FM Digital Audio Broadcasting

GME1R12/GME1R32

100W/300W Transmitter

Technical manual

1. Overview

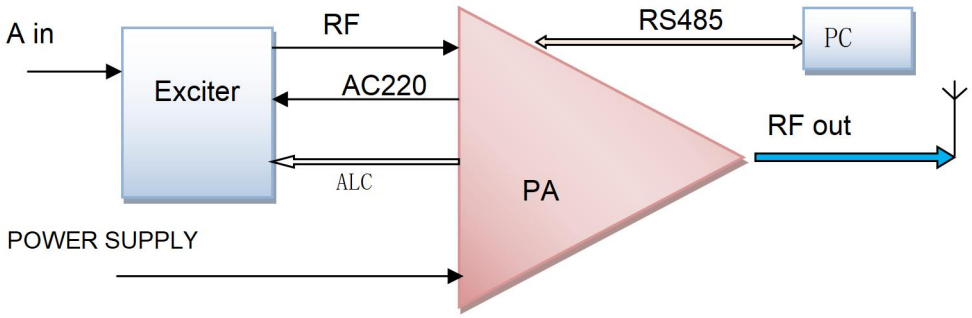
The GME1R12 100W FM frequency band digital audio broadcasting (CDR) transmitter is an economical new product developed by considering both standardization and serialization in appearance and structure, as well as aesthetic effects and practicality. Can meet CDR standards, with stable and reliable transmitter performance, simple operation, and easy maintenance.

1.1 System Characteristics

- LDMOS all solid state technology, the entire machine is fully solid-state.
- Comprehensive protective measures are in place to ensure the safe operation of equipment, including protection against VSWR, temperature, and over excitation.
- Modular design facilitates flexible selection of multiple exciters.
- Integrated design, small size, easy installation, the minimum size of the whole machine is a standard 19 "8U small cabinet; You can also choose other 2-meter 19 "cabinets, which can be either one cabinet with dual machines or one cabinet with multiple machines or N+1 mode.
- Intelligent monitoring system with LCD display of working parameters.
- RS485 interface, capable of remote control. Remote control software can be customized or developed by users themselves.
- Easy to operate, just turn on the power switch of the amplifier unit to complete the startup action.

1.2 Transmitter structure

This transmitter is mainly divided into two parts: exciter and power amplifier unit. The schematic diagram is shown below. The power amplifier unit is also the data processing and control unit of the whole machine. It can complete external communication and feedback control of the exciter, and display the data of the transmitter as a whole.



GME1R12 consists of two standard 19 "chassis, arranged vertically. The top is the exciter part (single and double exciters are optional), and the bottom is the 5U power amplifier unit. There is a lightning protection device and input switch at the back of the cabinet.

Front view of transmitter

2. Technical Parameters

2.1 General characteristics

Output power	100W/300W
Output Impedance	50Ω
Output	EIA 1-5/8”
Frequency	87 -108MHz
Working voltage	380V/50Hz AC
Power consume	≤4KVA
Dimension	600（W）*900(D)*1300(H)mm
Ambient Temperature	5-40℃
Altitude	≤2000m
Relative Humidity	≤95%
Remote	LAN
Audio input	XLR，Balanced or unbalanced
Audio input impedance	600Ω（balance）或 10KΩ
Audio Input Level	-13dBm~+14dBm
AES Input	XLR，110Ω
TS Input 1	LAN
TS 1	BNC，75Ω
10MHz input	BNC，50Ω
1PPS input	BNC，50Ω
TOD input	DB9-K RS232
Monitor	BNC-K 50Ω
RDS input	BNC 50Ω（optional）

2.2 Technical parameters of analog FM stereo broadcasting

No.	Content	Unit	Parameters
1	Residual radiation	dB	<-60

2	Parasitic amplitude modulation noise		dB	<-50
3	Pilot frequency deviation		Hz	0
4	38kHz residual component in S signal		dB	<-45
5	100% modulation frequency offset		kHz	conform to
6	Pre emphasis		50us	conform to
7	Distortion (100% modulation) Frequency response (no addition, deduplication)	L	%	<0.1
		R		<0.1
8	Frequency response (adding/removing duplicates) Signal to noise ratio (100% modulation)	L	dB	-0.1~0.1
		R		-0.1~0.1
9	Separation degree of left and right channels Distortion (100% modulation)	L	dB	0.0~0.1
		R		0.0~0.1
10	Frequency response (no addition, deduplication) Frequency response (adding/removing duplicates)	L	dB	>70
		R		>70
11	Signal to noise ratio (100% modulation)	L→R	dB	>55
		R→L		>55
12	Left and right channel level difference		dB	<0.1

2.3 Digital Audio Technology Parameters

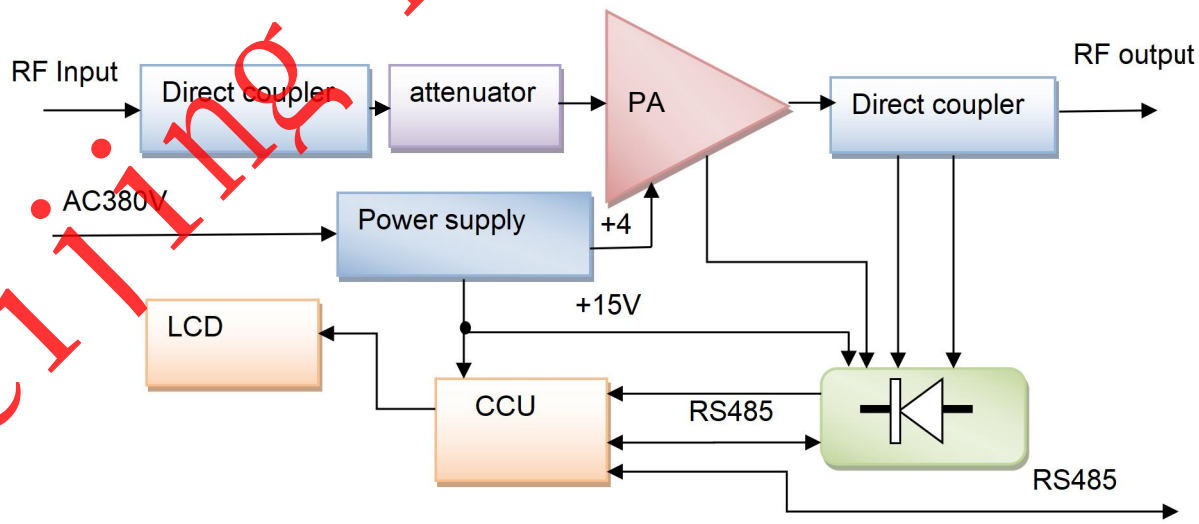
No.	Content		Unit	Parameters
1	Frequency		MHz	87~108
2	Frequency step	MFN	Hz	1
		SFN		1
3	Frequency accurate	MFN	Hz	25
		SFN		10
4	phase noise	@10Hz	dBc/Hz	≤-70
		@100Hz		≤-85
		@1kHz		≤-90
		@10kHz		≤-105
		@100kHz		≤-120
		@1MHz		≤-130
5	Spectrum Mask	-250kHz	dB	≤-90
		-200kHz		≤-89
		-110kHz		≤-85
		-100kHz		≤-50
		100kHz		≤-49
		110kHz		≤-87
		200kHz		≤-90
		250kHz		≤-90
6	In band spectrum compliance		dB	≤0.8
7	Power uniformity between sub bands		dB	≤0.5
8	shoulders		dB	≤-36
9	Out-of-band spurious	Unused transmission power within adjacent channel bands	dB	≤-50
		Unused transmission power outside the adjacent channel band		≤-60
10	RF effective bandwidth		kHz	conform to
11	RF output power stability		dB	-0.2~0.1

12	peak-to-average power ratio	—	conform to
13	MER	dB	≥32

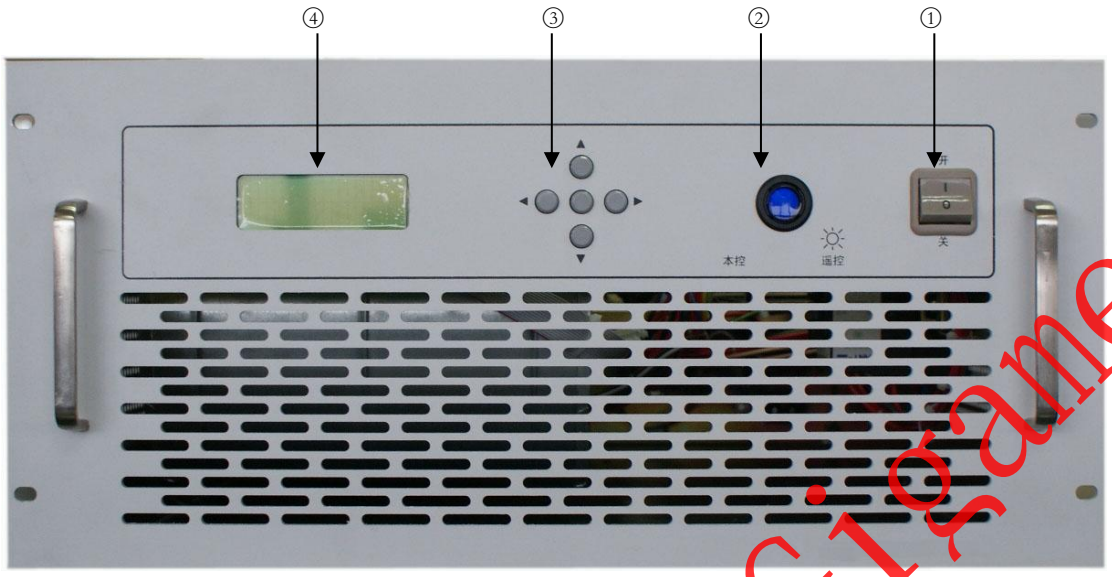
3. Power Amplifier Unit

The power amplifier unit is mainly divided into several parts: power amplifier module, detection board, switch power supply, and main control. The main function of the power amplifier module is to amplify the modulated RF signal generated by excitation and output it for transmission, and there is a directional coupler to extract part of the RF signal and send it to the detection board. The detection board is responsible for processing RF signals and converting them into DC detection voltages, which are then sent to the main control board and exciter. The main control board collects various sampling signals inside the power amplifier, including the working current, voltage, temperature of the heat sink, overall output power, and reflected power of the power amplifier; The main control board is also responsible for communication with the detection board, exciter (unable to communicate with BLU830 exciter), and external upper computer. The switch power supply is responsible for converting AC power into stable DC power to provide to the power amplifier module, main control board, and detection and analysis.

The schematic diagram of the power amplifier unit is as follows:



3.1 Front Panel



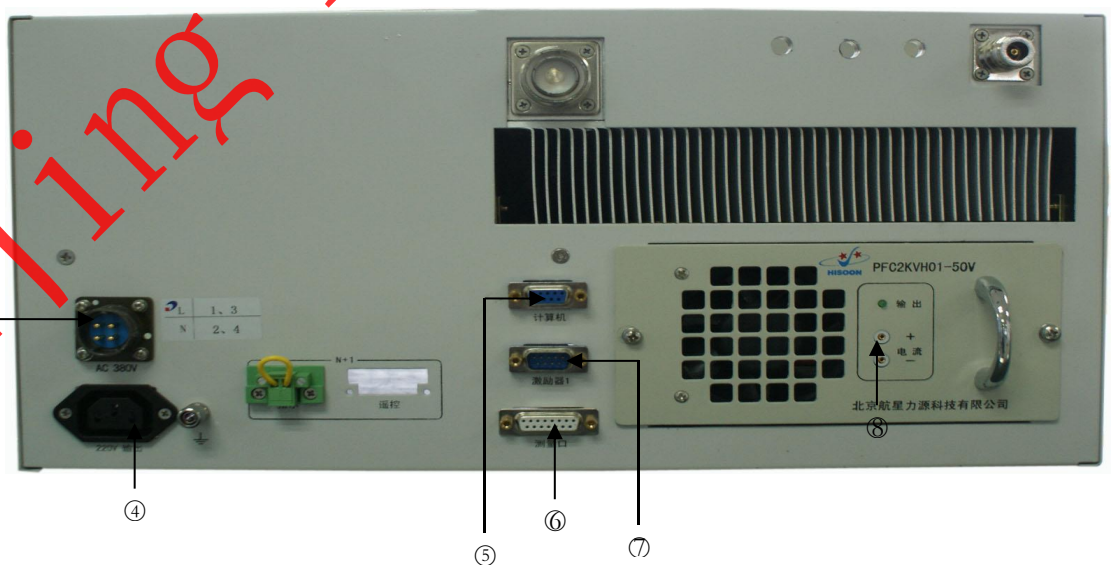
① Power Switch: ON： Turn on the device, OFF： Shutdown (or power on/off through remote control interface, 100W machine has remote control interface)

② Local and remote switchWhen the button is pressed, it is in local control mode and the transmitter can be directly turned on and off; At the same time as the pop-up button lights up, the transmitter is in the remote control on/off state.

③ Button

④ Liquid Crystal Display (LCD) Screen

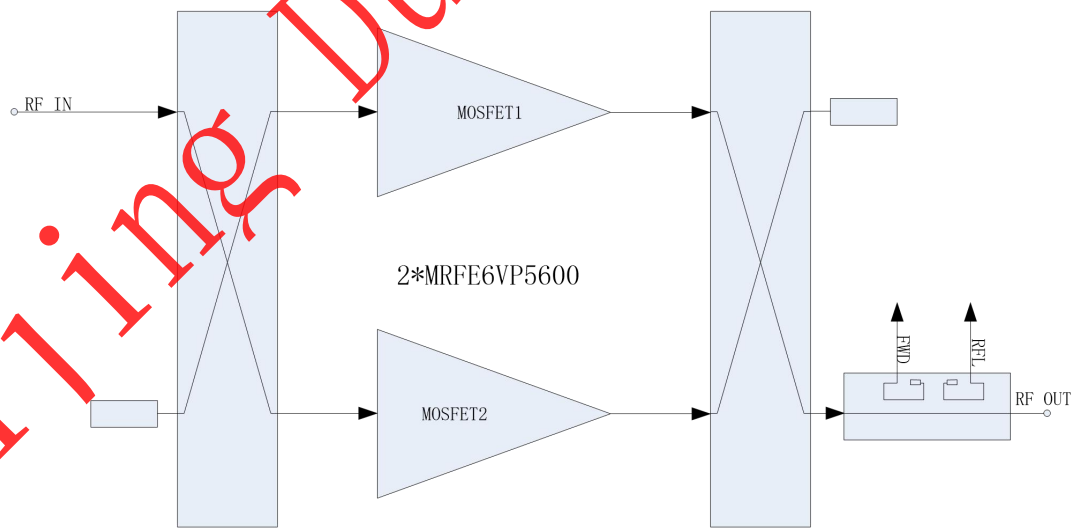
3.2 Rear panel



1	RF input	N-50K
2	RF Output	L29-50K
3	AC380V input	L→1、2、3 N→ 4
	AC220V input	L →1、2 N →2、4
4	Exciter Power input	
5	PC	RS485
6	ALC loop	Output detection voltage to the exciter for ALC loop control
7	Exciter A	RS485

3.3 Power amplifier module

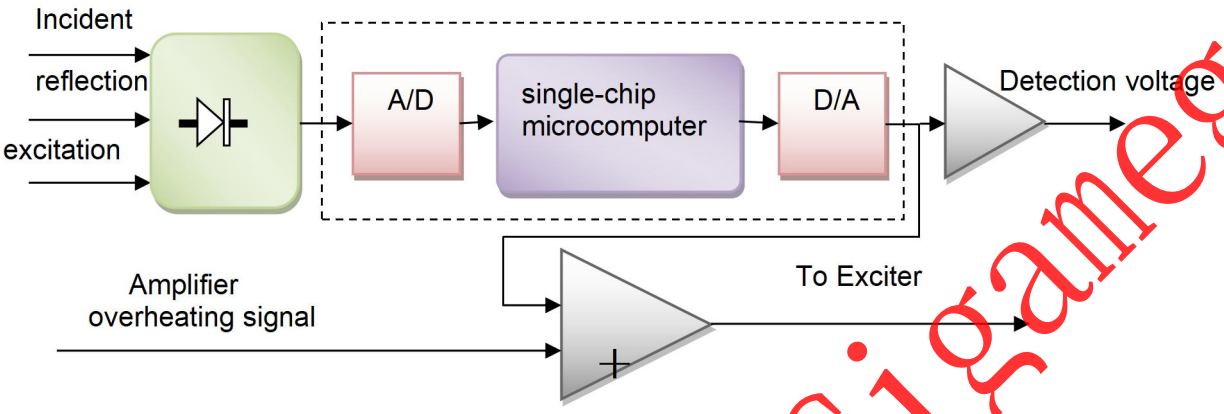
This amplifier is a broadband linear amplifier used for CDR broadcasting. Changing the operating frequency within 87-108MHz does not require any adjustments to the amplifier. The final stage adopts two imported 600W LDMOS power devices MRFE6VP5600 to form a balanced amplifier, which is well isolated from each other, has a large margin, and has high reliability. The amplifier includes a temperature compensation circuit inside to ensure stable output power and low temperature drift。



3.4 Detection board

The main functions of the detection board are twofold: first, to convert

RF signals into DC voltage; In addition, based on a certain relationship between power, frequency, and detection voltage, the DC detection voltage can be corrected to have a linear correspondence with power output.



Three RF signals are converted into DC voltage by three detectors (integrated circuits) and sent to the micro controller's built-in A/D converter for conversion. After software calibration by the micro controller, the DC detection voltage corresponding to the power is outputted through D/A. This voltage is further divided into two paths. One path is sent to the main control unit for output power indication, and the other path is added to the overheating signal of the power amplifier through an adder to obtain the feedback voltage for ALC, which is sent to the exciter. When the overheating signal of the power amplifier is at a low level, the detection voltage sent to the exciter is the normal and calibrated detection voltage, which is related to power. When the overheating signal of the power amplifier is at a high level, the actual voltage sent to the exciter contains the power amplifier overheating protection signal.

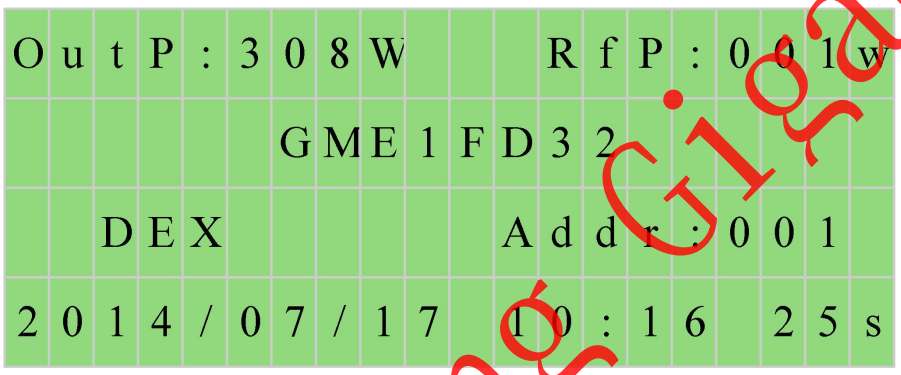
3.5 Central Control Board

The M&C8 control motherboard is the core of the main control unit, using AT89C55WD as the main control chip, configured with input channels, system clock, memory, and RS485 interface; Human machine interaction function

is achieved through panel keyboard and LCD display, and communication with other "lower level machines" inside the PC and transmitter is completed through RS485 interface.

4. LCD Screen Menu

➢ **Main Interface**



"OutP" Output Power

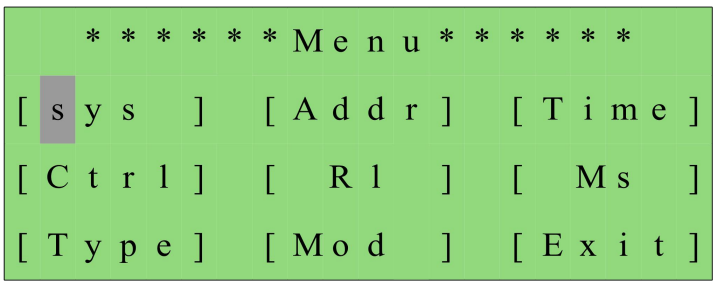
"RfP" Reflect Power

"GME1R12" Transmitter model

"DEX": Representing the selected exciter type, DEX represents the digitally processed exciter.

"Addr": The transmitter address is used for remote communication and can be set within the range of 1-255 under the "Addr" menu.

When the middle button on the panel is pressed, it enters the next level menu:



"SYS" : Transmitter system parameter display

"Addr": Transmitter communication address setting

“Time”：Time setting for transmitter display

“R1” ：Main control version information of transmitter

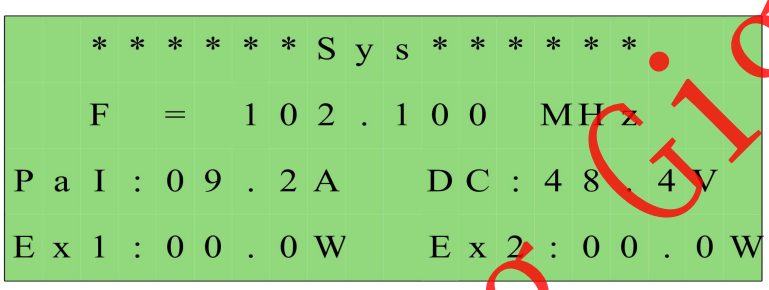
“MS” ：The status of the primary and backup transmitters is only used for debugging when the transmitter is equipped with a primary and backup exciter.

“Type”： Type setting of transmitter

“Mod”：Exciter(Modulator) type selection menu

“Exit”：Previous Menu

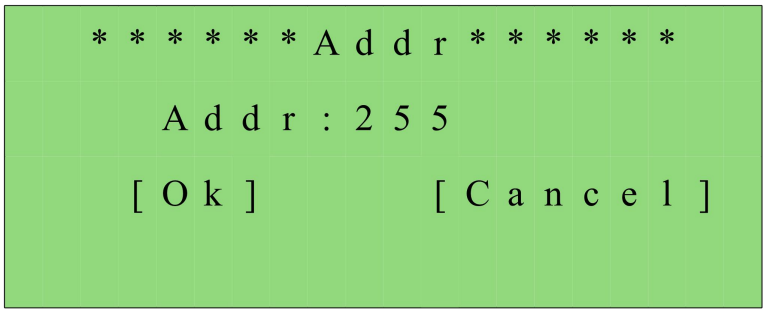
“SYS” Menu



- “F” The current operating frequency of the transmitter may be automatically read from the exciter or manually set depending on the exciter.
- “PaI” The current of the amplifier is approximately 25-30A at 100W.
- “DC” The working DC voltage of the amplifier is 48-50V.
- “Ex1” The output power of the main exciter varies with different frequencies.
- “Ex2” The output power of the backup exciter is invalid under single excitation conditions.

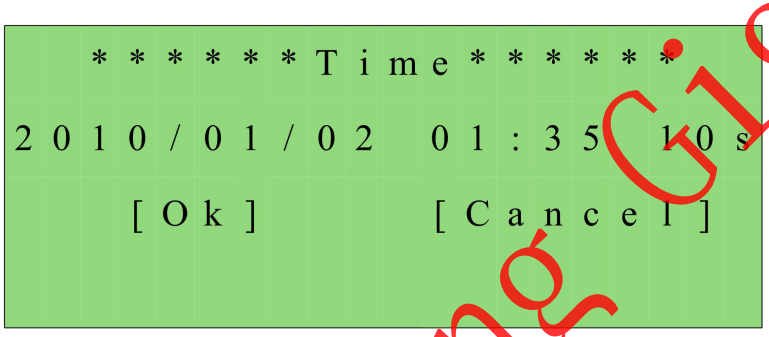
“Addr”

“Addr” Mainly used for setting the communication address of the transmitter, it can be omitted when not connected to computer monitoring. The address range can be set from 1 to 255, depending on the system used by the user.



“Time”

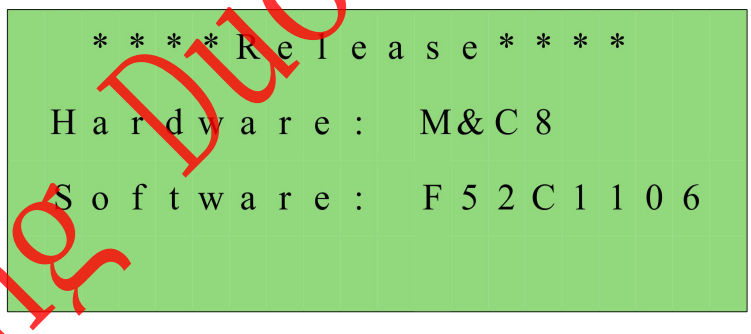
Under this menu, you can set the date and time format to (year/month/day hour: minute: second.



“Ctrl”：

Set the machine control mode.

“R1” ：



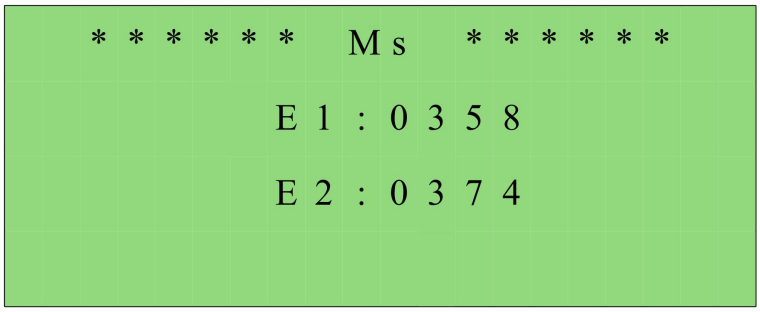
The second line is the hard version information of the control board, currently M&C7; The third line is the software version information, currently F52C1106. The software version may be upgraded during the production process, please refer to the display.

“MS” ：

When there are primary and backup exciters, this menu is useful for debugging the primary and backup exciters.

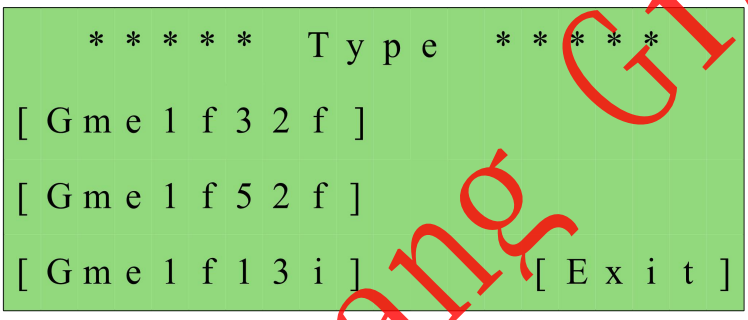
E1： Main exciter RF detection port detection voltage

E2： Backup exciter RF detection port detection voltage



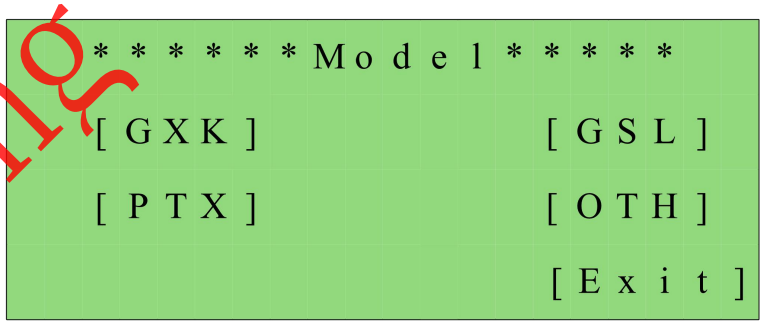
“Type”

Mainly set the current machine model and display it on the default interface of the screen.

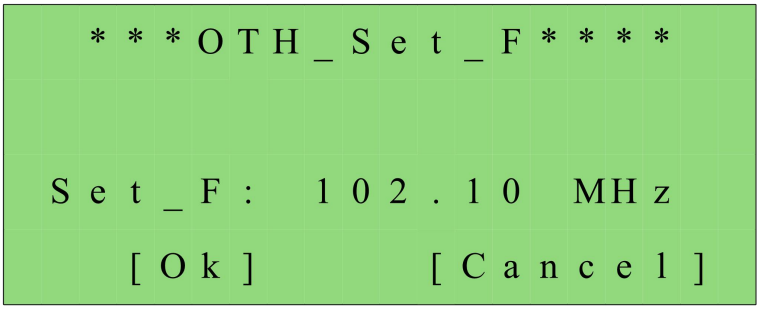


“Mod”

The main function is to set the type of exciter selected for the entire machine. The current version of the main control software can support three types of exciters with communication interfaces, as well as those without communication interfaces.



When selecting the OTH type, it means that the exciter does not support communication function, and a frequency setting menu will pop up as shown in the following figure:



In this menu interface, the operating frequency of the transmitter is set at the numerical position. When the cursor is moved to "OK" and the confirm button is pressed, the operating frequency of the transmitter is set, which is used for calibration of the detection system. And it will be displayed in the "SYS" menu.