

Installation and Operation Manual

ST-865IC SmarTrunk II™ Mobile Logic Board

For use in ICOM Transceivers

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INTRODUCTION

The SmarTrunk Module is a microprocessor based trunking logic board designed for use with ICOM transceivers. The SmarTrunk Module implements SmarTrunk II, an efficient channel allocation protocol. The SmarTrunk Module controls all radio functions. In combination with the ST-852/ST-853 SmarTrunk II Digital Trunk Controller, this provides a complete multi-channel, digital access trunking system. All features are programmed by the system operator.

The SmarTrunk Module, together with the ICOM transceiver, supports several new features beyond the feature set of earlier SmarTrunk Modules. Below is a summary of these new features:

- ◆ Channel banks allows subscribers to switch between different groups of frequencies
- ◆ Selectable Group Codes provides PTT access to 16 different groups
- ◆ Block Decode allows subscribers to receive calls placed to multiple groups
- ◆ SmartScan provides faster channel access time by automatically remembering available channels
- ◆ 4 number Turbo SpeedDial offers one-touch speed dial
- ◆ Dialed number display shows numbers as they are dialed

The SmarTrunk Module for ICOM transceivers also supports all features found in previous SmarTrunk Modules:

- ◆ Store and Forward Dialing
- ◆ 10 number Memory Speed Dial (user programmable)
- ◆ Last number re-dial
- ◆ Automatic mobile acknowledge eliminates wasted air-time
- ◆ Different ringing tones to distinguish the type of call
- ◆ Clear Channel Alerting tells the subscriber when a channel is available
- ◆ Priority override calls
- ◆ Conventional operation
- ◆ Two trunking modes: radiotelephone and dispatch operation
- ◆ Five digit security code for system operator programming
- ◆ Remote Radio-Kill to disable illegal and non-paying customers

This instruction manual describes the operation, installation and programming of the SmarTrunk Module.

Notes:

Channel selection, transmit control, receiver audio and other transceiver functions are all under the control of the SmarTrunk Module while in the trunking mode.

1.1 • Originating a PTT Call

When the Automatic PTT Mode is enabled, the subscriber can press the PTT button to place a call to the current Group Code shown in the transceiver's display. Three low frequency beeps indicate all channels are busy or access is not permitted. A go-ahead tone indicates the subscriber may begin talking.

The Group Switch is used for changing the current Group Code. When the Group Switch is first pressed, the current Group Code is shown on the transceiver's display for two seconds. If the Group Switch is pressed again during this two second window, the Group Code will advance by one. The Group Switch may be pressed additional times until the desired Group Code is displayed.

When the Group Code is advanced to the last code, the Group Code will return to 0. For example, if Group Code 0, Group Code 1 and Group Code 2 are programmed, then each time the Group Switch is pressed, the Group Code will cycle from 0, 1, 2, 3, 0, 1, 2, 3 and so on. Up to 16 Group Codes (Group 0 - Group 15) may be programmed in the SmarTrunk Module.

Audible feedback is also provided when the Group Switch is pressed. A short chirp is generated each time the switch is pressed. However, when Group 0 is selected, a high beep tone is generated. This allows the user to select a Group without viewing the transceiver's display.

Please refer to the radio transceiver's programming software for the key assignment of the Group Switch.

1.2 • Routing Codes for Keypad Calls

Routing codes are used for initiating a call from a subscriber to the appropriate destination. Routing codes are commonplace in PBX telephone systems. For example to place a call to an outside telephone line through a PBX, a call routing code of typically 0 or 9 must be dialed first. The SmarTrunk II system operates in a similar fashion.

The following table describes all the routing codes. The subscriber needs to be familiar only with the call routing codes that apply to their application.

Table 1-1 • Call Routing Codes

Routing Code	Destination
1	Subscriber to Landline 1
2	Subscriber to Landline 2
3	Subscriber to Subscriber
4	Group Dispatch Call
9	Mobile Operator
0	Emergency

1.2.1 • Subscriber to Landline Call

Routing codes 1 and 2 give the subscriber access to telephone line one or two respectively.

1.2.2 • Subscriber to Subscriber Call

Routing code 3 allows the subscriber to place a call to another subscriber or group of subscribers.

1.2.3 • Subscriber to Group Call

Routing code 4 places a Group Dispatch Call. The call is placed exactly as if PTT was used.

1.2.4 • Mobile Operator Call

Routing code 9 calls the subscriber that is pre-programmed as the Mobile Operator. This functions as though the subscriber had used routing code 3 with the Subscriber Number of the Mobile Operator. The Mobile Operator is programmed by the System operator. *See the ST-852/ST-853 SmarTrunk II Controller Manual for details on programming the mobile operator number.*

1.2.5 • Emergency Call

Routing code 0 causes the ST-852/ST-853 to access line 1 and dial the pre-programmed emergency phone number. The emergency phone number is programmed by the system operator. *See the ST-852/ST-853 SmarTrunk II Controller Manual for details on programming the emergency number.*

1.3 • Originating a Keypad Call

This section describes how to place a call using the keypad.

A number of different alerting sounds are generated during keypad operation. A short chirp is generated each time a key is pressed. A high frequency beep indicates a successful keypad entry sequence. A low frequency beep indicates that improper data has been entered.

Dialing has an automatic five second time-out. If the time between pressing keys in a dialing sequence exceeds five seconds the SmarTrunk Module times out. A low frequency beep will be heard and the dialing procedure must be restarted. To clear out previously entered data and restart dialing, press the # key.

A busy tone will be heard by the subscriber if connection is not possible. This can occur if a radio channel is not available, or if the subscriber unit is out of range. The subscriber must then retry the call at a later time, when within range and a radio channel is available.

The following table summarizes the dialing modes available:

Table 1-2 • Dialing Modes

Dialing Mode	Procedure
Manual Dialing	(routing code) + * + (wait for dial signal) + (number to dial)
Store and Forward Dialing	(number to dial) + (routing code) + *
Memory Speed Dialing	* + (memory location)
Turbo SpeeDial	(memory location)
Programming Memory Speed Dial (The ability to program speed dial numbers can be disabled by the dealer).	* (hold) + (memory location) + (number to store) + (routing code) + *
Redial Mode	* + *
Priority Redial (Priority Call Override)	* + * (hold)

1.3.1 • Store and Forward Dialing

This is the preferred method of placing a keypad call. This method is similar to placing a call on a cellular telephone.

1. Enter the telephone number, or Subscriber Number on the transceiver keypad. Note that the number dialed will scroll on the transceivers display (if present).
2. Enter the routing code for the destination of the call.
3. Press the * key.
4. Hear a beep followed by the phone system signaling.
5. Wait for the called party to answer the call.

Example: To dial the telephone number 633-8899 on Landline 1, enter the following sequence:
6 3 3 8 8 9 9 1 *

Any number of digits may be entered for the telephone number.

Up to fourteen digit telephone numbers may be entered.

1.3.2 • Manual Dialing

This is an alternative method of placing a keypad call.

1. Enter the routing code for the destination of the call.
2. Press the * key.
3. Wait for a dial tone or beep tone.
4. Press and hold the PTT switch on the transceiver and dial the telephone number or Subscriber Number on the transceiver keypad. *Note that the number dialed will scroll on the transceivers display (if present).*
5. Release the PTT switch and wait for the called party to answer the call.

Example: To dial the telephone number 633-8899 on Landline 1, enter the following sequence:

1 * (wait for the dial tone or beep tone) (press PTT switch)
6 3 3 8 8 9 9 (release PTT switch)

1.3.3 • *Memory Speed Dialing*

This procedure is used for dialing a telephone number or Subscriber Number that is stored in the speed dial memory:

1. Press the * key.
2. Enter the memory speed dial location (0-9).
3. Hear a beep followed by the phone system signaling.
4. Wait for the called party to answer the call.

Example: To call a telephone number from the speed dial memory location 6, enter the following sequence: * 6

1.3.4 • *Programming Memory Speed Dial Numbers*

The following procedure is used for programming a telephone number or Subscriber Number into the SmarTrunk Module memory, speed dial memory and the Turbo Speedial memory:

1. Press and hold the * key until a beep is heard.
2. Enter a speed dial location (0-9, A, B, C, D)
3. Enter the telephone number or Subscriber Number that you wish to program into the speed dial memory.
4. Enter the routing code.
5. Press the * key to complete the programming sequence.

Example: To program the speed dial memory location 3 with the telephone number 555-6666 routed to landline one, enter the following sequence:
* (hold), after the beep, 3 5 5 5 6 6 6 6 1 *

Up to fourteen digit telephone numbers may be programmed. The ability to program speed dial numbers can be disabled by the dealer.

1.3.5 • Turbo Speedial

This feature allows one-touch memory speed dialing. Turbo Speedial numbers are programmed in the SmarTrunk Module in the same manner as the Memory Speed dial numbers. Up to four Turbo Speedial numbers may be programmed. The A, B, C and D keys on a transceiver are dedicated to the Turbo Speedial feature.

After a Turbo Speedial key is programmed, simply press the Turbo Speedial key to activate the speed dialing. Disabling the Memory Speed Dialing also disables the ability to program the Turbo Speedial.

1.3.6 • Redial

Redial may be used after a telephone number or Subscriber Number has been dialed using Store and Forward Dialing.

Example: To redial the last number dialed: Press the * key twice.

Turning off the power to the transceiver clears the redial memory. If redial is attempted when no number has been entered, a low frequency error tone will be heard. Redial may be repeated as many times as desired.

1.3.7 • Priority Call Override

A subscriber unit programmed as a priority subscriber can initiate a Priority Call Override after a call is attempted but all channels are busy. Priority call override will try to pre-empt an ongoing call.

If a channel is not available for a call, Priority Call Override can be used to try to gain access to a channel.

To start a Priority Call Override: Press and release the * key, then press and hold the * key until a beep is heard.

When the ST-852/ST-853 receives a priority call override command, it compares the priority level of the current call in process with the override command. If the override command is a higher priority, it will pre-empt the call in process. Once the trunking channel is released, the priority subscriber's call will be processed in the normal fashion. If a channel is not made available, a busy signal will be heard by the subscriber.

Programming a subscriber unit as a priority subscriber does not guarantee access to the system. A priority subscriber may be denied access depending on the priority level of the other subscribers. Access may be impossible if the RF signal strength of the current subscriber on the trunking channel is stronger than that of the priority subscriber. Priority Call Override is a programmable option.

1.4 • Receiving A Call

The subscriber is alerted to an incoming call by ringing of the subscriber equipment. This alerting takes four forms, related to the type of incoming call.

- a. A long single high frequency ring is generated by the logic board, then a low frequency dual tone ring is generated by the controller. This indicates an incoming landline call.
- b. A short double high frequency ring is generated by the logic board, then a low frequency dual tone ring is generated by the controller. This indicates an incoming call from another SmarTrunk II radio subscriber.
- c. A short single high frequency ring is generated by the logic board, then a double beep is generated by the controller. This indicates a landline call was placed.
- d. A short single high frequency ring is generated in the calling radios logic board. This indicates a (PTT) dispatch group call.

For items a and b, the subscriber must press * on the DTMF keypad to answer the incoming call (Push-to-talk (PTT) is not pressed). For items c and d, the subscriber may communicate with other members of the group by pressing PTT (no answer action is required).

1.5 • Call Termination

A subscriber ends a call by pressing the # key WITHOUT PTT. The ST-852/ST-853 will disconnect and release the channel. For group calls all of the subscribers will be disconnected.

Call termination will also occur if the subscriber exceeds the call limit time, or if the subscriber unit activity timer expires. *See the ST-852/ST-853 SmarTrunk II Controller Manual for details about when calls are automatically terminated by the controller.* In addition, if a subscriber unit loses the signal from the ST-852/ST-853 for 5 seconds, the subscriber unit will return to the idle state.

A disconnect signal is indicated with a beep. After the beep, the subscriber unit returns to the idle state.

1.6 • Clear Channel Alerting

If a call is attempted and no trunking channels are available the subscriber will get a busy signal. The subscriber can try to redial over and over until the call is processed but this is very frustrating. Clear Channel Alerting Mode eliminates this problem.

If Clear Channel Alerting Mode is enabled and all channels are busy when a call is attempted, a busy signal will be generated by the SmarTrunk Module. After the busy signal, the transceiver will continue to scan all trunking channels looking for a free channel. The transceiver will chirp every 10 seconds while in this mode. When a channel is freed, the transceiver will generate a double beep. You can then attempt the call again. The SmarTrunk Module will not automatically redial. If other subscribers are using the clear channel alerting mode at the same time, the first subscriber to attempt a call will capture the channel.

Once a clear channel is detected, the Clear Channel Alerting Mode is canceled.

The subscriber can cancel the clear channel alerting mode and return to the trunking mode by pressing any key on the transceiver's keypad. Clear Channel Alerting is a dealer programmable option.

1.7 • Radio-Kill

If the transceiver has been remotely disabled by the System operator it will generate a continuous low frequency tone and the transceiver will not operate. The transceiver must be returned to the dealer or System operator for reprogramming.

1.8 • Switching Channel Banks

This feature allows subscriber units to easily switch between various trunking systems and conventional systems. A channel bank is defined as a number of channels that can be grouped together by the transceiver. Each channel bank may be configured as a 'trunking bank' or 'conventional bank'. When a trunking bank is selected, the SmarTrunk Module has full control of the transceiver. In a conventional bank, the SmarTrunk Module de-activates and returns control back to the transceiver.

A transceiver may have as many channel banks as memory allows. Each channel bank may have any number of channels, however, for SmarTrunk operation, the maximum number of channels in a trunking bank is limited to 16. Channel banks are programmed in the transceiver. No special programming is required in the SmarTrunk Module for channel banks. Channel bank switching is accomplished by the user by pressing the 'Channel Bank Button' on the transceiver. The Channel Bank Button is defined by using the transceiver's programming software. Please see the transceiver programming manual for more information.

1.9 • Conventional Mode

In Conventional Mode the SmarTrunk Module is disabled and the control of all functions is returned to the transceiver. To enter into the Conventional Mode, the subscriber switches to a conventional channel bank. See section 1.8 for more details.

1.10 • Landline to Subscriber Calls

When the ST-852/ST-853 is called from a telephone system, it answers the telephone line with two beeps. The caller then dials the Subscriber Number of the subscriber or group that they are trying to call.

If the Subscriber Number is valid the ST-852/ST-853 attempts to reach the subscriber over the air. If the Subscriber Number is for an individual subscriber unit that is powered off or is out of the operating area the caller will hear a busy signal. If the subscriber unit is powered on and is in the operating area the caller will hear ring back and the SmarTrunk Module will start ringing. The subscriber answers the call by pressing * without pressing the PTT.

If the subscriber does not answer within the Mobile Answer Time (programmable), the caller will get a busy signal for a few seconds and then the ST-852/ST-853 will hang up. If the subscriber does answer, the caller will hear two beeps and can then begin talking. If the Subscriber Number is for a group, the caller will hear one ring followed by two beeps. The caller can then begin talking.

2 • OPERATING MODES

The SmarTrunk Module may be operated in three modes: Radiotelephone, Dispatch and Conventional. The system operator determines which of these modes are enabled by programming the subscriber unit and the ST-852/ST-853.

2.1 • Subscriber Numbers/Paging Codes

All subscribers and group in a SmarTrunk II system are assigned a Subscriber Number. The Subscriber Number is the number a landline or radio caller uses to contact the subscriber or group. As a security measure this number is alias to another number known as a Paging Code, for over the air signaling. This security measure insures that a radio listener cannot correlate any of the over the air signaling with a number dialed. The Paging Code is expected to be a confidential number known only by the system operator and those who program the subscriber equipment. There is no requirement for the subscriber to have knowledge of the Paging Code associated with the equipment in use. The associated Subscriber Number provides sufficient subscriber information necessary for all SmarTrunk II operation.

The system operator activates an individual subscriber or group by programming the ST-852/ST-853 SmarTrunk II controller. This activation involves assigning a Subscriber Number, Paging Code, operational type and a number of other parameters.

An individual Subscriber Number and associated Paging Code are numbers assigned to one piece of subscriber equipment. The subscriber may be called as an individual by other subscribers or from the landline. A group Subscriber Number and associated Paging Code are numbers assigned to more than one piece of subscriber equipment. All subscribers in the group will receive a common alert if the Subscriber Number is called from another radio subscriber or from the landline. This signaling is commonly used for dispatch/fleet radio operation. Calls made by and to any subscriber in the group are accounted for and recorded by the ST-852/ST-853 SmarTrunk II controller.

2.1.1 • *Radiotelephone Mode*

The Radiotelephone Mode provides interconnect and operates in a similar fashion as a cellular telephone. To take full advantage of this mode, a transceiver must be equipped with a DTMF keypad. The subscriber may initiate and receive landline based telephone calls.

The subscriber may also initiate and receive 'inter-system' calls from other subscribers. These calls may be private one to one calls, or calls that may include multiple subscribers in a group. The subscriber unit is identified by the Primary Code when a call is placed using the keypad.

2.1.2 • Dispatch Mode

The Dispatch Mode is more closely associated with a typical 'radio trunking system', where a subscriber is included with multiple users in a group. A subscriber accesses the system by pressing the transceiver PTT switch. In a Fleet Dispatch scenario, a subscriber may be configured as follows:

1. A subscriber may be assigned a unique Paging Code that is only programmed in the Primary Code of the subscriber unit. This allows the subscriber to receive private calls from other subscribers.
2. A subscriber may also be included in a Group that uses the user selectable Group Codes. This allows the subscriber to communicate with any other subscribers that use the same user selectable Group Codes. Any number of subscribers may be included in a group.
3. A subscriber may also be included in additional groups when the Secondary Code or the Block Decode are programming.

***Note:** If a subscriber unit does not have a DTMF keypad, a subscriber may ONLY originate a call to the selectable Group Codes.*

2.1.3 • Conventional Mode

In the Conventional Mode, the SmarTrunk Module is completely disabled. While the SmarTrunk Module is disabled, the transceiver has full control. In this mode, all transceiver functions are usable. See the transceivers instruction manual for complete operating instructions in the Conventional Mode.

2.2 • Paging Codes Defined

A SmarTrunk Module uses Paging Codes as a means of radio identification of a transceiver unit. The SmarTrunk Module allows for multiple Paging Codes to be programmed for various applications. The Paging Codes are broken down into the following categories:

- ◆ Primary Code
- ◆ Secondary Code
- ◆ Lower Block Decode
- ◆ Upper Block Decode
- ◆ Group Codes 0 - 15

Any Paging Codes that are not used should be disabled. Each of the different Paging Codes are described in the following paragraphs.

2.2.1 • *Primary Code*

The Primary Code is generally programmed with an individual Paging Code that is unique to each subscriber unit. The Primary Code identifies the subscriber unit to the ST-852/ST-853 when a keypad call is placed. In addition, the Primary Code is used to receive calls.

When the 'Type' field of the Primary Code is set to 'Half-Duplex' in the ST-852/ST-853, an incoming individual call will cause the subscriber unit to ring and require the subscriber to press the * key to answer the call. When the 'Type' field of the Primary Code is set to 'Group', a keypad is not required to answer the call.

A common application is to assign a unique Paging Code to each radiotelephone subscriber in order to allow the subscriber to place and receive individual telephone calls. In a dispatch system, unique Paging Codes allow a subscriber to place a private call to another subscriber.

2.2.2 • Secondary Code

The Secondary Code is used to receive group calls. The subscriber unit will receive calls placed to the Paging Code programmed in the Secondary Code. The Secondary Code must have the 'Type' field set for 'Group' in the ST-852/ST-853. This code is used for incoming calls only and should be disabled (off) if it will not be used.

A common application is to program the Paging Code of a main group or "all call" group in the Secondary Code of all the subscriber units of a business. The business may have many individual subscribers and sub-groups. When the main group is called, all the subscriber units in the business will be called.

2.2.3 • Block Decode

The Block Decode feature is used to receive any group calls placed to a defined range of Paging Codes. Block Decode is enabled by programming the Lower Block Decode to the lowest Paging Code of the desired range and the Upper Block Decode to the highest Paging Code of the range. Up to 20 Paging Codes can be included in the range. These codes are used for incoming calls only and should be disabled (off) if they are not used.

Example:

Lower Block Decode: 6000

Upper Block Decode: 6010

The subscriber unit will receive any calls placed to Paging Codes 6000 through 6010.

This feature is useful for allowing a subscriber to receive calls placed to various groups or sub-groups. A common application is to allow a field boss of a group to receive any calls which are placed to one of the sub-groups of the business. The Block Decode is programmed to decode the range of Paging Codes which are assigned to the desired sub-groups.

2.2.4 • Group Codes

Group Codes are used to place and receive group calls when the Automatic PTT Mode is enabled. When the subscriber presses PTT, a call is placed to the current Group Code. In addition, the subscriber unit will receive calls placed to the Paging Code programmed in the current Group Code. Up to 16 Group Codes may be programmed in each subscriber unit. Group codes which are not used should be disabled (off).

Group Codes allow the subscriber to place calls to up to 16 different groups or sub-groups without having a keypad equipped transceiver. A common application is to allow a field worker to use a transceiver without a keypad to call various different sub-groups within a larger group. Another application is to allow a field worker to switch between different sub-groups on different days depending on the job assignment.

2.3 • Example System

The following example shows how a group of eleven users in a dispatch trunking system might be programmed. The main group Paging Code, which is used to place a call to all the users, is assigned to 1000 and is programmed in the Secondary Code of all subscriber units. All users have a unique Primary Code assigned (1001-1011). The main group is also divided into three sub-groups (1100, 1101, 1102). Only the Field Boss and the Base Dispatcher have keyboard equipped transceivers.

The Paging Code numbers used are for example only and need not be sequential, or grouped together in any way. For simplicity, the Subscriber Number and Paging Codes are identical. All users have the Automatic PTT Mode enabled. Diagram 2-1, shown below provides a graphic representation of how the users are organized in this example.

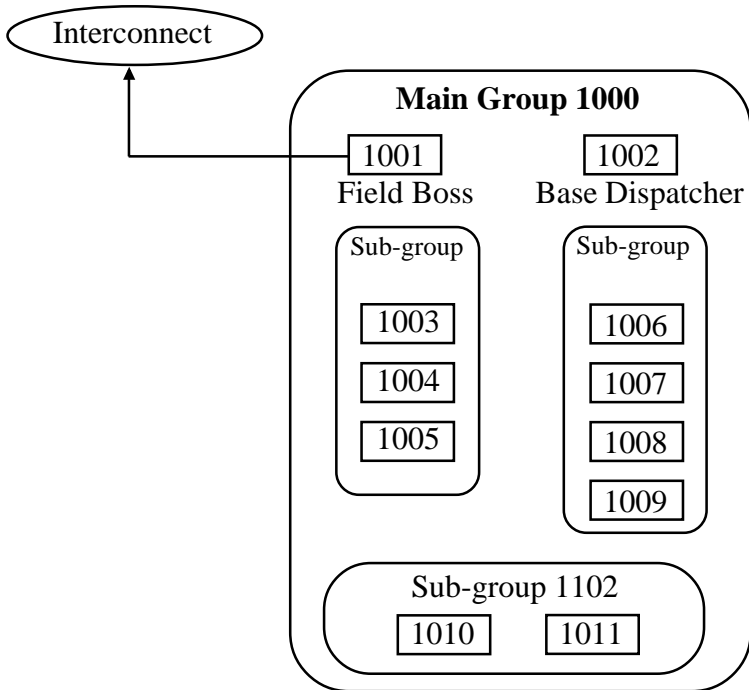


Diagram 2-1 • Dispatch Example

The Field Boss is programmed as follows:

Primary Code	1001
Secondary Code	1000
Lower Block Decode	1100
Upper Block Decode	1102
Group Code 0	1000
Group Code 1	1100
Group Code 2	1101
Group Code 3	1102
Group Code 4-15	off

The Field Boss can talk to any group by switching Group Codes (0-3). The field boss will also receive calls placed to any of the sub-group (1100-1102) or the main group (1000) at any time. Since he is equipped with a keypad, he also has access to all radiotelephone functions. Using the keypad, he may also contact any user in the group by dialing the user's Subscriber Number. The Base Dispatcher is programmed in the same fashion.

Below is an example of the programming for one of the individual users:

Primary Code	1003
Secondary Code	1000
Lower Block Decode	1100
Upper Block Decode	1100
Group Code 0	1100
Group Code 1	1000
Group Code 2	1002
Group Code 3-15	off

This user (1003) can receive calls from the main group (1000) and his sub-group (1100) at any time. By changing the Group Code (0 -2), he can originate calls to either his sub-group (1100), the main group (1000), or to the Base Dispatcher (1002).

Notes:

Installation consists of opening the transceiver and plugging in the SmarTrunk Module. The installation and alignment procedures are described below. Refer to the transceiver service manual for more details.

3.1 • Installation Procedure

The supplied sponge is for IC-F30/F40 series transceivers only. For IC-F30/F40 series transceivers, see the separate service manual or contact your dealer for disassembly instruction.

3.1.1 • *Installation into the IC-F30/F40 series transceiver:*

- ◆ Disassemble the transceiver as described in the service manual.
- ◆ Attach the ST-865IC as shown below.
- ◆ Attach the supplied sponge to ST-865IC.
- ◆ Reassemble the transceiver.

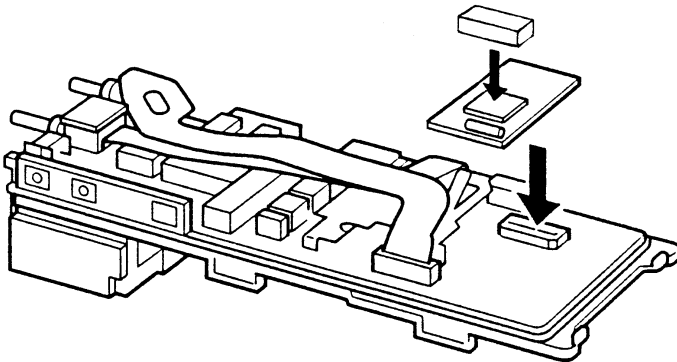


Figure 3-1 • Installation into the IC-F30/F40 transceiver

3.1.2 • Installation into the IC-F3/F4 series transceivers

- ◆ Attach the ST-865IC as shown below.

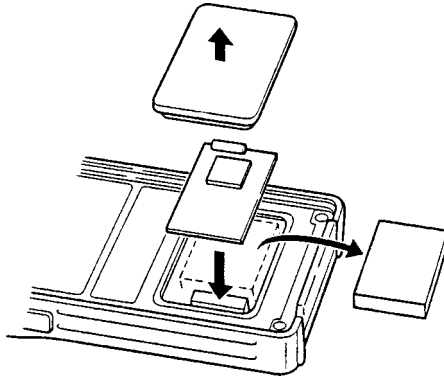


Figure 3-2 • Installation into the IC-F3/F4 transceiver

3.1.3 • Installation into the IC-F1010/F2010 and IC-F1020/2020 transceivers

- ◆ Attach the ST-865IC as shown below.

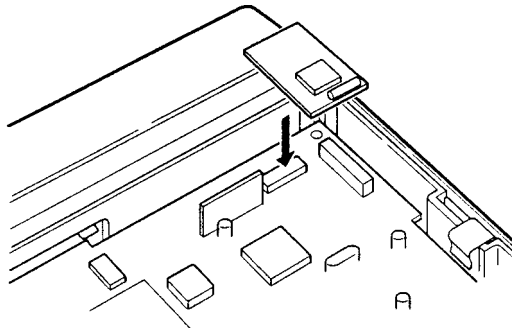


Figure 3-3 • Installation into the IC-F1010/F2010 and IC-F1020/F2020

3.2 • Alignment Procedure

To align the transceiver, enter the Alignment Mode. The Alignment Mode is used to set the transmit modulation level from the SmarTrunk Module. The alignment mode transmit frequency will be the first channel in the currently selected channel bank on the transceiver. To enter the Alignment Mode, enter the programming mode of the subscriber unit and press: 1 7 #. Refer to Section 4.1 for details about entering the programming mode.

Now set the SmarTrunk Module transmit deviation by pressing the transmit switch on the transceiver and at the same time, pressing '9' on the transceiver keypad. This will generate the DTMF digit 9 on the transmit frequency. Using a small slotted alignment tool, adjust the level pot on the SmarTrunk Module for a level of 2/3 of maximum deviation (3.3kHz on a 5kHz system).

Be careful that the DTMF signal is not limited, clipped or distorted in the transmitter. Do not use a deviation meter when making this adjustment because a meter can not indicate distortion or signal limiting. A service monitor with a modulation scope should be used instead.

Notes:

4 • LOGIC BOARD PROGRAMMING

These procedures are designed to be used by the installing technician after the SmarTrunk Module has been installed in the transceiver. The SmarTrunk Module is programmed by using the keypad on the front of the transceiver. No special cables or other attachments are required. All programming information is retained in a non volatile EEPROM.

To test the installation and programming of the SmarTrunk Module a functioning ST-852/ST-853 is required with the Trunking System ID Numbers and Paging Codes correctly programmed. *See the ST-852/ST-853 SmarTrunk II Controller Manual for details on adding Subscriber Numbers to the system.*

4.1 • Entering The Program Mode

To enter the programming mode, use the following procedure:

*** NOTE: DO NOT PRESS PTT DURING PROGRAMMING.**

1. Turn the transceiver off.
2. Press and hold the # key on the front panel keypad.
3. Turn on the transceiver.
4. Release the # key one second after the end of the power on beep.
5. Enter the dealer programmed 5 digit access code, followed by the # key. The default access code is 12345.
6. The SmarTrunk Module will respond with a high beep. If a low beep is heard the access code was incorrect. Turn the transceiver off and try the procedure again.

4.2 • Programming Feature Descriptions

A worksheet is provided on 41 for programming. This worksheet should be copied and filled out for each subscriber. The worksheet should be used as a record of the programming for that particular subscriber.

The following table summarizes the programmable features, the keypad sequence for programming and the default values as provided by the factory.

Each feature programmed requires 4 steps:

1. Enter a two digit programming code.
2. Press the # key (indicates end of programming code sequence).
3. Enter the data necessary to program that feature.
4. Press the # key (indicates end of data sequence).

Many of the programmable parameters required for proper operation of the SmarTrunk Module **MUST** be provided by the system operator. These features are indicated by an asterisk (*) at the beginning of the feature name.

After each feature is successfully programmed a high beep will be generated. A low beep indicates an error was made in the programming sequence. To return the transceiver to normal operation after programming is complete, turn the power of the transceiver off and then back on.

Table 4-1 • Summary of Programmable Options

Feature	Programming Sequence	Factory Default
System Tone	11# data#	3
Primary Code	12# data #	0000
Secondary Code	13# data #	0000
Lower Block Decode	28# data#	0000
Upper Block Decode	29# data#	off
Priority Subscriber Enable	14# 0# (off) 14# 1# (on)	off
Busy Channel Detect	15# 0# (carrier) 15# 1# (system tone)	system tone
Five Digit Access Code	16# data # data #	12345
Alignment Mode	17#	---
Return to Factory Default Values	19#	---
Trunking System ID Number	20# data #	00
Fleet Dispatch Mode	21# 0# (off) 21# 1# (on)	off
Emergency Call Override	22# 0# (off) 22# 1# (on)	off
Clear Channel Alerting Mode	24# 0# (off) 24# 1# (on)	off
Radio-Kill	25# 0# (active) 25# 1# (disable)	active
Memory Speed-dialing Programming	26# 0# (off) 26# 1# (on)	on
Group Code 0	40# data #	0001
Group Code 1	41# data #	off
Group Code 2	42# data #	off
Group Code 3	43# data #	off
Group Code 4	44# data #	off
Group Code 5	45# data #	off
Group Code 6	46# data #	off
Group Code 7	47# data #	off
Group Code 8	48# data #	off
Group Code 9	49# data #	off
Group Code 10	50# data #	off
Group Code 11	51# data #	off
Group Code 12	52# data #	off
Group Code 13	53# data #	off
Group Code 14	54# data #	off
Group Code 15	55# data #	off

4.2.1 • System Tone

This program code sets the sub audible System Tone that is used in a trunking system. The subscriber units in the trunking system can use this tone to detect that a trunking channel is busy. *When a Busy Channel Detect is set to System Tone, all subscriber units **MUST** be programmed with the same system tone that is programmed in the ST-852/ST-853.*

The system tones that can be used are as follows:

Table 4-2 • Available System Tones

STONE #	SYSTEM TONE
0	100.0 Hz
1	107.2 Hz
2	114.8 Hz
3	123.0 Hz
4	131.8 Hz
5	141.3 Hz
6	151.4 Hz

To program the system tone: Enter the programming code 11 followed by the # key, then the number that corresponds to the desired tone followed by the # key.

Example: To program the system tone to 123.0 Hz press:
1 1 # 3 #

4.2.2 • Primary Code

The Primary Code consists of a four digit number that is contained in the SmarTrunk II digital transmission. Any four digit number from 0000 to 9999 may be used. *Refer to Chapter 2 for more details.*

To program the Primary Code: Enter the program code 12 followed by the # key, then the Primary Code followed by the # key.

Example: To program a unit's Primary Code to 1234 press:
1 2 # 1 2 3 4 #

If the system is using Priority Call Override, the subscriber's priority level is the first digit of the Subscriber Number in an ST-852 system.

For this example, the priority level is 1.

4.2.3 • **Secondary Code**

The Secondary Code is used to receive calls. The subscriber unit will receive calls placed to the Paging Code programmed in the secondary code. Any four digit number from 0000 to 9999 may be used. *Refer to Chapter 2 for more information.*

To program the Secondary Code: Enter the program code 13 followed by the # key, then the Secondary Code followed by the # key. The Secondary Code may be disabled by entering the * key in place of the four digit Secondary Code number.

Example: To program a unit's Secondary Code to 1200
press: 1 3 # 1 2 0 0 #

4.2.4 • **Lower Block Decode**

The lower range of the Block Decode is defined by the Lower Block Decode. Any four digit number from 0000 to 9999 may be used. The subscriber unit will receive calls placed to any Paging Codes within the Block Decode.

When the Lower Block Decode is programmed, the Upper Block Decode is automatically set to the same value. A Block Decode range of up to 20 Paging Codes may then be defined by programming the Upper Block Decode.

To program the Lower Block Decode: Enter the program code 28 followed by the # key, then the Lower Block Decode followed by the # key. The Lower Block Decode may be disabled by entering the * key in place of the four digit Secondary Code number.

Example: To program a unit's Lower Block Decode to 1200
press: 2 8 # 1 2 0 0 #

4.2.5 • Upper Block Decode

The upper range of the Block Decode is defined by the Upper Block Decode. The Upper Block Decode must be programmed after the Lower Block Decode and can define a range of up to 20 Paging Codes. The subscriber unit will receive calls placed to any Paging Codes within the Block Decode.

To program the Upper Block Decode: Enter the program code 29 followed by the # key, then the Upper Block Decode followed by the # key.

Example: To program a unit's Upper Block Decode to 1200 press: 2 9 # 1 2 0 0 #

4.2.6 • Group Codes

Group Codes are used when the SmarTrunk Module is programmed to operate in the Automatic PTT mode. When a PTT call is placed, the subscriber unit initiates a call to the Paging Code programmed in the current Group Code. To call a different group, the subscriber may select a different Group Code. The current Group Code is also used to receive calls.

Up to 16 Group Codes may be programmed in the SmarTrunk Module. Any four digit number from 0000-9999 may be used for each Group Code. Group Codes that are not used should be disabled.

The program codes 40 - 55 are used for programming Group Codes. Program code 40 is used to program Group Code 0. Program code 41 is used to program Group Code 1 and so on up to program code 55. When programming multiple Group Codes, begin with Group Code 0 and progress up (Group Code 1, 2, 3, ...) to a maximum of 16 Group Codes. Do not skip any Group Codes. Please note that if the SmarTrunk Module is used in Automatic PTT Mode, a minimum of one Group Code must be programmed. *See Chapter 2 for information about assigning Group Codes.*

To program Group Code 0, enter the program code 40 followed by the # key. Then enter the four digit number for the Group Code followed by the # key.

Example: To program a unit's Group Code 0 to '0001'
press: 4 0 # 0 0 0 1 #

A Group Code may be disabled by entering the * key in place of the four digit Group Code number.

4.2.7 • **Priority Subscriber Enable**

Enabling this program code makes a subscriber unit a Priority Subscriber. A Priority Subscriber can pre-empt calls currently in progress when the trunking system is busy.

*** Care must be exercised when using this feature. A priority subscriber can terminate important calls of other subscribers. If too many priority subscribers are enabled, the priority subscribers themselves will be competing for trunking channels. Additional trunking channels should be installed if the system is heavily loaded.**

Priority override is possible only if the subscriber engaging the priority override has a higher priority level than the current subscriber on a channel.

For example, a subscriber with priority level 2 is currently using a trunking channel. If a subscriber with priority level 6 tries a priority override on the same trunking channel, the override will be successful. The call in process will be terminated and subscriber with priority level 6 will be granted access to the channel. If a subscriber with priority level 1 tries a priority override on that trunking channel, the override will be unsuccessful since the latter subscriber has a lower priority level. The original subscriber on the channel cannot be overridden by another subscriber with an equal priority level.

In an ST-852 system, there are ten priority levels, from 0 (lowest priority) to 9 (highest priority). The priority level is determined by the first digit of the subscriber's code. In an ST-853, there are 99 levels of priority which are determined by the Profile of the subscriber.

To program this feature: Enter the programming code 14 followed by the # key. Then 1 (enable) or 0 (disable) followed by the # key.

Example: To make a subscriber a priority subscriber press:
1 4 # 1 #


4.2.8 • Busy Channel Detect

Subscriber units normally determine the trunking channel is busy by detection of the sub-audible system tone. This is the recommended mode of operation.

If your system shares a radio channel with another radio system, you may need to inhibit the subscribers from transmitting if the other system is using the channel. This is done by programming the SmarTrunk Module to use RF carrier for detection of a busy channel. If your trunking system shares channels with other systems, the efficiency and capacity of the system will suffer.

To program this feature: Enter the programming code 15, followed by the # key. Then 0 (RF Carrier only) or 1 (System tone) followed by the # key.

Example: To make a unit use system tone for channel busy detect press: 1 5 # 1#

 Note that the transceiver's squelch control must always be set correctly.

4.2.9 • Five Digit Access Code

The five digit access code allows the dealer to enter the SmarTrunk Module programming mode and keeps others from surreptitiously using the programming mode. The access code is dealer programmable and may be set to any five digit number 00000 to 99999.

NOTE

Be sure to write down the new five digit access code. If the five digit access code is lost or forgotten, ACCESS TO THE PROGRAMMING MODE WILL BE IMPOSSIBLE.

The sequence for programming the five digit access code requires the dealer to enter the five digit number two times. This insures that no mistakes are made during the entry of a new access code.

To change the five digit access code: Enter the program code 16 followed by the # key, then the new five digit access code followed by the # key. Then enter the five digit access code a second time, followed by the # key. If the new access code was entered the same both times, the programming of the new access code will be accepted.

Example: To change the five digit access code to 45678
press: 1 6 # 4 5 6 7 8 # 4 5 6 7 8 #

4.2.10 • *Alignment Mode*

This feature is used during the SmarTrunk Module installation process. Refer to Chapter 3 for details.

4.2.11 • *Initialize EEPROM to Factory Default Values*

This programming feature will return the contents of the EEPROM to the default values as shown in Table 4-1. The Five Digit Access code is also returned to the factory default value.

Example: To initialize the EEPROM to factory defaults
press: 1 9 #

4.2.12 • *Trunking System ID Number*

The Trunking System ID Number is a number between 0 and 31. In an ST-852 system, all subscriber units on a trunking system MUST be programmed with the same Trunking System ID Number. In an ST-853 system, all subscriber units in the same group must have the same Trunking System ID Number. Refer to the *ST-852/ST-853 SmarTrunk II Controller Manual* for complete details.

To program the Trunking System ID Number: Enter the program code 20 followed by the # key, then the Trunking System ID Number followed by the # key.

Example: To program the Trunking System ID Number to 5
press: 2 0 # 5 #

4.2.13 • Automatic PTT Mode

When this mode is enabled, the subscriber simply presses the transmit switch (PTT) on the transceiver to gain system access. The SmarTrunk Module will automatically call the subscriber's selected Group Code - A for fleet-dispatch type trunking. No keypad entry is required to operate in this mode.

* This option should not be used if the primary function of a subscriber unit is for radiotelephone. However, both radiotelephone and fleet-dispatch subscribers can share the same trunking system.

To program the Automatic PTT mode: Enter the program code 21 followed by the # key, then either 1 (enable) or 0 (disable) followed by # key.

Example: To enable Automatic mode press: 2 1 # 1 #

4.2.14 • Emergency Call Override

When a subscriber places an emergency call by using routing code 0 (pressing *0), the SmarTrunk Module will dial the preprogrammed emergency phone number on line 1. If all channels are busy and Emergency Call Override is enabled, it will automatically begin a priority call override function to dial the emergency phone number. *See the ST-852/ST-853 SmarTrunk II Controller Manual for details on programming the emergency number.*

To program the Emergency Call Override feature: Enter the program code 22 followed by the # key and then either 1 (enable) or 0 (disable) followed by the # key.

Example: To enable Emergency Call Override press:
2 2 # 1 #

4.2.15 • *Clear Channel Alerting Mode*

Clear Channel Alerting Mode notifies the subscriber when a radio channel becomes available.

To program the Clear Channel Alerting feature: Enter the program code 24 followed by the # key, then either 1 (enable) or 0 (disable) followed by the # key.

Example: To enable Clear Channel Alerting press:
2 4 # 1 #

4.2.16 • *Radio-Kill*

This programming code is used to reactivate a transceiver that has been remotely disabled with the Radio-Kill function from the ST-852/ST-853.

Example: To re-activate a transceiver press:
2 5 # 0 #

4.2.17 • *Memory Speed Dial Programming*

This programming code controls a subscriber's ability to program Memory Speed Dial and Turbo Speed Dial numbers. If enabled, the subscriber can program Memory Speed Dial numbers using the transceiver's keypad. If it is disabled, the subscriber cannot program Memory Speed Dial numbers.

This does not prevent a subscriber from speed dialing if numbers have been programmed. The system operator can pre-program some Memory Speed Dial numbers for the subscriber, then disable the Speed Dial Programming. The subscriber can then call the system operator's programmed numbers.

To program the Speed Dial Programming feature: Enter the program code 26 followed by the # key, then either 1 (enable) or 0 (disable) followed by the # key.

Example: To disable Speed Dial Programming press:
2 6 # 0

Notes:

APPENDIX A • PROGRAMMING WORKSHEET

Feature	Programming Sequence	Values Used
System Tone	11# data#	
Primary Code	12# data #	
Secondary Code	13# data #	
Lower Block Decode	28# data#	
Upper Block Decode	29# data#	
Priority Subscriber Enable	14# 0# (off) 14# 1# (on)	
Busy Channel Detect	15# 0# (carrier) 15# 1# (system tone)	
Five Digit Access Code	16# data # data #	
Alignment Mode	17#	
Return to Factory Default Values	19#	
Trunking System ID Number	20# data #	
Fleet Dispatch Mode	21# 0# (off) 21# 1# (on)	
Emergency Call Override	22# 0# (off) 22# 1# (on)	
Clear Channel Alerting Mode	24# 0# (off) 24# 1# (on)	
Radio-Kill	25# 0# (active) 25# 1# (disable)	
Memory Speed-dialing Programming	26# 0# (off) 26# 1# (on)	
Group Code 0	40# data #	
Group Code 1	41# data #	
Group Code 2	42# data #	
Group Code 3	43# data #	
Group Code 4	44# data #	
Group Code 5	45# data #	
Group Code 6	46# data #	
Group Code 7	47# data #	
Group Code 8	48# data #	
Group Code 9	49# data #	
Group Code 10	50# data #	
Group Code 11	51# data #	
Group Code 12	52# data #	
Group Code 13	53# data #	
Group Code 14	54# data #	
Group Code 15	55# data #	

Radio Model #:	Radio Serial #:
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Model ST-865IC SmarTrunk II™ Mobile Logic Board

DATA FOR BANK #	TRANSMIT	RECEIVE
Trunking Channel #1		
Trunking Channel #2		
Trunking Channel #3		
Trunking Channel #4		
Trunking Channel #5		
Trunking Channel #6		
Trunking Channel #7		
Trunking Channel #8		
Trunking Channel #9		
Trunking Channel #10		
Trunking Channel #11		
Trunking Channel #12		
Trunking Channel #13		
Trunking Channel #14		
Trunking Channel #15		
Trunking Channel #16		

Radio Model #:
Radio Serial #: