

N7YG Digital Engine User Guide

Updated 8 February 2018

The N7YG Digital Engine (DE) is basically a scaled down version of PSKExpress (PSKE) and provides the basics needed to operate the digital modes of PSK, RTTY and MFSK and interface to the N3FJP suite of contest logging programs and eventually 10QSOLogger.

The main program has been further broken out into a separate window for the waterfall and it's associated controls and functions (figure 1)

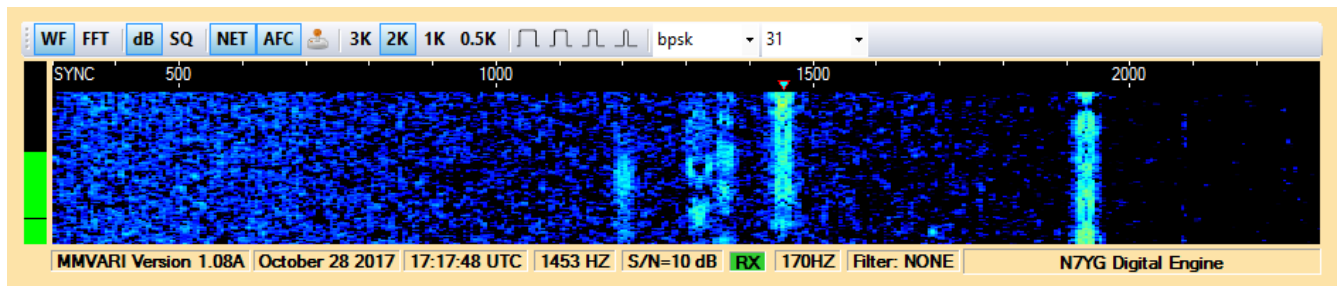


Figure 1

and the main GUI which has the remainder of the controls and functions to operate and configure the program settings (figure 2).

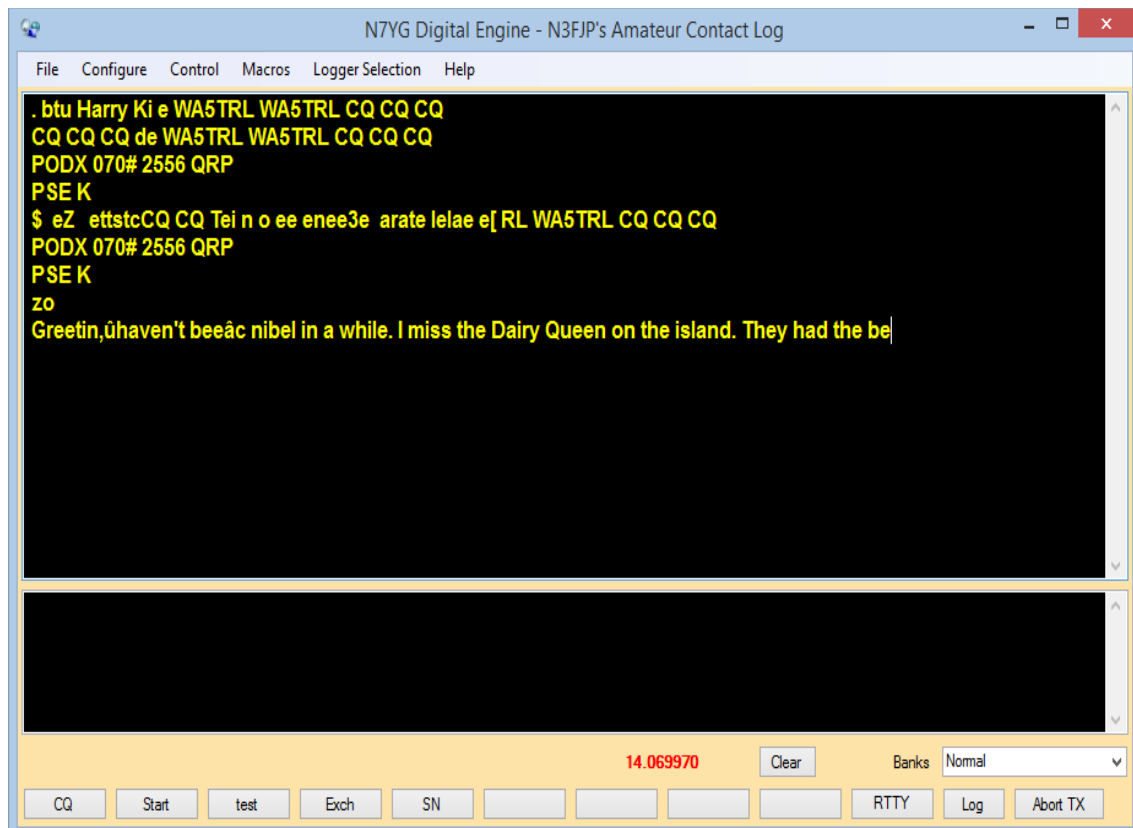
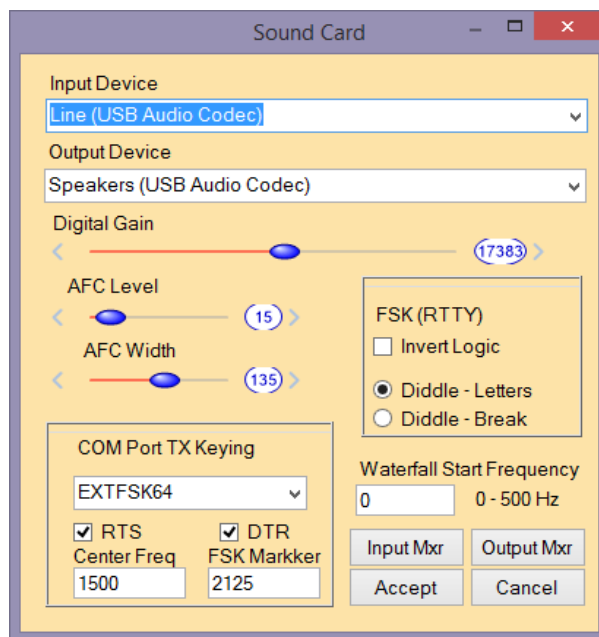


Figure 2

This window is setup very similar to most any other Amateur Radio digital terminal program with the main menu at the top, receive and transmit display areas and the banks of 10 Macro Buttons and the selection of 10 user definable macro banks for a total of 100 different macros for regular and contesting purposes.

Configuration

Before you can use the program to it's fullest extent, you must configure the program setting to you individual operating conditions. To access the sound card configuration from the Main Menu, click Configuration → Sound Card



Configuring your sound card is the most essential configuration of this software. The Input and Output device list will be populated with the available devices that are attached to your computer. Select those devices that you have attached to your radio.

The **Digital Gain** setting is a value form 0 to 32767 and is the raw output level from the software that is sent to the sound card. The default level is 16384, the mid point, and should be suitable for most situations. Use this in conjunction with your output mixer setting to control the digital audio drive to your radio. (Refer to the addendum at the end of this document titled *“Correctly Adjusting your Radios Transmit Audio”*)

Figure 3

The **AFC Level** (0 - 100) and **AFC Width** controls will set the level at which the AFC (Automatic Frequency Control) will begin to function and how wide the AFC will work and keep a signal centered. The AFC width is measured in Hz.

The **Input Mixer** and **Output Mixer** buttons will activate the associated operating system audio mixer control to allow the user to adjust the audio levels at the sound device. (Refer to the addendum at the end of this document titled *“Correctly Adjusting your Radios Transmit Audio”*)

COM Port TX Keying will determine how the software will key the radio when it's ready to transmit a signal. If you are using VOX or you have an interface such as a *Signalink* which has it's own built-in keying system, select NONE from the COM Port selection. Otherwise, select the COM Port that you have your interface unit connected to. The selections in the COM Port drop down are populated with only those COM ports that are available on your machine. If you are using a USB-Serial converter device, make sure that you have properly installed that manufactures

driver software and the unit is certified for your operating system. Select EXTFSK or EXTFSK64 if you are using virtual serial ports. In most cases a virtual serial port will not correctly generate the FSK signal if you elect to use real FSK with your radio. If you are using a 64 bit computer, you may find that you will have to select EXTFSK64 for correct functionality. If your computer has real installed serial ports, then if you elect to use FSK Keying, that keying line will always be the TXD line of the serial port you selected for PTT.

Refer to your interface users guide to determine if you need **RTS**, **DTR** or both to facilitate radio keying.

At this time there is no provision to key the radio using software control via the radios CAT interface. Radio control is left to the logging program, N3FJP in this case, and that software does not support that particular function at this time.

The **Center Freq** value is the value you can define as the center frequency of your radios audio pass-band and will be used only when the radio is being control by the remote logging program and you have selected the option to Center in Pass-band on the waterfall display. If you are using an RTTY mode, this will be the center of the shift frequency. For example, with a 170 Hz shift and a mark tone of 2125 Hz, you will want to set this frequency to 2210.

The **FSK Marker Frequency** can be selected to any audio frequency inside the waterfall. Normally you would set this to the mark or space frequency to get a general idea where your RTTY tones will be. This will be especially useful when using FSK mode. This marker frequency is enabled from the Control Menu.

In the **FSK (RTTY)** box, selecting Invert Logic will switch the Mark and Space logic. See the FSK addendum at the end of this document for using FSK with RTTY. FSK is selected from the mode drop-down on the waterfall tool bar.

The waterfall start frequency, if the value is greater than 0, will set the waterfall to start at a specific audio frequency.

Click the Accept button to apply your changes and close the Sound Configuration windows. Clicking Cancel will close the window and retain your current settings.

Next, you will want to configure your connection to the N3FJP software. For the most part, the default configuration should be suitable for most users. But if you are in a special environment where the N3FJP software might be running on a different computer, then you will need to configure the Host and Port setting to the computer where the program resides.

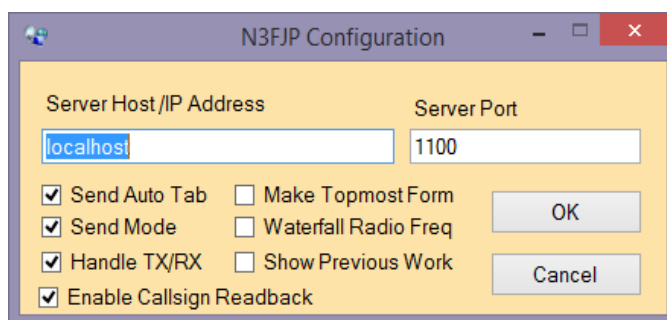


Figure 4

In your N3FJP software you will need to enable the Application Programmers Interface (API) by selecting Settings → Application Programmers Interface (API). Click the box that says TCP API Enabled (Server). Make sure that the port in this configuration matches the port number in the N3FJP software. The default is 1100 and unless you have a special condition, there should be no need to change that.

If your N3FJP software resides on a different computer, then you will need to enter that IP address or qualified host name in place of *localhost*.

The **Send Auto Tab** selection will enable/disable the Auto Tab selection. If this is selected, then when a call sign is sent to the N3FJP software, it will also perform the Auto Tab function in the logging program.

Enabling **Send Mode** will send mode changes from (DE) to N3FJP. This will only be practical if you are using ACLog as opposed to one of the contest elements.

You can make this the **Topmost Form** so that is always on top of all others. This is useful if you only have a single monitor and you have not reduced the form size of your AC Log.

Checking **Handle TX/RX** Control will allow AC Log to handle the TX/RX activities if you are using the CAT control features of AC Log or any of the associated contest programs. If you choose this method for TX/RX control, make sure you have selected NONE for the TX/RX COM Port in the Sound Card configuration.

Waterfall Radio Freq will allow you to display the radios frequency across the top of the water fall if you have the RigAPI enabled in the N3FJP Software. If this is unchecked, then the frequency displayed across the top of the water fall will be the audio frequency from 0 - 3000 HZ.

Enable Callsign Readback will send back a callsign that has populated the callsign box in the N3FJP program. Everything you type in that box will echo back to this program in the underline callsign variable and made available for you macros.

Click OK to save your changes and Cancel to revert to your previous settings.

The Background Color Selection will display the standard Windows Color dialog to allow you to select a more pleasing background color than the standard, drab control color of silver/gray. The color you choose will be applied to all windows and

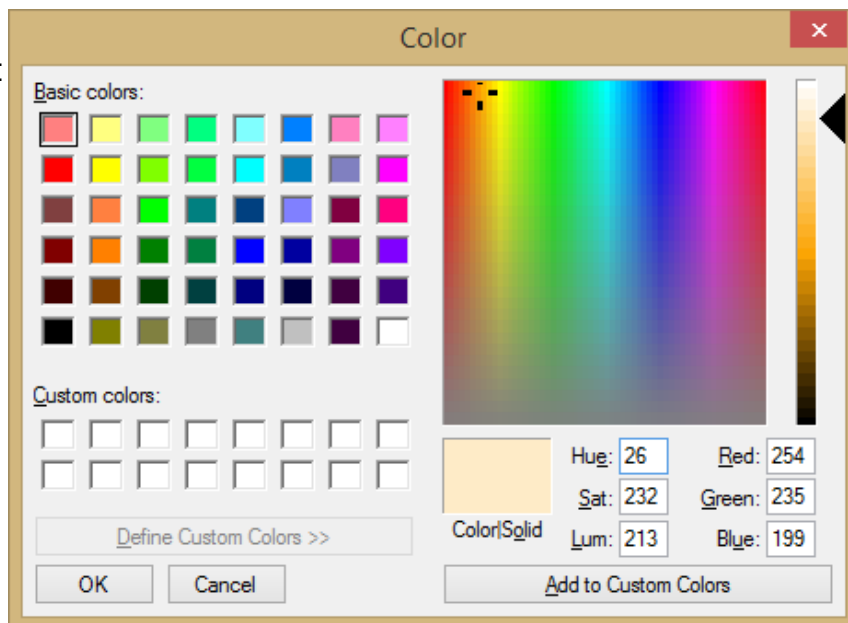


Figure 5

forms in the program and stored in the programs configuration file.

The **Personal Configuration** is not necessarily a requirement to operate the

software, but these values will be used when applying macro tags to your individual macros.

The CW ID is provide, but not active at this time. It will be active in a future release of the software.

Waterfall Display

The waterfall display is a separate window and can be

Call Sign	First Name	QTH (City,State,Province)	
N7YG	Jeff	Tucson, AZ	
County	Grid	CW ID	
Pima	DM42	de N7YG	
Ten-Ten	VP	EPC	PODXS 070
65084	3145	135	479
Email Address		Web Address	
n7yg@n7yg.com		http://www.n7yg.net	

Figure 6

positioned and sized by the user to match screen real estate. To change the height and width of the waterfall, simply grab the right or lower edge of the window and drag it to the height and/or width you desire. To move the waterfall to a different location on the screen, click the text "N7YG Digital Engine" in the status bar to grab focus, then hold down the right mouse button, and drag it to the position your desire. Size and location are saved in the configuration file so that the waterfall will position itself correctly on the next restart of the program.

The toolbar above the waterfall display contains a number of functions that control how the waterfall display actually looks along with how the decoders will function. The mode and speed selection will program the decode to the type of mode, PSK, RTTY or MFSK and the associated speed. Mode selection will determine the values that are available in the speed selection.

Mode:	Speeds
PSK	16,20,31,64,94,125, 250
RTTY,FSK	45,75, 110 Baud
MFSK	4,8,11,16,22,31,32,63

The PSK modes from the selection box are bpsk, qpsk-L and qpsk-U. Qpsk is an error correcting mode and the radios sideband selection must match the mode selection

RTTY and MFSK modes also have upper and lower side band selections and the radios modes selection must match the software's mode selection. NOTE: Some radios that have RTTY or digital mode selection on their radios will use the LSB selection on the radio for FSK. Selecting FSK from the mode drop-down will

automatically select RTTY-L as the default mode for the decoder. You can invert the FSK logic on the sound card configuration dialog.

The **WF** and **FFT** buttons will toggle the display between a waterfall as shown in figure 1 or the Spectrum display of figure 7.

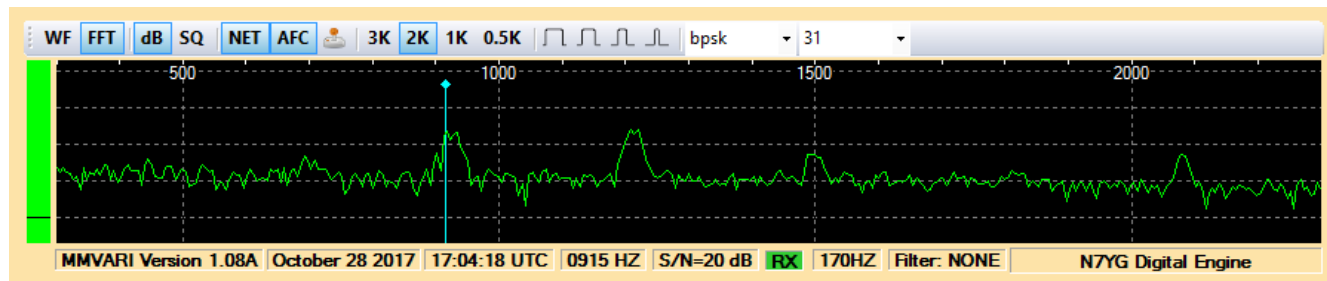


Figure 7

If you have some lid that is running PSK at 2KW with the processor on, use this display to take a snap shot and send it to them. It will be painfully obvious just how far they are splattering a 31 HZ signal!!!

The **dB** and **SQ** buttons determine how the noise floor is handled. The default is db which handles the signal through the 0 - 100db noise spectrum. If you have an extremely high noise level in your area, then selecting the SQ (Square Log) button will offer up a lower noise display and still show a good signal. Depending on the type of noise you have, this selection may prove better at picking out very weak signals.

The **NET** button will lock the TX audio frequency to the RX audio frequency. If you display this function, then when you click around on the waterfall for a signal, the RX pointer will move to the frequency selected, but the TX frequency will remain in the last spot.

The **AFC** button will enable/disable the Automatic Frequency Control function of the decoder.

The **Center in Pass-band** Button, (joy stick), when enabled, and the remote logging program (N3FJP) is controlling the radio, each time you click on a signal in the waterfall, the radios frequency will be adjusted so that the signal is in the center of the pass-band. The default is 1500 HZ, but can be changed to what ever frequency is the center of your radios pass-band. This option is especially effective when your radios frequency response falls off as the audio frequency moves away from the center of the audio pass-band.

The bandwidth buttons labeled **3K**, **2K**, **1K**, and **0.5K** will set the bandwidth of the waterfall display to 3000HZ, 2000Hz, 1000 Hz, or 500 hz.

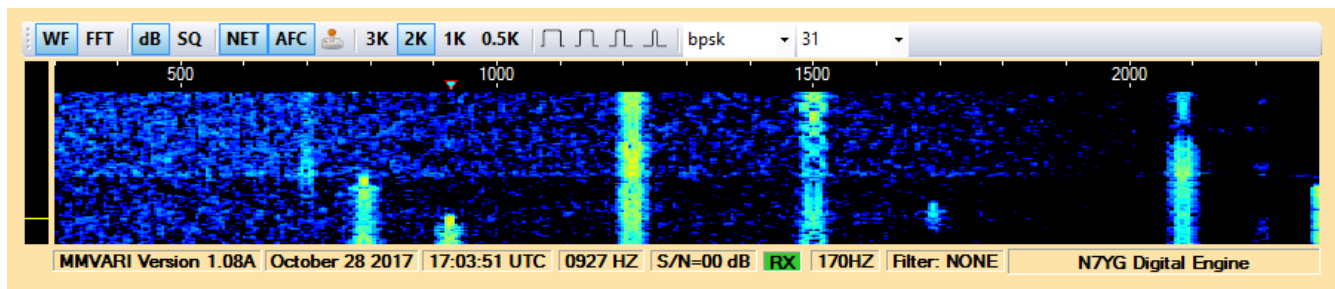


Figure 8

The four remaining buttons are the bandpass filter selections. You can select between None, Wide, Medium, Narrow and Thin. Click a filter selection to enable it. Clicking that button again will remove the filter selection. Clicking a different button will select that filter. Figure 8 shows the display with the narrow filter selected. If the Center in Passband option is set, the filter will follow the frequency as it moves.

The status bar at the bottom shows various parameters that are associated with the program.

N3FJP Interface

To use this with the N3FJP software, you must first make sure that software is running first, otherwise you will receive an error notification that DE was unable to make the connection.

From the Logger Selection menu, Click on N3FJP. If the connection is successful, you will see the name of the N3FJP software that is running in the decoration bar at the top, the Log and Clear buttons will become visible and if you have Rig Control running, the frequency of the main VFO will be displayed. If the contest you are running requires serial numbers for the exchange, the next serial number will also be displayed next to the frequency.

Macros

Macros are an integral part of any Amateur Radio digital program. They assist the user with repetitive tasks, especially when working a contest. There are also beneficial to those of us with “marginal” typing skills!!

This program offers up 100 macros arranged in 10 banks of 10 macros each. The macro buttons are identified with a short ID to describe the programming of that button. Each button from left to right has been assigned to a function key starting at F1 and going to F10. There is also a Macro Menu that can be displayed from the Configure Menu.

If you click a macro button with the left mouse button or press the associated function key, the assigned text for that button will be sent. Right clicking the button will bring up the Macro Editor for that specific button in the selected bank.

You select a specific bank in the Bank Selection drop down. The default names

are Bank0 – Bank9. You can edit those names to be more descriptive in the Macro Editor displaced in Figure 9.

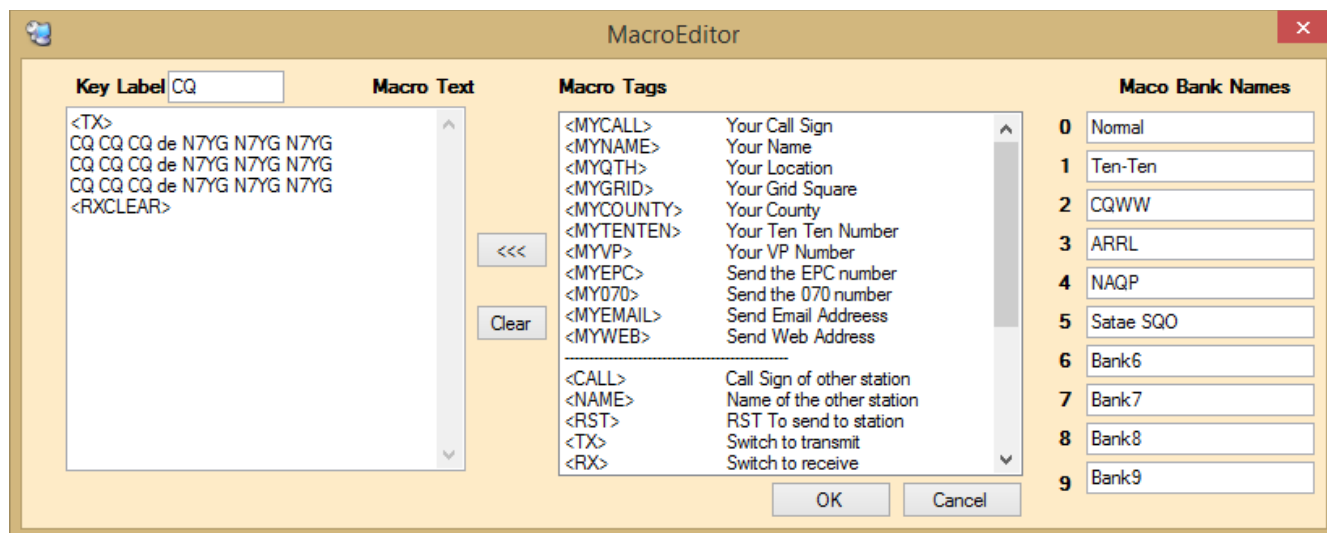


Figure 9

This window can be sized to the users choice. The Macro Text entry box will size to fill the additional space.

The Key Label is a short descriptive ID that will appear on the macro button

The Macro Text entry box is where you enter the text and macro tags for the selected macro. Everything in his box can be typed in free form to include carriage returns where needed. Macro Tags can be typed in by hand, or transferred as described below.

The Clear button will remove all content from the Macro Text Entry box. The button labeled <<< will transfer the selected macro tag into the Macro Entry Box Macro Tags are special tags placed into the text of you macro to allow special processing during macro compile time when sending a macro. For example the <TX> and <RX> tag will command the radio into transmit and receive respectively. The <MYCALL> tag will substitute your call sign whereas the <CALL> tag will substitute the call sign of the station you are working.

Inserting a macro tag can be accomplished either by manually typing the complete tag or selecting the tag and clicking the send to button or double clicking the tag. The tag will be appended to the end of the current text in the macro text box. There are 10 Macro Bank Name that can be used to identify the Marco Banks. The bank names are identified by Number, 0 – 9, and you can edit the name in the given text box. Clicking OK will save your changes while Cancel will abort any changes.

Macros can be Exported and Imported from the File Menu. At the preset time, the only macro format that is supported is the N7YG DE format. Future version will

support PSK Express and others. Exported Macros will be save in a folder of the user choice with a file for the bank names, and another file with the macros. These file use the CSV format with the pipe character (|) as the field separator. These file are text files and can be edited with a simple text editor. BEWARE: if you change a bank name in the bank name file, you must edit those names in the macros file.

Log and Clear Buttons

These button will become visible when you are attached to the logging program and will become invisible when the connection is broken. The buttons will send the appropriate command to the logging software to either log the current contact, or clear all data from the fields that are visible.

Control Menu

This menu will control how you transmit and receive in the event you want to do this manually. There is also an Abort function. This function will immediately abort the current transmission and dump any remaining characters that are waiting in the transmission buffer. The RX function will return the radio and decode to the receive only after any remaining characters in the transmission buffer have been sent.

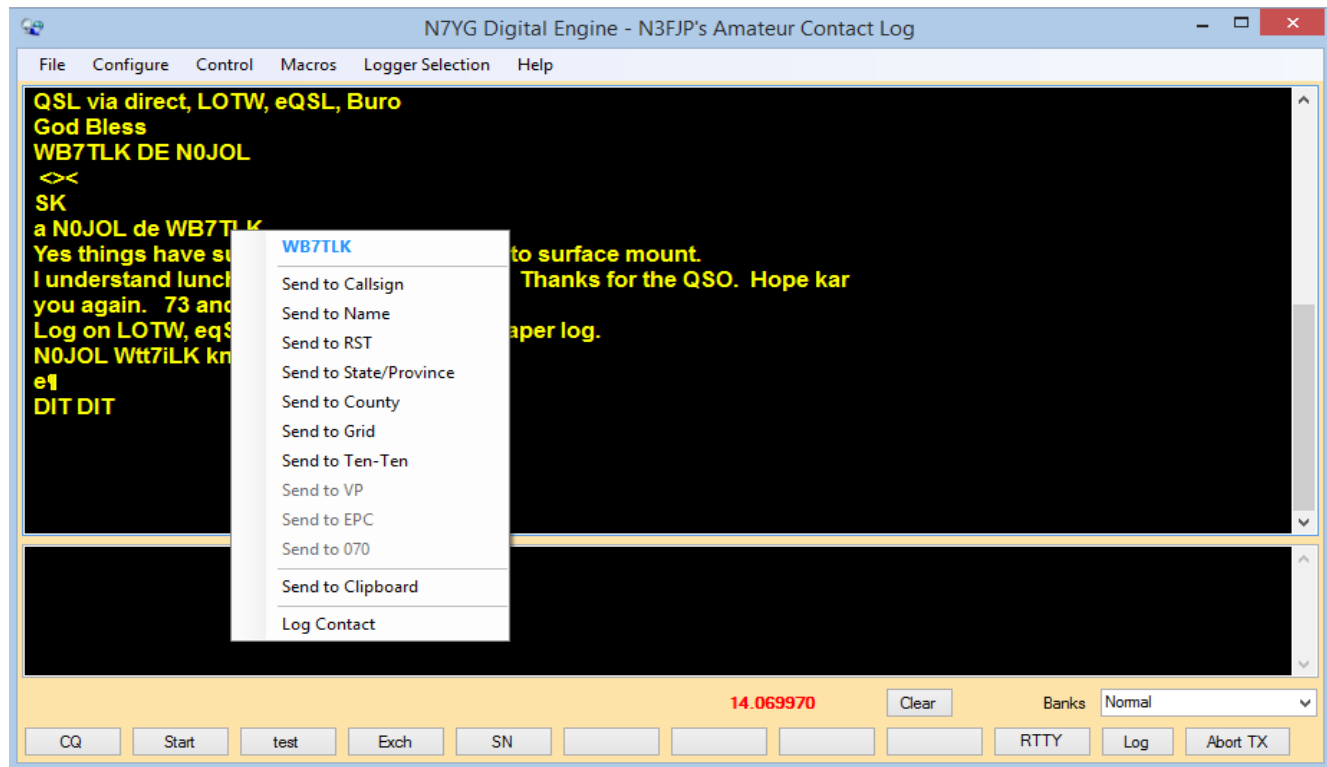


Figure 10

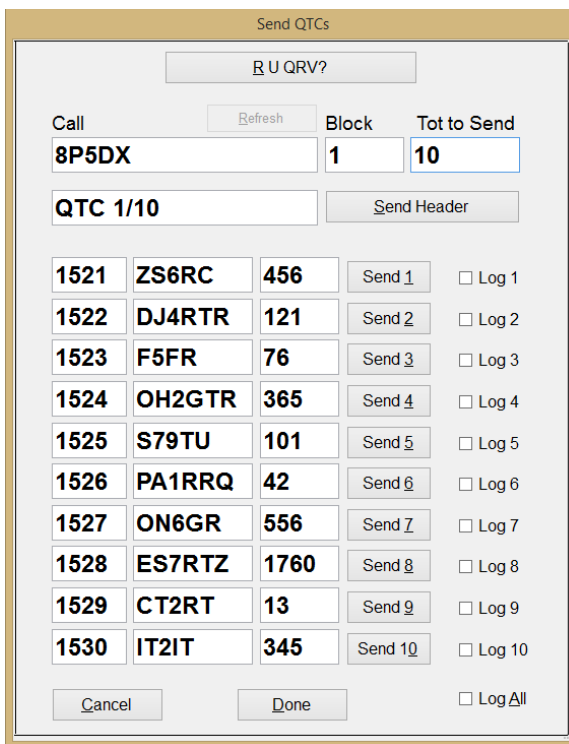
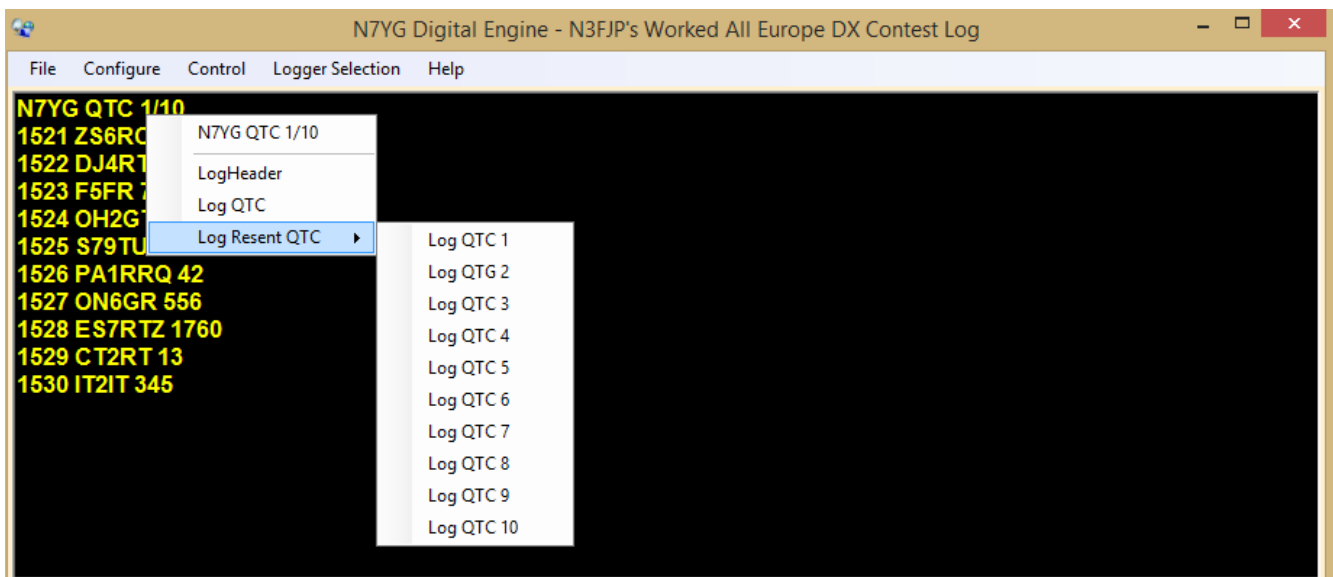
Using the Program

This program is not much different in use as any other Digital Terminal program, but with some very noticeable differences. You select signals in the waterfall to decode and the software will print the received data to the Receive Window. One noticeable difference is the absence of a logging facility. That is by design and all the logging functions will be handled by the software you have selected to log to. Getting the data there is also quite simple.

Using the mouse, point and click the data you are interested in. Figure 10 shows where I have selected the call sign of F1TAY along with a menu of fields I can send that data to. If I click (left mouse button) on the Callsign item, that callsign will be sent to the logging program and appear in the call box. If you have selected the Auto Tab feature for N3FJP, then that program will automatically fill the Country/Province box depending on the contest program you are using.

The word selection routine looks for a word that is offset by a space on the front of the word and a space or common punctuation mark on the end. The routine is not 100% and you may get some garbage that "tags" along for the ride. You can edit that out in the logging software or look for a cleaner copy someplace else in the receive window.

The receive window has a vertical scroll bar. You can scroll back the buffer to look at previous text, BUT, the routine that appends characters to this control has priority over the scrolling event. If you are participating in the Worked All Europe DX Contest (WAE) and plan on exchanging QTC traffic, then you can bring up the QTC menu by holding down the CTRL key and clicking on a line of data. The QTC floating menu will appear and give you the option of sending that line as the header, QTC traffic or a resend of a specific line in the event original data was garbled or defective. Make sure that you have QTC Receive window in the N3FJP WAE log open before you send anything.



Sending the QTC traffic to the other station is just a matter of clicking the appropriate buttons in the N3FJP software.

In the N3FJP software Click on Send QTC button. To display the dialog seen at the left.

The R U QRV button will send that text over for transmission.

Send Header will send the developed header text over for transmission.

Clicking each of the Send buttons will send each QTC traffic text over for transmission.

When you click any of these transmit buttons, and if the software is not already in the transmit mode, it will be set to transmit first.

Once the transmit holding buffer has sent out all of the characters it is holding, it will return to receive. If you have other text to send such as a return macro, make sure you either type that into the transmit window or click the appropriate macro button to include that text in the holding buffer for transmission after all the QTC traffic has been sent. Refer to the N3FJP help documents for use of the logging options in both the Send and Receive QTC windows.

Sub Channels

There are 8 sub channels that you can use for receiving multiple stations at one

time as displayed in Figure 11.



Figure 11

To invoke a sub channel, right click the mouse on a signal in the main waterfall and select a channel number from the floating pop-up menu.

The mini waterfall is only 500 Hz wide, but you can click in the waterfall to select other signals that are present. You can also slide the channel pointer in the main waterfall around to select other signals.

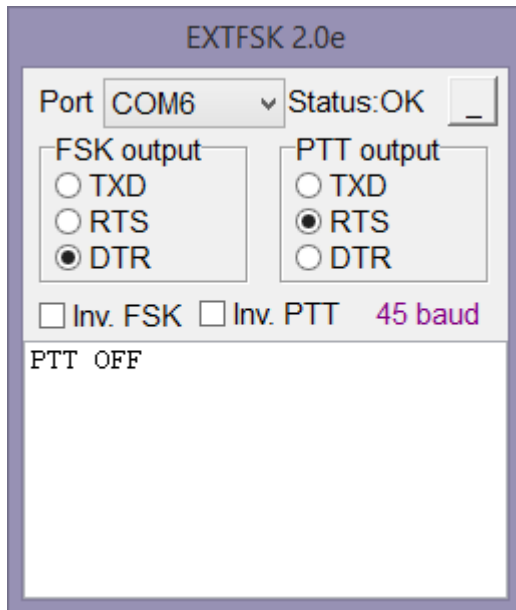
Right clicking the frequency label will present you with a pop-up menu of anchor frequencies you can select from to reposition that channel anywhere in the audio spectrum. You also have the option to swap this channel and the main channel in the event you want to transmit to this station. Do so will set the main channel to the frequency of the sub channel and the frequency of the sub channel to that of the main channel. It will also copy in all the lines from the sub channels receive buffer to the main channel receive buffer, enabling you to pick out data for logging purposes.

Clicking on the Font name will bring up the Font Selection dialog box so you can specify a new font for this channel.

Technical Support

The support element for this software will be the PSKExpress group as any developmental changes to this software will also be applicable to PSKExpress. You can subscribe to this group at groups.io and look for the PSKExpress group and subscribe to it.

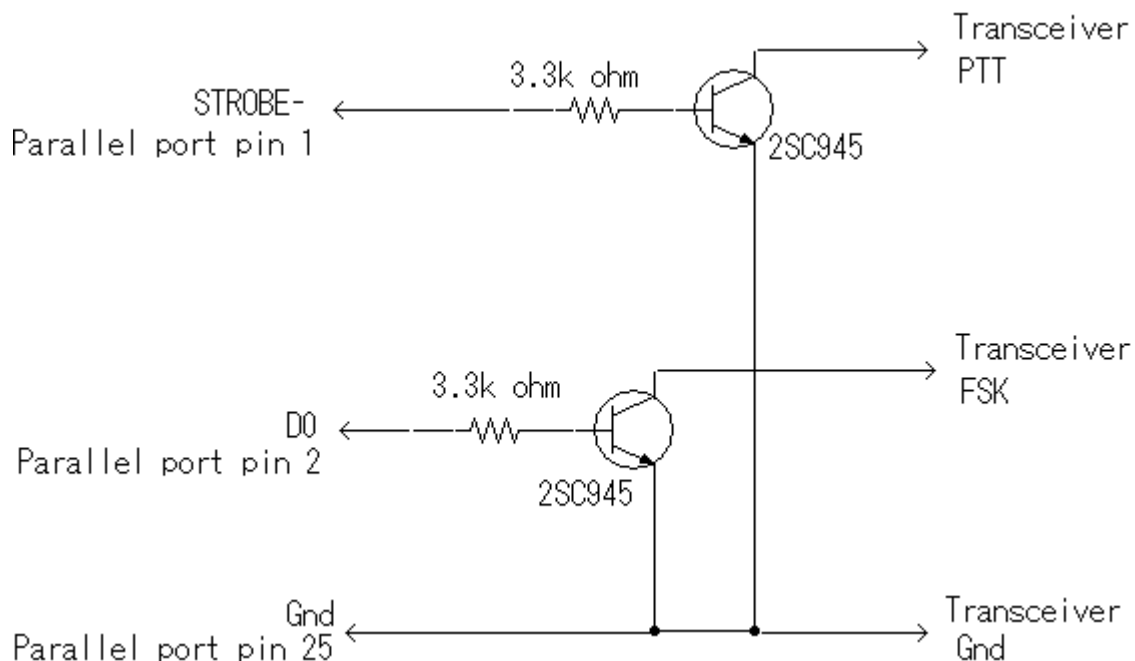
Addendum: RTTY and FSK



If your radio supports a direct FSK connection, then you have the option of using FSK as opposed to AFSK for transmission. The FSK mode is selected from the mode drop-down on the waterfall tool bar. FSK Keying can be accomplished with a serial port. You will have to select EXTFSK, or EXRFSK64 from the COM Port selection for keying if you are using virtual COM ports. You will get the EXTFSK configuration dialog that can be position anywhere on the screen or minimized once you make the selection of which line will be for FSK and which will be for PTT. If you have a newer computer which is lacking a serial port or a parallel port, you will have to purchase a port and install it into the computer. A USB to serial converter will work as long as you have the correct drivers for your

operating system.

Either FSK option will require you to have an external interface to couple the computer to the radio. The diagram below is a simple interface for using the parallel port.



To use this diagram with a serial port, Connect the STROBE- pin to RTS or DTR on the serial connector, DO to TXD on the serial connector and GND to ground.

In the diagram, you can substitute a 2N2222A for the 2SC945.

Addendum: Correctly Adjusting your Radios Transmit Audio

Setting up your transmitter is a little more challenging than receiving. The main thrust for this addendum is the number of poor quality PSK signal I have observed on the bands over the years. When transmitting a PSK signal you are subjecting your transmitter to 100% duty cycle similar to RTTY, FSK, or SSTV. Blow the dust off the equipments owners manual and familiarize yourself with the manufactures limits for 100% duty cycle transmissions. You might be surprised to discover your 120-watt radio is rated at 40 watts 100% duty cycle for a specific time duration. Armed with these limitations we can now set the software for transmission.

The audio output level will require the adjustment of the radios RF power control, mic gain control, the audio mixer volume slider and the wave slider. These setting will differ depending on your individual equipment, so experiment to get the best quality signal. Start with the RF power control at the maximum setting and the mic gain around the nine o'clock position. The volume and wave sliders will affect each other depending on where you are taking the output from the sound card. Set your radios meters to show output power and ALC. Active the software's transmit function to send an idle tone. Adjust the controls so you are not exceeding the manufactures power limitations and you have no noticeable ALC action. If you have a friend who can listen to your signal locally, this is the best method to determine if the signal is clean.

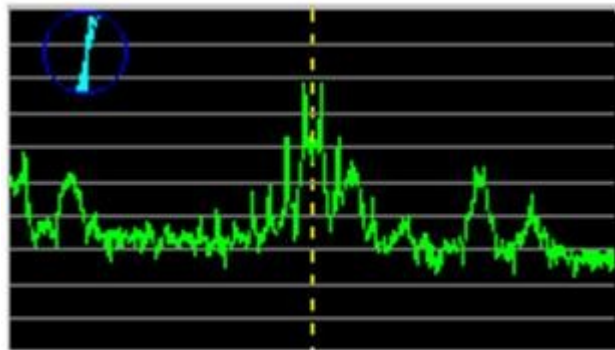


Figure 1

Figure 1 is a good example of an over-driven PSK signal. Notice the distortion on either side of the signal peaks. This signal was accompanied with an IMD reading of -12 dB. Strive for an IMD reading on the other end of something less than -25. IMD reading are only computed during idle time of the PSK signal and may not always be display on your software.

Change Log

Version 5.2.3.1 December 3, 2017 - Baseline Release

Version 5.2.3.3 January 12, 2017

1. Fixed Memory bank selection so that it is persistent on the next restart.
2. Fixed Mode and Speed selections so they remain persistent.
3. Added Support for FSK
4. Fixed serial number processing so that the serial number is available for DX station and not US stations when using the ARRL DX Contest.
5. Expanded users guide file and corrected errors and confusing image captions.

Version 5.2.3.4 January 13, 2017

1. Fixed persistence of RTTY Enable and FSK Invert
2. Fixed Boolean logic with selection of RTS and DTR

Version 5.2.3.5 February 12, 2017

1. Added support for EXTFSK and EXTFSK64
2. Added RTTY Diddle Selection
3. Fixed issue with serial number update when logging in N3FJP

Version 5.2.3.6 February 18, 2017

1. Added support to import macros
2. Added option to display audio or radio frequency across the top of the waterfall
3. Fixed configuration so that the settings of all the waterfall controls are saved and recalled on the next run.
4. Set dash character to act as a space character when deciphering words from the RXBuffer.

Version 5.2.3.8 February 21, 2017

1. Fixed Folder Dialog so that it works correctly with Windows 10 products.

Version 5.3.3.1 September 1, 2017

1. Added coding to support the WAE contest and QTC manipulation.

Version 5.3.4.1 28 October 2017

1. Added an Abort TX button to the main window to quickly abort a transmission.
2. Added an option to define the lower edge frequency for the waterfall.
3. Added option to configure the programs default font
4. Will now auto-connect to the N3FJP API if it was connected on the previous run and the N3FJP program is running.

Version 5.4.4.1 8 February 2018

1. added option for n3fjp call sign readback

2. added option for a marker frequency
3. Created an FSK mode that correctly sets all parameters for FSK keying.