CAT control your

Xiegu G90

with your PC and

start operating in digital modes

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1. Disclaimer

The technical details within this document had been put together by our engineers. Although we tried to be as accurate as possible, we do not guarantee this document to be free of errors. Use it at your own risk. Radioddity may not be held responsible for any damages caused by the use of the contained information.
We do not recommend to create required cables by yourself but either buy them at http://www.radioddity.com, via our Amazon-pages or at your local dealer.

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2. Intention of this document

This document can in no way replace the existing documentation for your Xiegu G-90 HF transceiver bought at Radioddity, but it is intended to provide additional information and help on getting your Xiegu G90 connected to and operated with the help of your PC.

3. Explanations on vocabulary

When connecting your PC to your Xiegu G90 you will sooner or later stumble across several abreviations and special words. Let´s explain some of those in more detail:

IO-port
IO-port is an abbreviation for the input and output port of a device.

CAT
A device used to control your radio is called a Computer Aided Transceiver.

CE-19
The Xiegu CE-19 is an addoe device for your Xiegu G90 transceiver that is connected via the ACC-port to your Xiegu G90. It has separate ports for PTT and AF (Audio). Furthermore, it has a miniDIN-6 socket required to operate a Xiegu XPA-125 amplifier.

OpenSource

According to Wikipedia, 'Open-source software (OSS) is a type of computer software where its source code is released under a license in which the copyright holder grants users the rights to use, study, change, and distribute the software to anyone and for any purpose. Open-source software may be developed in a collaborative public manner'.

Although such software is free for the user, it often is even more powerful than expensive licenced software. Therefore, we encourage all users of OpenSource-Software to honor their originators by either contribute in the development of the software or by others means ('cup of coffee', contribution to some social organization, or other ways). Examples for OpenSource software for HAM use may be found at: https://sourceforge.net/directory/communications/hamradio

4. Connect your Xiegu G90 to your PC

Depending on the type of computer aided transceiver control, you need certain connections or even additional interfaces.

The blue USB-cable

Together with the Xiegu G90 HF transceiver you bought at Radioddity, you quite likely also got a so called 'XIEGU radio universal data cable' also known as 'the blue USB-cable'. That cable has a total length of about 90cm and comes with a 3.5mm Stereo-jack on one side and a blue USB Type A plug on its other side.

Within the blue USB plug a FTDI-compatible FT232BL chip converts the USB-signals into normal serial-port signals. Only TX-Data, RX-Data and Ground are been connected to the Xiegu G90, which means there is no hardware-based handshake possible for the data transfer but software-based handshake.

Note: The very first Xiegu G90´s had been delivered with a black USB-cable. That black USB-cable is not based on a FTDI-chip but on a Prolific chip and therefore does require a different device driver. Everything else that's states about the blue USB-cable does apply to the black one as well.

The connections within the cable are as follows:

Signal	Naming within USB-part of cable	Cable colour	3.5mm TRS plug	G90 Signal
Ground	GND	black	sleeve	Ground
Transmit-Data	TX	green	tip	RX-data
Receive-Data	RX	white	ring	TX-data

Hint: In order to prevent unwanted interference between the PC and the Xiegu G90 transceiver via the blue USB cable, we advise you to add additional EMC magnetic rings or clip-on ferrite filters close to both ends of the cable (as shown in the picture).

Due to the fact, that the USB2Serial-converter circuit is not original FTDI but a compatible version, it might be required in order for the cable to be properly identified by your PCs device manager to install an older FTDI-driver version. Within the device manager of your Windows™-based PC, you should find a serial port of type FTDI. You may download the appropriate Windows™-driver for the FT232BL chip directly from the FTDI website at https://ftdichip.com/drivers/d2xx-drivers/
Make sure that you take version 2.08.24 !

With the blue USB-cable you can already accomblish the following tasks:
- Update of base-unit as well as update of display-unit
- Set parameters of your Xiegu G90 transceiver (except pushing the PTT)

Note: Audio signals will not be transmitted via the blue USB-cable.

| Intended use	base-unit	display-unit
Software-update of Base-Unit*[1]	blue USB-cable	n.a.
Software-Update of Display-unit*[1]	n.a.	blue USB-cable
CAT control	n.a.	blue USB-cable

*[1] Whenever updating your Xiegu G90 HF transceiver, make sure that both, the base-unit as well as the display-unit get the matching version numbers (normally both the very same).

Note: For updating the firmware of a Xiegu G90, the speed to be used is 115000 bps, whereas for CAT control the speed to be used is 19200 bps.

Hint: After turning on your Xiegu G90, connect the USB-cable to its IO-port. Never do it the other way round as that might corrupt your firmware, requiring to upload the firmware in order to get it operating again. When you shut down your Xiegu G90 do not forget to disconnect the cable that is connected to the IO-port.

The 8-pin miniDIN ACC cable

On the backside of your Xiegu G90 there is an 8-pin miniDIN socket for connecting accessories, named ACC.
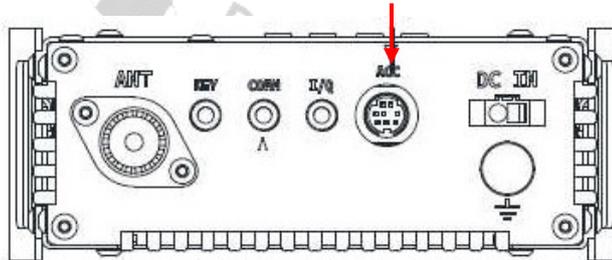
The pinout of this miniDIN-8 is shown in the below picture.

PTT	(1)		BAND	(2)
AF-IN	(3)		ALC	(5)
AF-OUT	(4)		+8V	(8)
DATA-OUT	(6)		GND	(7)
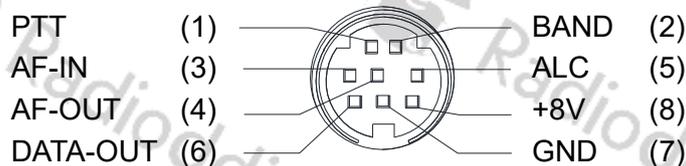
The purpose of each signal is as follows:

PTT (1)

If pin 1 of the miniDIN-8 socket is input as well as output. Whenever the transceiver is in TX mode pin 1 of the miniDIN-8 will be 'L'. If connected to ground via this pin, the transceiver will switch to Transmit-Mode. If not connected to ground, the transceiver will be in Receive-Mode.

Note: We will use VOX-control. But more on that in a later chapter.

BAND (2)

At pin 2 of the miniDIN-8 socket, the G90's ACC port provides a band data voltage output for each band. The band data can control peripheral to automatically switch the band or share the band information with other devices (e.g. XPA-125B amp). As you can see, the stepping value between each band is 230mV.

Band	Voltage	Band	Voltage
1.8MHz	230mV	14MHz	1380mV
3.5MHz	360mV	18MHz	1610mV
5MHz	690mV	21MHz	1840mV
7MHz	920mV	24MHz	2070mV
10MHz	1150mV	28MHz	2300mV

AF-IN (3)

As already mentioned, the audio signals are not transmitted via the blue USB cable. For the audio signal to be transmitted you do need this external audio frequency input interface to pin 3 of the miniDIN-8 socket. When the Xiegu G90 is used for data communication in conjunction with a computer or an external modem, the correct input signal options need to be selected as well.

1. Input the external audio signal to AF-IN of the ACC port.
2. Enter the second option of the INPUT button [FUNC+POW+POW] to select 'LINE' instead of 'MIC'.
3. In the system menu, select: AUX IN VOLUM to set the appropriate input volume (as described below).

When the AF-IN pin of the ACC interface is used for line input audio, set the appropriate input volume in the "AUX IN Volume" option in the system menu. Set it at a mid level value first. When using digital communications and the ACC port is used for audio input, the audio level coming in should be capable of 200mV.

Then watch TX power output (while keyed) and adjust your incoming audio from the PC (using the PC's sound card output volume level control). Remember that you want to set the radio at 20 W output in digital modes and lower the audio level coming from the PC such that the average power level on TX is around 10W. Digital modes can have long key-down times and the radio will heat up more. Plus, digital modes require a very clean signal which can be achieved with a lower audio drive level.

With a good antenna, 10W average out is easily sufficient for most digital mode communications, as they are very efficient. Keep a check on the temperature of the radio when you operate digital modes (and in general). Your ambient temperature might be 13°C (55°F) or 40°C (105°F) which has a great impact on heat that´s build-up. If the radio becomes very hot, you'll need to reduce power or give it a cool-down rest. The radio's transmit section is very conservatively designed, but any radio can be over-heated under certain challenging operating conditions.

Hint: We do offer a special 'G90-H1 Holder Cooling Fan Bracket for Xiegu G90'. Besides its cooling functionality, this stand also places the Xiegu G90 into a better reading position on your desk.

AF-OUT (4)

What AF-IN is for the transmitted audio input signal, AF-Out on pin 4 of the miniDIN-8 socket is for the received audio output signal, which is called 'AUXOUT' within the G90 firmware. In the system menu, select: 'AUXOUT Volum' to set the appropriate output volume but we get to that later.

The software you use for CAT-control often does provide an audio-meter showing best input levels (as seen from the PC).

- When using digital communications and the ACC AF-OUT port is used for PC-side TX audio input, the Iinput audio drive level of the PC should be capable of handling 200mV.

In the system menu, the following two settings are the ones to be adjusted for data communications:

Option	Parameter	Description
5	AUXIN Volum	Line input volume setting
6	AUXOUT Volum	Line output volume setting

For data communications, the volume output level (sound card output) of the PC is to be adjusted according to the 'AUXIN Volum' (which becomes your TX audio).

The volume of the input to the computer (normally the mic input) also needs to be adjusted according to the 'AUXOUT Volum' (received audio going to the PC).

Those PC settings are normally found within 'Sound devices'. It is best to set the radio to mid level settings and then adjust the PC's levels for proper operation. Fine tuning from that point can be done with the G90's menu settings.

ALC (5)
The input signal on pin 5 of the miniDIN-8 socket may vary between 0….3.3V. The higher the ALC voltage is, the higher the power.

DATA OUT (6)
Pin 6 of the miniDIN-8 socket is connected to tip and ring of a 3.5mm TRS jack on the Xiegu CE-19, labeled DATA CON but not routed within the G90.

GND (7)
Normal power supply ground is connected to Pin 7 of the miniDIN-8 socket.

+8V (8)
Pin 8 of the miniDIN-8 socket drives +8V DC for powering the CE-19 interface. The maximum current available at this pin is 50mA. This pin is not intended to connect any electronics.

The CE-19 interface

In order to make the required audio connections between the G90 and your PC, you do need the Xiegu CE-19 interface. Using the miniDIN-8 cable supplied with the Xiegu CE-19, the Xiegu G90 is conected via its ACC port to the miniDIN8-socket of the Xiegu CE-19 interface.
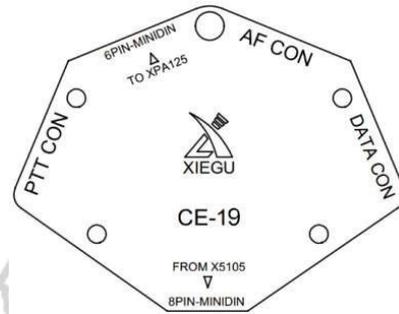
Note: The miniDIN6-socket also found on the XIegu CE-19 is used for connecting a Xiegu XPA-125B amplifier. Be careful as to not mix the two miniDIN-sockets up with each other as it would result in bent pins of the miniDIN plugs.

The CE-19 comes with 3 premade cables. On one side of those cables, there is a green 3.5mm TRS plug and the other side comes with coloured open ends.

The pin assignment of those cables is as follows:

Pin	Colour
Tip	White
Ring	Red
Sleeve	Black

Furthermore, you will also find three separate black 3.5mm TRS plugs.

PCs do have a speaker output and a line or mic input. You will need at least two of those supplied cables in order to make a proper wiring between your PC and the XIegu CE-19.

To connect your PC to the Xiegu CE-19 interface using two of the green plug cables and one black plug, you need to wire the cables as follows:

Cable	Colour	Green 3.5mm TRS plug	PC signal	G90 ACC signal	Black 3.5mm TRS plug
PC speaker	black	Sleeve	GND	GND	Sleeve
PC speaker	Red	Ring	Right audio out	AF IN	Tip
PC speaker	White	Tip	Left audio out	n.c.	n.c.
PC line in / MIC	black	Sleeve	GND	GND	Sleeve
PC line in / MIC	Red	Ring	Right audio in	AF OUT	Ring
PC line in / MIC	White	Tip	Left Audio in	AF OUT	Ring

To connect your PC to the Xiegu CE-19 interface using two of the green plug cables for the PC-side and the remaining green plug cable for the Xiegu CE-19 side, you need to wire the cables as follows:

Cable	Colour	Green 3.5mm TRS plug	PC signal	G90 ACC signal	Green 3.5mm TRS plug	Colour
PC speaker	black	Sleeve	GND	GND	Sleeve	Black
PC speaker	Red	Ring	Right audio out	AF IN	Tip	White
PC speaker	White	Tip	Left audio out	n.c.	n.c.	
PC line in / MIC	black	Sleeve	GND	GND	Sleeve	Black
PC line in / MIC	Red	Ring	Right audio in	AF OUT	Ring	Red
PC line in / MIC	White	Tip	Left Audio in	AF OUT	Ring	Red

Hint: The same that does apply for the USB cable also applies for any other cable. In order to eliminate RF signal interference between the PC and the Xiegu G90 transceiver, we advise you to add additional EMC magnetic rings or clip-on ferrite filters close to both ends of the audio cables.

5. CAT control

For CAT control you need to connect the 3.5mm stereo-jack of the blue USB cable to the IO-port of the display-unit (17) as the IO-port found at the back of your Xiegu G90 does not support CAT control.
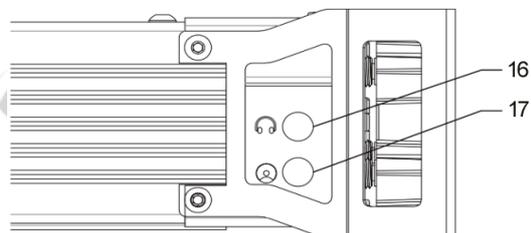
Note: If you do use the GSOC for operating your Xiegu G90 base-unit, CAT control is not supported as the GSOC does not have the IO-port required for CAT control.

Select Line input
Select Line input instead of Microphone by: [FUNC] + [POW] + [POW] to select 'LINE' instead of 'MIC'.

Set AUX-IN volume
Long-press [FUNC] to enter the configuration menu. Next press [NEXT], [NEXT], [NEXT], [NEXT] to advance to menu '5. AUXIN Volum'. Select a middle value of 7 or 8 as volume for AUX-IN (the allowed range is 0…15).

Set AUX-OUT volume

Hit [NEXT] once more to confirm the value and advance to the menu '6. AUX OUT Volum' for setting the volume of the AUX-OUT signal of your Xiegu G90. Set it to the maximum value of 15. Confirm your selection with [SAVE] which will also exit the configuration menu.

PTT method

For operating the PTT there are two possibilities, either via CAT control or by means of VOX. For automatic PTT by means of the audio out signal from your PC data-mode application, the VOX-function needs to be turned on. Hit [FUNC] + [VOL] and turn 'VOX: ON'. For PTT by means of CAT control, the VOX-function needs to be turned off. Hit [FUNC], [VOL] and turn 'VOX: OFF'.

Disable AGC

Next disable AGC by hitting [AGC] until it states 'AGC--" on the Xiegu G90 display

HF power and ALC

The output level from the computer to the radio should be adjusted so that the ALC value displayed on the screen ranges from 30 to 85. The lower the ALC, the better. You should set the radio a bit below it maximum of 20W output and adjust the PC's sound card output so that your ALC is within range.

Excessive high input signal level may overload the input amplifier, resulting in the modulation signal distortion. With ALC correct, the TX power output reading may jump around rapidly under digital modulation - but average power levels will be in the correct range for a clean and effective signal. Digital modes are highly efficient and require much less TX power.

6. CI-V implementation

CI-V is an abbreviation for '**C**omputer **I**nterface, version **V**', had first been introduced by ICOM and is been used for CAT control since several decades. As for the Xiegu G90, the communication is carried out using serial communication between the G90 and the PC using the blue USB cable or a cable compatible with that.

Table 1 (part 1/2)			
CMD	**Sub-CMD**	**DATA**	**Description**
0x00	-	see table2-1	Set acvive VFO frequency
0x01	-	see table2-2	Set acvive VFO mode
0x02	-	see table2-3	Get frequency edge
0x03	-	see table2-1	Get active VFO frequency
0x04	-	see table2-2	Get active VFO mode
0x05	-	see table2-1	Set active VFO frequency
0x06	-	see table2-2	Set active VFO mode
0x07	-	-	Select the VFO mode
	0x00	-	Select VFO-A
	0x01	-	Select VFO-B
	0xb0	-	Swap VFO-A/B
0x0F	0x00	-	SPLT OFF
	0x01	-	SPLT ON
0x11	X	-	Toggle ATT (X=don't care)
	-	-	Get ATT
0x14	0x01	-	Get AF level (Rx volume) return values are in BCD code format
	0x03	-	Get SQL level
	0x09	-	Get CW sidetone frequency
	0x0A	-	Get Tx power
	0x0C	-	Get CW key speed
	Others	-	Always return 255 (in BCD code format)
	0x01	BCD code	Set AF level (0~255 map to 0~100%, same below)
	0x03	BCD code	Set SQL level
	0x09	BCD code	Set CW sidetone frequency
	0x0A	BCD code	Set Tx power
	0x0C	BCD code	Set CW key speed
0x15	0x01	-	Get SQL level (return values are in BCD code format, 0~100% map to 0~255, same below)
	0x02	-	Get S-Meter
	0x11	-	Get Power-Meter
	0x12	-	Get SWR-Meter

CMD	Sub-CMD	DATA	Description
0x16	0x02	-	Get PRE switch
	0x12	-	Get AGC mode
	0x22	-	Get NB switch
	0x44	-	Get COMP switch
	0x50	-	Get dial encoder lock status
	0x02	0x00	PRE OFF
		0x01 or 0x02	PRE ON
	0x12	0x00	AGC OFF
		0x01	AGC Fast
		0x02	AGC middle
		0x03	AGC slow
	0x22	0x00	NB OFF
		0x01	NB ON
	0x44	0x00	COMP OFF
		0x01	COMP ON
	0x50	0x00	Dial encoder unlock
		0x01	Dial encoder lock
0x1C	-	-	Get PTT switch
	0x00	0x00	Release PTT
		0x01	Press PTT
	0x01	0x00	ATU OFF
		0x01	ATU ON
		0x02	ATU start tuning

Table 1 (part 2/2)

Table 2-1

BCD frequency		
Byte0	D[7:4]	10Hz
	D[3:0]	1Hz
Byte1	D[7:4]	1kHz
	D[3:0]	100Hz
Byte2	D[7:4]	100kHz
	D[3:0]	10kHz
Byte3	D[7:4]	10MHz
	D[3:0]	1MHz
Byte4	D[7:4]	1GHz
	D[3:0]	100MHz

Table 2-2

DATA	MODE
0x00	LSB
0x01	USB
0x02	AM
0x03	CW
0x07	CWR

Table 2-3

Lower edge	Separator	Higher edge
BCD frequency	'-'	BCD frequency

The Xiegu G90 does respond to various addresses, such as 0x70 (Hex) (default), 0x88 and others.

7. Details on some of the possible digital data modes

As amateur radio operators like to experiment with new technology as well as adapt existing industry standards to the amateur radio world, new modes of radio operation pop up every once in a while. Let´s have a closer look on some of those rather digital and data focused modes that are currently quite popular.

FT8

FT8 was first publicly proposed in 2017 by Joe Taylor and named after the first letters of the surnames of the two developers Steven **F**ranke (K9AN) and Joe **T**aylor (K1JT) following the number **8** to indicate, that eightfold frequency shift keying (MFSK8) is been used. Since then, FT8 has become extremely popular on shortwave.

JS8

JS8 had been derived from FT8 by Jordan Sherer (KN4CRD), resulting in its name **J**ordan **S**herer **8** (eightfold frequency shift keying). In contrast to FT8, JS8 is mainly focused on the exchange of personal messages with the remote station, like the chat functionality of the various instant messengers. The only software availably that currently does support JS8 is called JS8Call (see http://js8call.com/ for more details).

WSJT

This **W**eak-**s**ignal transmission method invented by **J**oe **T**aylor (K1JT) or WSJT-X as its current version, is rather a group of transmission protocols and free amateur radio software for communication using weak signals.

8. Software for CAT control and digital data modes

There are quite a few programs out there that may be used with your Xiegu G90. Some of them do support the Xiegu G90 out of the box, others need to be set for IC-7100 or IC-756PRO as those radio share most of their command set for CI-V CAT control with the Xiegu G90. The baudrate for CAT control of your Xiegu G90 should be set to 19200.

Warning: As some of the CAT control programs do poll the radio regularly, we advise in general to shutdown the PC program and disconnect the blue USB cable from the Xiegu G90 after operating your G90 with the PCs help in order to guarantee that the G90 does not boot up into firmware upgrade mode when it is turned on and the polling of the PC-software being interpreted as a keystroke for activating the update-function of the Xiegu G90.

FIrig

FIrig is mainly a CAT control program that may be used as a standalone solution or in combination with other programs such as fldigi or WSJT-X. Its main purpose is to control your Xiegu G90 via its IO-Port and the blue USB-cable connected between the G90 display-unit IO-port and your PC.

https://sourceforge.net/projects/fldigi/files/flrig/

On first use of flrig you need to configure flrig for use with your G90. In order to do so, select the 'Config' button in the top line of flrig, then move your mouse to 'Setup' and over to 'Transceiver'. Then click on your leftz mouse button to select that option.
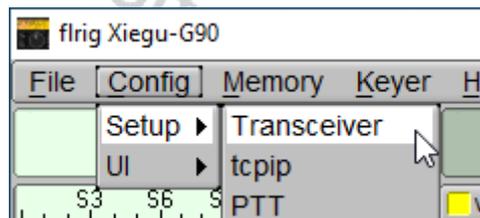
Now select 'Xiegu-G90' as your device (1), select the proper COM-port that your blue USB-cable has been assigned to (2) and select a baud rate of 19200 (3). Leave the other parameters as shown in the below screenshot. Next click the 'Init' button (4). You will hear some noise of the relais inside the Xiegu G90. After that initialization sequence has finished, the status indicator (5) right besides 'Connected' should be coloured green.
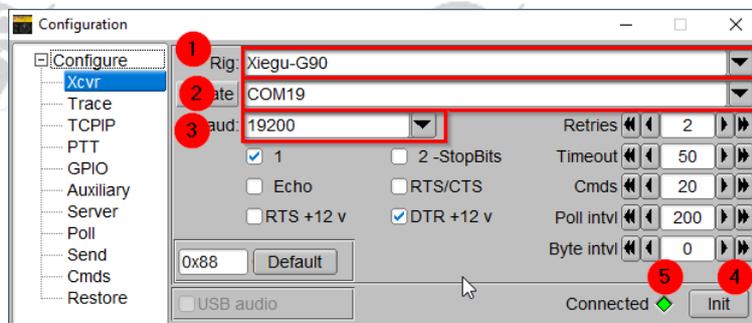
Your Xiegu G90 is now successfully connected and you should see the very same data displayed within flrig as on the display of your Xiegu G90.
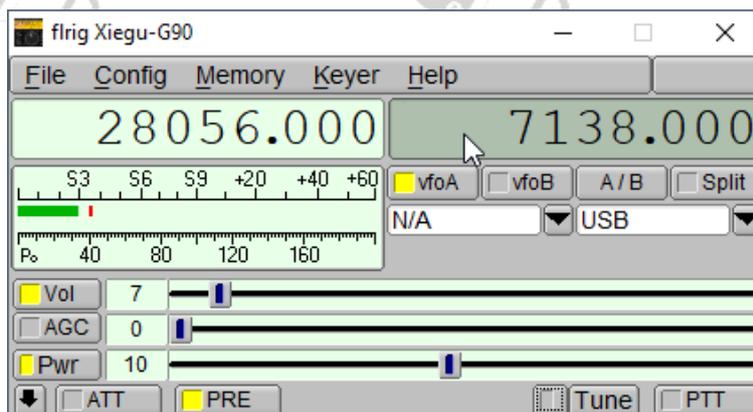
Whenever the Xiegu G90 has not been implemented yet within a CAT control software you´d like to use, you may often select 'flrig' as radio and use the software with flrig as the connection bridge to your Xiegu G90. This is a huge advantage of flrig.

FLdigi

Fast **L**ight **digi**tal Modem Application, pronounced 'F L digi' and abbreviated as FLdigi, is a cross-platform modem program that supports most of the peer-to-peer (live keyboard) digital modes used on the amateur radio bands.

Fldigi does require a PC with a soundcard in order to route analog input and output via the sound card of your PC.
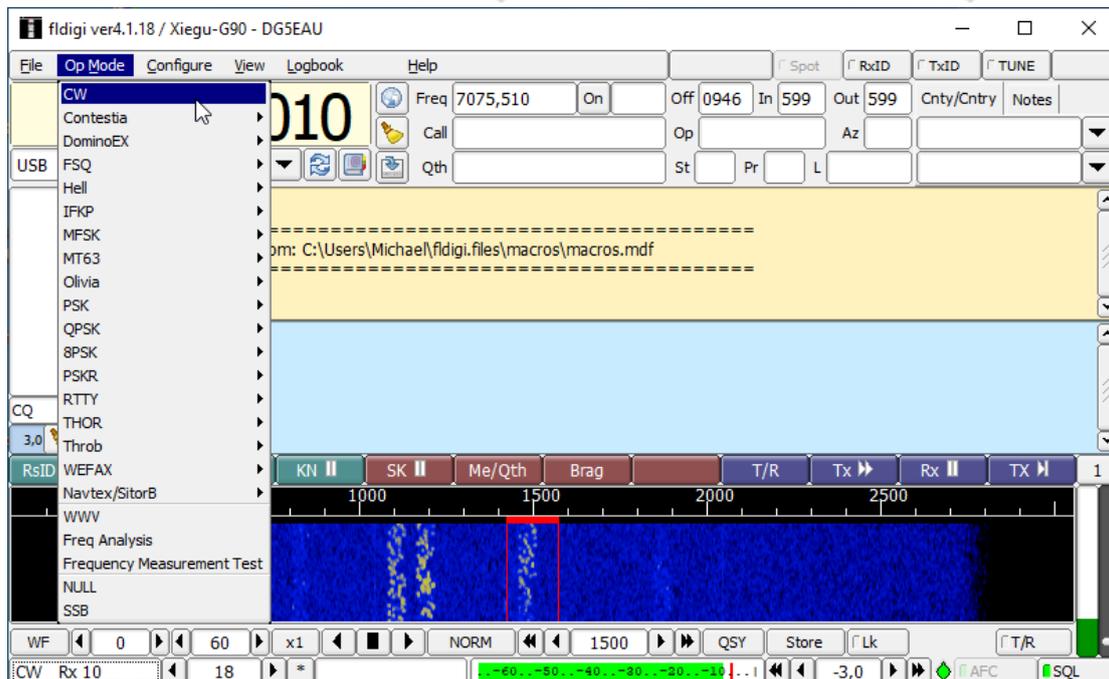
Fldigi is available for a variety of platforms, such as Linux™, OS X™, Windows™ and FreeBSD™.

http://www.w1hkj.com/ and https://sourceforge.net/projects/fldigi/

Flrig and Fldigi are both OpenSource and continuously maintained by its developers W1HKJ & Associates. Both software packages are free. However, you are asked for contribution made to http://www.gideons.org/ through their gift Bibles recognition program.

Ham Radio Deluxe

Ham Radio Deluxe combines contact logging, rotor control, rig control, satellite tracking and digital modes within one program suite. In order to test before you buy, you can install a 30-day trial version.

https://www.hamradiodeluxe.com/

WSJT-X

As already mentioned, WSJT-X is a group of transmission protocols and free amateur radio software for communication using weak signals. IN ored to get it running as expected, a few settings are required. The following screenshots do show examples of such.
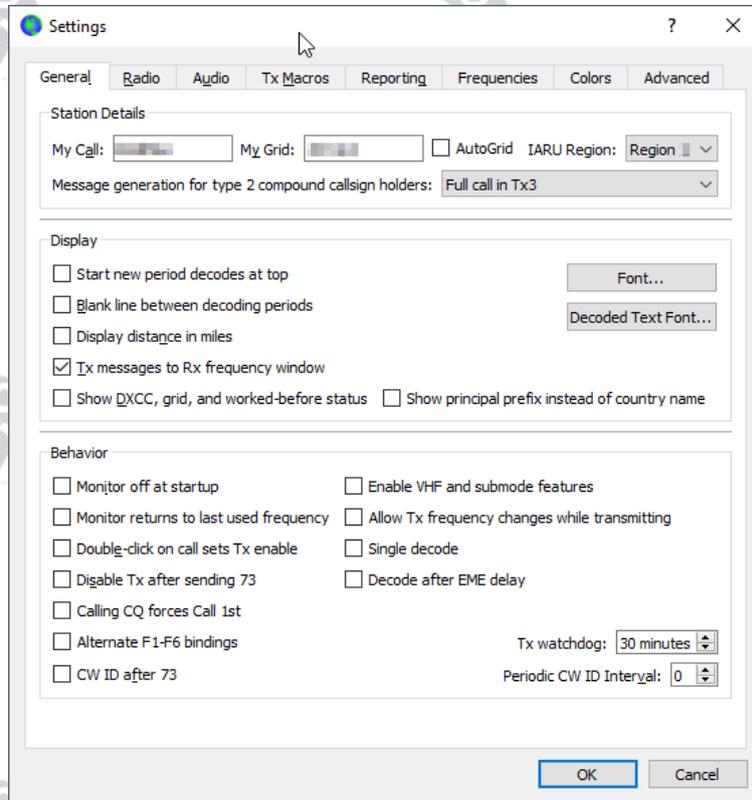
Within the 'General' tab you set your callsign, grid locator and IARU region. You may want to alter the 'Tx watchdog' value that does define the time at which WSJT-X gives up in case it could not successfully manage a QSO.
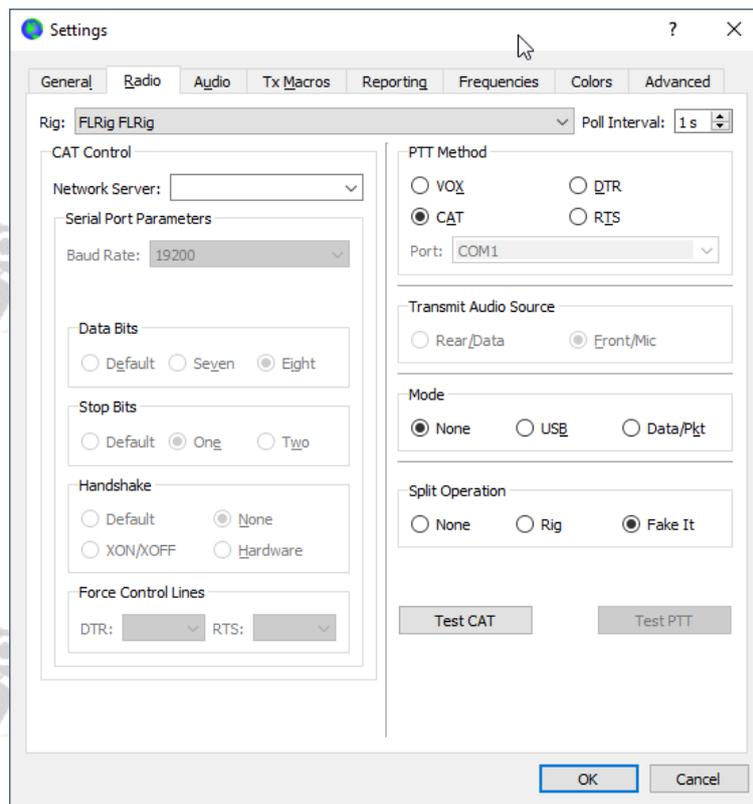
Within the 'Radio' tab you select your radio. As already mentioned, we advise to use 'flrig' for connecting to your Xiegu G90.
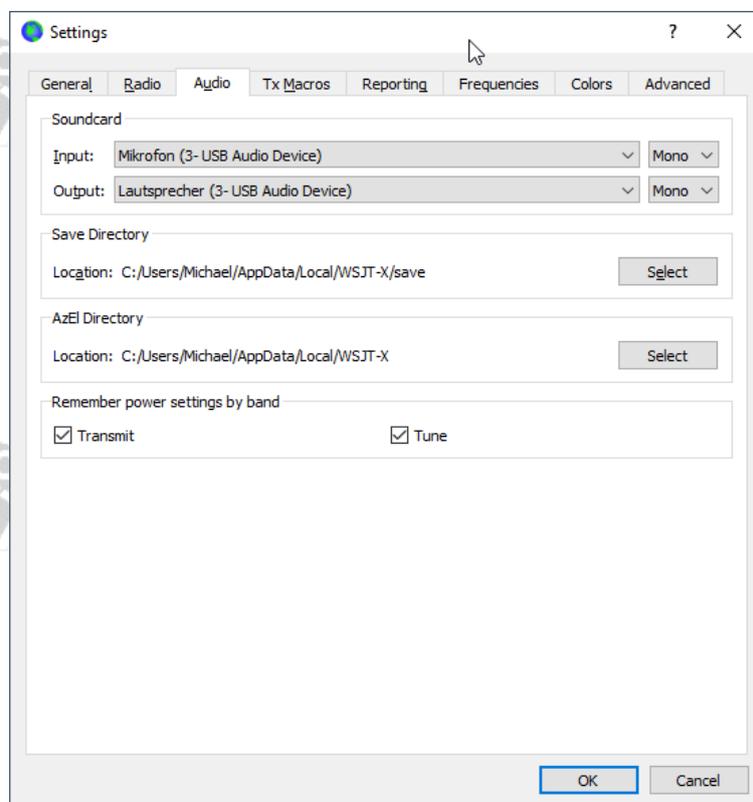
And not to forget the 'Audio' tab that is used to define the input and output signals used from your PC.

If all is setup correctly you should be able to decode digital signals. In order to make a QSO with another station you have to manually enable TX by clicking the 'Enable TX' button. The function will automatically be deactivated as soon as your QSO has been completed or the TX watchdog has kicked in.

https://physics.princeton.edu/pulsar/K1JT/wsjtx.html

Dimension 4

The successful operation of HF digital modes is depending on exact TX timing which is derived from the internal clock of your PC. Normally a PC would update its internal clock once a day. That is not sufficient for the described digital modes. That is, where Dimension 4 steps in. Is is capable of more regular updates to the internal clock using SNTP (Simple Network Time Protocol) time sources within the internet.
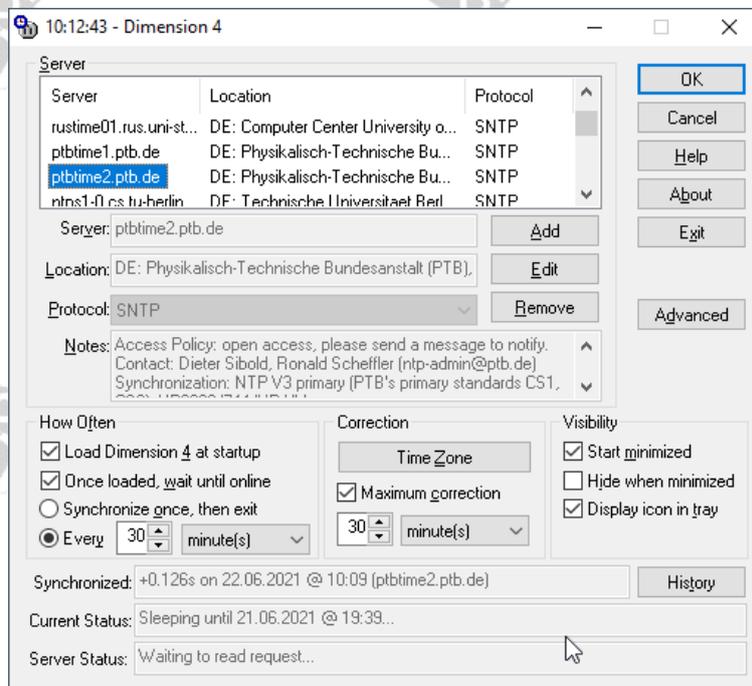

In the above example it is setup to synchronize the internal PC clock against ptbtime2.ptb.de every 30mins.

http://www.thinkman.com/dimension4/

GridTracker

Digital modes do have a high focus on messages that are as short as possible. For example, FT8 does not transmit the city of the station but their locator. In order to get a better overview on the geographical location of stations, GridTracker is your way to go. Besides its excellent graphical output, it also automatically links to WSJT-X.
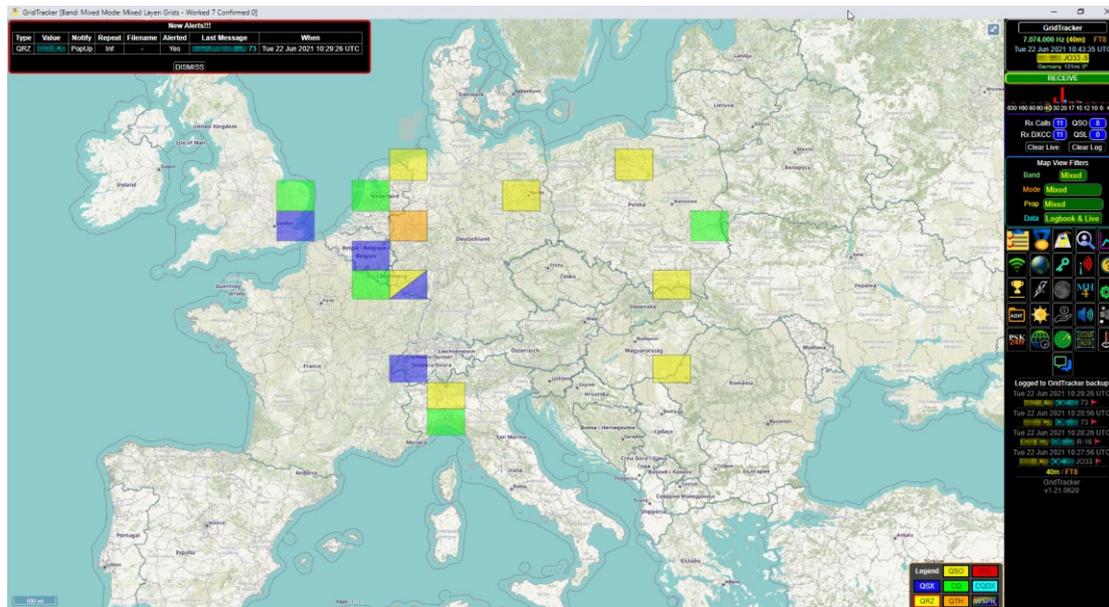
GridTracker is available for a variety of platforms, such as various Linux™ distributions, OS X™ and Windows™.
https://gridtracker.org/

We at Radioddity hope this document is of help for CAT control your Xiegu G90 with your PC and start operating in digital modes!

TUTORIALS, SUPPORT AND MORE CAN BE FOUND AT:

https://www.radioddity.com/

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