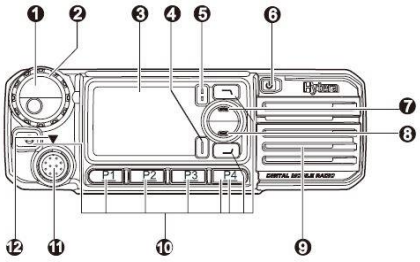
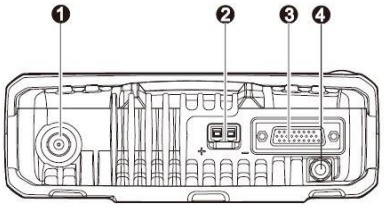
Hytera MD7xx/RB6xx Interface to other transceivers





As DMR 70cm becomes more and more usable as a general coverage radio network within Belgium and beound, the need to connect other transceivers to the DMR network in case of emergency becomes eminent.

As a small project this paper will explain such a connection between two transceivers equipped with a standard mini-DIN 6 pole DATA connector and a MD785G mobile transceiver of Hytera.

CPS Hytera Settings

The settings within the MD786 have to be modified, so the signaling on the expansion connector DB26 will be available with the correct level.

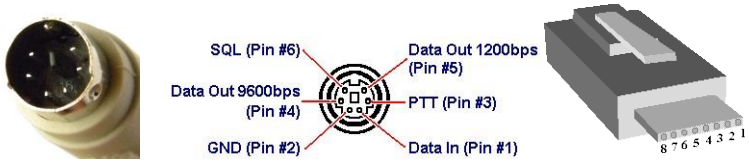
	Active Level	Feature	Debounce
Pin#3	High	Speaker Open Detect	☑
	Low To High	None	
	High To Low	None	
Pin#5	High	Ext Alarm/Horn & Lights	☑
	Low To High	None	
	High To Low	None	
Pin#12	Low	None	☑
	Low To High	None	
	High To Low	None	
Pin#16	Low	Ext Mic PTT	☑
	Low To High	None	
	High To Low	None	

We will make use of the “Speaker Open Detect” function connected to pin #3 generating a “high” level as an active signal is detected and the “Ext Mic PTT” connected to pin #16, activated with a “low” level.

The connections for the “audio out” at pin # 8 and mic in at pin #7 are fixed connections without any settings.

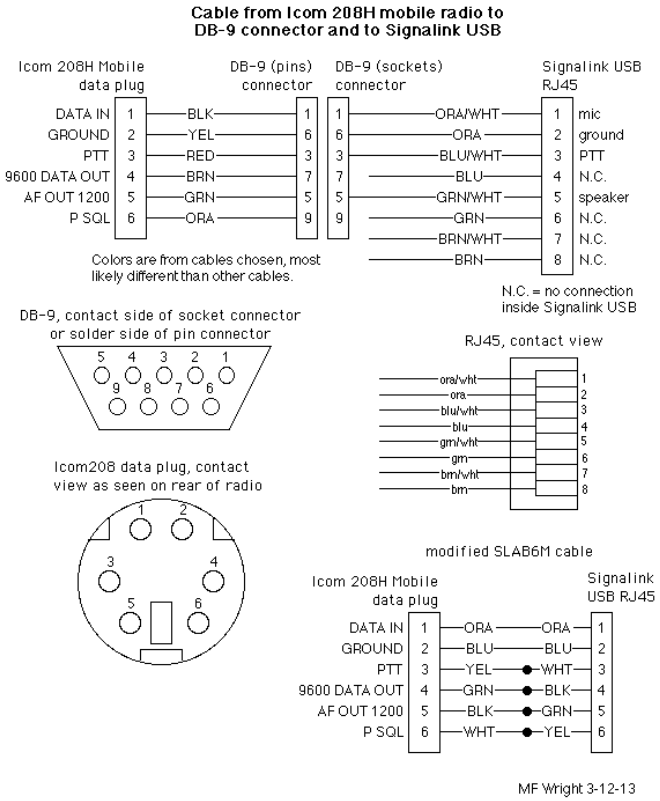
The ground signal can be found at pin #2 of the DB26 connector.

Signalink Cable SLCAB6PM



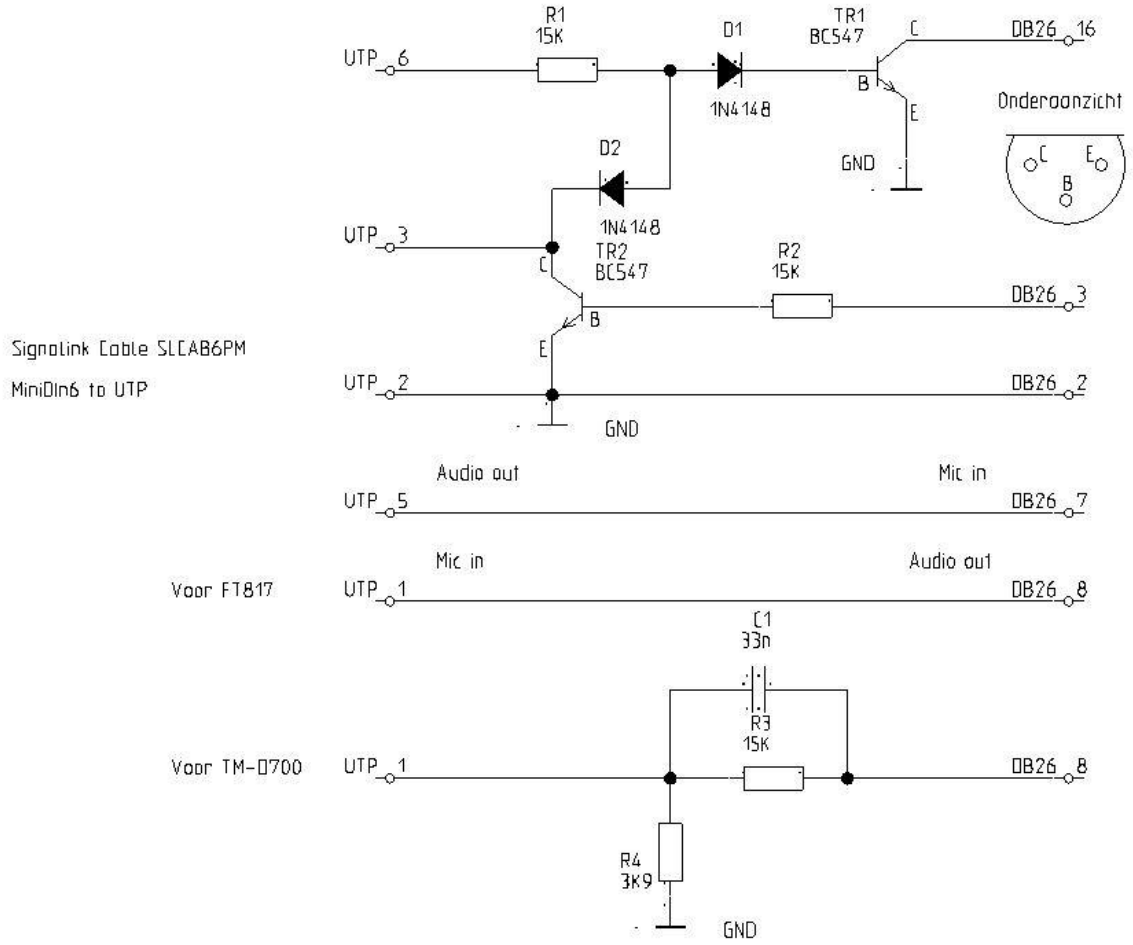
As the inter-connection cable, I make use of the Signaling prefabricated cable SLCAB6PM, used in many configurations. It consists of one mini-DIN 6pole plug and one RJ45 plug.

Because Tigertronics makes beautiful sound card interfaces, they have all kinds of interface cables and use one RJ45 jack to connect them to their equipment. This standardization eases a lot and provides us with all kinds of transceiver connection cables.



The interface

The interface is constructed around one RJ45 jack (Signalink Layout) and one DB26 plug.



The “High” levels of the signals detecting audio or a carrier are used to trigger a transistor to generate a “low” level for PTT action.

As it seems that some transceivers (TM-D700) generate also a “Carrier detect” in case of an external PTT activation, this action is inhibited through the circuit constructed around D1,D2.

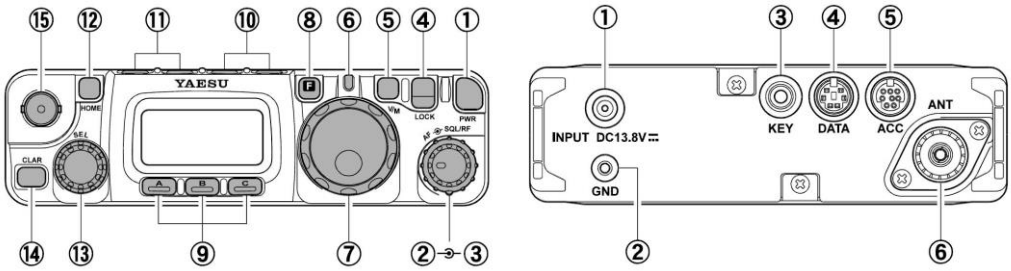
Not all transceivers cope well with high level audio signals. For the FT817, the levels are well defined and within the Hytera specs, for the TM-D700 the Mic in signal is defined as maximum 40mVptp. As it enters the transceiver after the pre-emphasis network, low frequencies will be saturated. I constructed a little add-on RC network to avoid this effect and to reduce the signal level entering the Mic input. It is made of a RJ45-jack and Plug that can be placed in between the interface and the Signalink cable, so the original interface does not have to be modified.

Values of components are not critical, only the termination should be > 10K at most pins.

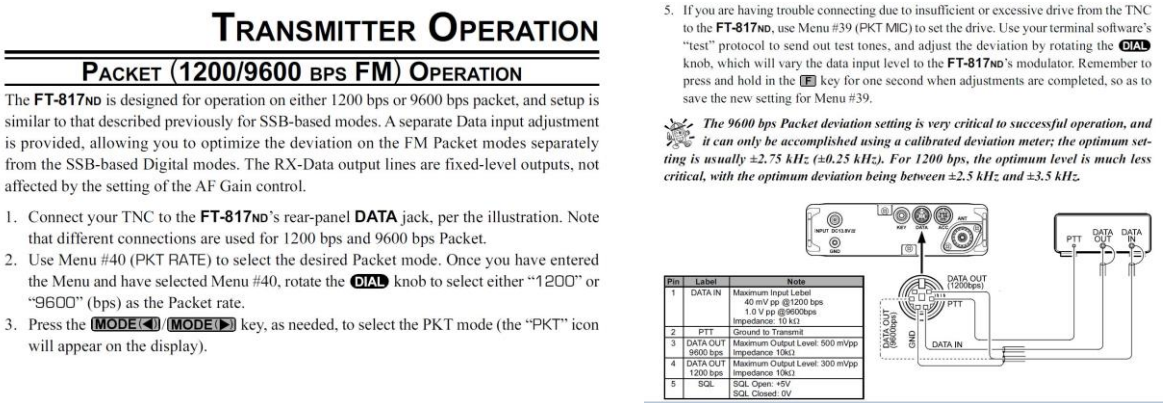
Transceiver settings

The settings to use this cross-link connection for the different transceivers are as follows:

FT-817



1. Set the Packet rate to 1200bps to select the proper audio path within the transceiver (menu item #40)
2. If necessary change the PKT MIC settings to the proper level (menu item #39)
3. Switch the transceiver to PKT mode for operation.



TRANSMITTER OPERATION

PACKET (1200/9600 BPS FM) OPERATION

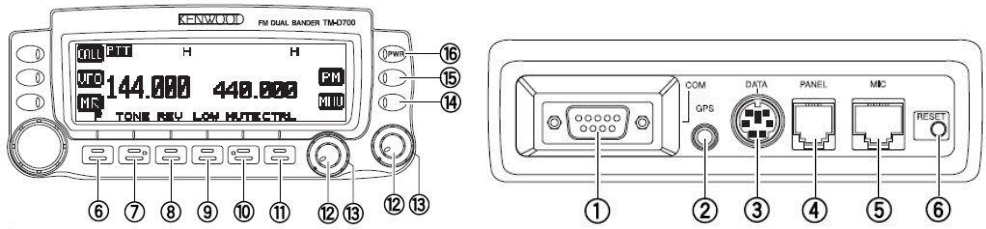
The **FT-817ND** is designed for operation on either 1200 bps or 9600 bps packet, and setup is similar to that described previously for SSB-based modes. A separate Data input adjustment is provided, allowing you to optimize the deviation on the FM Packet modes separately from the SSB-based Digital modes. The RX-Data output lines are fixed-level outputs, not affected by the setting of the AF Gain control.

1. Connect your TNC to the **FT-817ND**'s rear-panel **DATA** jack, per the illustration. Note that different connections are used for 1200 bps and 9600 bps Packet.
2. Use Menu #40 (PKT RATE) to select the desired Packet mode. Once you have entered the Menu and have selected Menu #40, rotate the **DIAL** knob to select either "1200" or "9600" (bps) as the Packet rate.
3. Press the **MODE(◀)**/**MODE(▶)** key, as needed, to select the PKT mode (the "PKT" icon will appear on the display).
5. If you are having trouble connecting due to insufficient or excessive drive from the TNC to the **FT-817ND**, use Menu #39 (PKT MIC) to set the drive. Use your terminal software's "test" protocol to send out test tones, and adjust the deviation by rotating the **DIAL** knob, which will vary the data input level to the **FT-817ND**'s modulator. Remember to press and hold in the **F** key for one second when adjustments are completed, so as to save the new setting for Menu #39.

The 9600 bps Packet deviation setting is very critical to successful operation, and it can only be accomplished using a calibrated deviation meter; the optimum setting is usually ±2.75 kHz (±0.25 kHz). For 1200 bps, the optimum level is much less critical, with the optimum deviation being between ±2.5 kHz and ±3.5 kHz.

Pin	Label	Note
1	DATA IN	Maximum Input Lebel 40 mV pp @1200 bps 1.0 V pp @9600bps Impedance: 10 kΩ
2	PTT	Ground to Transmit
3	DATA OUT 9600 bps	Maximum Output Level: 500 mVpp Impedance 10kΩ
4	DATA OUT 1200 bps	Maximum Output Level: 300 mVpp Impedance 10kΩ
5	SQL	SQL Open: +5V SQL Closed: 0V

TM-D700



1. Set the Data band to the desired band. Normally it will be band A. (menu 1-6-1)
2. Set the DCD SENSE to both bands (menu 1-6-1)
3. Set the DATA SPEED to 1200Bd (menu 1-9-6) as the Mic level will be reduced to 40mVptp. At 9600 the transceiver would need a 2Vptp level, way too high for our application.
4. For operation you can use any setting you desire, sub-tone, memory channel, narrow or wide, but switch any TNC action OFF.

SELECTING DATA BAND

This transceiver is capable of receiving packet data on one band (data band) while receiving audio on the other band. In order to use the built-in TNC, access Menu 1–6–1 (DATA BAND) and select band A or B as the data band for receiving or transmitting packets. "D" indicates the current data band; the default is band A.

Note:

- *In Menu 1–6–1, the selection switches among A, B, A:TX B:RX, and A:RX B:TX. Select A:TX B:RX or A:RX B:TX when accessing a PACSAT {page 7}.*
- *The selection in Menu 1–6–1 is invalid for an external TNC. Use the TX band to transmit and receive packets through an external TNC. When using an external TNC, access Menu 1–9–6 (DATA SPEED) and select 1200 bps (default) or 9600 bps as the transfer rate between TNCs. This selection is valid only for an external TNC.*

TM-D700E Only: *Do not select the narrow transmit deviation on the data band.*

DCD SENSE

You can also select the method for inhibiting the built-in TNC from transmitting. Access Menu 1–6–2 (DCD SENSE) and select one of the two methods. The default is "DATA (RX) BAND".

DATA (RX) BAND	The TNC does not transmit when signals are present on the data band (D) or RX data band (R).
A AND B BANDS	The TNC does not transmit when signals are present on band A or B.

Conclusion and testing

In case of an emergency operation communication is mostly used "portable". This setup could be used not only as a range extender (cross-band repeating) but also as an analog-to-DMR gateway.

The latter would be of great value to extend the coverage of analog portable equipment due to the fact that the DMR relays are easily interconnect able through the DMR server network and widely covering a territory like Belgium.

As one of the major applications this mini-transponder setup can be used within a car to get outside and use a normal 2m portable transceiver to communicate over 70cm DMR making use of a dual-band antenna on the car rooftop and a diplexer to connect both transceivers to the same antenna.

Putting both transceivers together in a box , the DMR transceiver into Roaming mode at and you other transceiver at a 2m frequency with CTCSS and a magnet dual-band antenna with diplexer gives you a quick and portable setup that could be quickly installed within another car or on top of a building.

The roaming functionality will automatically look the strongest DMR relay in the vicinity and in case this relay will go down, the DMR transceiver will automatically switch over to the next one, making this an automated system.

I hope this triggers others to think about "emergency communication" as an incentive to discover all kinds of new interconnection-modes.

Have fun! 73 de ON4AWM, Walter