

# Modification of an AOR AR-8600 receiver to tune it with a ACECO FC-3002 frequency finder

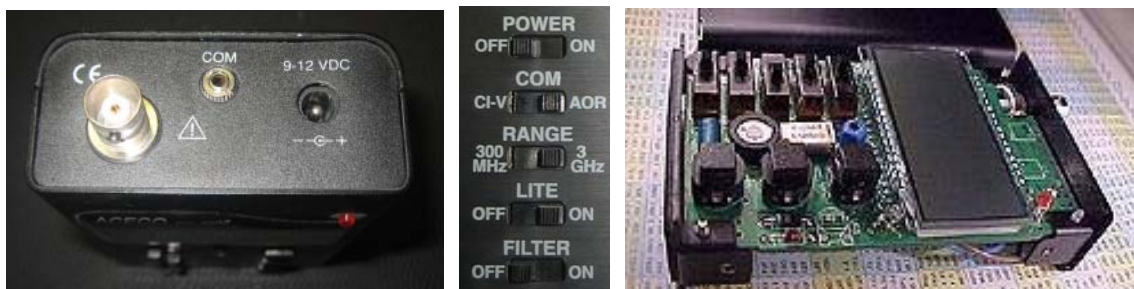
Matthias DD1US  
updated June 2<sup>nd</sup> 2011

## Description of the ACECO FC-3002 unit:

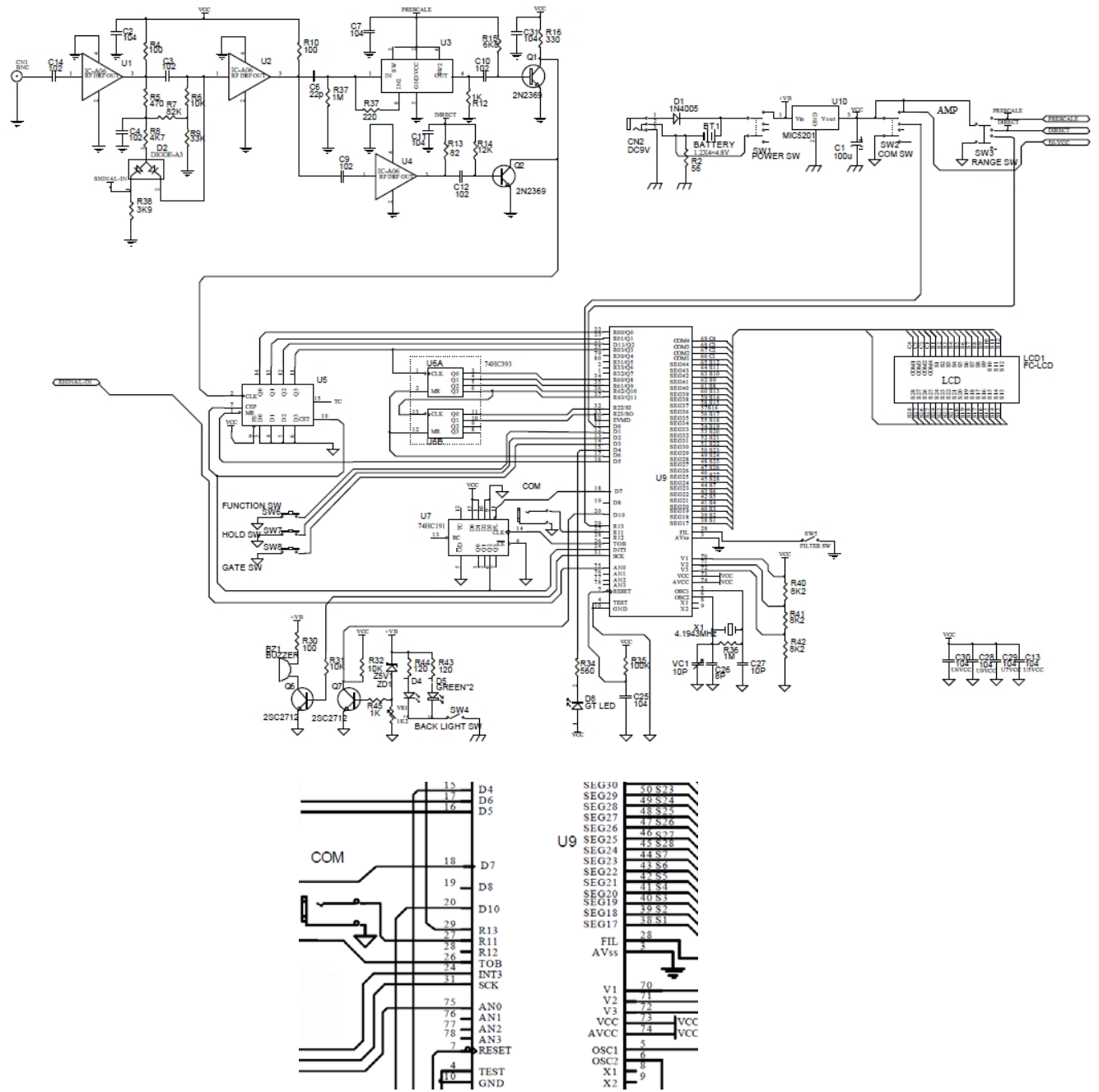
The ACECO FC-3002 is a handheld frequency finder. It is basically a fast and sensitive frequency counter. It displays the measured frequency (in the range from 1 MHz to 3 GHz) as well as the signal strength on a 10 digit LCD display. Furthermore it can transmit the frequency information on its serial port to other receivers and thus tune them to the frequency of interest. This is sometimes also called “reaction tuning”.



The ACECO COM port is a 2.5mm phone jack on top of the unit. As it is a mono jack only a unidirectional serial signal can be transferred. The output signal from the frequency finder is sent unidirectional with a baud rate of 9600bd to a connected receiver. A switch at the FC-3002 allows to select either the ICOM CI-V or AOR protocol.



On the next page you will find the schematic of the ACECO FC-3002 frequency finder.



As can be seen in the next diagram the COM port (2.5mm mono jack) of the FC-3002 is directly connected to pin 29 (R11) of the Microcontroller. It is NOT a RS-232 level interface but uses 5V TTL levels. Therefore special care has to be taken when connecting the FC-3002 to other devices. Make sure not shorten the signal line to ground and do not inject any signal to this COM port.

**Interface ACECO FC-3002 to ICOM radios:**

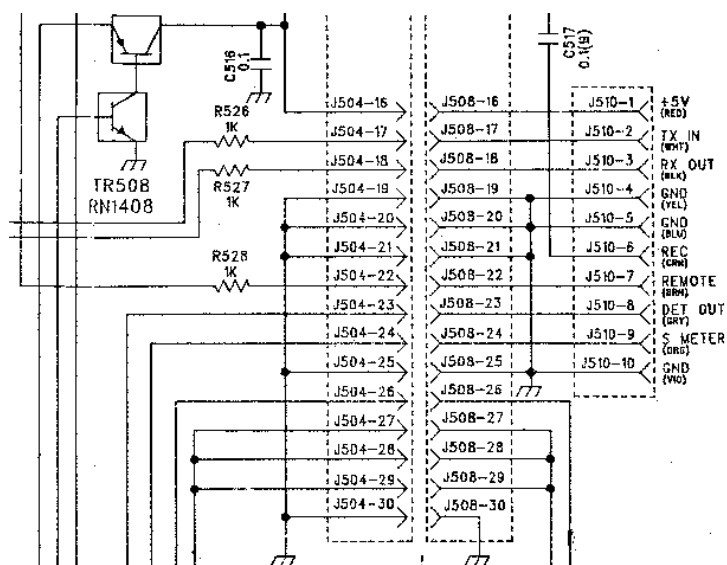
To control ICOM receivers the COM port is also ICOM CI-V compatible. The FC-3002 always uses the address \$58, which is used by Icom for the IC-706MkII-G. To have the FC-3002 send the frequency information you have to put it in function/hold mode. Push function button once after switching the unit on. Now, the FC-3002 transmits the frequency information each time a steady signal is encountered. It uses 9600 baud as transmission speed.

## Interface ACECO FC-3002 to AOR AR-8200:

The AOR AR-8200 and ACECO FC-3002 are connected by a special cable, which connects the “COM port” of the FC-3002 (2.5mm connector) to the 10 pin “accessory port” of the AR-8200. As both devices use 5V TTL levels on their ports the FC-3002 and the AR-8200 do not need any special interface electronic. The ACECO FC-3002 COM port is unidirectional and thus the measured frequency is sent to the AOR receiver. A switch at the FC-3002 lets you choose between ICOM and AOR radios and thus please make sure that AOR has been chosen. The baud-rate of the FC-3002 is 9600bd and has to be selected also in the settings menu of the AR-8200 receiver. To have the FC-3002 send the frequency information you have to put it in function/hold mode. Simply push the “function” button once after switching the unit on and the FC-3002 transmits the frequency information each time a steady signal is encountered.



The 10-pin connector for accessories of the AOR AR-8200 handheld receiver is called J510 in the schematic below. It provides a serial port but uses 5V TTL levels and not true RS232 signal levels. The RXD and TXD lines are connected to the uC by 1 kOhm resistors (R526 and R527 in the schematic below).



## Interface ACECO FC-3002 to AOR AR-8600:

In contrast to the AR-8200, which has a TTL level based serial port, the AOR AR-8600 features a fully RS-232 level compatible COM port. Therefore the FC-3002 and the AR-8600 cannot directly connected. Fortunately the AR-8600 uses the same protocol as the AR-8200 and thus only a small modification is necessary to make them work together.

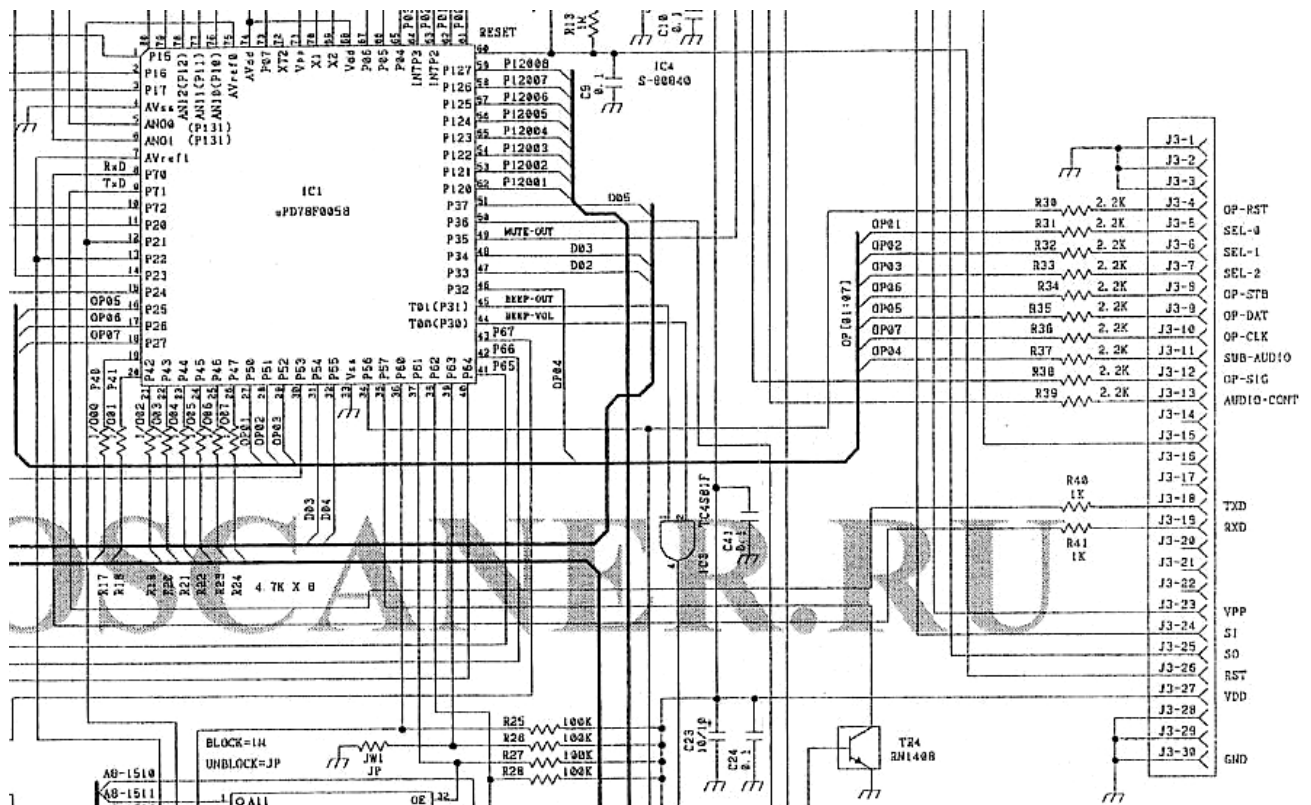


The female 9 pin Sub-D connector on the rear side of the AOR has the following pin-out:

- Pin2: RxD
- Pin3: TxD
- Pin5: Gnd
- Pin4, Pin6, Pin8: tied together

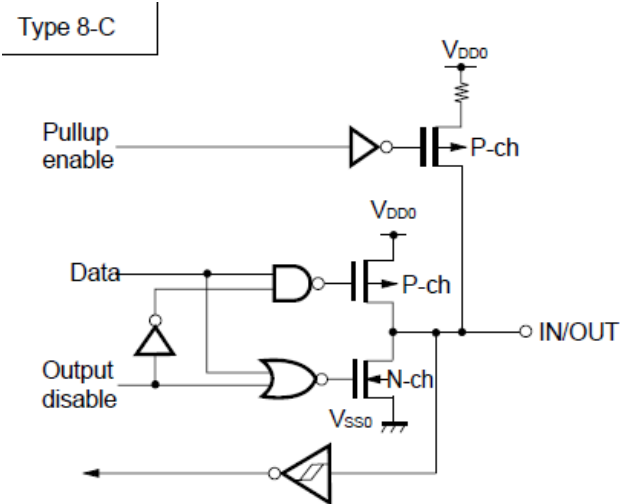
The main Microcontroller in the AOR AR-8600 is the 8 bit uC from NEC uPD79F0058. Its absolute maximum ratings are: VDD=-0.3 to 6.5V, the nominal supply voltage range is 2.7 to 5.5V.

This uC also provides the RXD/TXD connections (on TTL level) which are later converted to true RS232 levels by a MAX3221 (described later).

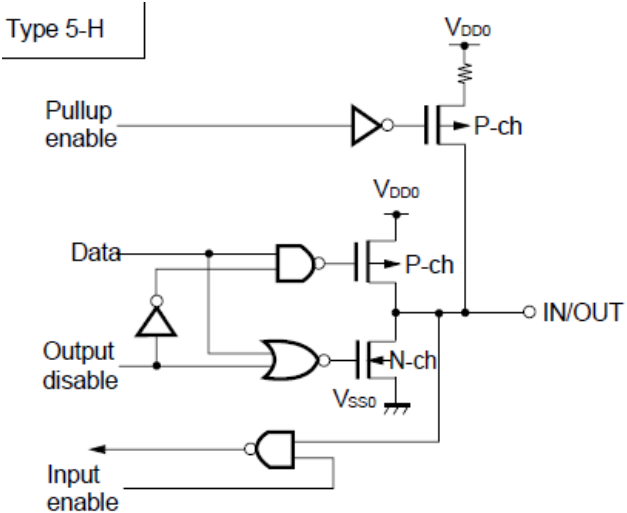


Pin 8 of the uC is the RxD port, Pin 9 is the TxD port. The RxD and TxD lines are connected from the uC by 1 kOhm resistors (R40 and R41) to the connector J3. J3-18 is TxD, J3-19 is RxD. J3 is connected to J6 (see description of J6 later). The detailed specifications of the NEC uPD79F0058 ports of interest are:

**PIN 8, RxD:**  
 Specification: UART, P70/SI1/RxD0, Type 8-C,  
 Input voltage: -0.3V to VDD+0.3V

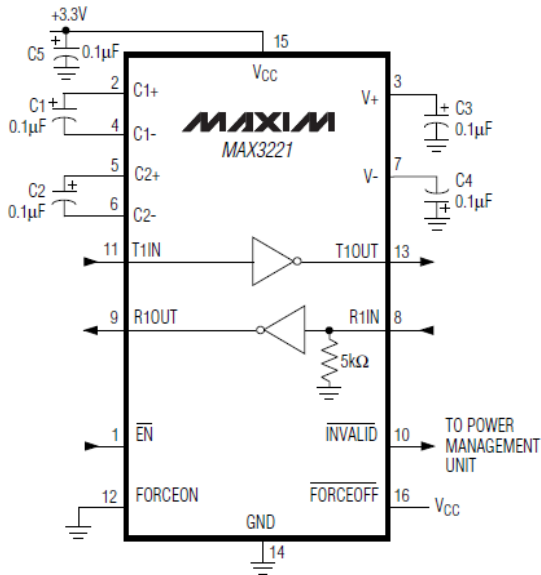


**PIN 9, TxD:**  
 Specification: UART, P71/SO2/TxD0, Type 5-H  
 Output current high: -15mA  
 Output current low : 50mA peak, 20mA RMS

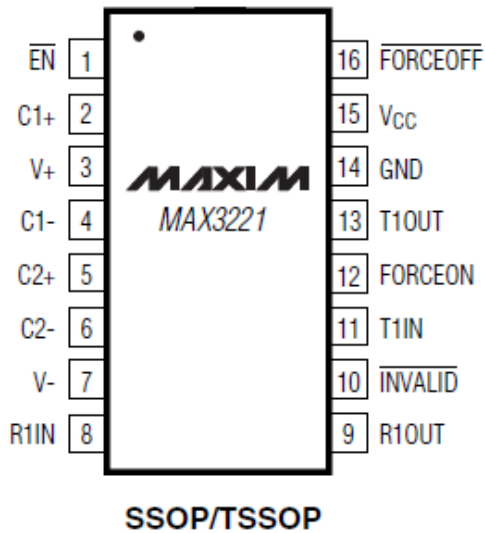


In the AOR AR-8600 we can find an interface circuit (MAXIM MAX3221) to convert the 5V TTL to true +/- 12V RS232 levels. The remote port at the 9 pin SUB-D connector is thus a true RS-232 COM port. The MAX3221 is connected to the RS-232 COM-connector (CN3) by 2 EMI filters (ferrite bead inductors) from Murata (type BLM11B252).

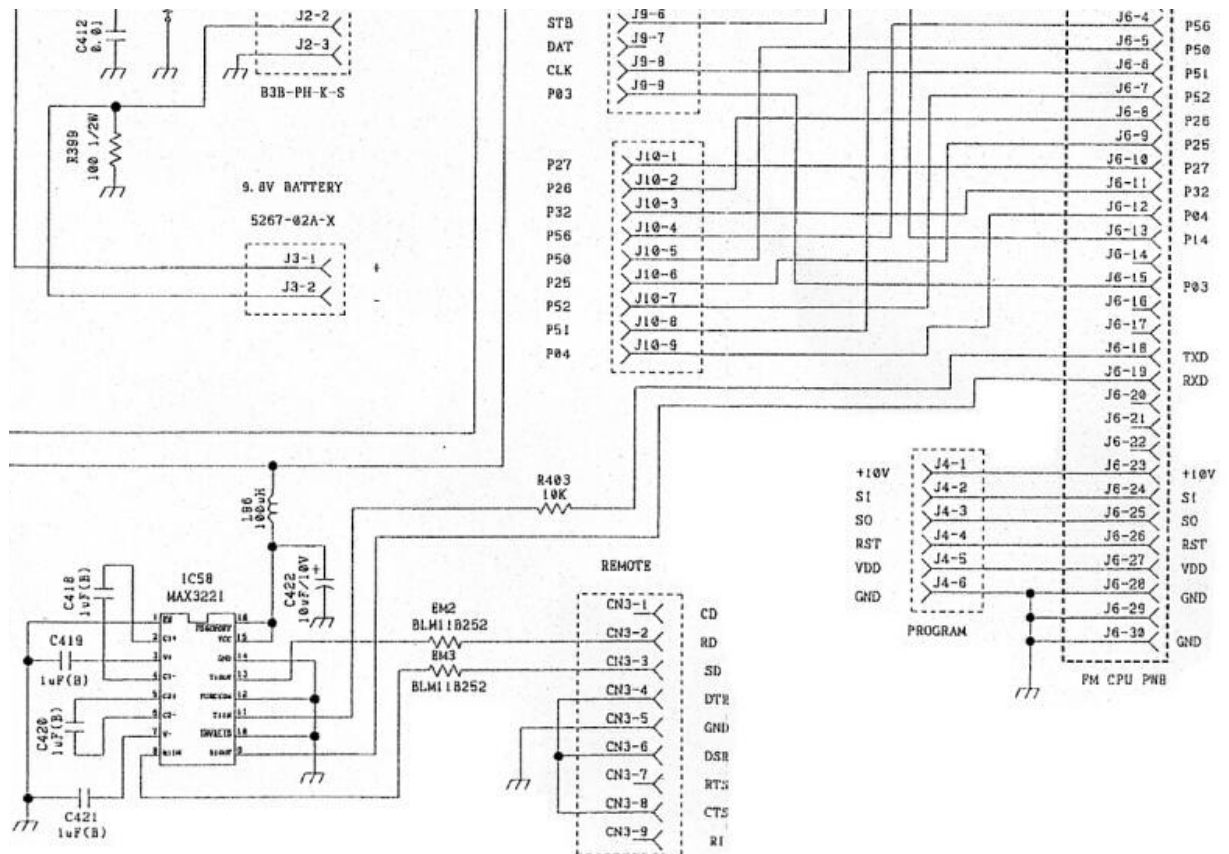
MAX3221 application circuit



MAX3221 pin out

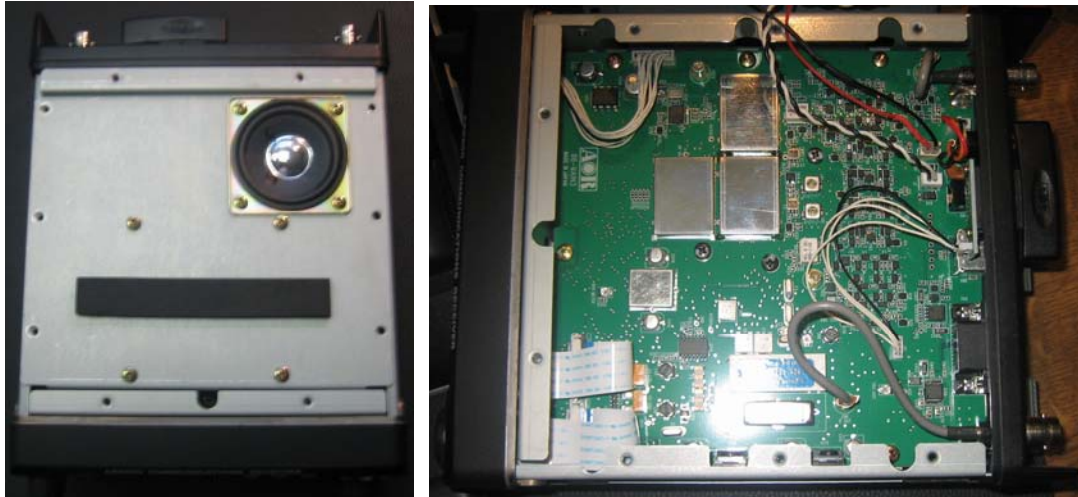


J6 is a connector which connects this interface block to the uC. Pin J6-18 is TxD (transmitting data from the uC to the serial port) and connected via a 10kOhm resistor to PIN 11 of the MAX3221 (T1in). Pin J6-19 is RxD (receiving data from the serial port to the uC) and connected directly to PIN 9 of the MAX3221 (R1out).

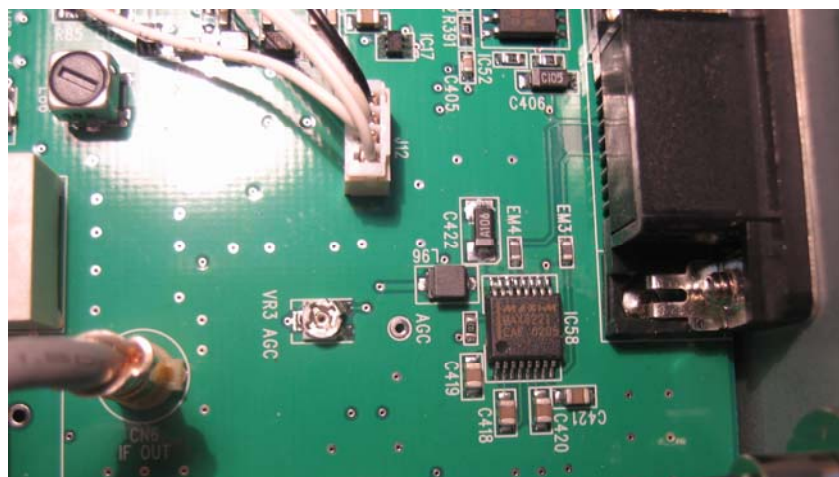


## Modification of the AOR AR-8600 receiver:

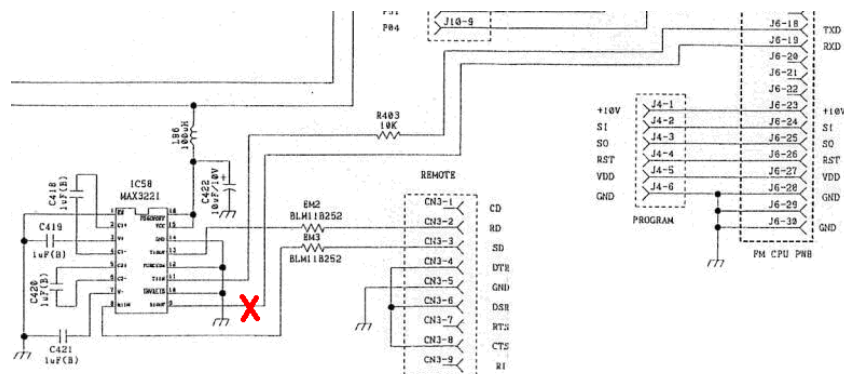
Next you will find the description how to modify the AOR AR-8600 to make it compatible with the ACECO FC-3002. First you have to remove the top cover and then the shield inside to get access to the top side of the PCB.



In the back right corner close to the SUB-D connector you can find IC58 (MAX3221).

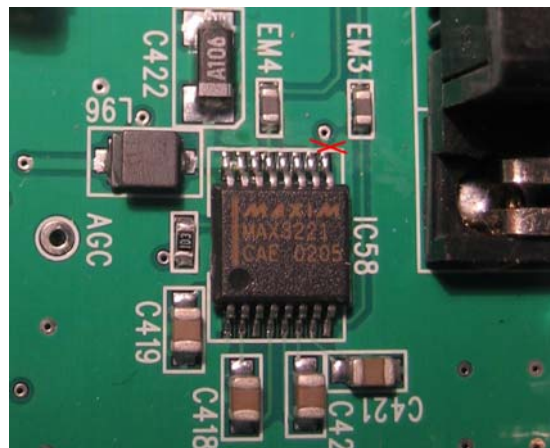


PIN 9 of the MAX3221 is the port where we can find the TTL level of the COM port.

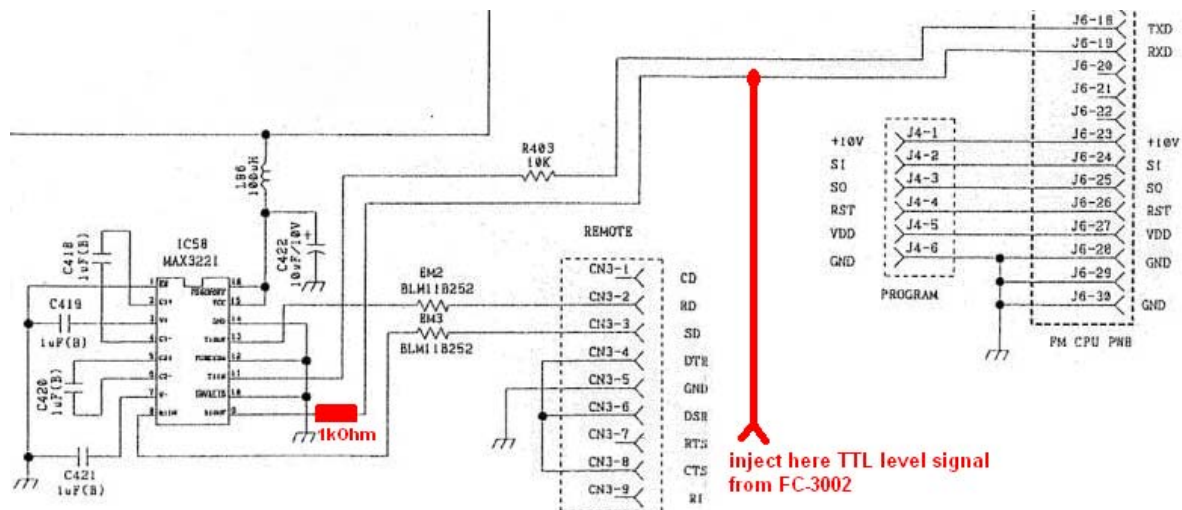


Next we have to either cut the line between PIN9 and the nearby through-hole or bend PIN9 up to disconnect it from the line on the PCB. I used the second method in my modification.

The modification of IC58 (MAX3221) is critical and if you don't care you may destroy it.



Now we insert a 1kOhm resistor between PIN9 and the line on the PCB and finally inject the TTL level signal from the FC-3002 between this resistor and connector J6.



To supply the signal from the FC-3002 to the AR-8600 I drilled a small hole in the back panel and mounted a 2.5mm jack. This is how the modification of the AR-8600 looks from outside and inside.



The connection between the FC-3200 and the AR-8600 is now possible using a simple straight through cable with 2.5mm phone connectors at both ends.



The setup works perfectly: the FC-3002 tunes the AR-8600 properly to the measured frequency. Please be aware that the FC-3002 is not a high sensitive receiver but a frequency counter with decent sensitivity and thus the input signal has to be rather strong ...



All information given here may be subject to errors. I cannot guarantee that the description is free of errors. Any modification of your equipment is at your own risk.

Please feel free to send me questions to the Email address given below.

Best regards

Matthias DD1US

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