SmarTrunk Systems, Inc.

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Installation and Operation Manual

ST-865KW2 SmarTrunk II™ Logic Board for Kenwood TK-270/278/370/378 Portable Radios

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All warranty repairs must be performed at the SmarTrunk factory in Hayward, California, or other factory authorized repair depot. Any unauthorized repair attempted by the customer, alteration or modification of the equipment, damage by external sources, or removal or alteration of the serial number label or date code, will void the warranty. Specifically excluded from this warranty are batteries, fuses, lamps, and damage caused by lightning, power surges, or mechanical abuse.

Equipment for repair may be returned to the factory without prior written authorization; however, a note must be sent with the packing list briefly describing the nature of the defect. Repairs must be shipped freight prepaid and will be returned freight prepaid. Shipments should be directed to:

SmarTrunk Systems, Inc.
ATTN: Repair Department
23278 Bernhardt Street
Hayward, CA 94545, U.S.A.

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INTRODUCTION

The ST-865KW2 is a microprocessor based radio trunking logic board designed for use with Kenwood TK-270/278/370/378 Portable Radios. The ST-865KW2 implements SmarTrunk II, an efficient radio channel allocation protocol. The ST-865KW2 controls all radio functions. In combination with the ST-852/ST-853 SmarTrunk II Digital Trunking Controller, this is a complete multichannel digital access radio trunking system.

The ST-852/ST-853 is the heart of the SmarTrunk II system. Programming and operation is performed by the System Operator/Manager. Many of the programmable features of the ST-865KW2 require information unique to a specific system. These system specifics can only be obtained from the System Operator/Manager.

This instruction manual describes user operation, dealer programming, and dealer installation of the ST-865KW2. **Please read the entire manual before proceeding so that you can take advantage of all the advanced features.**

- Store and send dialing
- 10 number memory speed dial (user programmable)
- Last number re-dial
- Different ringing tones to distinguish the type of call
- Channel clear alerting tells the subscriber when a channel is available
- Ten levels of priority call override
- Two trunking modes: radiotelephone and fleet dispatch
- Conventional operation
- Faster channel access time
- Automatic mobile acknowledge eliminates wasted air time
- Five digit security code for dealer programming
- Remote Radio Kill™ to disable illegal and non-paying customers

The last section of this manual describes the installation procedure for the radios. It is important that the installer also read the programming section. Necessary adjustments are accessible through the programming mode.

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Subscribers already familiar with the original SmarTrunk system will find the SmarTrunk II digital system just as easy to use. There are also many additional features and enhancements.

The ST-865KW2 begins trunking operation as soon as the radio is powered on. Channel selection, transmit control, receiver audio, and other radio functions are all under the control of the ST-865KW2. Radio channel access is tightly controlled. Unauthorized transmission and monitoring of trunking channels is not possible.

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. Three long low frequency beeps indicates all channels are busy or improper keypad operation. DTMF tones are heard during DTMF overdialing.

1.1 • Landline To Subscriber Call

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 ID number of the subscriber or group that they are trying to call.

If the subscriber ID number is valid, the ST-852/ST-853 attempts to reach the subscriber over the air. If the subscriber ID number is for a radiotelephone subscriber that is powered off or is out of the operating area, the caller will hear a busy signal. If the subscriber is powered on and is in the operating area the caller will hear ring back and the ST-865KW2 will start ringing. The subscriber answers the call by pressing * without 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 ID number is for a group, the caller will hear one ring followed by two beeps. The caller can then begin talking.

1.2 • 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 manually dialed group call.

d. A short single high frequency ring is generated in the calling radios logic board, then a double beep is generated by the controller. 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).

1.3 • Call Routing Codes For Subscriber Initiated Calls

Call routing codes are used for initiating a call from a subscriber to the appropriate destination. Call 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, however, the call routing code is placed at the end of the calling sequence.

The following table describes all the call 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	Fleet-Dispatch *I* Group Call
9	Mobile Operator
0	Emergency

1.3.1 Subscriber To Landline Call

Routing codes 1 and 2 give the subscriber access to telephone line one or two respectively. A subscriber may be restricted from line 2, or there may not be two telephone lines connected to the ST-852/ST-853. In this case, routing code 2 is not valid.

1.3.2 Subscriber to Subscriber Call

Routing code 3 allows the subscriber to place a call to another subscriber or group of subscribers. The call is routed through the ST-852/ST-853 and does not use the telephone system.

1.3.3 Fleet Dispatch (Subscriber) to Group Call

Routing code 4 allows the subscriber to place a call to the subscriber's own group. This functions as though the subscriber had used routing code 3 with the ID number of the subscriber's own group.

1.3.4 Mobile Operator Call

Routing code 9 calls the subscriber that is preprogrammed as the Mobile Operator. This functions as though the subscriber had used routing code 3 with the subscriber ID number of the Mobile Operator. The Mobile Operator is programmed by the System Operator/Manager. *See the ST-853 SmarTrunk II Digital Trunking Controller manual for details on programming the Mobile operator number.*

1.3.5 Emergency Call

Routing code 0 causes the ST-852/ST-853 to access line 1 and dial the preprogrammed emergency phone number. The emergency phone number is programmed by the System Operator/Manager. *See the ST-853 SmarTrunk II Digital Trunking Controller manual for details on programming the emergency number.*

1.4 • Conventional Mode

The TK-270/278/370/378 radios provide a conventional operating mode in addition to the SmarTrunk mode. The conventional mode allows standard two-way radio operation on a bank of channels which are separate from the trunked bank of channels. The conventional bank of channels may be programmed as simply talk-around frequencies or as repeater channels for use on a conventional community repeater system. (See the Kenwood radio service manual for radio channel programming details).

To change the radio operation from trunked to conventional, or from conventional to trunked, perform the following.

1. Turn the radio off.
2. Press and hold the radio monitor button. (The monitor button is located just below the PTT switch on the left side of the radio).
3. While holding the monitor button down, turn the radio on and release the monitor button after 3 seconds.
4. Observe the radio display. If the channel number is continuously changing, the radio is set to SmarTrunk mode. If the channel number is steady, the radio is set to conventional mode.

1.5 • Originating A Call

This section describes the advanced SmarTrunk II dialing methods. Dialing has an automatic five second time-out. If the time between pressing keys in a dialing sequence exceeds five seconds, the ST-865KW2 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 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 advanced dialing modes available:

Table 1-2 • Dialing Modes

Dialing Mode	Procedure
Store and Send Dialing	(number to dial) + (routing code) + *
Memory Speed Dialing	* + (memory location)
Programming Speed Dial Memory (The ability to program speed dial numbers can be disabled by the dealer).	* (hold until beep) + (memory location) + (number to store) + (routing code) + *
Redial Mode	* + *
Priority Redial (Priority Call Override) (dealer programmable)	* + * (hold until beep)

1.5.1 Store And Send Dialing

This is the normal method of placing a telephone call.

1. Enter the telephone number, or subscriber ID number on the radio keypad.
2. Enter the routing code for the destination of the call.
3. Press the * key.
4. Hear a beep followed by the phone system signalling.
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****

Note: Up to fourteen digit telephone numbers may be entered.

1.5.2 Memory Speed Dialing

This procedure is used for dialing a telephone number or subscriber ID 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 signalling.
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***

1.5.3 Programming Memory Speed Dial Numbers

The following procedure is used for programming a telephone number or subscriber ID number into the ST-865KW2 speed dial memory.

1. Press and hold the * key until a beep is heard.
2. Enter a memory speed dial location (0-9).
3. Enter the telephone number or subscriber ID 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 ****

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

1.5.4 Redial

Redial is most often used after a telephone number is dialed using the store and send method and the line is busy or a trunking channel is not available.

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

Turning off the power to the radio 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.

1.5.5 Priority Call Override

A subscriber 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 and then
Press and hold the * key until a peep a heard.

Each subscriber is assigned one of ten priority levels. 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 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 dealer programmable option.

IMPORTANT NOTE REGARDING PRIORITY USAGE!

Since the original SmarTrunk system uses DTMF signaling, the procedure for handling a priority call override is different. Only one level of priority existed in the original SmarTrunk protocol. It is highly recommended that only the new SmarTrunk II mobiles be made priority callers so that the ten priority levels are used. Any mobiles that are using the priority call override feature in the original SmarTrunk system should be upgraded to an ST-865KW2 SmarTrunk II Logic Board. All SmarTrunk II mobiles are higher priority than original SmarTrunk mobiles.

1.5.6 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 ST-865KW2. After the busy signal, the radio will continue to scan all trunking channels looking for a free channel. The radio will chirp every 10 seconds while in this mode. When a channel is freed, the radio will generate a double beep. You can then attempt the call again. The ST-865KW2 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 radio's keypad. Clear Channel Alerting is a dealer programmable option.

1.6 • 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 activity timer expires at the ST-852/ST-853. *See the ST-853 SmarTrunk II Digital Trunking Controller manual for details about these times.* In addition, if a subscriber loses the signal from the ST-852/ST-853 for 5 seconds, the subscriber will return to the idle state.

1.7 • Radio Kill

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

The ST-865KW2 may be operated in three modes; Radiotelephone, Fleet Dis-patch and Conventional. The System Operator/Manager determines which of these modes are made available to each subscriber.

The features of the operating modes are described below:

- ***Radiotelephone*** **-** The subscriber receives private calls and group calls. He can initiate telephone calls, call other radiotelephone subscribers and call any group. Call records for each subscriber and group are maintained for billing.

- ***Fleet Dispatch*** **-** The subscriber is assigned to two groups and receives calls for both groups. If Automatic PTT is enabled, the subscriber can call the main group by simply pressing PTT, with no keypad entry. The subscriber may also initiate telephone calls, call radiotelephone subscribers and call any group. Call records for both groups are maintained for billing.

- ***Conventional*** **-** The TK-270/278/370/378 radio provides a conventional operating mode in addition to the SmarTrunk mode. The conventional mode allows standard two-way radio operation on a bank of channels which are separate from the trunked bank of channels. The conventional bank of channels may be programmed as simply talk-around frequencies or as repeater channels for use on a conventional community repeater system. (See the Kenwood radio service manual for radio channel programming details).

2.1 • Subscriber ID Numbers/Paging Code Numbers

SmarTrunk II modes (Radiotelephone and Fleet Dispatch) are a function of subscriber identification programming.

Each subscriber in a SmarTrunk II System may be assigned two Subscriber ID Numbers. Subscriber ID numbers are similar to a telephone number. This is the number a landline or radio caller uses to contact the subscriber. As a security measure, this number is aliased to another number (Paging Code Number) for over the air signaling. The Paging Code is expected to be a confidential number known only by the System Operator/Manager who programs 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 ID Number provides sufficient subscriber information necessary for all SmarTrunk II operation.

The System Operator/Manager activates a subscriber (individual or group) by programming the ST-852/ST-853 SmarTrunk II Controller. This activation involves assigning a Subscriber ID Number, Paging Code Number, operational type and a number of other controller parameters. As previously stated, each piece of SmarTrunk II subscriber equipment is capable of "over the air" operation with two Paging Code Numbers. These are the numbers that will be programmed into the subscriber equipment.

An individual Subscriber ID Number and associated Paging Code are numbers assigned to one subscriber. The subscriber may be called as an individual by other subscribers or from the landline. Calls made by and to the individual subscriber are accounted for and recorded by the ST-852/ST-853 SmarTrunk II controller.

A group Subscriber ID Number and associated Paging Code are numbers assigned to more than one subscriber. These grouped subscribers will receive a common alert if the Subscriber ID Number is called from another radio subscriber or from the landline. This signalling 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.

Example #1: If a subscriber is only a radio telephone user, the Primary Code is programmed for the Paging Code associated with the Subscribers ID Number. When the subscriber has no need for radio group calling, the Secondary Code should be programmed with the same number as the Primary Code. In this case, the SmarTrunk II subscriber equipment operates similar to single line telephone.

Example #2: If a subscriber has a requirement to operate radio telephone and radio group calling, the individual Paging Code is assigned to the Primary Code and the group Paging Code assigned to the Secondary code. The operator of this equipment can receive and initiate individual calls to and from other subscribers and the landline. Additionally, this equipment can be contacted as part of the radio group.

Example #3: If a subscriber primarily has only radio dispatch/fleet requirements, both the Primary Code and the Secondary Codes may be assigned to group Paging Codes. When programmed in this manner, the equipment will respond to two groups (Group and Sub-Group). The operator of this equipment can only receive Group or Sub-Group calls. An individual user in the subscriber group can make individual outgoing calls to the landline (Primary Code is used).

Table 2-1 illustrates a possible programming/activation scenario. The first three subscribers are individual subscribers using half duplex type equipment. These paging codes will be programmed into only one piece of subscriber equipment in the Primary Code position. The fourth and fifth entries are group subscribers. The group paging code may be programmed into many pieces of subscriber equipment as Primary Code or Secondary Code (Group/Sub-Group).

Table 2-1 • ST-852/ST-853 Programming

Subscriber ID Number	Type	Paging Code
10000	half	4100
10001	half	4101
10003	half	4102
90000	group	4103
90001	group	4104

Table 2-2 depicts how four pieces of user equipment may be programmed related to Table 2-1.

Subscriber Equipment #1 will operate as an individual user.

Subscriber Equipment #2 will operate as an individual and be grouped with #4.

Subscriber Equipment #3 will operate as an individual, with grouping to #4 but NOT grouped with #2.

Subscriber Equipment #4 operates with two groups. Thereby being associated with #2 and #3.

Table 2-2 • Mobile Programming

	Subscriber Equipment #1	Subscriber Equipment #2	Subscriber Equipment #3	Subscriber Equipment #4
Primary Code	4100	4101	4102	4103
Secondary Code	4100	4103	4104	4104

Installation Instructions

NOTE
A Kenwood TK-270/278 or TK-370/378 service manual is required to perform the following ST-865KW2 installation Procedure.

3.1 • Portable Radio Programming

Program the radio for the SmarTrunk II operating frequencies and the various radio operating parameters required. NOTE:frequencies used for SmarTrunk operation MUST be programmed into channel locations 17 through 32. Channels 1 through 16 can be used for conventional operation. Refer to the radio instruction manual for specific instructions. When the radio programming is complete, the SmarTrunk II Logic Board can be programmed by following the procedure described in Section 4.

The most effective method to evaluate proper programming of a radio involves system use. It is recommended that the System Operator/Manager set up at least two specific Subscriber ID Numbers and associated Paging Codes for each designated installer for test purposes. This provides a basis for programming all radios prior to specific subscriber activation. It also provides an evaluation capability for installers. One set of numbers should be individual (half duplex type) the other group type).

3.2 • Squelch Adjustment

SQUELCH ADJUSTMENT MUST ALWAYS BE SET AT THE SQUELCH THRESHOLD.

After the squelch is set properly, the subscriber should not readjust the squelch control. ***Improperly adjusted squelch will cause reduced performance of the trunking operation.***

To adjust the radio squelch setting, the radio must be placed in the non-trunked conventional mode. The radio is toggled between non-trunked conventional operation and trunked operation by pressing and holding the monitor button while turning the radio on. (The monitor button is located just below the PTT switch on the left side of the radio).

When the radio is set to trunked operation, the display indicates scanning by showing continuously changing channel numbers. When the radio is set for non-trunked conventional operation, the display indicates one channel number. Make certain that the radio is set to the non-trunked mode then adjust the squelch as detailed in the radio operator manual. Once the squelch adjustment is complete, return the radio to trunked operation.

3.3 • Logic Board Installation

Refer to the Kenwood radio service manual for radio disassembly instructions and disassemble the radio.

Locate the option board pad area on the radio TX-RX unit board (X57 - 4850 -xx). The option board pad area is located on the foil side of the TX-RX unit board, near the bottom of the radio behind the keypad area.

3.3.1 Solder Ribbon Wires

Refer to figure 3-1 and solder the ribbon wires from the ST-865KW2 to the pads as shown.

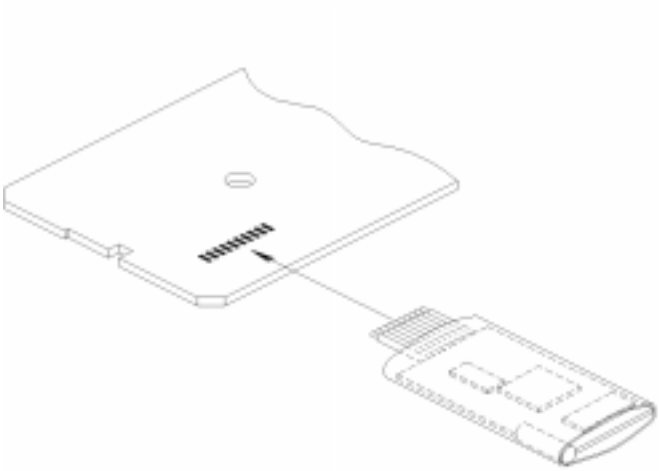

Figure 3-1 • Ribbon cable connection detail

3.3.2 Fold Ribbon Cable

Carefully fold the ST-865KW2 over as shown in figure 3-2 so that the ST-865KW2 is parallel to the radio TX-RX unit board.

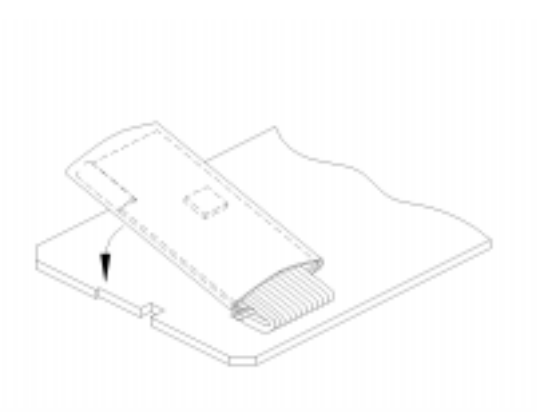

Figure 3-2 • Ribbon cable fold detail

3.3.3 Radio Option Area

Gently place the ST-865KW2 in the radio option area as shown in figures 3-3 and 3-4.

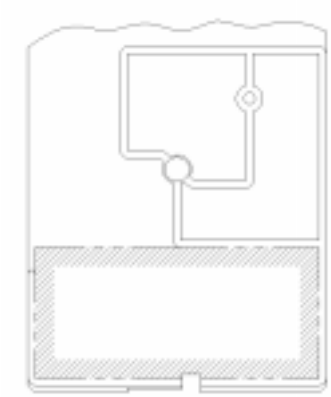

Figure 3-3 • Radio Option Area Detail

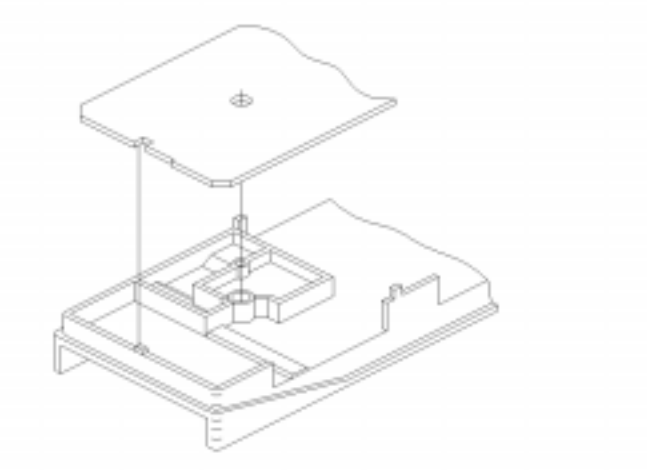

Figure 3-4 • Radio Option Assembly Detail

3.3.4 Reassemble Radio

Reassemble the radio as shown in the Kenwood radio service manual.

Once the radio is assembled, turn the radio on and observe the display. If the channel number is continuously changing, the radio is in trunked mode and the installation is complete. If the channel number is set to one steady number, the radio is in the non-trunked conventional mode and must be placed in the trunked mode as follows.

1. Turn the radio off.
2. Press and hold the radio monitor button.
3. While holding the monitor button down, turn the radio on and release the monitor button after 3 seconds. Observe the radio display and make certain that channel number is continuously changing.
4. If the channel number is steady, repeat the above steps.

4 • LOGIC BOARD PROGRAMMING

The ST-865KW2 provides the installing technician a flexible programming capability after the ST-865KW2 has been installed in the radio. The ST-865KW2 is programmed by using the keypad on the front of the radio. 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 ST-865KW2, a functional ST-852/ST-853 with the system ID numbers and paging codes correctly programmed is required. *See the ST-853 SmarTrunk II Digital Trunking Controller manual for details on adding subscriber ID numbers to the system.*

4.1 • Entering The Program Mode

To enter the programming mode, perform the following steps:

a. Turn the radio off.

b. Press and hold the # key on the front panel keypad.

c. Turn the radio on.

d. After the beep is heard, release the # key.

e. Enter the dealer programmed 5 digit access code, followed by the # key. The default access code is 12345.

f. The ST-865KW2 will respond with a high beep. If a low beep is heard, the access code was incorrect. Turn the radio off and try the procedure again.

4.2 • Programming Feature Descriptions

The ST-865KW2 programming features are described herein. A programming worksheet is provided in Appendix A. This worksheet should be copied and filled out for each subscriber and used as a record of the programming for that particular subscriber.

Table 4-1 summarizes the programmable features, the keypad sequence for programming, and the default values as provided by the factory.

Each feature programmed requires the following steps:

a. Enter a two digit programming code.

b. Press the # key (indicates end of programming code sequence).

c. Enter the data necessary to program that feature.

d. Press the # key (indicates end of data sequence).

Many of the programmable parameters required for proper operation of the ST-865KW2 MUST be provided by the System Operator/Manager. These features are indicated by an asterisk (*) at the beginning of the feature name.

After each feature is successfully programmed, a high frequency beep will be generated. A low frequency beep indicates an error was made in the programming sequence and the sequence should be repeated.

To return the radio to normal operation after programming is complete, turn the power of the radio off and then back on.

Table 4-1 • Programming Options Summary Table

Feature	Programming Sequence	Factory Default
*Number of Trunking Channels	10# data #	4
*System Tone	11# data#	3
*Primary Code	12# data #	0000
*Secondary Code	13# data #	0000
*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
Conventional Alignment Mode	17#	——
Return to factory default values	19#	——
*Trunking System ID Number	20# data #	00
*Automatic PTT 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# (disabled)	active
*Memory Speed-dialing	26# 0# (off) 26# 1# (on)	on

Note: Items marked with an asterisk (*) require information from the System Operator/Manager prior to programming.

4.2.1 Number of Trunking Channels

This program code sets the number of trunking channels that are used in a SmarTrunk II trunking system.

To program the number of trunking channels: Enter the program code 10 followed by the # key, then the number of trunking channels in your system, followed by the # key.

Example: *If your trunking system is a five channel system press: 1 0 # 5 #.*

4.2.2 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 use this tone to detect that a trunking channel is busy. *All subscriber units on a trunking system 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 Acceptable System Tones

TONE #	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 #***

4.2.3 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. *See Section 2 (Operating Modes) before assigning the Primary Code.*
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 #.*

4.2.4 Secondary Code

The Secondary Code consists of a four digit number contained in the SmarTrunk II digital transmission. Any four digit number from 0000 to 9999 may be used.
See Section 2 (Operating Modes) before assigning the Secondary Code.

To program a Secondary Code: Enter the program code 13 followed by the # key, then the Secondary Code followed by the # key.

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

4.2.5 Priority Subscriber Enable

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

Note: ***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.***

A priority override is possible only if the subscriber engaging the priority override has a higher priority level than the current subscriber on a channel. There are ten priority levels, from 0 (lowest priority) to 9 (highest priority). The priority level of a SmarTrunk II subscriber is determined by the first digit of the subscriber's Primary code.

For example, a subscriber with a Primary code of 2468 (priority level 2) is currently using a trunking channel. If a subscriber with a Primary code of 6722 (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 6722 will be granted access to the channel. If a subscriber with a Primary code of 1234 (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. If a subscriber with a Primary code of 2401 (priority level 2) tries a priority override on the same trunking channel, the override will be unsuccessful.

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 #.*

4.2.6 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 ST-865KW2 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 radio's squelch control must always be set correctly.

4.2.7 Five Digit Access Code

The five digit access code allows the dealer to enter the ST-865KW2 programming mode and keeps unauthorized personnel from accessing 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.

To change the five digit access code to 45678 press:

1 6 # 4 5 6 7 8 # 4 5 6 7 8 #

4.2.8 Return To Radio Default Values

This programming feature will return the contents of the EEPROM to the default values as shown on the Programming Options Summary Table (Table 4-1). The Five Digit Access code is returned to the factory default value (12345).

Example: *To initialize the EEPROM TO FACTORY DEFAULTS PRESS: 1 9 #.*

4.2.9 Trunking System ID Number

All ST-852's have a Trunking System ID Number from 0 to 31. All subscriber units on a trunking system must be programmed with the same trunking system ID number. Subscriber units can only access ST-852's with matching Trunking System ID Numbers. The ST-853 allows more than one ID Number per controller. See the ST-853 manual for details.

For example, if a subscriber unit with a trunking system ID number of 1 tries to access a trunking system with a trunking system ID number of 5, access will be denied. If you wish to allow subscriber units to roam on different SmarTrunk II systems, all trunking system ID numbers must be identical. The Trunking System ID Number will be used in the future for roaming and networking features.

To program the ST-865KW2 with a trunking system ID number: Enter the program code 20 followed by the # key, and then the trunking system ID number followed by the # key.

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

4.2.10 Automatic PTT Mode

The Automatic PTT mode makes radio operation simple for the dispatch operation. With this mode enabled, the subscriber simply presses the PTT switch on the radio to gain channel access. The ST-865KW2 will automatically call the subscriber's Secondary code for fleet-dispatch type trunking systems. No keypad entry is required to operate in this mode.

Note: This option should not be used if the primary function of a subscriber is for radiotelephone. Both radiotelephone and fleet-dispatch mobiles can share the same trunking system.

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

Example: *To enable automatic PTT mode press: 2 1 # 1 #.*

4.2.11 Emergency Call Override

When a subscriber places an emergency call by using routing code 0 (pressing *0), the ST-865KW2 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-853 SmarTrunk II Digital Trunking Controller manual for details on programming the emergency phone 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 #.*

4.2.12 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, and then either 1 (enable) or 0 (disable) followed by the # key.

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

Note: 24 # 0 # disables this function

4.2.13 Radio-Kill

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

Example: *To re-activate a Portable Radio press: 2 5 # 0 #.*

4.2.14 Memory Speed Dial Programming

This program code controls a subscriber's ability to program speed dial numbers. If enabled, the subscriber can program speed dial numbers using the Portable Radio's keypad. If it is disabled, the subscriber can not program speed dial numbers. This does not prevent a subscriber from speed dialing if numbers have been pre-programmed. The System Operator/Manager can pre-program some memory speed dial numbers for the subscriber, and then disable the Memory Speed Dial Programming. The subscriber can then call the System Operator/Manager's programmed numbers.

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

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

Features	Programming Sequence	Factory Default	Value Used
*Number of Trunking Channels	10# data #	4	
*System Tone	11# data #	3	
*Primary Code	12# data #	0000	
*Secondary Code	13# data #	0000	
*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	
Conventional Alignment Mode	17#	———	
Return To Factory Default Values	19#	———	
*Trunking System ID Number	20# data #	00	
*Automatic PTT 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# (disabled)	active	
*Memory Speed-dialing	26# 0# (off) 26# 1# (on)	on	

Note: Items Market with an (*) require information from the System Operator/Manager prior to programming.

Radio Model Number:
Radio Serial Number:

TRUNKING CHANNELS	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		