



APPLICATION NOTE

NCS-AN-108A

NCS-C250 Radio Signal Requirements and Interface Methods

1.0 Introduction

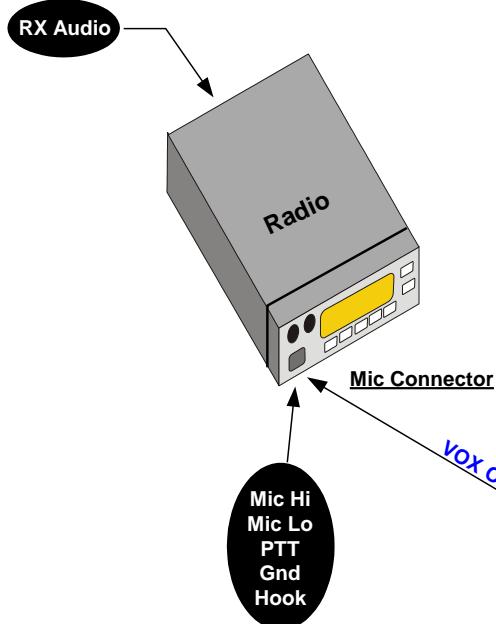
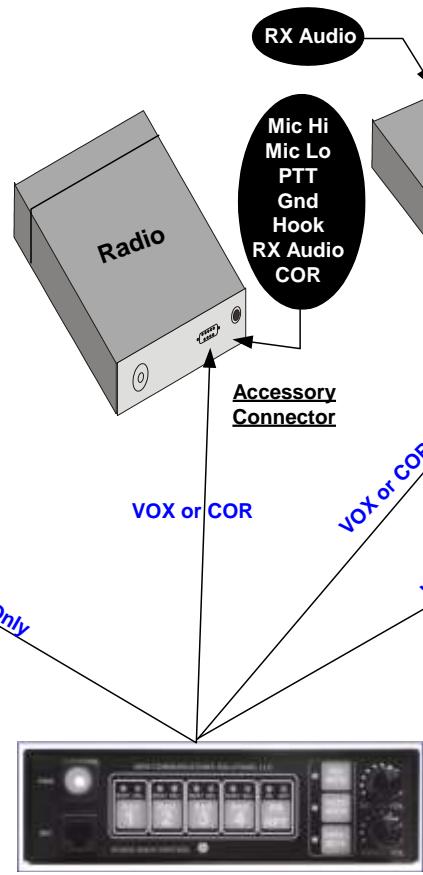
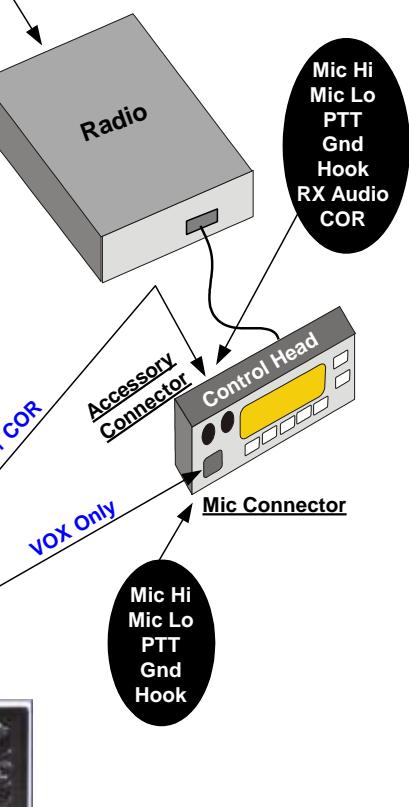
This document discusses the signal requirements and interface methods for connecting various manufacturers' radios to the NCS-C250. The interface information in this document also applies to the NCS-C251 Expansion Unit.

1.1 Signal Detection Method

The NCS-C250 will support VOX or COR signal detection in the RPT (Repeat) mode. While the VOX method works well, the use of the COR signal is preferred since it gives a more positive indication of a received signal. The C250 allows for a mixture of VOX or COR operation among the connected radios to accommodate radios, such as portable radios, that may not have a COR signal readily available.

1.2 Connection Methods

Generally, there are three methods of connecting the C250 to the radio: (1) via the microphone connector and the speaker output jack, (2) via the control head accessory connector (on some radios) and (3) via the accessory connector on the radio. The latter is the preferred interface, since the accessory connector will most likely make available the required signals. Method 2 is highly dependent on the type radio and control head and must be carefully evaluated to assure that all required signals are available. Method 1 is unlikely to have a COR signal or receive audio available on the microphone connector. Figure 1 illustrates these interface methods.

Method 1**Method 3****Method 2****Figure 1**

2.0 Required Radio Connections

The radio should provide the following connections. Some are optional depending on whether VOX or COR signal detection is used in the RPT mode and whether the hookswitch function of the radio is utilized.

Connection	Description	Notes
Mic Audio Hi	Mic audio from the C250 to the radio	Required.
Mic Audio Lo	Mic ground	Required. Use as ½ of balanced input to radio. Ground for single ended radio input.
RX Audio	Receive audio from radio to C250.	Required. May be speaker output audio or “fixed” line level audio
PTT	Push-To-Talk signal input to radio from C250	Required.
COR/TOR	Unsquelch indication signal from radio to C250	Optional. Not required if VOX is used for cross banding radios.
Hookswitch	Output from C250 to radio’s “hook” signal input	Optional.
Ground	Analog or digital ground	Required.

2.1 COR Polarity

The COR signal from the radio may be active high or active low. The default setting in the NCS-C250 is active low. Active low means that the COR signal goes low when the radio is unsquelched. Active high means that the COR signal goes high when the radio is unsquelched. If the polarity of the COR signal from the radio and the COR polarity selected in the NCS-C250 are not the same, the busy light on the C250 for that radio will be on when the radio is connected with no signal being received. To correct this condition the COR polarity in the C250 should be changed to match that of the radio. Refer to the C250 instruction manual for instructions on setting the COR polarity. Alternatively, in many radios the COR polarity can be changed in the radio using its programming software.

2.2 COR vs TOR

Many radios allow selecting COR or TOR in the programming software. TOR is the same as COR except that only signals with a correct CTCSS tone will produce an unsquelched signal indication. TOR should be used in applications where CTCSS tones are used and it is not desired to repeat signals via the C250 other than those with the correct CTCSS tone.

3.0 Connection Methods

As illustrated in Figure 1, there are basically three methods of interfacing a radio to the NCS-C250. There are pros and cons to each method depending on the application. These three methods are explained below.

3.1 Method 1 – Microphone Jack /Speaker Jack Interface

Interfacing the C250 through the radio's microphone jack is perhaps the simplest and easiest method of connection and requires no programming or modification of the radio. Figure 2 shows two examples of radio interface cables that interface to the mic jack and speaker jack of the radio.

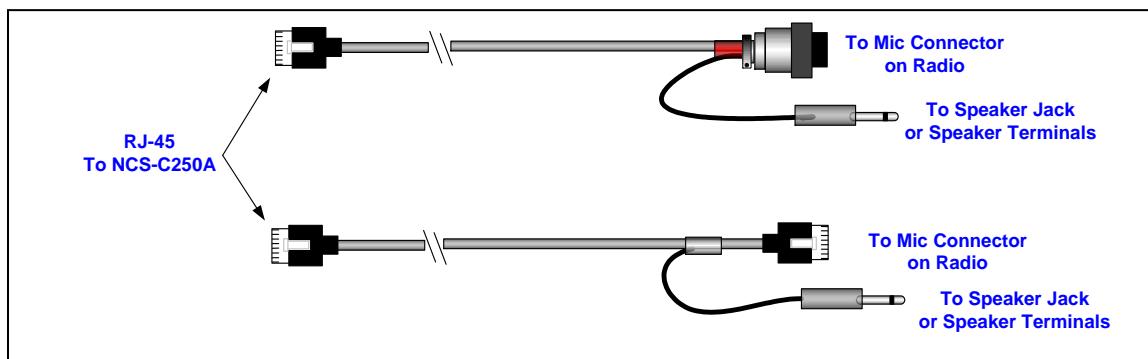


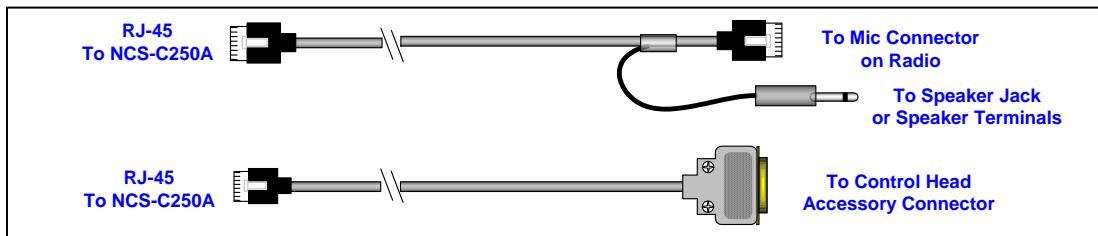
Figure 2

The mic connector does not provide a COR signal from the radio, therefore, VOX signal detection must be used for cross banding of radios. Interfacing to the mic connector of the radio and using VOX signal detection offers a good alternative interface method in cases where a COR signal is not readily available.

3.2 Method 2 – Control Head

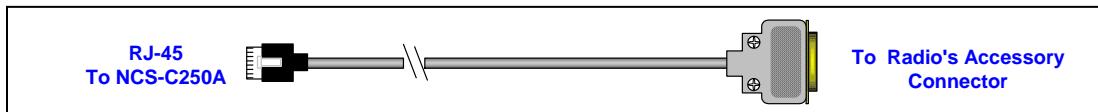
Interfacing to the control head of the radio offers the advantage of not having to run additional cables through the vehicle to radios that may be remotely located. There are potentially two methods of interfacing to the control head of the radio. The first is interfacing to the microphone jack and speaker terminals and is essentially the same as Method 1 described in paragraph 3.1.

The second method is interfacing to the accessory connector on the control head, if available. Many control heads do not have accessory connectors or do not have accessory connectors with the required signals, so this must be carefully evaluated for the particular radio in question. Some radios do have accessory connectors on the control head that provide access to all of the necessary signals including COR. Again, this is the preferred interface method if the C250 is to be operated in the RPT Mode (cross-banding). Figure 3 shows typical radio interface cables for interfacing to the mic jack or accessory connector of the radio's control head.

**Figure 3**

3.3 Method 3 – Radio’s Accessory Connector

Interfacing to the radio’s accessory connector is generally the preferred method of connecting the C250 to the radio. The accessory connector often provides all of the necessary connections to interface the C250 including the COR signal. If not, modifications to the radio may be required. These modifications may include internal jumper changes and/or programming changes. A typical radio interface cable for interfacing to the radio’s accessory connector is shown in Figure 4.

**Figure 4**

3.3.1 Physical Changes or Modifications

On some radios internal jumpers must be changed to activate the *External Mic Audio, External PTT or External RX connections*. These type modifications are generally explained in the radio’s Service Manual.

If the radio does not have a COR connection on the accessory connector and it is desired to use COR signal detection for cross banding, a jumper wire will have to be added at a point in the radio to bring the COR signal to an appropriate pin on the accessory connector.

Many radios handle some or all of these modifications using the radio programming software, eliminating or reducing the need for physical changes or modifications to the radio.

3.3.2 Radio Programming

Programming of certain radio functions are often required to enable the necessary connections on the accessory connector. Typical inputs/outputs that may require programming are *External Mic Audio Input, External Receive Output, External PTT, COR, and Hookswitch*.



These signals may or may not be programmable in a particular radio. Refer to the radio's programming software manual and/or the radio's service manual for programming requirements.

4.0 Interfacing to Portable Radios

Portable radios typically do not have a COR signal available and VOX signal detection mode must be used when cross banding. Interfacing to the portable radio is usually accomplished using its speaker/microphone connections. A typical radio interface cable for a portable radio is shown in Figure 5.

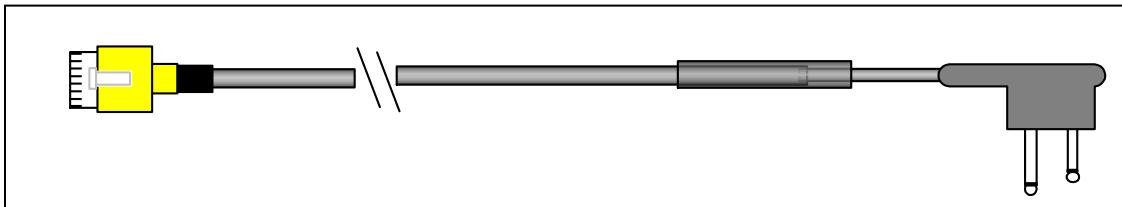


Figure 5

5.0 Collcomm Assistance

Collcomm has existing cable designs for most radios. If a cable design does not exist, Collcomm will be glad to provide recommendations for interfacing the NCS-C250 to a particular radio, based on the customer's application and requirements. If the interface information is not available in our database for the radio in question and a new radio interface cable must be designed, the customer may be required to furnish some or all of the following items to facilitate the design of an appropriate radio interface cable.

- Connector Type
- Connector Pin-outs

Collcomm will:

- Design a radio interface cable.
- Furnish customer with a cable schematic and instructions with the purchase of the cable.

The customer will be responsible for all shipping charges. Collcomm will provide the cable design and engineering at a minimal charge. The cable design will be the property of Collcomm.

Contact us at:

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