Cross-Zone Interface

User Manual

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PREFACE

This document describes the installation, commissioning and operation of TASC Systems Cross-Zone Interface.

Hardware and software described in this document is subject to ongoing development and improvement. Consequently there may be minor discrepancies between the information in this document and the performance and design of the hardware and software.

Periodically throughout this manual, you will find text such as this, which has been shaded and bolded with a pointed finger to catch your attention. These are special notes and tips to assist you.

1. INTRODUCTION

The Cross-Zone Interface (CZI) is cross band radio bridging unit. Its state-of-the-art electronic construction enables it to offer a range of additional facilities. Operational features include Voice Announcement, on-board Dual VOX with full Voice Delay, and extended signaling and programming facilities.

A complete system comprises the Cross-Zone Interface controller and 2 radios. One radio (connected to “Port B”) is always a SmartZone radio. The second radio (connected to the AUX port) is usually a Conventional radio (for SmartZone to Conventional applications), which can also be a SmartZone radio (for SmartZone to SmartZone applications).

While extremely flexible, the Cross-Zone Interface system, as supplied ex-factory, comes fully set up and programmed for the application. It only requires the radios to be plugged in to form a complete operational system.

Figure 1 – Front Panel

2. OPERATIONAL FEATURES

2.1. Basic Cross Band Function

The prime function of the CZI is to provide Cross Band operation between two radio networks, where signals received on “the one” radio will be re-transmitted on “the other” radio and vice versa. The Cross-Zone Interface radios are usually a SmartNet/SmartZone radio and a Conventional radio, but the system is also capable of linking two SmartZone networks together using two SmartZone radios.

The cross band function may be enabled or disabled with the AUX 1 switch on the front panel, and/or by remote DTMF signaling, and/or subject to several programmable Connect Time Out functions.

2.2. Front Panel Controls

The CZI is fitted with two auxiliary switches, marked AUX 1, a 3-position momentary switch, and AUX 2, a 3-position latching switch. The AUX 2 switch is used for special applications only and not connected for standard ex-factory deliveries.

To enable the Crossband mode, push the AUX 1 switch to the A position. To disable the system, press the switch toward the B position.

When the system switches On, the CALL LED will go On, and both the PTT/T (trunked) and PTT/C (trunked) will light up, keying up both radios. During this period the “System is On” voice message will be played back to the side of the system that received carrier last (the system will default to the side it was switched to last if no carrier had been received last).

(It should be noted that the voice announcement operation when “switched from the front” is not an operational function. As such, it is meant as a workshop/installation aid only. The reason for this is that the voice announcement is normally only played back to that side of the system that sent the last DTMF command, see section 2.3 below).

2.3. Remote CrossBand Enable/Disable Control

The CZI Cross Band function may be enabled remotely by sending a unique 4 digit DTMF address command to the unit. This address is programmable to any number between 0000 and 9999 (10,000 addresses in total).

To enable the system, transmit the unit's 4-digit DTMF address, followed by the # character. To disable the system, transmit the address followed by the * character. New DTMF digits must be entered within a period of 1 second from the previous digit. If a new digit is not received within this period, the CZI's address memory will be cleared completely. Incorrect address messages are ignored.

When the remote message is received successfully, the system will transmit a (Workshop pre-recordable) Voice Announcement message (System is On, System is Off) to the user, to confirm correct execution of the remote command to the sending party. The message is sent to that "side" of the system that sent the control command.

Units delivered ex-factory are set for Enable/Disable control from both "sides" of the system, the default address is 5999.

Note that the Remote DTMF control is not just an aid to remote control switching. It is also a very effective means of checking that the system is "On Air" (sending it its DTMF address and returning its voice message).

2.4. Voice Announcement Messages

The CZI has a total capacity of 5 voice messages, each up to 6 seconds long. Of these, only 3 are used with the current firmware:

a) The "System is On" acknowledgement message

b) The "System is Off" acknowledgement message

c) The "System is Busy/System Error" acknowledgement message

Messages a) and b) will be heard by the party that sent the original DTMF command. They will also be heard when the AUX 1 switch on the front panel is operated.

Message c) will be heard if there is a system error.

2.5. Trunked "System Busy/Not Available" Handling

Under certain conditions the trunked mobile may not have access to the system. This may be caused by any of the following conditions:

a) The system is busy as no voice channels are currently available.

b) The trunked Radio's transmitter has timed out (this will occur if it has been transmitting for a period of 60 seconds or higher).

c) The trunked radio or its antenna system is faulty.

The CZI will automatically detect any such error conditions and report this to the second trunked radio network by transmitting the “error” voice message to the side that attempted access under System Busy/System Not Available conditions.

As remote trunked radios normally operate in Simplex mode, they would not hear an error message if this was sent while they were still transmitting. For this reason,

CZI will store a possible error condition in memory, and transmit the error message once the second trunked radio has stopped transmitting. This will indicate to the operator that their last transmission to the Talk Group was unsuccessful and not heard by the trunked radios.

The function also provides a method for other trunked radios to “seize” a Talk Group by briefly transmitting a carrier burst. If the error tone is heard, the attempt was not successful (“try again in a few moments”). If the error tone is not heard, the conventional radio operator will know that the trunked radio has successfully seized a Talk Group. The operator can now safely proceed with an extended transmission, without the risk of time waste (provided the transmission is made within approx. 3 seconds of having seized a Talk Group channel).

2.6. Repeater Control Function

The Cross-Zone Conventional interface is designed for direct connection to any standard repeater, but CZI built in Repeater Control function also allows for connection of two standard Simplex radios, with the CZI providing all necessary switching and audio control functions, in addition to a programmable Repeater Tail Time and (overall) Repeater Time Out Time.

The Repeater Control facility may also be used to provide TalkThrough control of standard base stations, as this is often an easier way to implement combined TalkThrough Repeater and Cross-Zone control.

2.7. Simplex Operation

The CZI is designed to interface to both Simplex and Duplex (talk through) radio systems.

While the preferred operating mode is to use a duplex/talk through Conventional radio set up, simplex operation can have significant advantages in terms of hardware complexity of the Conventional base (a single radio unit is sufficient, there is no need for duplex filters, and antenna filtering equipment is usually simple). And sometimes, simplex operation is simply an operational must (for instance, if the conventional radio fleet is a collection of direct radio-to-radio single frequency simplex system).

VOX based PTT switching is an inevitable consequence of simplex operation, as the radio's "carrier received" line can not be used to key up "the other' radio.

To cater for these equally important simplex applications, the Cross-Zone Interface is fitted with fully programmable on-board Single (on one radio port only) or Dual (on both radio ports) Digital VOX facilities.

The SmartZone radio is always a simplex device. If the other radio is a full duplex device there is no need for VOX operation (although the Voice delay may still be advantageously used to overcome possible transmitter switching and/or link establishment time delays).

If however the other radio is a simplex device, the SmartZone port will require its VOX to be enabled. Furthermore, if the other port's radio faces a repeater with an extended tail time (other than none), VOX must be enable on that port as well, as that port's Mute (COR) input can not be used to key up "the other" radio. This includes the case of SmartZone to SmartZone applications.

The digital VOX operation is near perfect but it does necessarily have a finite response and de-response time. To ensure the "Shoot" command receive syndrome (where the message actually was "Don't Shoot"), there is a programmable Voice delay function, which will delay the received audio by up to 480 msecs, before it is retransmitted. This will completely eliminate any "lost syllables" problems.

Other important VOX parameters are:

a) A fully programmable VOX Tail Timer, to smooth out rapid switching during pauses in received speech signals.

b) A VOX Inhibit timer, which eliminates the possibility of system "motor boating" due to unexpected key up glitches that can lead to system instabilities (a glitch is produced, this will activate the VOX, which will key up the transmitter, which will produce a glitch etc etc).

c) Fully programmable VOX trigger sensitivity, to cater for various audio levels encountered. The typical trigger setting is Setting 3 (which corresponds with an audio input level about 17 dB below normal line up level)

2.8. Indicators

The CZI font panel is fitted with a total of 7 LED indicators. These are (from left to right):

Run	Flashing when DC power is connected and the software is running OK
Clear	Not used for CZI applications.
Rx DTMF	On when receiving DTMF digits
Call	On when the system is Enabled (Cross-Zone Interface is “On”).
PTT/C	On when Port A / AUX (DB25) Port radio is keyed up
PTT/T	On when the Port B (DB15) radio is keyed up
VOX	Indicates VOX is active (before tail timer is appended)

2.9. System Operating Mode

The Cross-Zone Interface system operates in a fixed mode known as the **“TalkGroup Extender”** Mode.

As the name suggests, the ***"TalkGroup Extender"*** Mode is used where a (semi) permanent Talk Group coverage extension is required. This mode is often used by large Network Operators. In fact, the DTMF address of the Cross-Zone site is often kept a "secret" to Network users. The System is enabled or disabled by the Network Operator himself by only using a normal SmartZone radio installed at the Network Control Centre to send the Cross-Zone Interface DTMF Control messages to the system, as and when required.

Similar considerations apply for SmartZone to SmartZone applications. (In fact, there is not much difference between SmartZone to SmartZone, and SmartZone to Conventional systems).

2.10. DC Power Requirements

The Cross-Zone Interface requires a nominal 12VDC (from 10 to 16 Volts, drawing a current of approximately 100 mA max). The power is supplied by the radio(s) that the Cross-Zone Interface is connected to. Power may be supplied from either radio as the radio’s DC lines are linked together inside the Cross-Zone via isolating diodes (which double as polarity reversal protection diodes).

3. SYSTEM INSTALLATION

3.1. Radio Preparation

MCS2000 radios do not require any special adjustments or level settings. Any standard MCS2000 will interface directly to the Cross-Zone Interface.

Configure the radios such that they power up automatically after a power black out (without the need of pressing the On/Off button). Please refer to the radio's manual for the relevant details.

3.2. System Assembly

MCS2000 Rx audio output levels have been taken as 230 mV RMS. Essentially, all that is needed is to complete the system is to connect it to its two radios, using the interface cables as defined in the Appendix of this Document.

3.3. System Switch On and Test

The system is powered up by switching on either one of its radios. The Run LED will start flashing, both radios will be keyed up, and the voice announcement will be played back to one of the two radios (depending on which one accessed the system last). The Call LED will go on, or stay off, depending on the state the system was left in before switch off. To further test the system, use the AUX 1 switch to switch it from on to off.

To further test the system, an on-channel RF signal of standard deviation may be applied to one radio (temporarily switch the SmartZone radio(s) to a Conventional channel). This should produce a key up of the other radio, at the same standard system deviation.

Switching the trunked radio to trunked operation, with its antenna disconnected, may test the System Busy/Error function. Transmit to the other radio port for a few seconds (using a third test radio, e.g. a portable radio). On release of the portable's PTT switch the error message will be heard at the portable.

The same effects will be observed for SmartZone to SmartZone operation (except that the error message will not be heard on the AUX port side of the system. This will be included with the next firmware upgrade).

On successful completion of these checks the systems will now be ready for full operation.

4. CZI RADIO INTERFACE CABLE DETAILS

4.1. General

The new CZI is fitted with 2 D-range radio interface connectors, and 1 DB9/F RS232 port (used for programming purposes. A DB9/F to DB9/M programming cable, all connections straight through, is included in the shipment. This cable will plug straight into a PC Communications port).

The Radio Interface connectors are labeled as follows:

- **Port B** (a male DB15 connector)
- **Port A** / **AUX** (a DB25/M connector)

Port B is always a trunked radio interface, the AUX port is either the Conventional radio interface or, in trunked to trunked applications, the second trunked interface.

4.2. Cable Pin Out Details

4.2.1. MCS2000 to DB15/M Port B cable

DB15	**MCS2000 DB25 Acc**	**Function**
(radio does not require any special level or programming adjustments)		
5	21	PTT
9	3	SPK-
13	11	Rx Audio
7	23	Tx Audio
15	10	Ground
8	14	SWB+ (current draw is about 100 mA)

Important! Inside the Motorola DB25 back shell, link DB25 Pins 4 and 9 (to avoid it switching to Emergency mode), and Pins 1 and 2 (to enable the internal speaker if/when applicable).

Do not connect any DB15 connections not listed (as these points may carry other signals).

4.2.2. DB25/M Port A/ AUX to Conventional

DB25	Conventional DB25 Acc	Function
5	21	PTT
18	3	SPK-
14	11	Rx Audio
16	23	Tx Audio
2	10	Ground
1	14	SWB+ (current draw is about 100mA)

Important! Do not connect any DB25 connections not listed (as these points may carry other signals).