

# Exeter Amateur Radio Society

## *Raynet Data Operations Guide*

*Version 3 - 4 March 2012*

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### Introduction

This document describes how a Raynet member should prepare for and use data modes during RAYNET operations. It is specifically for Exeter RAYNET's choice of computer operating system, software applications, data interface and radios.

**This document draws heavily on the “Fldigi Operating Guide” prepared by Mike Sloan GU3WHN (RAYNET Controller Bailiwick of Guernsey), which was updated for ICE9 by G8RXA and G6BJJ. Full credit for the scope and detail of this guide is due to them.**

Before a RAYNET member attends an exercise they should run through the PREPARATORY section. This will ensure a minimum of set-up and testing effort in the field.

Once in the field for the event, the member should follow the OPERATIONS information.

Finally the member should archive and clean up using the POST-OPERATIONS information.

# 1. PREPARATORY

This document assumes that participating members are using the following devices:

1. Portable computer using the Windows (7/Vista/XP) operating system.
2. The latest Fldigi software program
3. G4ZLP Digimaster Pro+ data interface and associated cables
4. Yaesu UHF/VHF transceiver. A CAT interface is not necessary.

Before attending an event it is essential to assemble and test the hardware, cabling and software and to learn to use the Fldigi software. This Preparatory section explains how to “get started” assuming you may not have used any of these devices before.

Some points:

- Operation is primarily on VHF and UHF. HF is feasible but impractical because of interference.
- A single frequency is used on VHF/UHF with a Controller determining the use of that frequency. At any time voice conversations OR data bursts can be heard between the Controller and members. This technique is a standard and has evolved to minimize confusion.

## 1.1 Computer

### 1.1.1 Choice of hardware

You will need to have a laptop or netbook computer running a recent version of the Microsoft Windows operating system. The computer should have at least two USB sockets and audio jacks for **Microphone In** and **Headphones Out**. The Digimaster Pro+ is delivered with a USB sound card that provides these two audio sockets.

Although the programs do not require fast processors and large memory, newer laptops or netbooks have a battery life of over 4 hours which is very useful in the field. If you use an older, slower computer with Windows XP or Vista, you may be slowed down with installation problems. The most recent version of Windows (Windows 7) is the easiest to configure. The latest operating system version is easiest to use, so the faster you will be using the software.

Make sure you are connected to the Internet because during installation you will need to download applications and reference files, which is not possible once you are in the field.

### 1.1.2 Sound

You must understand how your computer processes audio. You will need to recognize and use the names of the individual subsystems for recording audio and playing it back.

Audio can be recorded using a microphone built into the front of the laptop computer, or using an external USB webcam or from a 3.5 mm audio jack on the edge of the computer.

Audio can be played back through internal loudspeakers or through a 3.5 mm audio jack on the side of the computer.

The exact menus and their options are very dependent on whether you are using a standard audio interface or an additional sound card. For a basic laptop with no attached webcam, follow these instructions:

1. If you are using a USB sound card, plug it in and wait for Windows to configure it by monitoring the pop-up messages from the System Tray.
2. Right-click on the “Speaker” icon in the System Tray and select “Recording Devices”. A Microphone should be listed. Make a note of what it is called, e.g. “Realtek High Definition Audio”. (This phrase will be used later in the Fldigi configuration.)
3. Click on the “Microphone” and then click on “Properties”.
4. Under the “Listen” tab, make sure “Listen to this device” is not selected.
5. Under the “Levels” tab, slide Microphone to 100% and set Boost to 0 dB.
6. Under the “Enhancements” tab, ensure “Disable all sound effects” is ticked.
7. Click OK.
8. You are returned to the “Recording” tab. Now click on the “Playback” tab.
9. Make a note of the name of the “Speakers”. Usually it is the same as microphone (e.g. “Realtek.....”) (This phrase will also be used later in the Fldigi configuration.)
10. Click on “Levels” and make sure the main audio slider is 100%. If there is a slider for “Microphone”, click on the small speaker icon to Mute it.
11. Click on the “Enhancements” tab and ensure “Disable all sound effects” is ticked.
12. Press “OK”.
13. You are now back in the “Sound” screen. Click on the “Sounds” tab.
14. We need to disable all system sounds. Under the “Sound Scheme” drop down menu, select “No Sounds”
15. Click “OK”.
16. Reboot the computer.

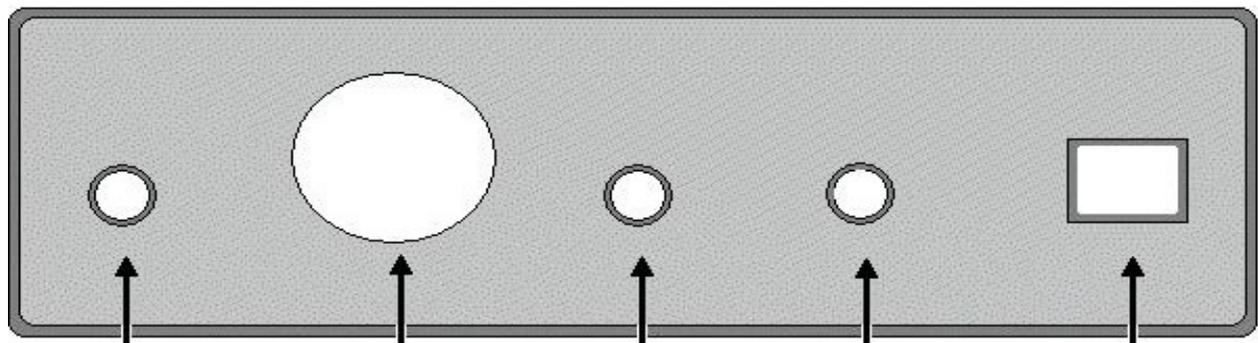
### **1.1.3 Raynet Folder**

1. Create a folder in which to keep all RAYNET related documentation and forms. Right-click on the Desktop and select “New” → “Folder”. Change the name to “RAYNET Data Files”.
2. Double click on the “RAYNET Data Files” and in the empty folder create the following folders using the same sequence: “Documentation”, “macros”, “Pending Files”, “Received Files”, “Templates Copy” and “Transmitted Files”.
3. Using the weblink in the Resources section at the end of this document, download the “CHALET Text Form Master.txt” into the “Templates Copy” folder.
4. Also download the “ICEmacros\_v5.mdf” file into the “macros” folder.

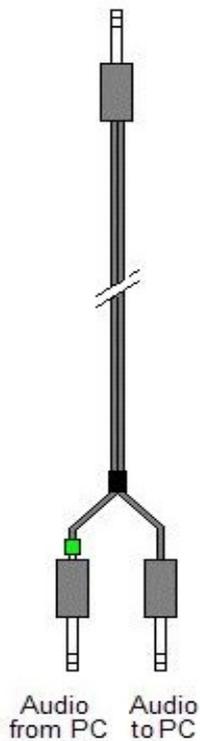
## **1.2 Digimaster Pro Data Interface**

The documentation for the Digimaster Pro+ can appear bewildering as it does not clearly specify the functions of the unit. Instead it describes in great detail its versatility and vast number of protocols and radios that it works with. The device essentially provides opto-isolated interfaces for the audio input/output which gets around awkward earthing problems when using a computer and radio both connected to the same earth. It also adds a USB interface to control PTT keying. The most useful feature is the CAT interface that allows simple remote control of the radio from Fldigi (and Ham Radio Deluxe or Digipan). Experience has shown that the CAT interface is not useful on exercises. Because the computer may need to be connected to transmitters that may or may not have a CAT interface, it is recommended that it is not connected and disabled in the Fldigi program.

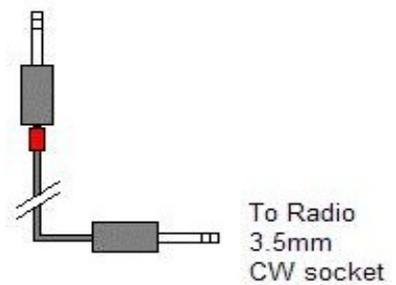
Inspect the Digimaster Pro+ unit, rear connectors and cables. Correct installation appears difficult because there are no socket labels, however by looking at the following diagram copied from the Digimaster Pro+ instructions, you will see that there is only one way to connect the unit. The following instructions are adapted from the instructions referred to in the Resources appendix at the end of this document called “Digimaster Pro+ Installation”.



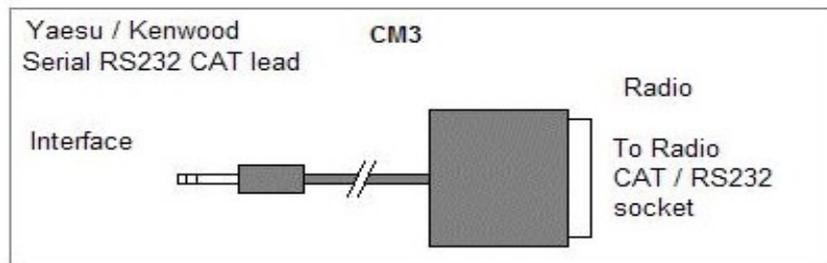
Audio to/from PC    DATA lead to radio    CAT lead to radio    CW lead to radio    USB lead to PC



DATA lead to radio is available for most radios and the 6 pin mini din connector fits here, the other end of the cable connects to your radio.



The choice of CAT connecting lead is determined by the choice of CM[x] module



Optional external plug in USB soundcard

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1. Make sure the computer is switched off.
2. Place the Digimaster Pro+ so that the power push-button is on the left. Push its power button in.

3. Set the two front panel controls (transmit and receive level) to the 9 o'clock position.
4. Attach the USB cable from the computer to the Pro+.
5. Turn on the computer.
6. Windows should identify the Pro+ and use drivers to enable the interface. When Windows has configured the port the red LED indicator on the Pro+ flashes red/green three times. The LED when green indicates power is on and the interface is in receive. When red, the LED indicates TX, either DATA or CW.
7. See the Resources page in this document appendix and download the "Digimaster Pro+ Com Port Test" program. It will download an executable program called "Find Digimaster PRO" into your Downloads folder.
8. Double click on this downloaded program. Click "OK" or "Yes" to any pop-ups about security. A small application opens with a single "Find" button.
9. Click on the "Find" button and wait 20 seconds while the program scans up to 96 virtual COM ports. When it completes it reports on two COM port interfaces with information such as "**COM 8 G4ZLP Digimaster PRO+ PTT/FSK/CW port**" and "**COM 9 G4ZLP Digimaster PRO+ CAT port + LOOPBACK**".
10. Make a note of the exact COM port numbers, which will be needed when Fldigi is configured.
11. Attach the audio cable from the computer to the Pro+. Take care to align the arrow on the connector housing with the top of the unit. It is a tight fit on the Pro+.
12. Attach the audio cable from the Pro+ to the Yaesu. The appendix to this document contains a copy of the Yaesu FT-857D manual showing the standard layout for most Yaesu radios.
13. Attach the (CW) PTT cable from the computer to the Yaesu.
14. Only connect the CAT interface if absolutely necessary. Raynet recommends it is **not** connected. Take care to align the arrow on the connector housing with the top of the unit. It is a tight fit on the Pro+.
15. This completes the Pro+ installation.

## **1.3 Yaesu radio**

### **1.3.1 Data mode**

For the purpose of the RAYNET exercise on VHF/UHF, data modes will be used on the same frequency as audio, so there is no need to change the "Mode" away from FM. (On HF operation, you would change to use "DIG" mode.)

### **1.3.2 CAT interface (Only in special circumstances)**

As stated in Section I.2, experience has shown that the CAT interface is not useful on exercises. Current SW Raynet practice recommends **NOT** using the CAT interface as it can add to operational confusion. Using a laptop for CAT control and data entry and capture can create potential for accidentally altering configurations due to too many windows being open.

If you have to use the CAT interface, make sure the Yaesu is correctly configured. Use the configuration buttons on the Yaesu to set the CAT interface speed and assignment.

In general, **Menu Mode 20** allows you to set the device connected to the CAT/Linear socket on the rear panel. Set this to the default of “**CAT**”.

**Menu mode 19** sets the Yaesu's CAT baud rate, so set this to **38400** bps, and not the default 4800 bps.

### 1.3.3 RF Power level

Data modes need to operate over a linear part of the power amplifier in the transmitter. Therefore, do not run the RF Power level at 100% as this will distort the audio frequencies leading to garbled data transmission and resulting in over-modulated distortion.

Set the RF power level to about 40% of the maximum rating of the transmitter. e.g. 40W on a 100W rated transmitter.

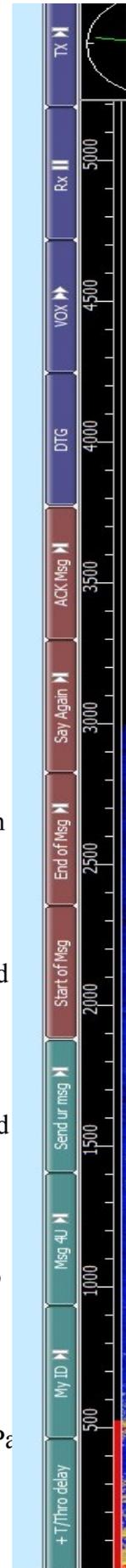
## 1.4 Fldigi Software

The Fldigi software ranks as one of the most reliable and versatile of the data mode applications. As there are so many data modes (over 60?), there are many options to support, so when looking at the program user interface for the first time it can be daunting. Before going any further, read more about the program on its Wiki page references in the Resources page as “Fldigi user guide”.

If you are upgrading to a newer version of Fldigi, SW Raynet has found that the inbuilt un-installer does not work properly. They recommend using REVO UNINSTALLER (freeware) or a similar Windows uninstaller and registry cleaner.

1. Download the latest stable Fldigi application from the reference in the Resources page for “Fldigi downloads”.
2. Run the downloaded program answering “Yes” to all the questions.
3. When installation is complete, locate the new Fldigi icon and double click to start the program .
4. Fldigi uses a folder of customized information called “fldigi.files” in your Home directory. As this is the first time the program has been run, it will ask questions about you and your computer to start creating these customised files. A set of “wizard” screens will request information from you. Click “Next”.
5. Begin by telling the program about yourself. Under “Operator Information”, enter your call sign, name and QTH. Leave the Locator and Antenna fields blank unless you plan on doing HF data modes with other hams. Click “Next”.
6. For Fldigi to communicate with the Windows processes, it needs to know the names of the audio subsystems, so add these to Fldigi. Under “Audio Drivers” → “Devices”, select “PortAudio”. Remembering the names of the audio devices you noted in the Computer Sound setup, use the drop-menu arrows to select those names for “Capture” (Recording) and “Playback”.
7. There is nothing to alter under the other two tabs “Settings and Tx. Level”, so click “Next”.
8. If you really need to use the CAT interface, then follow the steps 9 to 14:
  9. Fldigi now needs to know the type of radio equipment you are using. It has libraries of configuration information for almost all known radio models. The “Transceiver Control” screen has five tabs. Commence with “Hamlib”. Click on “Use Hamlib” to enable this function.

10. Under “Rig”, select your Yaesu model number from the drop down list.
11. Fldigi needs to know which USB port to use to communicate with CAT to the transceiver. Under “Device” select COM port for the CAT interface that you recorded earlier.
12. Under “Baud rate”, make sure the default 38400 bps is set.
13. Enable “PTT via Hamlib command”
14. Click on the red “Initialise”.
15. Make sure that the box marked “Use Hamlib” is left not ticked.
16. Now click on the “Hardware PTT tab”.
17. Click to select “Use separate serial port PTT”.
18. Click on device and select the COM Port for the “PTT/FSK/CW” port that you recorded earlier.
19. Click on both “Use RTS” and “Use DTR”,
20. Click on the red “Initialize” button.
21. Click on “Finish”.
22. The Wizard ends and the Fldigi program start running.
23. Click on “File” → “Exit”. When asked to save the configuration information, click on “Save”.
24. In your “Home” folder there is now a customised “fldigi.files” folders containing the information you have entered.
25. Start Fldigi again.
26. If you have not already done so, download the SW Raynet Fldigi macro file ICEmacros\_v5.mdf (4.3kb) that contains definitions for each of the F1 to F24 macro keys. The weblink is in the Resources section near the end of this document. A full explanation of these appears in the Appendix. These macro definition files are being constantly improved. Make sure you are using a version agreed in the ICE briefing document.
27. Move the file to the previously created sub-folder: “Raynet Data Files” → “macros”.
28. In Fldigi, click on “File” → “Macros” → “Open”. Change to the above folder and select “ICEMacros\_v5.mdf”. The macro bar should now appear as shown on the right side of this page.
29. Click on “Configure” → “User Interface”. Select the “Macros” tab.
30. Enable the last two options on the page “Load last used macro file on startup” and “Display macro file name on startup”.
31. Click on “Configure” → “Misc” → “Sweet Spot”. Make sure all the values are set to “1000”. This is the default offset of 1 kHz for each data mode.
32. Click on “Waterfall” → ”Display”. Click on “Always show audio frequencies” to enable it.
33. Click “Save” and “Close”.



34. If you want to change the size of characters displayed by Fldigi, use “Configure” → “Colours and Fonts”. You can use this to increase the size of received text, for example. Click on “Close”.
35. Slide the cursor to 1000 Hz on the waterfall and then click on the “Lk” button under the display to hold it at that value. You can fine tune the value using the adjacent arrow keys. A single arrow changes the value by 1 Hz and the double arrow by 10 Hz.
36. At the base of the screen ensure the waterfall signal range settings are set to “-20” dB and to 70 dB for the signal range. You can alter the values with the adjacent arrow keys.
37. At the bottom right of the screen is a slider control to adjust squelch (ALC). Slide it to between one third to half way up depending on signal strength received. Too low a setting introduces random characters. Too high a setting can lose data.
38. Select the correct data mode to use. Click on “Op Mode” → “NBEMS modes” → “BPSK250”. Raynet Control may later request this be changed should propagation conditions be unfavourable.
39. The use of a text based macro for Talk-Through latching is unnecessary as Fldigi (later versions only) already contains this facility. Select “Configure”->”ID”. At the lower right is the pre-signal tone box with setting up to 10 seconds, 0.1 resolution. This has the advantage of making delay time independent of mode. Select “5” seconds.
40. Click on “File” → “Exit”.
41. Start Fldigi again and ensure a message confirming the loading of the ICEmacros\_v5.mdf file has been completed. Double check this with the labels on the macro bar. (Some Fldigi versions can say the macros have been loaded when they have not been. Use the “File” → “Macros” → “Open” procedure listed above to load them.)

## **1.5 Testing**

To start testing, disconnect cables between the Pro+ and the Yaesu. This will stop you accidentally sending bursts of tone data when you were not planning to do so. If your laptop has a headphone socket, you can remove the audio jack and listen to the generated BPSK audio through the laptop loudspeaker. This is a good test to ensure that you have correctly configured Fldigi audio. Similarly if the laptop has a built-in microphone you can use it to pick up sounds that are randomly displayed as noise on the waterfall display.

Make sure that both Receive and Transmit windows are clear. Right-click in each window for the drop down menu in each window to achieve this.

Enter the name, call sign and location of the Raynet Control in the logging window at the top of the screen.

Play a macro by clicking on the Macro 2 button (“My ID”). Text will appear in the “Transmit” window and a burst of tone through the laptop loudspeaker will be heard. While this tone is playing you should hear a click from the Pro+ implying it would be generating the PTT for the transmitter. If this does not happen, it is best to call another Exeter Amateur Radio Society member and talk through your tests.

Assuming the audio could be heard, then you are ready to proceed. Connect the leads from the Pro+ to the Yaesu.

Now repeat the test. At this point you are ready to contact another radio amateur who can confirm correct data mode transmission and reception.



## 2. OPERATIONS

### 2.1 Fldigi usage

Operation is on VHF/UHF within the Zone and generally BPSK is used, any data mode could be employed. A one-to-one exchange is assumed but the procedure is equally capable of outstations sending data to each other, as long as Control is actually in **control** of the net to avoid confusion and interference. All links will be established by voice prior to turning the net over to data.

Each station with data to transmit must first notify Control and await clearance. The rest of the net is placed on standby during the transmission of the data.

Data for transmission on location must be recorded on a single paper record such as an approved message pad. This must be filed for legal reasons. This will typically be a CHALETS text file.

1. Prepare this data file while you are off-air.
2. Open the "Raynet Data Files" folder on your Desktop. Open the "Templates Copy" file.
3. Right click on "CHALETS Text Form Master" and select "Open With" → "Wordpad". (Do not use "Notepad" as this will drop all text formatting.)
4. Edit the form with the data on the submitted message form. You will note that it reflects exactly the fields on the approved CHALETS form using the alpha numeric identity of the items rather than the text titles.
5. "Save As" the file into the "RAYNET Data Files" → "Pending Files" folder. Save it as a separate Text File in a suggested format of either  
<call sign>Serial#.txt                    i.e. g4wdr0022.txt or  
<call sign>DTG\_Serial#.txt            i.e. g4wdr102030\_001.txt  
Close the file.  
Here is an example:

CHALETS TEXT FORM for Data transmission via RAYNET			
From: <b>CEPO</b>	Location: <b>DORCHESTER</b>		
To: <b>CEPO</b>	Location: <b>PLYMOUTH</b>		
Info:			
DTG: <b>102030 A</b>	Incident: <b>ICE9</b>	Serial #: <b>001</b>	
C			
:1 <b>100</b>	:2	:3	
H			
:4	:5	:6 <b>NO</b>	:7 :8
A			
:9	:10	:11 <b>YES</b>	
L			
:12	:13	:14 <b>40</b>	
E			

:15 :16 :17 :18

T

:19 **TRAIN** :20

S

:21 :22

---

Sent DTG: **102035 A**

By: **G8RXA**

You should now prepare to go on-air.

On the main Fldigi screen enter the receiving station (RAYNET Control) call sign, location and name details. Note that the “VOX” button is used to alert others that voice communications are required, as most stations will have their speaker muted.

***Use the ICE Macros in this order...***

1. **[Tuning][My ID]** ... this logs you as “On Net” with control. Even centring everyone's Waterfall to the same location it will still be necessary to send a transmitted test tone for participants to 'net in' owing to a degree of uncertainty with individuals' radio frequency settings.
2. Control should reply **[Ack Message]**.
3. **[Msg 4U]** ... this sends a tx request to Control/other station.
4. When given the go ahead to send, click macros in this order...
5. **[Start of Message], [DTG]** – this puts correct headers on the message for you.
6. Place cursor below last entry in Tx window, Right click, “**Insert File**”. Scroll to your pre-prepared completed CHALETS TEXT File in “RAYNET Data Files” → Pending Files”. The text is automatically pasted into the window.
7. Scroll to the bottom of the lower (Tx) window Check the accuracy of the data.
8. Check the accuracy again !!!
9. **Make absolutely sure that the cursor is at the end of the file.**
10. Check again that the recipient's call sign and location has been entered in the top logging window.
11. Click on the **[End of Message]** macro button. All the above macro's and file content is now (finally) transmitted. The file should appear to transmit to the top window at this point.
12. Ensure all data is copied and remember that the cursor must be at the end of the edited file before transmission. If not, only partial data will be sent. The radio returns to receive.
13. Once the file has been transmitted, wait for confirmation message from Control that the file has been received **[Ack Message]**. Be prepared to re-transmit. **[Say Again]**. If OK, save the transmitted data in the upper window by using the right mouse button to bring up the menu, i.e., “Save to file”
14. Choose the “Raynet Data Files” → “Transmitted Files” folder and save the file using a unique file name appropriate to the operation.
15. Clear both windows of any data. Right Click “Clear”
16. (At Raynet Control, the Controller will right click on the file he has received and save it in a relevant folder using a unique file name. A hard copy may be printed at Control to enhance the audit trail.)
17. Repeat this sequence as necessary. **Clear both windows of all data before preparing a**

**new message!!!!!!**

- 18. f you find you have made a mistake in sending data or the transmitter “locks On” you can perform an *emergency transmit stop* and force FLDigi and the radio back into receive mode by pressing the macro button [ **Tx STOP! ||** ]**

### **3. POST-OPERATIONS**

[This section will be written after the ICE-10 exercises.]

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## 4. RESOURCES

Fldigi main website: <http://www.w1hkj.com/>

Fldigi downloads: <http://www.w1hkj.com/download.html>

Fldigi user guide: <http://www.w1hkj.com/beginners.html>

Fldigi waveforms and sounds lookup: <http://www.w1hkj.com/FldigiHelp-3.20/Modes/index.htm>

Digimaster Pro main website: <http://www.g4zlp.co.uk/>

Digimaster Pro+ : [http://www.g4zlp.co.uk/unified/DM\\_PRO\\_PLUS\\_complete.shtml](http://www.g4zlp.co.uk/unified/DM_PRO_PLUS_complete.shtml)

Digimaster Pro+ Installation: [http://www.g4zlp.co.uk/Instructions/DigiMaster\\_PRO/DigiMaster%20PRO.pdf](http://www.g4zlp.co.uk/Instructions/DigiMaster_PRO/DigiMaster%20PRO.pdf)

Digimaster Pro+ Com Port Test:

<http://www.g4zlp.co.uk/Downloads/DigiMasterUtilities/DigiMaster%20PRO/Find%20DigiMaster%20PRO.exe>

Digimaster Pro+ Driver Windows XP and Vista Device Driver instructions:

[http://www.g4zlp.co.uk/Instructions/Device\\_Manager/Device%20Manager.pdf](http://www.g4zlp.co.uk/Instructions/Device_Manager/Device%20Manager.pdf)

CHALET form and ICEmacros\_v5.mdf file: <http://www.exeterars.co.uk/raynet/> Look in the folder for the current exercise to find the latest forms and macros.

## 5. Appendices

### 5.1 ICE Macros (Version 5)

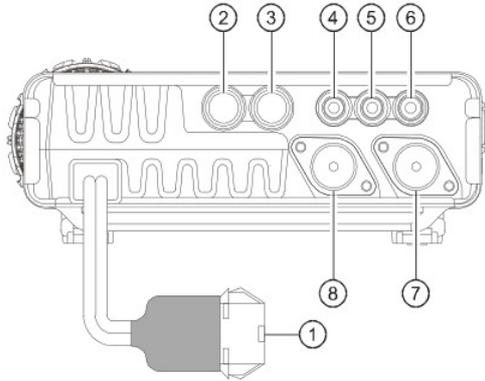
Macro Number	Macro Abbreviation	Meaning / Action
1	[Tuning]	Transmits a tuning signal to allow all stations to “net in” on your station
2	[My ID]	Transmits your call sign, QTH and Name as “On net” ready
3	[Msg 4U]	Sends I have a message for you
4	[Send Ur Msg]	Transmit clearance to send a message to you.
5	[Start of Msg]	Adds pre-amble to an out going message
6	[End of Msg]	Adds post script to your message and Transmits whole message.
7	[Say Again]	Requests repeat of last message
8	[Ack Msg]	Sends “message received”
9	[DTG]	Adds a date time group to a text string
10	[VOX]	Transmits a request to change to voice mode
11	[Tx STOP!]	Emergency Stop Tx and forces Radio/fldigi back to Rx mode.
12	[TX]	Forces Radio/fldigi to Transmit all data in lower screen
13	[CQ]	Transmits a standard CQ call
14	[ANS]	Replies to an incoming call
15	[Free QSO]	Adds pre-amble to a “free QSO” contact
16	[BTU]	Adds invite to station to reply to you
17	[SK]	Send '73 es tnx for QSO for a “free QSO”
18	[Blank CHALETS]	Puts blank chalets form in Tx window ready for editing prior to being transmitted.
19	[Msg Pad]	Puts blank Message Form in tx window ready for editing prior to being transmitted.
20	[CW ID]	Transmits your call-sign in CW
21	[BPSK31]	Sets data transmission mode to BPSK31
22	[BPSK125]	Sets data transmission mode to BPSK125
23	[BPSK250]	Sets data transmission mode to BPSK250 (default)
24	[BPSK500]	Sets data transmission mode to BPSK500

### 5.2 Yaesu Rear Panel Connectors

*Copyright: Vertex Standard Co., Japan 2011*

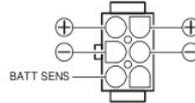


## REAR PANEL CONNECTORS



### ① INPUT Jack

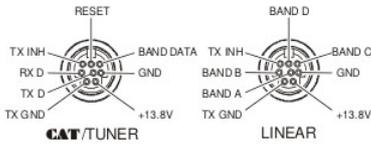
This is the DC power supply connection for the transceiver. Use the supplied DC cable to connect this jack to the car battery or DC power supply, which must be capable of supplying at least 22 Amps @ 13.8 VDC. Make certain that the Red lead connects to the Positive (+) side of the power source, and that the Black



lead connects to the Negative (-) side of the power source. This Jack also provides an Transmit Power Control terminal. If you connect pin-3 (BATT SENS) of the DC power jack to the ground, the **FT-857** automatically switches to 20 Watts (430 MHz: 10 Watts) of output power.

### ② CAT/LINEAR Jack

This 8-pin mini-DIN jack is used for connection to the **FC-30** External Automatic Antenna Tuner. It is also used for interfacing to a personal computer for control of the transceiver using the **CAT** system, and for interconnection to the **VL-1000** Linear Amplifier.



## REAR PANEL CONNECTORS

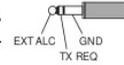
③ **DATA Jack**

This 6-pin, mini-DIN jack accepts AFSK input from a Terminal Node Controller (TNC); it also provides fixed-level Receiver Audio Output, Push-To-Talk (PTT), Squelch Status, and ground lines.



④ **ACC Jack**

This 3.5-mm 3-pin jack accepts external ALC (Automatic Level Control) voltage from a linear amplifier on the tip connection, and accepts a "Transmit Request" command on the ring connection. The main shaft is the ground return. The "TX Request" connection, when shorted to ground, puts the **FT-857** into the transmit mode, and sends out a steady CW carrier, for linear amplifier or manual antenna tuner adjustment.



⑤ **KEY Jack**

This 3.5-mm, 3-pin jack is used for connection to a CW keyer paddle or a straight key.

⑥ **EXT SPKR Jack**

This 3.5-mm, 2-pin jack provides variable audio output for an external speaker. The audio output impedance at this jack is 4 Ω ~ 16 Ω and the level varies according to the setting of the front panel's **AF** control.



⑦ **144/430 MHz Antenna Jack**

Connect your 144 and/or 430 MHz antenna's 50 Ω coaxial cable to this M-type ("SO-239") connector.

⑧ **HF/50 MHz Antenna Jack**

Connect your HF and/or 50 MHz antenna's 50 Ω coaxial cable to this M-type ("SO-239") connector.

