EMERGENCY MEASURES RADIO GROUP	**EMERGENCY MEASURES RADIO GROUP**
AMATEUR RADIO RAC EMERGENCY SERVICE	**OTTAWA ARES**

Two Names - One Group - One Purpose

Standard Radio Interface
EMRG-210

Version: 0.4

DRAFT

EMRG PUBLIC

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Written by: Peter Gamble for the EMRG Management Team

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1.0 REVISION SUMMARY

Date of Change	Revision Number	Summary of Changes (Section #, type of change)
2003-10-26	0.1	Initial document created using template, based on original document
2004-11-25	0.2	• Change name to from 14 Pin Interface to Standard Radio Interface and apply latest document template • Change interface connector from 15 pin high density DA15video to standard DA15 connector
2004-11-29	0.3	• Update per review feedback
2004-12-05	0.4	• Add packet PTT and additional details and corrections in many areas. Major document re-write.

2.0 PURPOSE OF THIS DOCUMENT

This document defines an EMRG standard interface for radio communications signals. The interface will be used on radios, and devices that connect to radios, such as TNCs, Repeater controllers and phone patches.

3.0 INTRODUCTION

3.1 OVERVIEW

Almost every piece of equipment has an audio and control interface of some type. It might be the microphone and speaker jacks on an Amateur radio, the multi pin jack on the back of a commercial radio, or the radio interface connections on a TNC. Some vendors maintain a standard within one or more model lines, but in general there are no manufacturer standards for these equipment interfaces. Each manufacturer uses a different type of connector and a different pin assignment.

Each time new equipment is purchased the matching connectors must also be purchased and new cables created to interface to other equipment. If there is only one set of equipment to connect together or multiple installations of the exact same equipment, a custom interface cable is wired to connect the desired radio(s) to the equipment. The equipment could be a TNC, Phone Patch, Repeater Controller or a Remote Console.

3.2 EMRG CHALLENGE

EMRG has many different radios and different pieces of accessory equipment, so there is an infinite number of possible interface connections. In order to be able to swap equipment in an emergency, extra interface cables for each combination would have to be built in advance, labelled and stored.

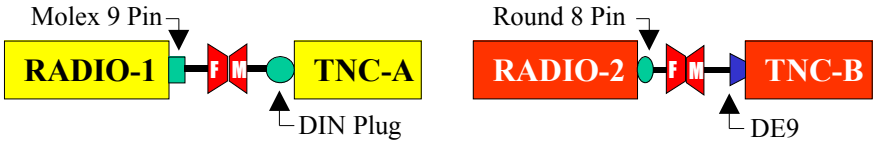
The drawing below shows the typical situation for EMRG where there are two different manufacturers of radio; Radio-1 & Radio-2, and two different makes of TNC; TNC-A & TNC-B.

Each radio and TNC uses a different connector, so custom cables are required for each Radio - TNC installation. In an emergency, there is no way to swap equipment, such as to connect RADIO-1 to TNC-B, without building a new cable.

3.3 STANDARD RADIO INTERFACE

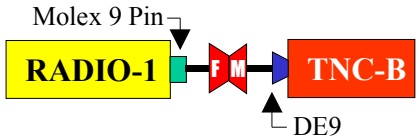
The solution to connecting different pieces of equipment together is to define a standard interface and build cables from each piece of equipment to the standard interface.

The figure below shows the same radios and TNCs shown in section 3.2, but now each device is wired to a standard connector.

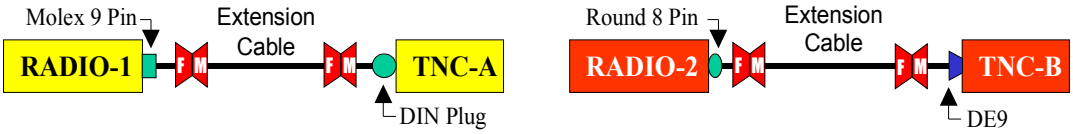


Implementing a standard interface will allow radios and peripherals to be swapped as required in an emergency. This means that if a radio fails in a phone patch, another radio equipped with the standard interface can be used in its place, without having to make adapter cables in the field.

The previous problem of connecting RADIO-1 to TNC-B is not a problem now, because the connection is made at the standard interface connector as shown below. It does not matter what connectors the Radio and TNC have.



The device connecting to the radio may not be a TNC, it could be a user interface for distributing microphone and speaker audio. With standard interface connectors, extension cables can be built various lengths to separate the radio and the connecting device.



4.0 STANDARD CONNECTION SPECIFICATION

4.1 STANDARD CONNECTOR

The standard EMRG radio interface is the DA15 connector. The DA15 is similar in shape to the DE9 and DB25 and it's size is between the two. The DA15 was chosen for the following reasons;

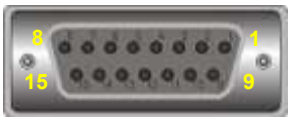
- contains enough pins for the signals that need to be assigned
- widely used in industry, so connectors are readily available for a reasonable price
- available in crimp pin or solder pin
- reasonable size for amateurs to work with
- not used in commercial or amateur radio systems, so there is no confusion about connectors

D connectors use letters to signify the number of pins; DE=9, DA=15 and DB=25. Typically DB is used incorrectly to refer to all D connectors.

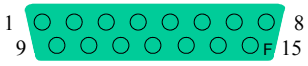
Several other connectors were considered, such as DE9, RJ45 and DIN. These connectors are readily available and easy to work with. The problem is that they don't have enough pins to bring out all the desired signals in one connector, plus the DE9 and RJ45 are commonly used in radios and computers and both are currently used for other purposes in amateur radio. To confuse things more, the RJ45 is commonly used as a microphone connector, but with different configurations for each manufacturer.

- **DA15F**: Wired to Radios. The radio may be used without anything connected to the DA15 connector, so the Female connector is used on radios, so there are no exposed pins.

DA15F (female) Connector



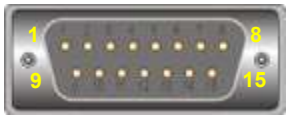
Front View

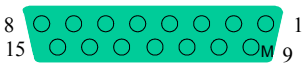


Back View
Wiring Connections

- **DA15M**: Wired to TNCs, controllers and phone patches. These devices are not used unless they are connected to a radio, so the exposed pins on the male connector are less of a potential problem.

DA15M (male) Connector





Back View
Wiring Connections

4.2 AUXILIARY POWER

Most devices that connect to a radio using the standard interface require 12 VDC power to operate. Typically these devices, such as a TNC, user interface box, or phone patch do not require more than 1A. The DC interface will be fused at 2 amps, meaning devices that require up to 1.3A can be supported.

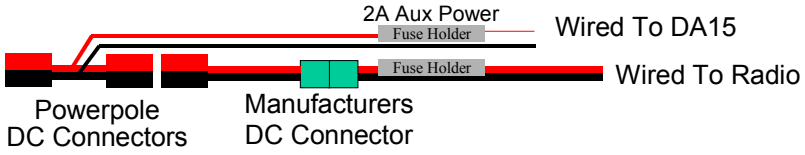
The fuse selection is based on the requirement that the smallest wire that will be used for the standard interface is 24 gage. This size wire will support 2 amps in a bundled cable. By selecting the fuse rating of 2 amps, the current cannot exceed the operating rating of the cable. The cable will support higher current, but it will get warmer, however the fuse will not support more than the rated 2A for the wire.

The fuse will not support continued operation at its full load rating, so the actual operating current for the fuse is lowered to 1.3 Amps. This allows the fuse to be 1.5 times greater than the rated current (1.3A x 1.5 = 1.95A).

The auxiliary power can be wired permanently with the radio connection, so no additional Powerpole connectors are required, or it can be wired using 2 connectors, so the standard interface can be removed from the radio.

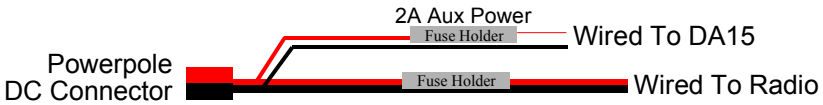
4.2.1 REMOVABLE AUXILIARY POWER CONNECTION

Two Powerpole connectors are required to provide the Auxiliary power connection, so that the BASIC interface cables can be removed from the radio. The figure below shows the wiring.



4.2.2 PERMANENT AUXILIARY POWER

On radios with an ENHANCED or CUSTOM interface, the other interface connections will be permanent, so there is no need to make the auxiliary power connection removable. The drawing below shows how to wire the auxiliary power to the radio Powerpole connector.



4.3 STANDARD CONNECTOR PIN OUT

PIN	Signal	Description	PACKET CONNECTIONS
1	PTT-Packet	Some radios provide rear packet connector with PTT which typically mutes microphone	Dedicated radio packet connector –PTT Requires TNC to have Switch Interface
2	Microphone Audio	Standard microphone connection on radio (Audio Input to TX -Before Pre-emphasis)	1200B TX IN (Std)
3	PTT-Mic	Microphone PTT switch	
4	Flat TX Audio	Audio Input to TX -After Pre-emphasis (Inject CTCSS tone at this point)	
5	Direct TX Inject	Audio Input to TX (Typically at RF section)	9600B TX IN & 1200B TX IN (Option)
6	SG GND & External Speaker -	Signal Ground & External Speaker – Connect to common ground point	Ground
7	COR/COS	Squelch Output	
8	+12 VDC	Auxiliary DC + (1.3 Amp for TNC or audio amp)	DC Power +
9	GND	Auxiliary DC Ground	DC Power -
10	Receive Audio	Audio Output before volume control	1200B RX OUT (Option)
11	Flat Receive Audio	Audio Output from RX before De-emphasis	9600B RX OUT
12	Aux Input +	Auxiliary Audio Input (Second Radio)	
13	Internal Speaker +	Loop to Ext SPK + for internal speaker	
14	External Speaker +	For external speaker or Loop to Int SPK + for internal speaker (Audio output must be referenced to ground)	1200B RX OUT (Std)
15	SPARE	Not Assigned At This Time	

4.4 ASSUMPTIONS - EXPECTATIONS

4.4.1 Supported Equipment

The standard interface must support all VHF/UHF radios, TNCs, repeater controllers and phone patchs, and should support as much other equipment as possible, including CB radios, HF, scanners and Broadcast radios.

4.4.2 Equipment Wiring

Some radios provide most of the required connections on existing connectors. Adapter cables would be required from the radio's connector, to the standard interface.

If there are no external connections on the radio, or only a few, the standard interface can be wired directly into the radio.

For some radios the required connection points are readily available within the radio, while others require additional components such as resistors or transistors to be added. These components may need to be installed in an external mini box attached to the device.

4.4.3 PTT –Push To Talk

In the standard interface, the PTT signal refers to a normally high with low indicating a valid PTT signal. For equipment that does not provide this type of PTT output, additional circuitry will be required either in the radio or inside an attached box.

The first phase of the standard is the physical connections. Future development will better define the electrical characteristics of the interface and suggested circuits for signal inversion and level changes.

4.4.4 Speaker Ground

The standard interface is based on the speaker using ground as one connection. On radios that that require the speaker to be independent of the ground connection, a custom adapter will be required. (the design for this adapter has not been defined at this time)

4.4.5 Hook Switch

On commercial radios, the hook switch feature must be disabled or the hook switch pin must be grounded inside the radio.

4.4.6 Internal Speaker +

The internal speaker + connection is wired to the standard interface, but is not used by any of the interface devices. The connection is included so that the option of internal or external speaker can be configured. For radios that are being used with no external devices, the loop plug can be added, so the radio will function using the internal speaker.

4.4.7 Dedicated Packet Radio Connectors

Some radios have a separate connector, dedicated to Packet radio. The connector typically supports separate 1200 & 9600 baud receive

connections, a common 1200 & 9600 baud transmit connection and a PTT connection.

The Standard Radio Interface will support these dedicated connections, based on the following assumptions;

- The EMRG standard for 1200 Baud packet will wire to the microphone input, microphone PTT, and speaker output by default. To use other connections, such as a dedicated Packet connection, the TNC must be wired with the TNC Switch Interface Option.
- Support for 9600 baud radios and TNCs will use pins 5 and 11 as the default connections. This will be true for radios with a dedicated packet connection or radios that are modified to support 9600 baud. The only option for 9600 baud is the PTT. Radios that support 9600 baud packet transmit, will wire the transmit connection to pin 3, microphone PTT, with an optional switch to select the dedicated packet PTT.

4.4.8 PTT Packet

Some radios support a separate packet PTT on the rear radio connector. The packet PTT mutes the microphone, while the normal microphone PTT mutes the packet input. In order to standardize the packet PTT, the following rules apply;

- If the radio supports the packet PTT, it will be wired to pin 1 on the standard interface.
- All TNCs will use pin 3 for PTT.
- To access the packet PTT, the TNC must be wired with the TNC Switch Interface option.

5.0 STANDARD INTERFACE CLASSES

5.1 THREE INTERFACE CLASSES

The standard interface defines a full set of interface signals that could be used for end user interfaces (Mic, PTT, Spk), repeaters (COS/COR, Flat TX/RX) and 9600 baud packet (direct TX inject). The full set of interface signals will not be available on some radios and will require internal connections for some signals. Internal connections to the radio may not be desired or possible on all radios.

There are three classes of standard interface, which define sub sets of signals that are required to serve specific requirements. Each interface class has a colour indicator to indicate which class the radio supports. Indicator colours must be included on the cable using heat shrink tubing or tape, or on the connector using paint. The three interface classes are;

BASIC Interface

- Supports end user interfaces and 1200 baud packet radio
- Signals available using only microphone and external speaker jacks
- Indicator colour is RED (tape, heatshrink or paint)

ENHANCED Interface

- Supports all BASIC interface signals
- Supports devices that require a COS/COR indication from the radio, such as repeater controllers and phone patches without VOX.
- Signals require connections inside the radio and may require modifications such as cutting traces or adding components
- Indicator colour is YELLOW

CUSTOM Interface

- Supports all BASIC interface signals
- May or may not support ENHANCED interface signals. IF the custom interface supports the ENAHNCED interface signals, the cable will have the yellow indicator for ENHANCED and the blue indicator for CUSTOM.
- Supports special applications such as 9600 baud packet radio as well as repeater controllers that provide CTCSS encode and decode.
- Signals require connections inside the radio and may require modifications such as cutting traces or adding components
- Indicator colour is BLUE
- Enhanced interfaces require a label to indicate which extra interface connections have been wired

5.2 BASIC STANDARD INTERFACE REQUIREMENTS

The BASIC Standard Interface defines the minimum requirement to wire a standard interface. Some equipment, such as most Amateur radios, will not support all of the connections defined for the full standard interface unless connections are made inside the radio. The standard interface defines a minimum signal requirement, which can be obtained from a standard Amateur radio, using only the Microphone and Speaker jacks, plus an inline DC power connection. The BASIC Interface signals include;

- Mic Audio
- Mic PTT
- Signal Ground / External Speaker -
- Aux DC +
- Aux DC -
- External Speaker +

Connectors wired with the BASIC requirement must be labelled with red tape or heat shrink tubing on the cable, near the DA15 connector, or with a red marker or paint on the connector shell, to indicate that it supports the BASIC requirement.

5.2.1 BASIC INTERFACE PIN OUT

On a typical amateur radio, which has an external speaker jack and a microphone jack, the following pins are used. There are some commercial radios that only provide a microphone jack and a standard 3.5mm (1/8") speaker jack.

PIN	Signal	Description
1	PTT – Packet	Dedicated radio packet connector -PTT
2	Mic Audio	Audio Input to TX -Before Pre-emphasis (Standard microphone connection on radio)
3	PTT- Microphone	Microphone PTT
6	SG & Ext Spk-	Signal Ground & External Speaker -
8	+12 VDC	Auxiliary DC + (1.3 Amp for TNC or audio amp)
9	DC GND	Auxiliary DC Ground
14	Ext Spk +	External speaker

5.3 ENHANCED STANDARD INTERFACE REQUIREMENTS

The ENHANCED Standard Interface defines BASIC interface signals plus the addition of two signals; COS/COR and Internal Speaker +. All radios will require an internal connection for the COS/COR signal and may require an additional component, usually a transistor.

On most commercial radios, the Internal Speaker + connection is available from the built in rear multi pin connector. The reference section discusses the use of the Internal Speaker + connection and how to access this connection on radios with a 3.5mm (1/8") external speaker jack. The ENHANCED Interface signals include;

- Mic Audio
- Mic PTT
- Signal Ground / External Speaker -
- Aux DC +
- Aux DC -
- External Speaker +
- Internal Speaker +
- COS/COR

Connectors wired with the ENHANCED requirement must be labelled with yellow tape or heat shrink tubing on the cable, near the DA15 connector or with a yellow marker or paint on the connector shell, to indicate that it supports the ENHANCED requirement. ALL Enhanced interfaces will support the BASIC interface requirements so no additional marking is required.

5.3.1 ENHANCED INTERFACE PIN OUT

PIN	Signal	Description
1	PTT-Packet	Dedicated radio packet connector -PTT
2	Microphone Audio	Audio Input to TX -Before Pre-emphasis (Standard microphone connection on radio)
3	PTT-Microphone	Microphone PTT
6	SG & Ext Spk-	Signal Ground & External Speaker -
7	COR/COS	Squelch Output
8	+12 VDC	Auxiliary DC + (1.3 Amp for TNC or audio amp)
9	DC GND	Auxiliary DC Ground
13	Int Spk +	Internal speaker
14	Ext Spk +	External speaker

5.4 CUSTOM STANDARD INTERFACE

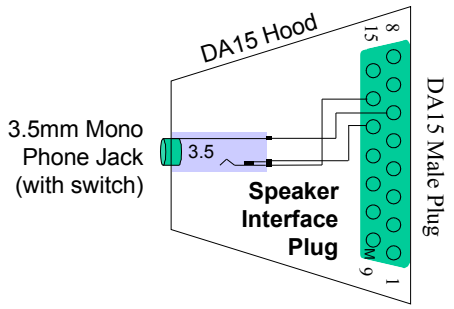
The CUSTOM Standard Interface defines BASIC interface signals plus a non standard set of additional signals from the set of signals defined for the standard interface. Devices wired with the CUSTOM interface standard must be labelled to indicate which additional signals they support. Most radios will require an internal connection for the additional signals which may require additional components and traces to be cut. There are Amateur radios which are have a connector to support 9600 baud packet radio. This is an example where the interface is CUSTOM, but there is no internal radio wiring.

Connectors wired with the CUSTOM requirement, must be labelled with blue tape or heat shrink tubing on the cable, near the DA15 connector, or with a blue marker or paint on the connector shell, to indicate that it supports the CUSTOM requirement. If the connector also supports all the ENHANCED interface signals, an additional YELLOW indicator should be included with the blue.

6.0 ACCESSORIES

6.1 SPEAKER JACK

Once a radio is wired for the Standard Radio Interface, there is no speaker jack available. For radios that use the basic interface, plugged into the radio speaker jack, the plug can be pulled to connect a speaker. An alternative is to build an adapter.



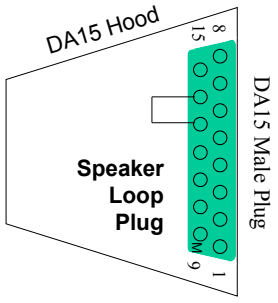
The adapter is built into the DA15 plastic hood. The jack is a 3.5mm (1/8”) mono type, with built in switch. When nothing is plugged into the jack, the External Speaker + and Internal Speaker + are connected together, so the radio’s internal speaker is active.

When a speaker plug is pushed into the jack, the switch breaks contact with the Speaker Internal + connection, so the internal speaker is off and the external speaker is active. (See section 8.2 for more information on speaker wiring)

6.2 SPEAKER LOOP PLUG

Commercial radios typically wire the non ground lead of the speaker out to the interface connector on the back of the radio. To use the internal speaker, a wire jumper is installed from the pin for Internal Speaker +, to the pin for External Speaker +. This activates the internal speaker.

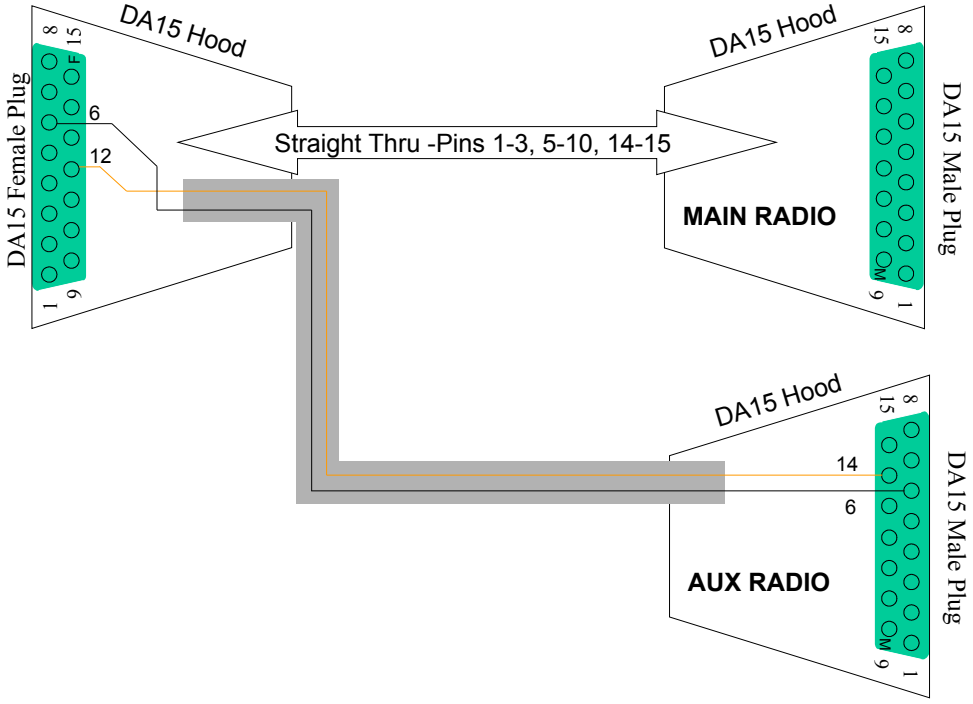
On radios wired with the ENHANCED interface a DA15 male loop plug will be required if the radio is operated as a stand alone mobile. The loop can be wired inside the connector hood and the hood can be attached to the radio connector with a short length of string.



Pins 13 & 14 Connected Together

6.3 AUXILIARY AUDIO ADAPTER

The standard interface includes a wire to extend the receive audio for a second radio. This is useful to distribute audio from a local AM/FM radio for background information, an FRS radio used for local communications or a second Amateur radio frequency. The users have the option to listen or not to the auxiliary signal and they have a volume control.



7.0 Extension Cables

Two types of extension cables have been defined, one short and one long. The driving factors are the purpose for the extension and signal loss over distance. There are physical limits to how far control, audio and DC signals can be extended.

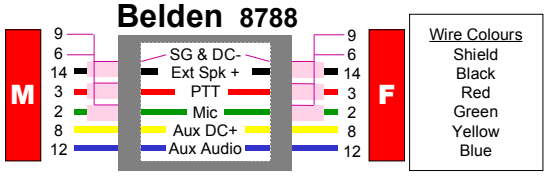
7.1 STANDARD EXTENSION (1M – 20M)

The standard extension cable allows the radio and other device to be separated by a limited distance, but supporting all signals and DC power. This might be a short 1 metre cable so the TNC sits on a shelf or longer so that the radio can sit on the other side of the room from the operator. The full set of signals is included, except for the signals associated with repeater controllers.

The cable is a 12 wire with common shield. The Standard Extension will include the following pins; 1-3, 5-10, 14-15. There will be some voltage drop along the length of the cable. The standard extension will support the full 1.3A rating for shorter distances, but the current limit should be de-rated to 800mA for cables that are above 15 metres in length due to voltage loss.

7.2 LONG EXTENSION (30M – 200M)

The long extension is designed to allow the end users to be located a significant distance from the radio. The cable has individual shields on 3 of the 5 wires. The cable will extend the basic user signals as well as the 12 volts DC and the auxiliary audio.



The 12 VDC power will suffer voltage drop along the length of the cable, so the current supported is de-rated to 500mA for the long extension. The purpose of the DC supply is to power a Standard User Interface, which has LED indicators, PTT switching and microphone bias.

The 200 metre distance is a guess/hope, based on the results found in the UK for the CAIRO interface. The EMRG standard is using a different cable and has an additional signal, so the results may differ. Testing will be done to confirm the results before making the standard official.

8.0 PACKET RADIO

8.1 TNC WIRING

The Basic Interface will support 1200 baud packet, using the microphone input (pin 2) for TNC Transmit (TX), and the external speaker + (pin 14) for TNC Receive RX. The connection points in a radio for 1200 Baud packet are not the same as for 9600 Baud packet. The EMRG standard interface provides pins for these different connections, so radios that support both 1200 & 9600 Baud can be pre-wired.

The TNC cable will be wired differently depending on whether the TNC port is 1200 Baud or 9600 Baud. Some Amateur radios provide a rear connector for packet radio, with some of these using a common Transmit input for 1200 & 9600 baud packet.

8.2 PACKET PTT

Some amateur radios have a rear connector for packet radio and this connector provides a PTT connection. The packet PTT mutes the microphone, while the standard microphone PTT will mute the packet input. The Standard Interface supports both PTT connections. Standard microphone PTT is on pin 3 and the packet PTT is on pin 1.

If a radio has a separate dedicated packet PTT connection, it is wired to pin 1 and the microphone PTT is wired to pin 3. Packet radio devices, such as a TNC, will always connect to the Microphone PTT on pin 3.

The TNC Switch Interface option is required on the TNC in order to use the dedicated packet radio connection. The same option is required for TNCs that support both 1200 & 9600 baud.

8.3 TNC POWER

The Standard Radio Interface provides 12 VDC power on pin 8 (+) and pin 9 (-). The auxiliary power is provided for devices such as TNCs, which draw less than 1.3 Amps of current. Using the 12VDC on the standard interface allows the TNC to be connected with a single connector, plus there is no extra DC connector to attach.

8.4 TNC SWITCH INTERFACE

The minimum connections for 1200 baud packet are microphone IN (pin 2), PTT-Microphone (pin 3) and External Speaker OUT (pin 14). The interface option would be added to the TNC cable, to support the following situations;

- The TNC supports 1200 & 9600 baud operation
- The TNC is normally connected to a radio with a separate dedicated packet connection. This would typically be a personal station that has a radio with the packet connection, but the user also wants to be able to support radios that do not have a dedicated connection.

8.4.1 Transmit (TX) Audio

Some Amateur radios provide a rear connector for packet radio, with some of these using a common Transmit input for 1200 & 9600 baud packet. In the cases where they use a common input, a switch can be added to the TNC interface cable to select between the two connections; pin 2 for microphone or pin 5 for direct inject.

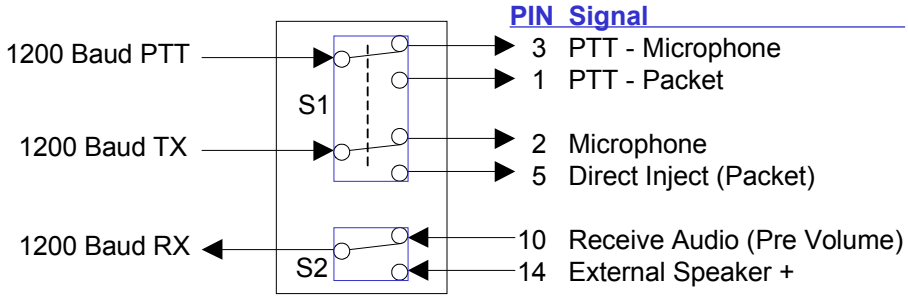
8.4.2 PTT – Packet

When a radio is equipped with a dedicated packet connector, the connector provides input and output connections, which includes PTT. The switch for the Transmit Audio is a DPDT type, which also switches the TNC PTT connection from Microphone PTT to Packet PTT.

8.4.3 Receive (RX) Audio

Some radios support a constant volume output, which is tapped off at the volume control. By using this output, the volume control does not adjust the signal level. Some commercial radios are wired for this capability and EMRG will wire in this option on radios where the signal can be wired using internal connections.

8.4.4 Option Interface Layout & Wiring



9.0 REFERENCE MATERIAL

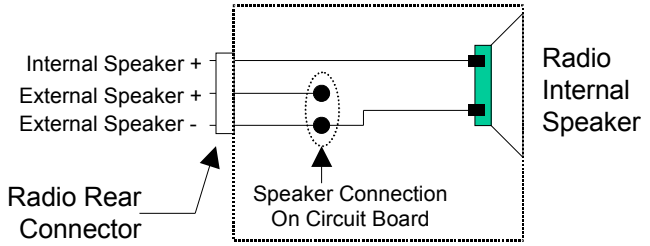
9.1 AUDIO CONNECTIONS

There are three audio output connections that can come from the radio;

1. External Speaker - 8 Ohms, output level controlled by radio volume control
2. RX Audio - Squelched audio before the volume control. Provides a constant signal level regardless of where the speaker volume is set.
3. Flat RX Audio - Squelched audio before the de-emphasis circuits. Provides a constant raw audio signal, which is required for extracting CTCSS to a decoder and for 9600 Baud data.

9.2 COMMERCIAL RADIO SPEAKER CONNECTIONS

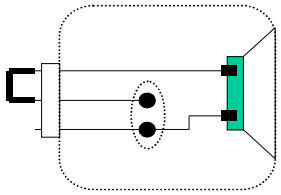
On most commercial radios there is no speaker jack. The only connection on the back of the radio is a multi-pin connector with 5 to 16 pins, depending on the make and model of radio. The type of connector will also vary by make and model. The multi-pin connector supplies power to the radio and provides any inputs or outputs for the radio.



The radios internal speaker is wired to one of those pins, labelled Internal Speaker + or Int Spk +, as shown in the diagram. The assumption in commercial radio is that the radio will be installed in a vehicle and will not be moved, so the installation tech will either connect up the internal radio speaker or install an external speaker.

Radio Speaker

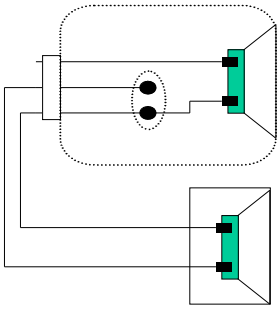
External jumper wire installed on the multi-pin connector, from Ext Spk + pin to Int Spk + pin.



No jumper = no audio

External Speaker

External speaker wired to Ext Spk + pin and Ext Spk - pin.



Typical Commercial Radio Speaker Wiring

9.3 HOOK SWITCH

Commercial radios typically use CTCSS tones, which are referred to by names such as PL for Motorola's Private Line or CG for General Electric's Channel Guard.

When different user groups share a common repeater, such as different companies renting space on a radio compan's repeater, each user group has a different CTCSS tone. These shared repeaters are called Community Repeaters.

On a shared repeater, with different CTCSS tones for each user group (company), each user will only hear a signal, if it has their groups matching CTCSS tone. So if a user hears nothing, it can mean that no one is using the repeater, but there could be a user from another group with a different CTCSS tone.

Commercial radios use a control lead called Hook Switch, to disable the CTCSS tones, so a user can tell if anyone is using the repeater, regardless of CTCSS tone. The Hook Switch lead is normally grounded to enable CTCSS on receive and lifted from ground to disable CTCSS. The transmit (encode) CTCSS is always enabled.

The Hook Switch lead is wired to the a special microphone clip, used for hanging the microphone when it is not in use. The button on the back of the microphone is metal and is wired to ground. When the mic is placed in its matching clip, the hook switch lead is wired to the grounded button on the back of the microphone, enabling CTCSS. When the user picks up the microphone, the ground is removed from the Hook Switch lead and CTCSS on receive is disabled. This is only required on systems that use multiple CTCSS tones on the same frequency.

When radios are not used with the Hook Switch option, the Hook Switch lead on the rear radio connector is jumpered to the ground pin, so the CTCSS on receive is always enabled.

Many commercial radios also have a MON button on the front of the radio, which when pressed, disables the CTCSS on receive. In some radios, if pressed twice, it also opens the squelch.

9.4 COMMERCIAL RADIO JUMPERS

There are two functions on a commercial radio which typically require a jumper wire on the rear connector; Internal Speaker (Section 5.2) and Hook Switch (Section 5.3). When the standard 15 pin interface is wired on a commercial radio, the jumpers can be wired into a DA15M connector with a hood, which plugs onto the radios DA15F connector.

10.0 WIRING WORK SHEET

10.1 15 PIN CONNECTOR

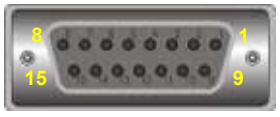
DA15 Pin #	Color	Signal	Connection Point
1		PTT-Packet	
2		Microphone Audio	
3		PTT-Mic	
4		Flat TX Audio	
5		Direct TX Inject	
6		SG GND & External Speaker -	
7		COR/COS	
8		+12 VDC	
9		GND	
10		Receive Audio	
11		Flat Receive Audio	
12		Aux Input +	
13		Internal Speaker +	
14		External Speaker +	
15		SPARE	

** Terminate only at the radio end

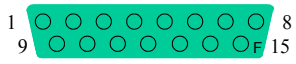
Device Type	{i.e. TNC, Radio, Phone Patch}
Make	
Model	
Connector Type(s)	{i.e. RJ45, 8 Pin Round, 3.5mm phone}

DA15 Type	**[ ] F = Female** = Radio **[ ] M = Male** = TNC, Phone Patch, Controller

DA15F (female) Connector

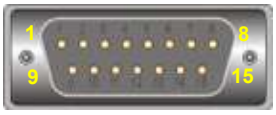


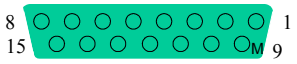
Front View



Back View
Wiring Connections

DA15M (male) Connector





Back View
Wiring Connections

10.2 BASIC INTERFACE

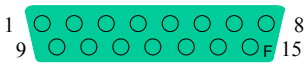
DA15 Pin #	Color	Signal	Connection Point
2		Microphone Audio	
3		PTT-Mic	
6		SG GND & External Speaker -	
8		+12 VDC	
9		GND	
14		External Speaker +	

Device Type	{i.e. TNC, Radio, Phone Patch}
Make	
Model	
Connector Type(s)	{i.e. RJ45, 8 Pin Round, 3.5mm phone}

DA15 Type	**[ ] F = Female** = Radio **[ ] M = Male** = TNC, Phone Patch, Controller

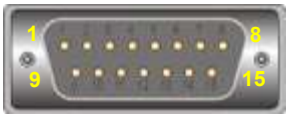
DA15F (female) Connector

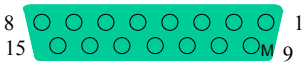
Front View



Back View
Wiring Connections

DA15M (male) Connector





Back View
Wiring Connections