Store the critical waveforms

- When fault happens, critical waveforms will be stored .
- Very helpful for trouble shooting.

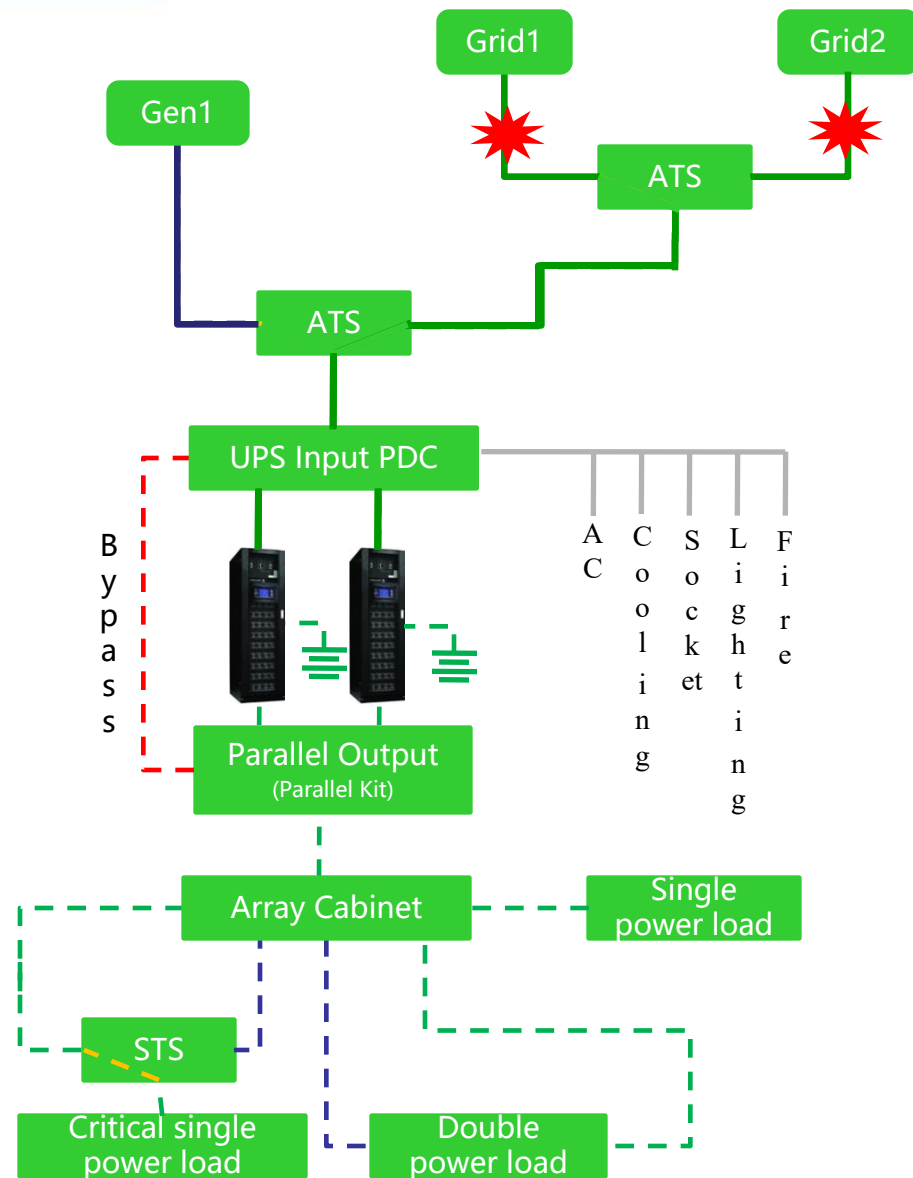


Programmable Dry Contact

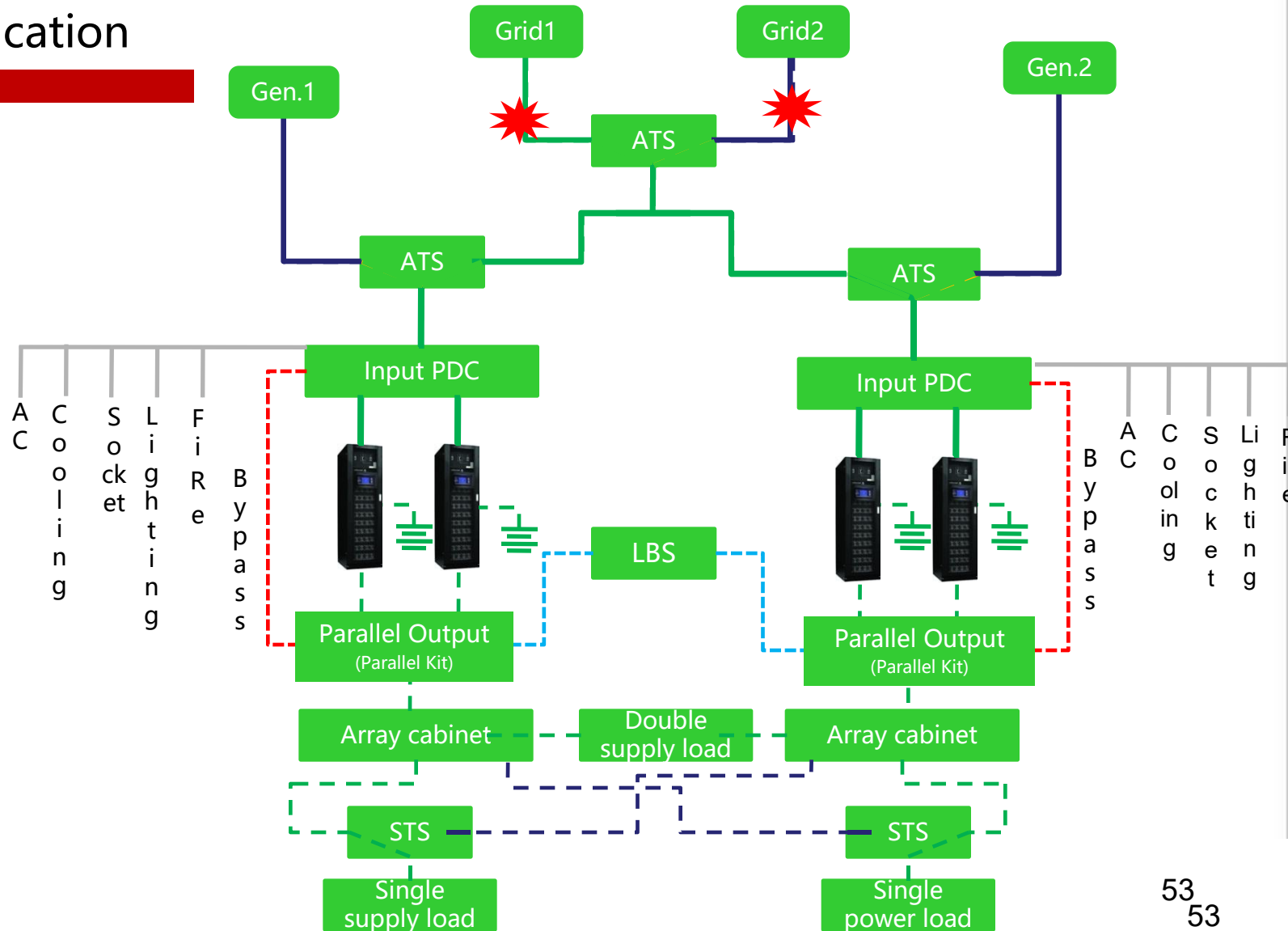


10 optional signals as input dry contact
14 optional signals as output dry contact

1 + 1 Parallel redundancy



LBS application



invt

invt 英威腾电气

品质至精
Delicate Quality

深圳市英威腾电源有限公司
INVT POWER SYSTEM (Shenzhen) CO., LTD.

Address: 5# Building, Gaofa Industrial Park, Longjing, Nanshan District, Shenzhen, China

TEL: 0755-26782664 FAX: 0755-26782664

Website: www.invtpower.com