

Using the Elad FDM-Duo EXTIO SPI Connections to Control External Band / Frequency Switching

Andy Talbot G4JNT

With thanks to Neil G4DBN for doing the initial pulse measurements and publishing his findings on the EladSDR IO Group.

Introduction

On the rear of the FDM-Duo transceiver is a 9-way D type socket used for interfacing of certain peripherals. It carries three different signals types. There is a serial interface operating at 115200 baud that can be used to input the full set of CAT commands, but with only a few receiver parameters being sent out; not the full CAT set. Full details of this serial interface can be found on the Elad website [1].

Two pins on the EXTIO connector are labelled I2C and are designed to drive a DAC5571 D/A converter to give a Yaesu-compatible band-switching voltage. The remaining three pins form an SPI interface that is intended for control of the Elad SPF-08 external preselector filter but can be used as a more general output of band/frequency setting data.

The SPI signal consists of Clock, Data and Strobe, and is designed to drive a 74HCT595 latched shift register to provide eight band-select outputs, only one of which is ever active at any time. The timing of the logic lines is shown in Figure 1. For the data pattern shown, the pulse position without dotted lines corresponds to that for setting line 3.

The lower and upper frequencies of each band, where each of these eight lines can be activated, is fully user-programmable using a CAT command.

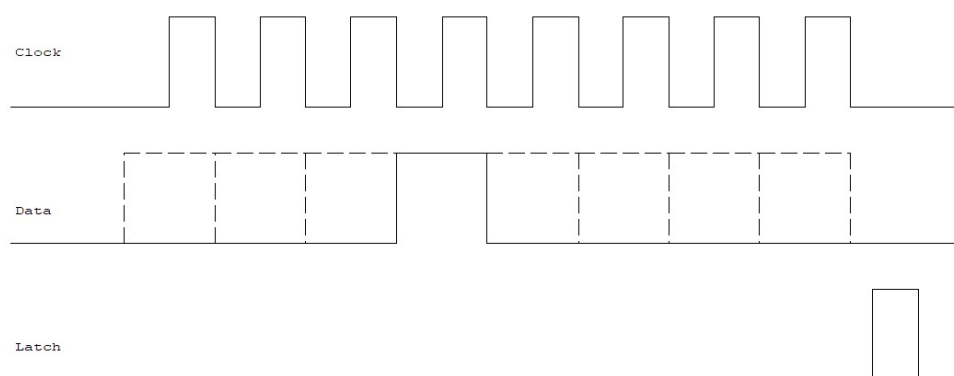


Figure 1 SPI Signal

Connections and Choice of Logic Family

Figure 2 shows the connections to the 74HCT595 device, the eight outputs are 0/5V logic levels appearing on the pins on the right hand side. As the Duo provides 0/3.3V logic levels on its EXTIO pins, a certain amount of care needs to be taken over interfacing. If the '595 is run from 5V, available on pin 9 of the EXTIO socket, then the device needs to be of a logic family that is compatible with

these logic levels. The 74HCT595 meets the requirement when running from a 5V rail, with thresholds guaranteed at <0.8V and >2.4V. The 74HC595 family device, when running from 5V supply has an upper threshold around 3V, which will work but the margin is a bit too low for comfort. Alternatively a 74HC595 could be run from a 3.3V rail generated by a voltage regulator from the +5V supply.

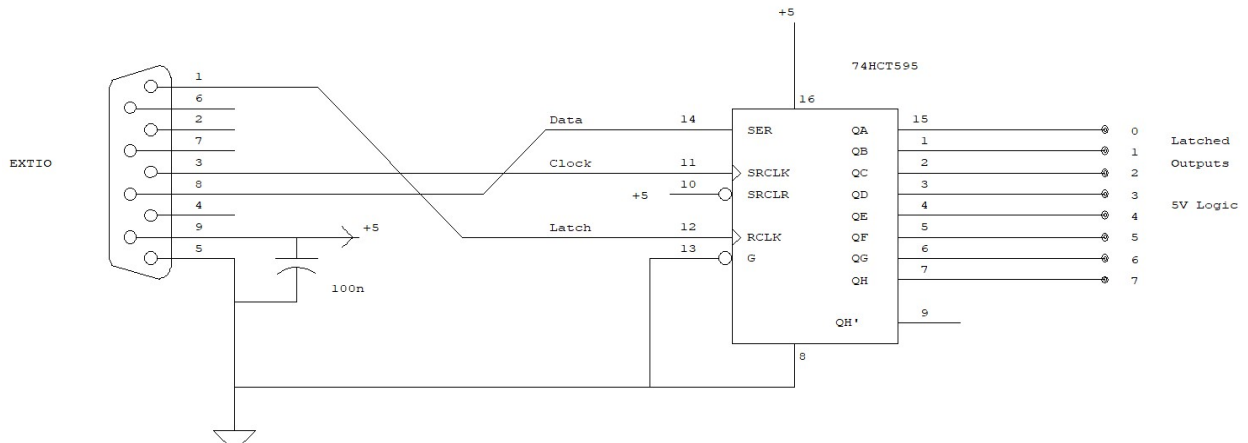


Figure 2 SPI interface connections to 74xx595 Latched Shift Register

Programming the Frequency Band Thresholds.

The **SF** CAT command is used to configure the band edges, and is used separately for each of the eight lines. For the purposes of this description, each of the eight pins, or settings, is called a channel, and takes on the values 0 to 7. Formally, when used with the SPF-08 preselector, they are referred to as the 'filter index', similarly taking on the values 0 – 7. Full details of the **SF** command can be found on page 53 of the User Manual, [2]. The subset here is sufficient to set the band edges as required. Note that the semi-colon is the command terminator, there is no carriage return or line feed character used. Commands can also be concatenated by using the semi-colon to separate each one.

To read the current setting, issue the CAT command **SF***x*; where *x* is the channel number. A return will be generated in this form: **SFYx1ssssssssssffffff;**

x is the channel number. The 11 digits *ssssssssss* correspond to the starting, or lower frequency edge of that channel, and *ffffff* to the finish, upper frequency edge. Both are in units of 1Hz and can specify up to 99.999999999GHz. (Before anything is set up, the 'Y' may possibly be replaced by 'N' and the '1' by a '0'. These will be corrected when they have been programmed, as described next).

To set one of the eight channels, use the command: **SFFx1ssssssssssffffff;** where, *ss...* and *ff...* are eleven digits corresponding to the start and finish of the appropriate band. See the full description of the SF command in the transceiver manual for more details of the other characters.

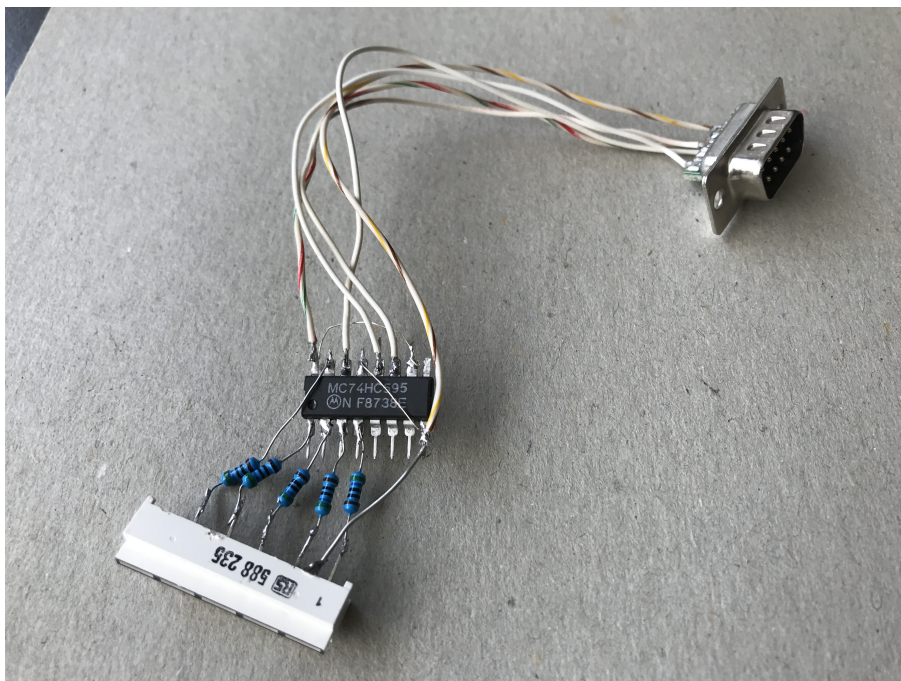
No immediate response is generated after this command has been issued, but its operation can be checked by issuing an **SF***x*; command as described above. Concatenation can be used to read / check all eight together by issuing the command: **SF0;SF1;SF2;SF3;SF4;SF5;SF6;SF7;** which will result in a response of the form:

```
SFY010000000000000000000000199999;SFY110000020000000000199999;SFY210000200000
000054000000;SFY3100054000000000080000000;SFY4100080000000000164000000;SFY
50000000000000000000000000;SFY60000000000000000000000000;SFY70000000000000
0000000000; (note that only channels 0 – 4 have been programmed in this example)
```

When all eight channels have been set up, whenever the radio is tuned to a dial reading falling into any of the programmed ranges, the appropriate bit on the shift register will go high. If frequency bands overlap, the one 'just entered', will dominate; only one output can be active at any time. For example, consider channel 3 is programmed for 50 to 80MHz and channel 4 for 70 – 70.5MHz. Line 3 will go high when the frequency reaches 50 – 70MHz or 70.5 - 80MHz, but when entering the range 70 – 70.5MHz, channel 4 will go active and 3 will be dropped. If the frequency falls in none of the programmed bands, no line goes active.

Using Frequencies Above 54MHz

When programming any frequency bands above 54MHz, the LP filter has to be switched out using either the main menu item 2 (RX-LP) or the CAT command **LPO**; Failure to switch out the filter will result in a value of 54MHz being entered in place of the required value.



[1] EXTIO Serial Protocol <http://www.eladit.com/download/sdr/FDM-DUO/ELAD%20FDM-DUO%20-%20EXTIO%20Serial%20Protocol%20-%202017-09-08.pdf>

[2] Elad FDM-Duo User Manual <http://sdr.eladit.com/FDM-DUO/ELAD%20FDM-DUO%20-%20User%20Manual%20v2.11%20EN%20-%20User%20Manual.pdf>