Technical Specification of GME1F33/GME1F53 FM Broadcasting Transmitter

Beijing Duoyang Gigamega Technology Co., Ltd.

1. Technical manual

1.1 Transmitter composition and working principle

GME1F33/GME1F53 all solid FM transmitter mainly consists of five parts: exciter, RF system (including power amplifier unit, distributor, synthesizer, directional coupler and so on), control system, air cooling system and power supply; please refer to GME1F33/GME1F53 type FM3KW/5KW transmitter structural drawing.

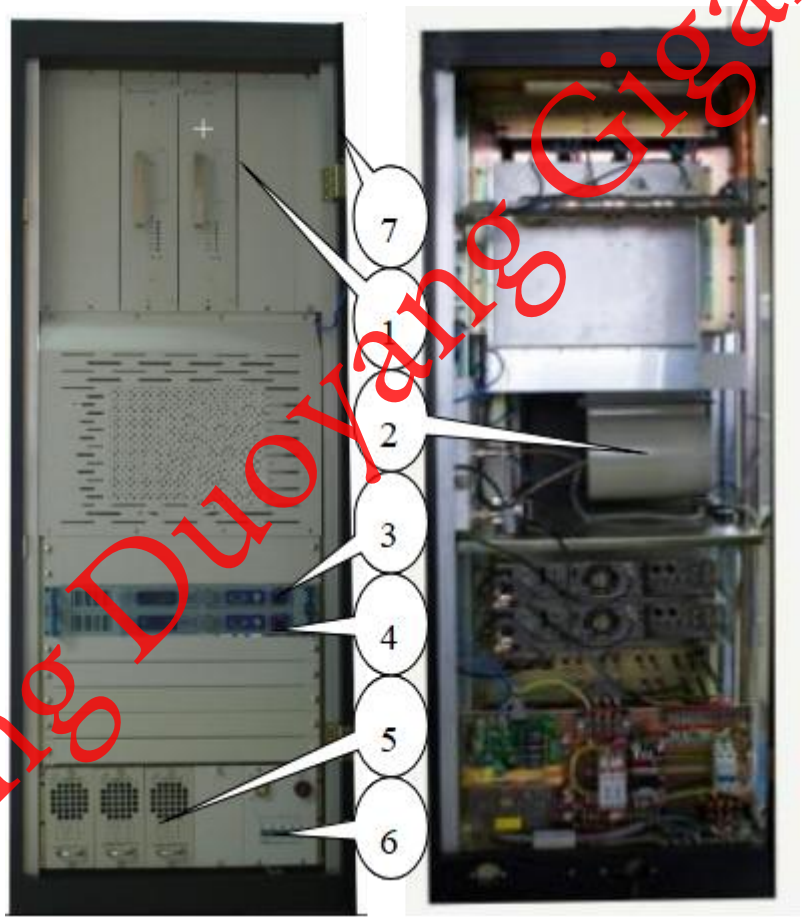


Fig. 3-1: Transmitter Structural Drawing

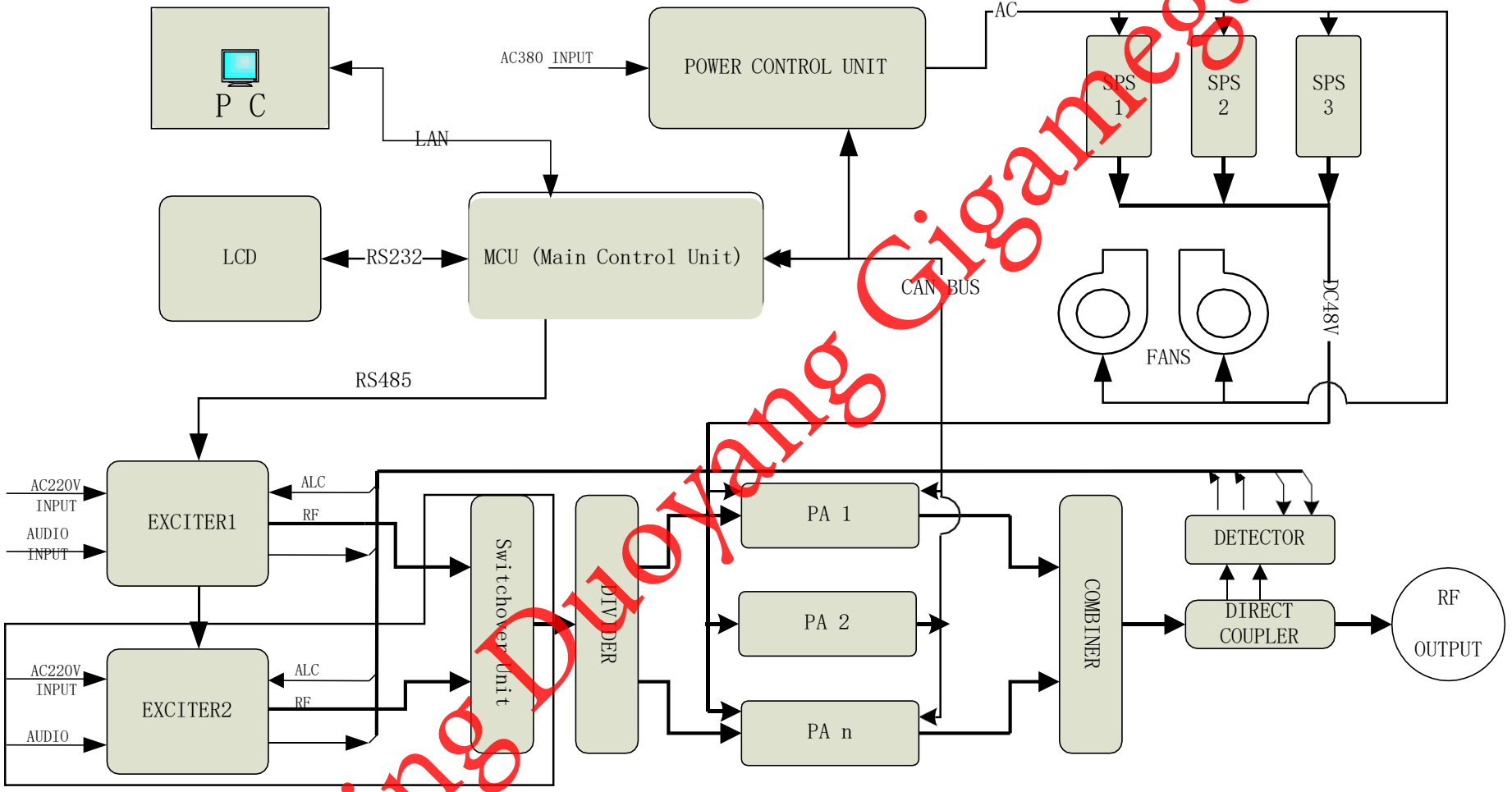


Fig 3-3: Functional Block Diagram of GME1F33/GME1F53 Type FM Broadcasting Transmitter

Note: part in dotted box is options of user; GME1F33 adopts two-way distribution (combination); GME1F53 adopts three-way distribution (combination).

1.2 Technical indicator

1.2.1 General characteristics

Output power	3KW/5KW
RF output impedance	50Ω
Output interface	EIA 1-5/8" non-flange
Frequency range	87~108MHz
Frequency stability	+/-1ppm (-10~50°C)
Sparious radiation	It is less than carrier wave 60dB
Power voltage	380V/50Hz, three-phase four-wire
Power consumption	≤6KVA(GME1F33)/≤10KVA(GME1F53)
Boundary dimension	581*996*1600(mm)
Ambient temperature	5-40℃
Altitude	≤2000m
Relative humidity	≤95%
Remote-control interface	LAN

1.2.2 Audio indicator

1.2.2.1 L/R input stereo broadcasting

Audio input interface	XLR, balanced or imbalanced
Audio input impedance	600Ω (balanced) or 10KΩ
Audio input level	-13dBm~+14dBm
Pre-emphasis time constant	0、50、75us (select)

Frequency response	±0.5dB (30Hz~15KHz)
Harmonic distortion	≤0.5%，(30Hz~15KHz)
FM signal to noise ratio	≥65dB
Separation degree of left and right channels	≥40dB, 100% modulation (30Hz~15KHz)
Level difference of left and right channels	≤0.4dB
Frequency deviation of pilot signal	±1Hz

1.2.2.2 MPX input stereo broadcasting

Audio input interface	BNC, unbalanced
Audio input impedance	10KΩ
Audio input level	-13dBm- +14dBm
Frequency response	±0.2dB (30Hz~100KHz)
Harmonic distortion	≤0.1%, (30Hz~100KHz)
FM signal to noise ratio	≥70dB
Separation degree of left and right channels	≥50dB, 100% modulation

1.2.2.3 Monophonic broadcasting

Audio input interface	XLR, balanced or unbalanced
Audio input impedance	600Ω (balanced) or 10KΩ
Audio input level	-13dBm- +14dBm
FM signal to noise ratio	≥65dB
Frequency response	±0.5dB (30Hz~15KHz)
Harmonic distortion	≤0.3%, (30Hz~15KHz)

1.2.2.4 SCA characteristics (whether it is equipped with optional functions related to models of chosen exciters)

SCA input interface	BNC, unbalanced
SCA input impedance	10 KΩ
SCA input level	-20dBm- +10dBm
Frequency response	±0.2dB (40KHz~100KHz)

2. Operation manual of exciter (please refer to *User Manual of FM Broadcasting Exciter*)

3. Definition of audio signal input interface

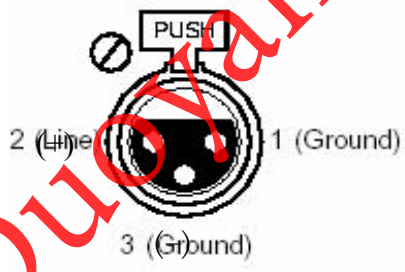


Fig 5-1: Connection of audio signal

Pin No.	Description	Remark
1	GND	Balanced input
2	A +	
3	A -	

4. Transmitter control system

4.1 Overview of control system

Control system of GME1F** series FM broadcasting transmitter is based on "stepwise" monitoring system of CAN bus and RS485 agreement. Its structure is shown in Fig. 6-1. And its composition includes:

- "First stage subsystem": main control unit (CCU), which has CAN/RS485/RS232 interfaces for sub units in lower level;
- "Second stage subsystem": amplifier unit adopts CAN bus;
- Electronic control unit PCU adopts CAN bus, and its subsystem in lower level is power supply management panel;
- Output power detection panel of complete machine adopts CAN bus;
- Exciter (RS485 interface is adopted by considering universality of exciters with different configuration, and there is two exciters);
- "Third stage subsystem": switching power supply management panel PSC, higher level of which is electronic control panel.

4.2 Control system function

Control system is "command" center in operation of transmitter, and its functions include:

- Logic control of transmitter: including startup and shutdown operation;
- Equipment failure protection and alarm: such as VSWR and temperature and so on;
- Indication of operating state;
- Indication of main operating parameters measurement, such as equipment output power, voltage, current and so on.

4.3 Control system structure

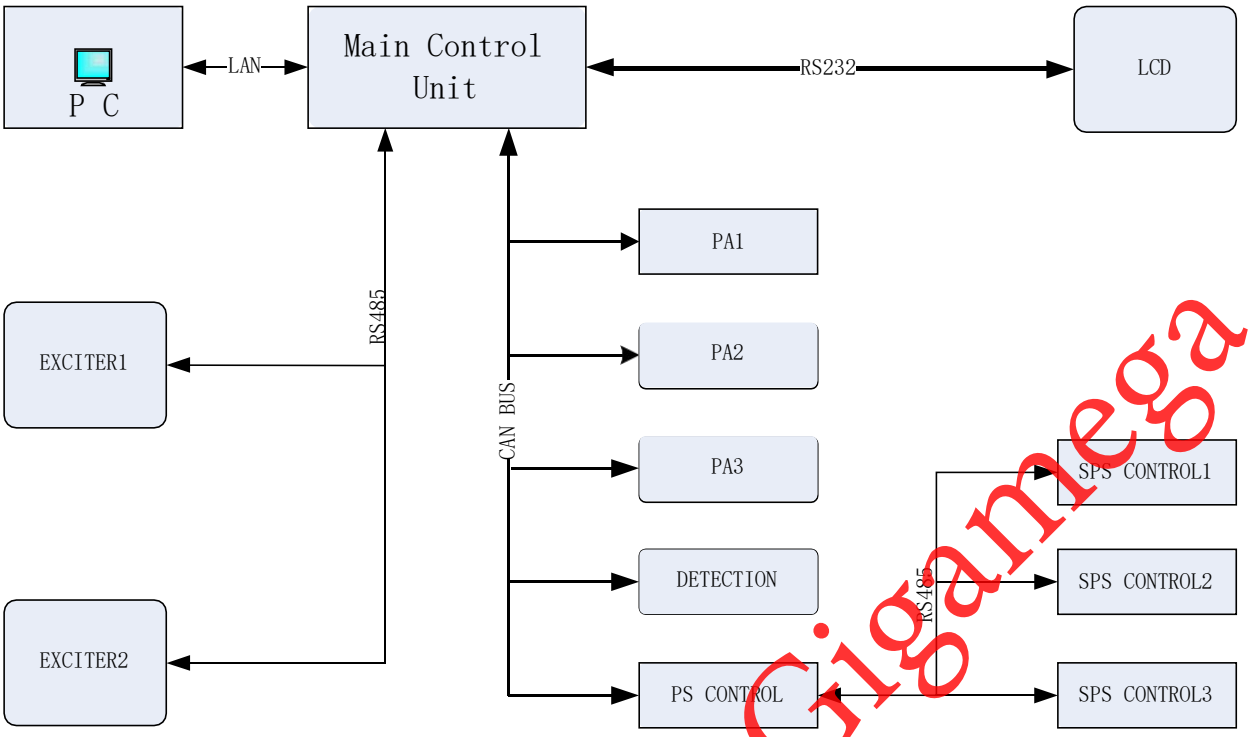


Fig. 6-1 Monitoring System Structure of GME1FXX Series FM Transmitter

5. Main control unit

5.1 Overview of main control unit

Main control unit consists of two parts of ARM chip namely control panel and switching power supply. Its functions include:

- Data collection, storage and analysis of complete machine
- Complete machine control and parameter setting
- Provide external control interface of complete machine
- Failure protection and alarm

Main control unit is the center of whole transmitter control system. It is responsible for outward connection and data collection and control of other subunits in transmitter. Main control adopts ARM9 as core processor. Method of main analysis combined with small core panel is adopted on structure, which is convenient for system maintenance. Main control unit is equipped with LINUX

operating system; therefore, starting time of power-up initializing maybe longer than system of which core processing adopts single chip. Multi threading work is adopted in operation, timeliness of which is much stronger than single thread work with single chip in processing problem.

5.2 Principle of main control unit

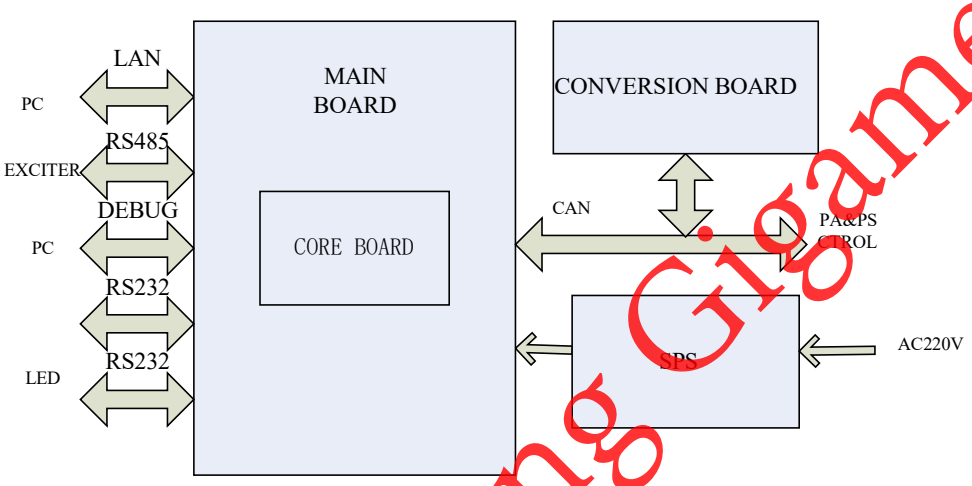


Fig. 7-1: Functional Block Diagram of Main Control Unit

7.3 Internal layout of main control unit

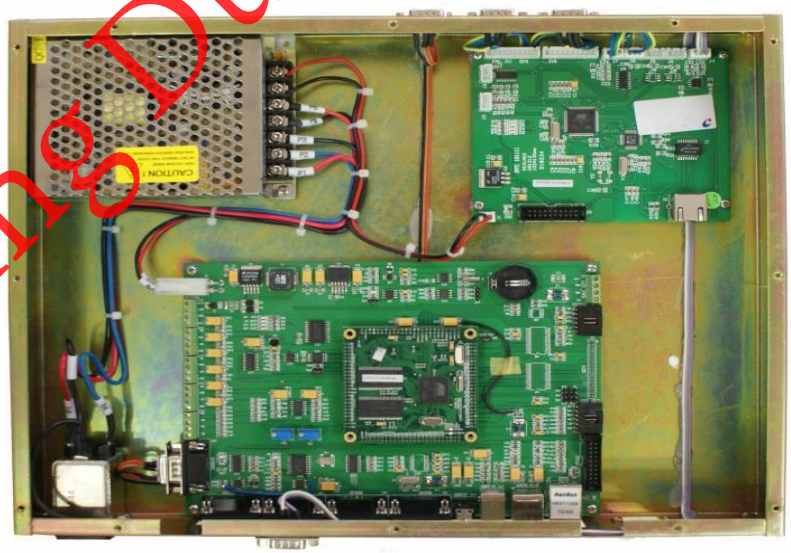


Fig. 7-2 Main Control Unit

7.4 External interfaces of main control unit

The external interfaces of main control unit include the following types:

- 1 LAN interface, interface of transmitter and external monitoring equipment, conforming to standards of Ethernet;
- 3 USB interfaces, mainly used to download software;
- 1 CAN bus interface, used in communications between internal power amplifier and electric control;
- Data communication (RS485) interface, mainly used in the communication with exciter;
- Data communication (RS232) interface, 3 RS232 interfaces, where one is used to communicate with touch screen; one is the DEBUG of main control, it conforms to RS232 standard; one is reserved interface.

Table 7-1: Definition of Interface Pin for CAN Communications

Pin No	Descriptions	Pin No	Descriptions
1	NC	6	NC
2	A +	7	NC
3	A -	8	NC
4	NC	9	NC
5	GND	---	

Table 7-2: Definition of Interface Pin for RS485 Communications

Pin No	Descriptions	Pin No	Descriptions
1	NC	6	NC
2	Date_A	7	NC
3	Data_B	8	NC
4	NC	9	NC
5	GND	---	

Table 7-3: Definition of Interface Pin for RS232 Communications

Pin No	Descriptions	Pin No	Descriptions

1	NC	6	NC
2	Send data	7	NC
3	Receive data	8	NC
4	NC	9	NC
5	GND	---	

7.5 Function and operation of main control unit

7.5.1 Functions of main control unit

Main control unit is the core of complete machine of transmitter and it is equipped with the following functions:

1. **Function of man-machine interaction:** man-machine interaction function of main control unit is realized through RS232 interface and touch screen. Working parameters of major components can be observed and system parameters can be set by operating touch screen.

2. **Collect transmitter information**: collect whole data means to collect unit data of major components such as exciter, power amplifier and power source; record fault information of transmitter including occurrence time and fault points. Operator can access the information above through touch screen.

3. **On/off mode control of transmitter**: transmitter has two on/off modes, manual/automatic modes; the main control unit has four on/off modes in the automatic mode:

a) Key on/off mode KEY: control by the on/off button on touch screen:

b) Remote on/off mode REM: control power on and power off on monitoring PC;

c) Timing on/off mode TIME: timing switch on/off can be set on main control unit and monitoring PC;

d) Coexisting mode ALL: “key on/off KEY”, “remote on/off” and “timing on/off” can coexist.

Priorities of on/off: Key, Time and Rem from high priority to low priority.

4. User setup

a) System time, total operating time, transmitter address, transmitter type,

exciter, etc;

b) Automatic on/off mode: KEY, TIME, REM and coexisting mode ALL;

c) Timetable of Timing on/off

5. Data display: Display on the touch screen on the front door

a) Time information: system time, timing on/off time, total operating time of equipment, etc

b) Whole machine information: on/off state, incident power, reflection power, VSWR, fault information of whole machine, etc

c) Exciter information: major state parameters of exciter

d) Amplifier information: the number of amplifiers, and power, voltage, current and fault information (temperature, super excitation and VSWR) of all amplifiers

e) Power supply information: the number of switch power supplies and parameters of each switch power supply

6. Communication with monitoring PC: communicate with main control unit by special monitoring software

a) Receive inquire order of PC and report local state;

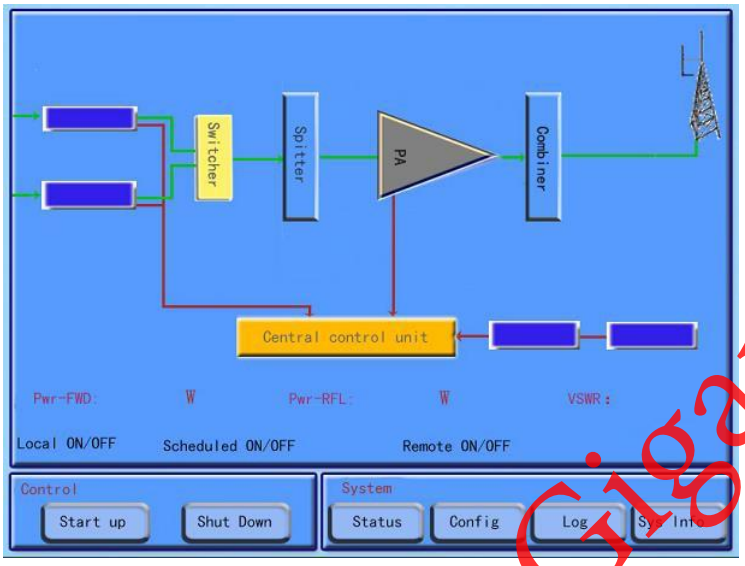
b) Receive PC setup: on/off mode and control parameters;

c) Receive control order from PC, like start up and shut down operations;

d) Operate exciter and check parameters of exciter.

7.5.2 Display and operation of touch screen

7.5.2.1 Main interface

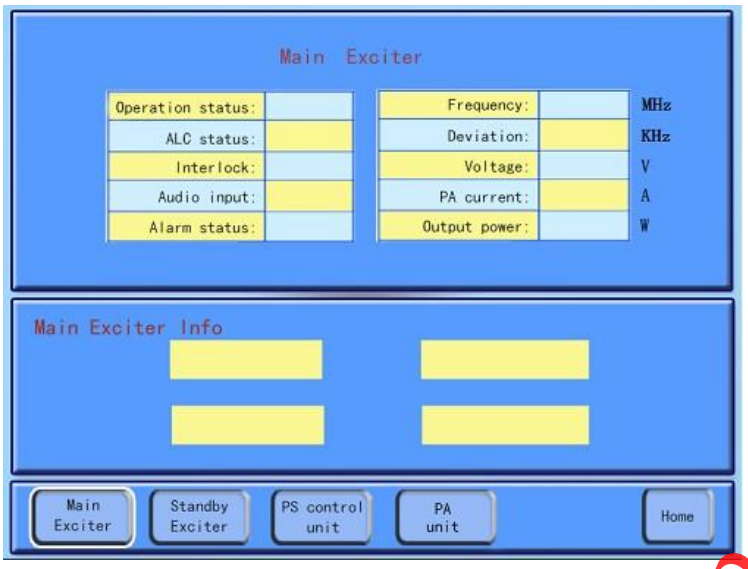


Working state order is on the top left corner of this interface. When the main control unit stands by normally, there is a “STAND BY” on the top left corner of the touch screen (shown in picture above). If “ON AIR” is shown on the transmitter, it means it has RF output.

7.5.2.2 System initialization

Provided that the main switch of transmitter is closed in system, the touch screen will keeps on all the time. When the transmitter does not need remote on/off after result work, it is better to cut off the power supply of transmitter to guarantee the safety of whole transmitter.

7.5.2.3 Parameter interface of exciter



Parameters of exciters are divided into parameters of main exciter and parameters of standby exciter and are displayed in two pages. The working state of display parameters is off-line when the exciter is off or does not exist. When it is on-line, other parameters will be displayed.

Loop state: manual, internal loop and external loop. Internal loop is the loop in the exciter itself and external loop is the big closed loop formed by exciter and final-stage power amplifier module.

Interlock state: it will display "locked" when exciter is locked by other equipment (main exciter is locked by standby exciter or standby exciter is locked by main exciter). It will display "normal" when RF is output.

Audio mode: it displays the current audio signal source type of exciter and it has AES (digital audio) and analog audio.

Alert state: it refers to the general alerting state of exciter. "ON" is displayed here if

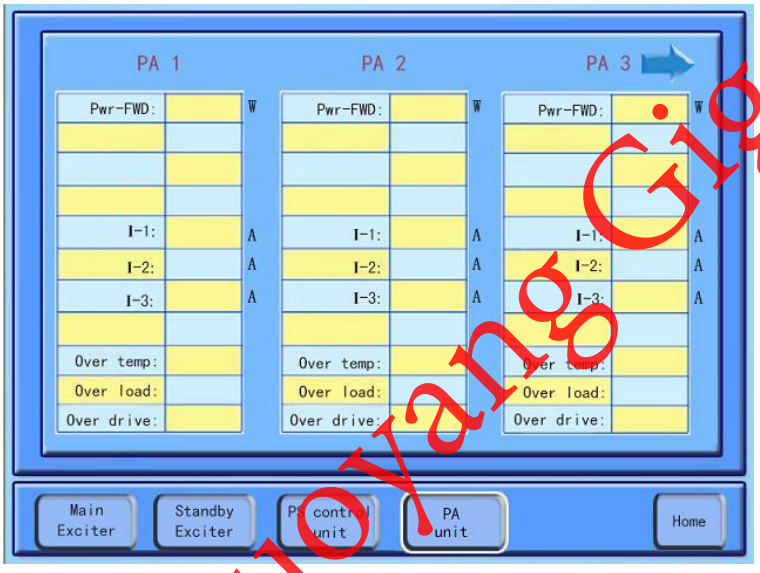
there is an alert of exciter.

Working frequency: it displays the working frequency of exciter, unit is MHz and display accuracy is 0.1MHz.

Frequency offset: display unit is KHz and display accuracy is 0.1 KHz

ALC voltage: ALC loop control voltage of exciter, this voltage is not displayed all the time. It will be displayed only if the exciter provided by our company is used. RVR exciter has no such display.

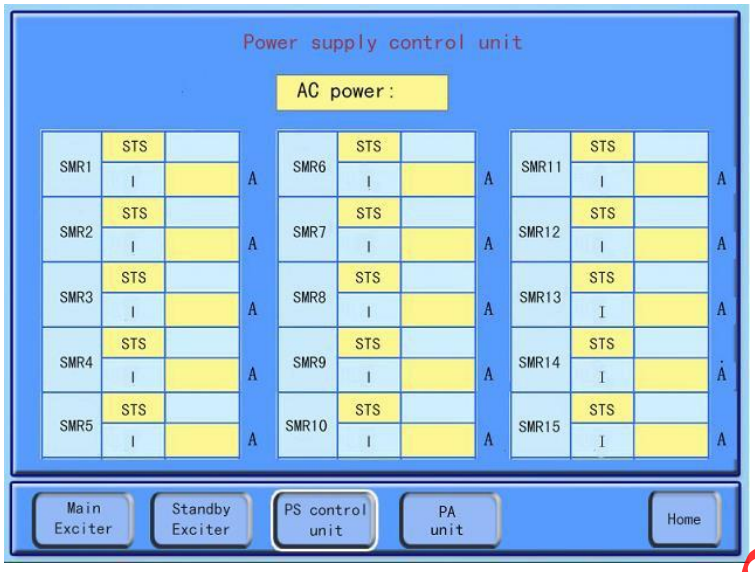
7.5.2.4 Parameter interface of power amplifier



Description； the number of power amplifier units are different in GME1F33/GME1F53.

Click the button at the bottom of interface and switch to the display page of its parameters.

7.5.2.5 Parameter interface of power control



The current parameter adoption of switch powers of the system is first collected by power management board and then sent to main control by power control board. (Description: GME1F33 displays 3 switch powers and GME1F14 displays for switch powers)

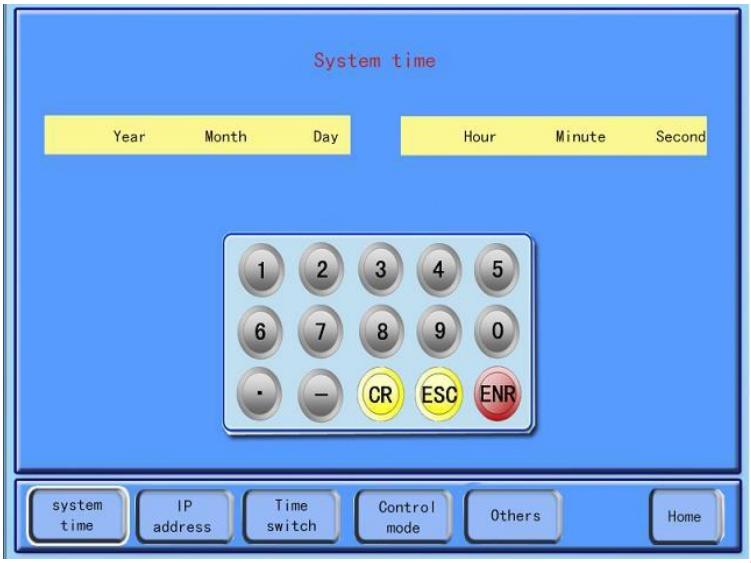
Power state: if it is normal, it means switch power has no alert information.

Power current display: users can judge whether the switch power is working in current-sharing situation according to the current indicates above.

7.5.2.6 System settings

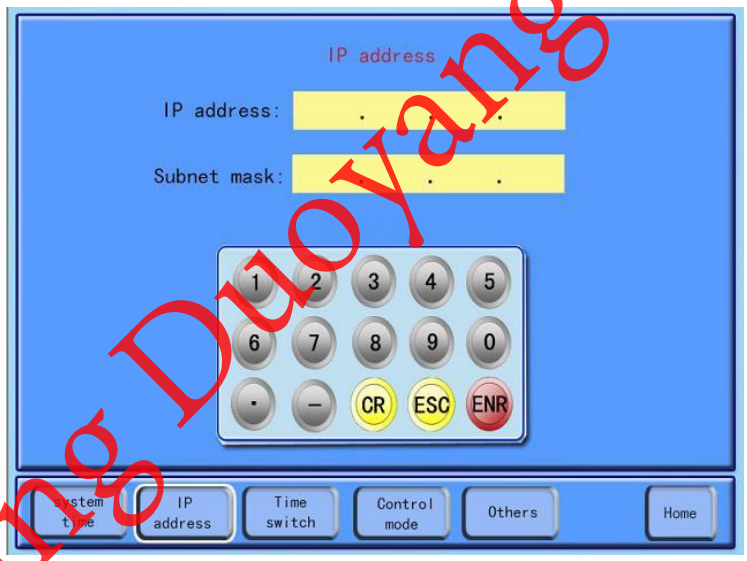
System settings include settings of system time, IP address, timing on/off mode, control mode and other items. Page switch button for the parameter settings above is at the bottom of every page. All parts are shown as follows.

Time setting interface:

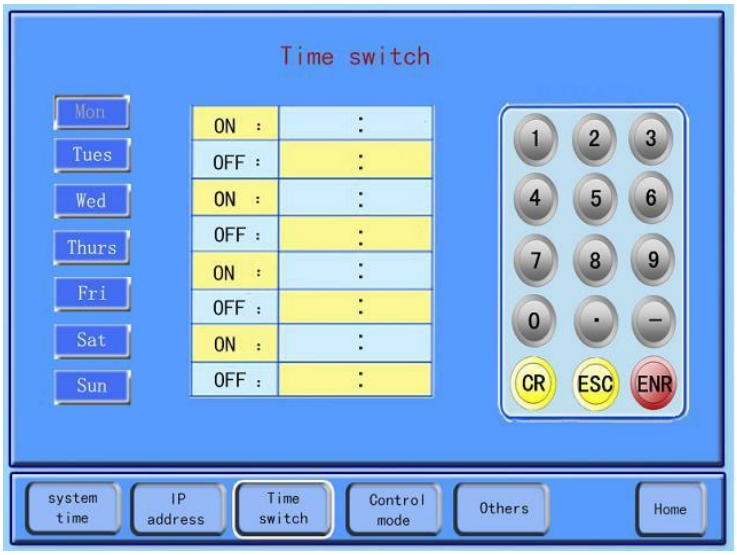


Setting interface of IP address

Transmitter use TCP/IP protocol to external and relevant IP address shall be set by users according to actually used network environment.



Setting interface of timing on/off mode



It is shown in the picture that timing on/off mode is designed on the basis of seven days a week and four on/off times for each day. When the transmitter operates on the timing on/off mode, it is designed on the basis of one circulation for seven days.

When setting: first choose one day of the week and the color of chosen day will change. Drag cursor to the on or off time column of corresponding time period, click the right keyboard to input the set time and click "ENR" to conform the set time is correct. Attention: on time shall be less than off time. Otherwise, it will cause errors and automatic on/off operation cannot be normally carried out according to the set time.

8.5 Switch control panel

Switch control panel is at the front bottom of equipment. Two switches and one indicator light are installed on the panel (referring to Fig 8-3), from left side to right side are: automatic/manual switch and main power switch.

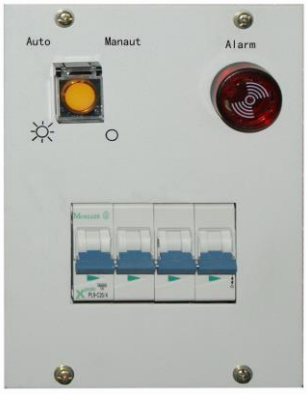


Fig 8-3: Switch Control Panel

- **Automatic mode**: carry out on-off operation according to pre-set equipment program of equipment control system. It can be “KEY mode”, “REM mode” and “TIME mode”. Please refer it to introduction of main control unit.
- **Manual mode**: it is a “life support” on/off mode for the equipment. If there is a failure in equipment control system, use “manual mode” to carry out on/off operation. It is also can be used when the control system operates normally. But if the machine is started up in “manual mode”, the communication between some units with main control unit is cut off. Therefore, **when the equipment control system operates normally, “manual mode” is not suggested.**

6. RF system

Transmitter RF system can be divided into two parts: active part and passive part; active part is mainly composed of power amplifier and interface unit of amplifier, passive part is mainly composed of distributor, synthesizer, output filter, directional coupler. Equipment of double exciters needs switch unit for double exciters.

6.1 Power amplification unit

GME1F33 transmitter is configured with two 2KW power amplification units and DY1F53 transmitter is configured with three 2KW power amplification units. Each power amplifier unit has two 1100W power amplification module (PA).

6.1.1 1100W power amplification module (PA)

Core device of PA is LDMOS power tube and circuit design is “push-pull” mode (referring to Fig 5-1), broadband design, working voltage 48VDC, gain is about 26dB and maximum output power is about 1100W.

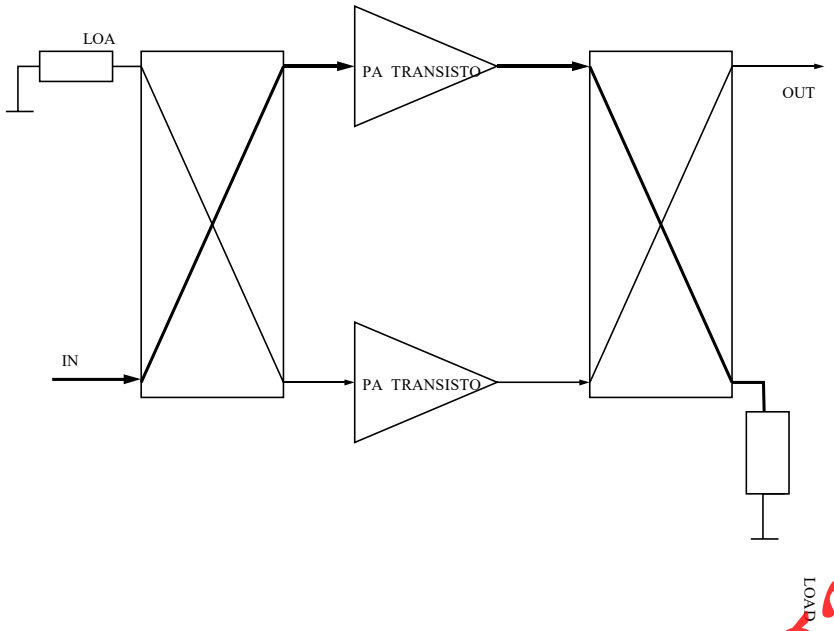


Fig 9-1: Block Diagram of 1100W Power Amplifier

6.1.2 2KW power amplification unit (PAU)

Two 1100W power amplifier, distributor/synthesizer, absorption low-pass filter and directional coupler compose a 2KW power amplifier (referring to Fig 9-2), 22dB gain, 2KW maximum output power.

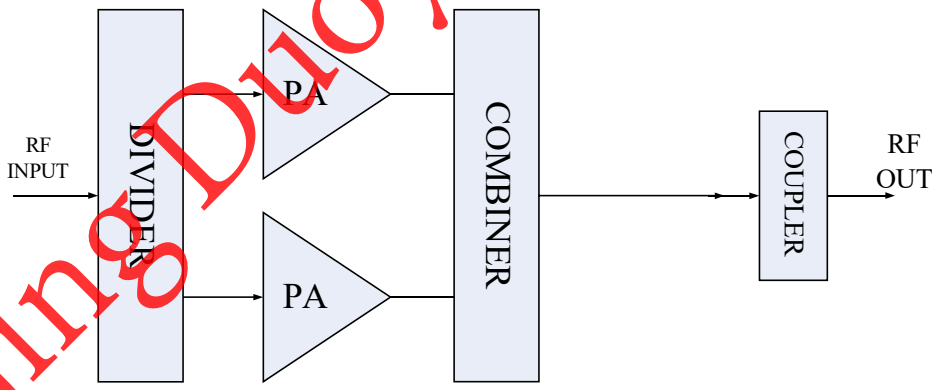


Fig 9-2: Functional Block Diagram of FM2KW Power Amplification Unit (PAU)

Description: the amplifier has already been adjusted to the best conditions when the equipment left factory. Unless it is otherwise specified, please don't adjust the potentiometer arbitrarily.

Internal distributor/synthesizer of 2KW power amplification unit (PAU) is compounded by in-phase assignment. Two 1100W amplification modules and distributor/synthesizer

compose a balanced amplifier, which has good input and output VSWR.

2KW power amplification unit (PAU) has fault indicators for temperature, super excitation and VSWR. Protection shall coordinate with exciter. Fault protection is displayed by the LED on the amplifier panel.

Table 9-1: Technical Indicators of 2KW Power Amplification Unit (PAU)

Frequency range	87~108MHz
Supply voltage	+48V
Input interface/impedance	C9-50J
Output interface/impedance	7/8"/50Ω
Output power	≥2000W
Gain	≥22 dB
Efficiency	≥75%
Temperature protection points	70±5ºC
VSWR protection points	VSWR≥2
Super excitation protection points	Increased exciting power 0.8dB
Cooling	air

Table:9-2：PA:

DL29Z	
1，2,3,4	V+ in
11	CAN_ H
12	GND
13	CAN_L
26,27 ,28,29	V-in

Fig 9-3: Picture of Power Amplification Unit (PAU)

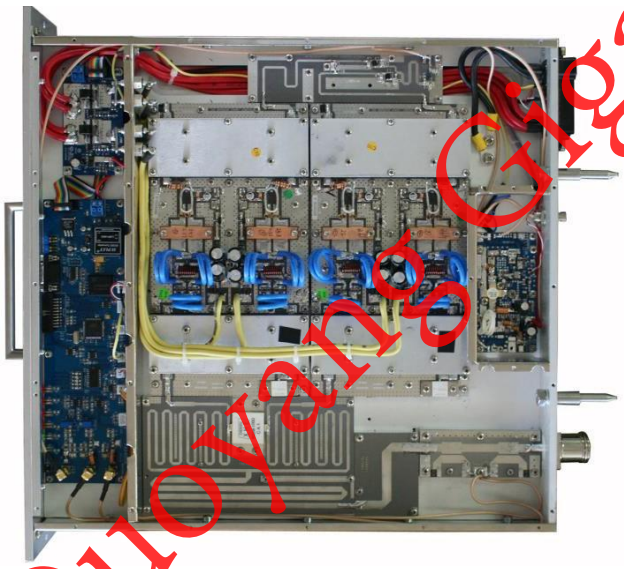


Fig 9-4: 2KW Power Amplification Unit (PAU)

7. Power and air cooling system

7.1 Power

7.1.1 AC power supply system

Transmitters use three phases and four lines to supply power with 380VAC. AC power supply system include power distribution units, on-off control panel and arresters on the baseboard of devices. AC power supply system in charge of distribution, control, protection, alarm and interlock of AC power of complete machines.

- Power distribution: power distribution units shall supply power to all units of devices

using AC power, including exciters, fan blowers and switching power supply.

- Control: electronic control unit in charge of the on-off control of fan blowers, switching power supply and exciters.
- Protection: install an arrester on the baseboard of equipment to complete three-level lightning protection of complete machines; equip the protection of default phase, phase dislocation, over voltage and low-voltage of AC power, over voltage and low-voltage and faults on the electronic control units.

- Alarm: at the time of default phase and phase dislocation of AC power, overvoltage and low-voltage protection;
- Interlock: set interlock contacts on the electronic control units to guarantee the safe operation of equipment (including the need that transmitters connect an external coaxial switch and the need of load work). The interlock contacts shall close when power-on, otherwise, transmitters can not work. Through this method, the safe operation of machines and other relevant devices can be protected.
- Power-on and power-off: transmitters have two ways to power on and power off, one is manual operation and the other is automatic operation. The automatic way is that electric control bar controls the corresponding relay to supply power to the corresponding parts. There is a button of manual emergency switch inside the panel in the front of the equipment cabinet. There is a bulb inside the button. If the bulb lights off, it means transmitters is in the local manual emergency power-on state.

7.1.2 Switching power supply

Final amplifiers of transmitters use switching power supply to supply power. The input power is AC 380V50 Hz and the rated output power is 40A. It has the protection of temperature, voltage and current. It has hot swap. The external interface references to Fig. 11-1:

Fig. 11-1: the External Interface of Switching Power Supply

7.2 Air cooling system

1) Transmitters adopt forced air cooling method. The components which need cooling include exciters, PAU and switching power supply. Switching power supply has its own fan blowers. Cooling fans of PAU are in the middle of equipment cabinets with inlet air in the bottom and outlet air in the top. Main air blowers adopt centrifugal fans with advantages of large blast capacity, high air pressure and low noise. Considering the stability and redundancy of transmitters, 3KW/5KW transmitters adopt two centrifugal fans which are reserved for each other.Model and Order contract)