Technical Manual

SC90 Selcall Board
for use with
Kenwood TK90 Radio

SC90 Operation

Basic Commands keys:

A –   Channel Up

Steps radio up one channel at a time - wraps to lowest channel
Also used to step through menus.

B –   Channel Down

Steps radio down one channel at a time - wraps to highest channel
Also used to step through menus.

C –   Enter Call Menu (See page 2.1)

D –   Enter Data/Display Menu (See page 3.1)

✱ – Scan/Mute on/off

If the TK90 is in normal mode and scanning is enabled then pressing ✱ starts scanning and sets mute ON.
If the TK90 is scanning, or mute is on, then pressing ✱ stops scanning and/or switches mute OFF. The TK90 will jump to the channel it was on when scanning was started.
If the TK90 is scanning and a call has been received then pressing ✱ stops scanning and switches mute OFF. The TK90 will jump to the channel it was on when the call was received.
If the TK90 is in alarm mode then pressing ✱ will cancel the alarm and reset the display.
✱ is also used as a general delete, back space or exit command depending on where it is used.

PTT - PTT can also be used to exit a function or cancel an alarm.
Warning: If PTT is pressed while the TK90 is scanning then scanning will stop and the radio will transmit on the current scan channel. When the PTT is released the TK90 will jump back to the channel it was on when scanning was started or to the channel an incoming call was received on. Because of this the PTT should only be pressed momentarily to stop scanning.

–   Mute only on

Pressing **#** will switch the audio mute ON. To switch the mute OFF press ✱.

Locked Mode

If the radio display shows "== LOCKED ==" see page 4.1

Call Menu

Basic Commands keys:

A – Selection up

Steps menu up one selection at a time - wraps to lowest selection

B – Selection down

Steps menu down one selection at a time - wraps to lowest selection

C - Selects the displayed selection

The following selections are available:

Note: Pressing any key except **A**, **B** or **C** will exit the menu.

* "Send GPS", "Request GPS" and "Emergency Call" may not be available in the menu depending on programmed options.

The SC90 will remember, and automatically enter, any last used Selcall or Telephone number where required. This makes it simple to repeat a call. Whenever the unit is switched off these numbers are deleted.

Selcall

No previous calls sent

Operation	Display
Press **C** to enter Call Menu	SELCALL
Press **C** to select menu option * see note 1)	CALL TO
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to send a selcall to the number displayed	CALLING NNNN

To resend previous call

Operation	Display
Press **C** to enter Call Menu	SELCALL
Press **C** to select menu option * see note 1)	CALL TO NNNN
Press **C** to send a selcall to the number displayed	CALLING NNNN

After previous calls have been sent

Operation	Display
Press **C** to enter Call Menu	SELCALL
Press **C** to select menu option * see note 1)	CALL TO DDDD
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to send a selcall to the number displayed	CALLING NNNN

1) Pressing ✱ will exit the menu.

2) Pressing ✱ will delete the last digit entered. When no digits are displayed pressing ✱ will exit the menu.

Beacon Call

No previous calls sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`BEACON`
Press **C** to select menu option * see note 1)	`CALL TO`

Enter four digits of selcall ID to be called
 	
* see note 2)
	`CALL TO      N`
	`CALL TO     NN`
	`CALL TO    NNN`
	`CALL TO NNNN`

Press **C** to send a call to the number displayed	`BEACON   NNNN`

To resend previous call

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`BEACON`
Press **C** to select menu option * see note 1)	`CALL TO NNNN`
Press **C** to send a call to the number displayed	`BEACON   NNNN`

After previous calls have been sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`BEACON`
Press **C** to select menu option * see note 1)	`CALL TO DDDD`

Enter four digits of call ID to be called
 	
* see note 2)
	`CALL TO      N`
	`CALL TO     NN`
	`CALL TO    NNN`
	`CALL TO NNNN`

Press **C** to send a call to the number displayed	`BEACON   NNNN`

1) Pressing ✶ will exit the menu.

2) Pressing ✶ will delete the last digit entered. When no digits are displayed pressing ✶ will exit the menu.

Hang Up Call

No previous calls sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	HANG UP
Press **C** to select menu option * see note 1)	CALL TO
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to send a call to the number displayed	HANG UP NNNN

To resend previous call

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	HANG UP
Press **C** to select menu option * see note 1)	CALL TO NNNN
Press **C** to send a call to the number displayed	HANG UP NNNN

After previous calls have been sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	HANG UP
Press **C** to select menu option * see note 1)	CALL TO DDDD
Enter four digits of call ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to send a call to the number displayed	HANG UP NNNN

1) Pressing ✶ will exit the menu.

2) Pressing ✶ will delete the last digit entered. When no digits are displayed pressing ✶ will exit the menu.

Telcall

No previous calls sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	TELCALL
Press **C** to select menu option * see note 1)	CALL TO
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to continue	ENTER TEL NO
Enter up to 16 digits of telephone number 1 digit 2 digits 8 digits 9 digits 10 digits * see note 1) 16 digits	TEL: 1 TEL: 21 TEL:12345678 TEL+23456789 TEL+34567890 TEL+90123456
Press **C** to send a telcall to the number displayed	CALLING NNNN

To resend previous call

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	TELCALL
Press **C** to select menu option * see note 1)	CALL TO NNNN
Press **C** to continue * see note 3)	TEL+90123456
Press **C** to send a telcall to the number displayed	CALLING NNNN

After previous calls have been sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	TELCALL
Press **C** to select menu option * see note 1)	CALL TO DDDD
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN

Press **C** to continue * see note 3)	`TEL+90123456`

Enter up to 16 digits of telephone number   1 digit
                                 2 digits
                                 8 digits
                                 9 digits
                              10 digits
* see note 1)   16 digits
OR
go directly to next step to use the existing telephone number
	`TEL:` `1`
	`TEL:` `21`
	`TEL:12345678`
	`TEL+23456789`
	`TEL+34567890`
	`TEL+90123456`

Press **C** to send a telcall to the number displayed	`CALLING NNNN`

1) Pressing ✶ will exit the menu.

2) Pressing ✶ will delete the last digit entered. When no digits are displayed pressing ✶ will exit the menu.

3) Telephone numbers are stored as a string of 16 digits/spaces.
A display of TEL: shows that there are 8 or less telephone digits.
A display of TEL+ shows that there are more telephone digits before the 8 digits shown.
You can toggle the display between the last 8 digits and the first (up to) 8 digits by pressing the # key (but only when at this step).
For a stored 16 digit telephone number of 1234567890123456 the display will show for example TEL+90123456 for the last eight digits and TEL12345678+ for the first eight digits. The + sign means there are more digits either in front (TEL+90123456) or behind (TEL12345678+) the digits shown.

Request GPS

No previous calls sent

Operation	Display
Press **C** to enter Call Menu	`REQUEST GPS`
Press **C** to select menu option * see note 1)	`CALL TO`

Enter four digits of selcall ID to be called
 	
* see note 2)
	`CALL TO    N`
	`CALL TO   NN`
	`CALL TO  NNN`
	`CALL TO NNNN`

Press **C** to send a call to the number displayed	`GPS REQ NNNN`

To resend previous call

Operation	Display
Press **C** to enter Call Menu	`REQUEST GPS`
Press **C** to select menu option * see note 1)	`CALL TO NNNN`
Press **C** to send a call to the number displayed	`GPS REQ NNNN`

After previous calls have been sent

Operation	Display
Press **C** to enter Call Menu	`REQUEST GPS`
Press **C** to select menu option * see note 1)	`CALL TO DDDD`

Enter four digits of selcall ID to be called
 	
* see note 2)
	`CALL TO    N`
	`CALL TO   NN`
	`CALL TO  NNN`
	`CALL TO NNNN`

Press **C** to send a call to the number displayed	`GPS REQ NNNN`

1) Pressing ✶ will exit the menu.

2) Pressing ✶ will delete the last digit entered. When no digits are displayed pressing ✶ will exit the menu.

Send GPS

No previous calls sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	SEND GPS
Press **C** to select menu option * see note 1)	CALL TO
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to send a call to the number displayed	CALLING NNNN

To resend previous call

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	SEND GPS
Press **C** to select menu option * see note 1)	CALL TO NNNN
Press **C** to send a call to the number displayed	CALLING NNNN

After previous calls have been sent

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	SEND GPS
Press **C** to select menu option * see note 1)	CALL TO DDDD
Enter four digits of selcall ID to be called * see note 2)	CALL TO N CALL TO NN CALL TO NNN CALL TO NNNN
Press **C** to send a call to the number displayed *see note 3) **OR**	CALLING NNNN NO GPS DATA

1) Pressing ✶ will exit the menu.
2) Pressing ✶ will delete the last digit entered. When no digits are displayed pressing ✶ will exit the menu.
3) If no GPS data is available then an error tone will be heard after a short time and the NO GPS DATA warning will be displayed for 2 secs.

The GPS must be enabled in the options programming to be used.

Emergency Call

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`EMERGENCY`
Press **C** to select menu option * see note 1)	`SEND EMERGY?`
Press **C** to send an emergency call * see note 2)	`EMERGCY CALL`

1) Pressing ✱ will exit the menu.

2) If the GPS options are enabled then the SC90 will attempt (for up to 6 seconds) to get the GPS location data and send a GPS Emergency call. If no GPS data is available the SC90 will send an Emergency Selcall instead.   If the GPS options are not enabled then the SC90 will immediately send an Emergency Selcall.

3) The Transmit Emergency option has to be programmed for this menu item to be available.

Emergency calls may also be initiated by using an external push button or toggle (on/off) switch connected between pin 6 of the 9 way D connector and ground.

If a push button is used then it has to be pressed for a minimum of two seconds to initiate the emergency call. Each press of the push button (for more than two seconds) will send an emergency call.

When an external toggle (on/off) switch is used then the operator only has to activate the switch. The SC90 will then send three emergency calls with thirty seconds of silence between them. To repeat this sequence the operator has to set the switch to off and then back to on again.

The SC90 will send a GPS Emergency Call, if a functioning GPS unit is attached, otherwise it will send an Emergency Selcall.

Note that the radio is "silent" when an emergency call is sent using the external emergency switch (that is no tones are heard while the call is being sent).

Memory Store

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`MEM STORE`

Press **C** to select menu option
 	
Or
Or
	`M01 SEL DDDD`
	`M01 TEL DDDD`
	`M01  EMPTY`

Press **A** or **B** to select desired memory location xx
(M01 to M10)
* see note 1)
	`Mxx SEL DDDD`
	`Mxx TEL DDDD`
	`Mxx  EMPTY`

When desired memory location is displayed enter four digits of selcall ID to be called
 	
* see note 2)
	`Mxx   TO    N`
	`Mxx   TO   NN`
	`Mxx   TO  NNN`
	`Mxx   TO NNNN`

Press **C** to allow entry of telephone numbers If the stored call is to be a Selcall then goto **1)** below * see note 3)	`ENTER TEL NO`

Enter required telephone number   1st digit
(max 16 digits) example   2nd digit
telephone no:1234567890123456   8th digit
                                                  9th digit
* see note 4)   16th digit
	`TEL:        1`
	`TEL:       12`
	`TEL:12345678`
	`TEL+23456789`
	`TEL+90123456`

1) Press **C** to store the memory details	`MEMxx STORED`

Note 1) Select an empty location to insert a new memory or select an occupied location to overwrite the existing details.

Note 2) Entering the Selcall number into a currently used location will clear the existing number from the display

Note 3) The same procedure is used for storing Selcalls and Telcalls, the only difference is that no telephone number is entered for a Selcall (just press the **C** key again). The SC90 will store the call in the required format.

Note 4) The display shows TEL: for the first 8 digits entered and the digits are displayed. After 8 digits are entered the display shows TEL+ and the last eight digits entered are displayed. The "+" shows that more than 8 digits have been entered. It is not possible to see the preceding digits.

Memory Recall

Note: Only Selcalls (SEL) and Telcalls (TEL) can be stored.

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`MEM RECALL`

Press **C** to select menu option
Or (Selcall)
Or (Telcall)
	`M01  EMPTY`
	`M01 SEL DDDD`
	`M01 TEL DDDD`

1)
Press **A** or **B** to select desired memory location xx (M01 to M10).If you wish to see a stored telephone number go to **2)** below.
	`Mxx SEL DDDD`
	`Mxx TEL DDDD`
	`Mxx  EMPTY`

Press **C** to send a Selcall (SEL) or Telcall (TEL) to the displayed ID.	`CALLING NNNN`

2)
a) If the stored telephone number is 8 digits or less the display will show the full telephone number.
 	
Pressing the **#** key again will show the memory location details again.
 	
Repeated pressing of the **#** key will toggle between these two displays.
 	
b) If the stored telephone number is 9 digits or more the display will show the first 1 to 8 digits.
 	
Pressing the **#** key again will show the last 8 digits.
 	
Pressing the **#** key again will show the memory location details again.
 	
Repeated pressing of the **#** key will toggle between these three displays.
 	
Pressing **A** or **B** will take you back to **1)** above.
	`TEL:12345678`
	
	`Mxx TEL DDDD`
	
	`TEL       12+`
	
	`TEL+34567890`
	
	`Mxx TEL DDDD`

Press **C** to send a Telcall (TEL) to the selected ID.	`CALLING NNNN`

Recent Incoming Calls

Note: Calls are stored in reverse order, that is the latest call is stored in memory location R01. Details of up to 10 calls can be stored. The details are lost when the radio is switched off.

The only incoming calls stored are Selcalls, Telcalls and GPS Data calls. When a GPS Data call is stored the return call will be sent as a Selcall.

When a call is returned (by pressing the **C** key) it will be sent on the channel the radio is currently set to. You must manually select another channel number, if required, before sending the call.

Operation	Display
Press **C** to enter Call Menu then **A** or **B** to select >	`RECENT CALLS`

Press **C** to select menu option
 	
Or
Or
Or
	`R01 SEL DDDD`
	`R01 TEL DDDD`
	`R01 GPS DDDD`
	` NO CALLS`

1) Press **A** or **B** to select desired memory location xx (R01 to R10). Additional information (including channel number) is stored with the call.
For a Selcall (SEL) go to **2)** below.
For a Telcall (TEL) go to **3)** below.
For a GPS data call (GPS) go to **4)** below.
	`Rxx SEL DDDD`
	`Rxx TEL DDDD`
	`Rxx GPS DDDD`
	`Rxx  EMPTY`

2) A stored Selcall is indicated by the SEL in the display.
Pressing the **#** key will show the channel number the call was received on.
 	
Repeated pressing of the **#** key will toggle between these two displays.
 	
Pressing **A** or **B** will take you back to **1)** above.
	`Rxx SEL DDDD`
	
	` CHANNEL nn`

To Selcall the stored number press the **C** key	`CALLING NNNN`

3) A stored Telcall is indicated by the TEL in the display. To see a stored telephone number press the **#** key.	`Rxx TEL DDDD`
a) If the stored telephone number is 8 digits or less the display will show the full number.	`TEL:12345678`
Pressing the **#** key again will show the channel number the call was received on.	`CHANNEL nn`
Repeated pressing of the **#** key will toggle between these three displays.	
b) If the stored telephone number is 9 digits or more the display will show the first 1 to 8 digits	`TEL      12+`
Pressing the **#** key again will show the last 8 digits	`TEL+34567890`
Pressing the **#** key again will show the channel number the call was received on.	`CHANNEL nn`
Repeated pressing of the **#** key will toggle between these four displays.	
Pressing **A** or **B** will take you back to **1)** above.	
Press **C** to send a Telcall (TEL) to the selected ID.	`CALLING NNNN`
4) A stored GPS Data call is indicated by the GPS in the display.	`Rxx GPS DDDD`
To see the stored latitude press the **#** key.	`12 34.567 N`
Pressing the **#** key again will show the longtitude.	`123 45.678 W`
Pressing the **#** key again will show the channel number the call was received on.	`CHANNEL nn`
Repeated pressing of the **#** key will toggle between these four displays.	
Pressing **A** or **B** will take you back to **1)** above.	
Press **C** to send a Selcall (SEL) to the selected ID.	`CALLING NNNN`

Data/Display Menu

Basic Commands keys:

A – Selection up

Steps menu up one selection at a time - wraps to lowest selection

B – Selection down

Steps menu down one selection at a time - wraps to highest selection

D - Selects the displayed selection

The following selections are available:
Selcall Type & ID	This page
Software Version	This page
Scan Timer clear	Page 3.2
Display GPS	Page 3.2

Note: Pressing any key except **A**, **B** or **D** will exit the menu.

Selcall Information

Operation	Display
Press **D** to enter Call Menu then **A** or **B** to select >	SELCALL INFO
Press **D** to select menu option **Or**	BARRETT NNNN CODAN NNNN

Note: NNNN is the Selcall ID of this unit.

Software Version

Operation	Display
Press **D** to enter Call Menu then **A** or **B** to select >	SOFTWARE VER
Press **D** to select menu option	UUUU VVVV.VV

Note: UUUU is the model number (eg: SC90)
VVVV.VV is the version number (eg: GCA1.00)

Auto-scan reset timer off

Operation	Display
Press **D** to enter Call Menu then **A** or **B** to select >	SCAN TIMER
Press **D** to select menu option	TIMER OFF

If enabled, the auto-scan reset timer is a timer which will automatically start the radio scanning after a programmable period if the radio is not put into scanning mode by the user. This eliminates the radio being left on a channel on which it cannot be contacted.

Use this selection to temporarily disable the timer. Pressing the ✱ key will re-enable the timer and put the radio back into scan mode.

Display GPS

Operation	Display
Press **D** to enter Call Menu then **A** or **B** to select >	DISPLAY GPS
Press **D** to select menu option	WAIT FOR GPS
If GPS data is NOT available	NO GPS DATA
If GPS data is available	GPS LOCATION
To see stored GPS data press the **#** key. The display will show the latitude. Pressing the **#** key again will show the longtitude. Pressing the **#** key again will show the message. Pressing the **#** key toggles between these three displays.	12 34.567 N 123 45.678 W GPS LOCATION

Locked Mode

If the radio display shows "== LOCKED ==" when switched on then the radio has been disabled. You have 5 seconds to start entering the unlock code (see below) - each key press resets the 5 second timer.

The radio is disabled (LOCKED) by sending a "Transceiver Lock Call" type of selcall from a suitably equipped base station.

The SC90 can also be programmed to automatically lock the radio on power up by selecting the "Power On Lock" in the optioning software.

To unlock the radio simply press the ✳ key on the keypad followed by the 8 digit unlock code, then press the # key. If you are successful then the radio will beep three times and display "= UNLOCKED =" before resetting.

A wrongly entered code will result in the error noise. The entry sequence can be restarted at any time by pressing the ✳ key.

The Lock and Un-Lock codes can be different numbers but both are 8 digits long.

A locked radio can also be reset by using the optioning programme. Start the optioning programme and get to the "Connect" screen but do not click on the "Connect" button. Switch on the radio then wait until the error tone sounds and the "== LOCKED ==" message appears on the display. Then click on the "Connect" button in the optioning programme to enable reading and reprogramming the SC90.

Note: A locked radio will automatically switch off 5 seconds after power on, or 5 seconds after the last key press, provided the Un-Lock code is not successfully entered.

Receiving Calls

The SC90 can receive and process several different types of calls. The following type of calls will sound an alarm (ringing) and be shown on the TK90 display:

Selcall	Page 5.2
Telcall	Page 5.2
GPS Data call	Page 5.2
Emergency selcall	Page 5.3
GPS Emergency call	Page 5.3

The following types of calls will be automatically handled by the SC90 and not sound any alarm or be shown on the TK90 display:

Beacon call	radio responds with four long beeps
Hang up command	radio ignores
GPS request call	radio send back GPS location data
Radio lock call	radio is disabled (see page 4.1)

The number of rings (alarm) that sound when receiving an incoming call can be set in the option programming.

When the radio is in scanning mode the length of time the radio will stay on channel before resuming scanning (Dwell Time) can be set in the option programming.

The incoming call details shown on the TK90 display will remain there until the PTT or the ✽ key is pressed. The TK90 will jump to the channel the call was received on either immediately, when the ✽ key is pressed, or after the PTT is released.

When calls have data attached (for example Telcalls or GPS calls) this information can be accessed by pressing the **#** key repeatedly. This data is only available until the PTT or the ✽ key is pressed. After this the call data is stored in the "Recent Calls" list.

When a call has been received, and the alarm cancelled, the caller can be called back by using the CALL menu and selecting Selcall (for any of incoming Selcall, GPS data call or Emergency call) or selecting Telcall for an incoming Telcall. The Selcall ID and telephone numbers are automatically entered providing no other calls have been made.

Note: only a Selcall can be sent in response to GPS data or Emergency calls.

Receiving Selcalls

Operation	Display
Selcall received - no other data stored	`SELCALL NNNN`

Where NNNN is the ID of the calling station.

Receiving Telcalls

Operation	Display
Telcall received	`TELCALL NNNN`
1) If telephone number is 8 or less digits Press **#** to show number	`TEL:  123456`
Press **#** again to show caller ID	`TELCALL NNNN`
2) If telephone number is greater than 8 digits Press **#** to show first (up to) 8 digits	`TEL  123456+`
Press **#** again to show last 8 digits	`TEL+78901234`
Press **#** again to show caller ID	`TELCALL NNNN`

Where NNNN is the ID of the calling station.

Repeatedly pressing the **#** key will scroll through these displays.

Receiving GPS Data calls

Operation	Display
GPS data call received	`GPSCALL NNNN`
Press **#** to show latitude of calling station	`12 34.567 N`
Press **#** again to show longtitude of calling station	`123 45.678 W`
Press **#** again to show caller ID	`GPSCALL NNNN`

Where NNNN is the ID of the calling station.

Repeatedly pressing the **#** key will scroll through these displays.

Receiving Emergency calls

Operation	Display
Emergency call received	`EMERGCY NNNN`
If call is a GPS Emergency call then press **#** to show latitude of calling station	`12 34.567 N`
Press **#** again to show longtitude of calling station	`123 45.678 W`
Press **#** again to show caller ID	`EMERGCY NNNN`

Where NNNN is the ID of the calling station.

Repeatedly pressing the **#** key will scroll through these displays. If not a GPS emergency call then pressing the **#** star key will have no effect.

When an emergency call is received the alarm sound is not the normal ringing but is three repeats of five rising tones.

Installing and programming the SC90 Selcall Board

Setting up the TK-90

Note: Before installing the SC90 make sure that the TK-90 has been "flashed" with new firmware (TK90_M_FIRMV20400.HEX). The radio is programmed using the KPG102D Ver 2.10 programming software (use KPG102D_V210.zip). When the radio is operational there will be a "dot" on the TK-90 display just above and between the 4th and 5th lower line character positions on the TK-90 display.

1) Programme all channels as required making sure that "Scan add" and "Selcall" are both set to "NO" and that "AUX" is set to "inactive". The SC90 can scan a maximum of 20 channels starting at channel 1. Channel numbers higher than the highest number programmed in the SC90 can be accessed only using the channel UP/DOWN buttons on the front panel of the radio.

2) Programme all "Optional Features" as required making sure on the "Common Page" that:
     a) "Call Type" is set to "OFF".
     b) "Com Port Settings" is set to "PC command".
     c) "Polarity" is set to "Normal".
     d) "Mic Key Command" is ticked
     e) "User Activation" is set as "Disabled"

3) Programme the "Key Assignments" as required making sure on the "Mic Key" page that the "Keypad" is selected as "16 Key". All other functions on the page are not available, nor are the functions of the "Direct Channel" page. Functions on the "Panel" page are available but care should be used when selecting them as to not conflict with the operation of the SC90.

4) On the "Extended Functions" programme "AUX1" so that "I/O" is set to "Output", "Function" is set to "TX SENS" and "Active" is set to "low". Ensure that none of the "Optional Boards" are selected (ticked).

5) The following pages are not active when using the SC90:
     a) Scan Information
     b) Selcall Function
     c) GPS
     d) Special alert tone
     e) Emergency Information
     f) Embedded Message
     g) Embedded Message with Password

Installing the SC90

Once the TK-90 programming is complete we are ready to install the SC90.

1) Remove the top cover from the TK-90

2) Install the SC90 in the position normally reserved for the ALE board (front right of radio) using the three screws provided.
Note: The provided screws are thread cutting screws and will be relatively hard to screw in the first time as they cut the thread in the chassis mounts. When re-inserting the screws after they have been removed be very careful to ensure they use the existing cut thread.

3) Install a wire from the PCB side of CN10 pin 8 to IC521 pin 8.

4) Install a wire from the PCB side of CN10 pin 9 to IC521 pin 9.
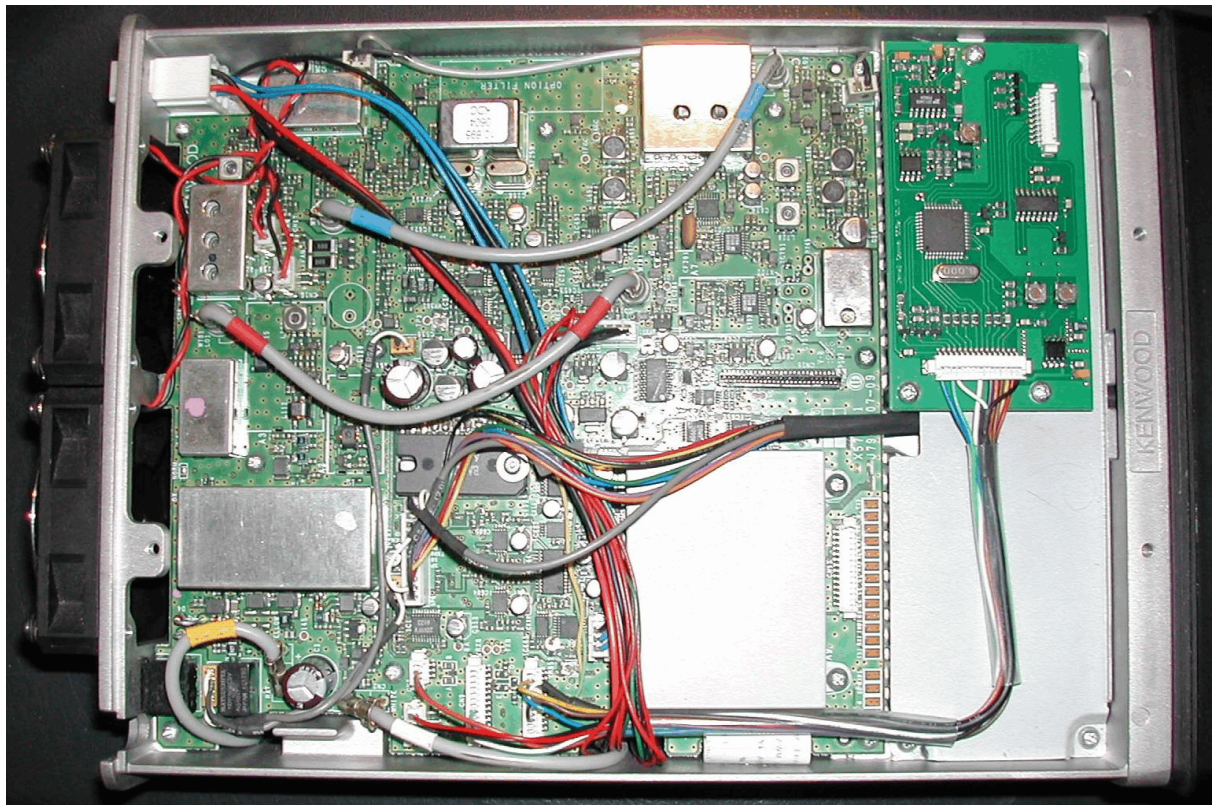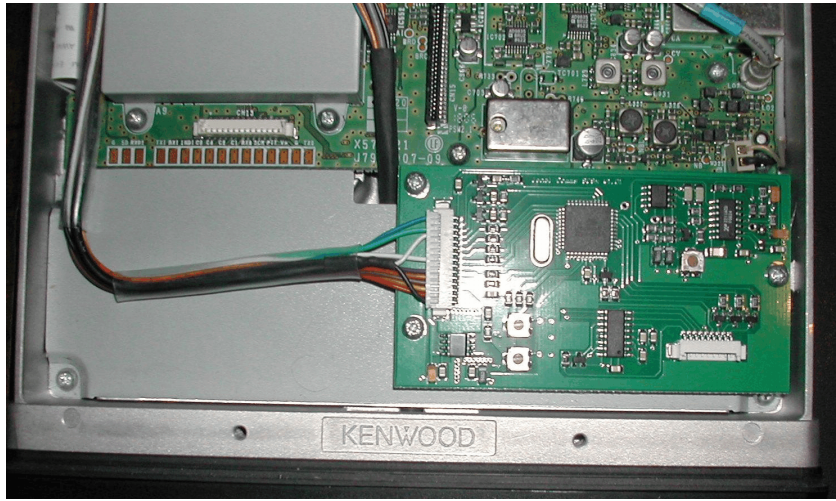
5) Plug the 15 way connector of the cable loom into the 15 way connector on the SC90 and position the cable loom so it runs down the left hand side of the radio between CN14 and the cover 700 (see Exploded View in the TK90 Technical Manual).

6) Plug the 11 way connector of the cable loom into CN10 of the TK-90.

7) Plug the 12 way connector of the cable loom into CN9 of the TK-90.

8) Plug the small 3 way connector of the cable loom into CN8 of the TK-90.

9) Plug the large 3 way connector of the cable loom into CN7 of the TK-90.
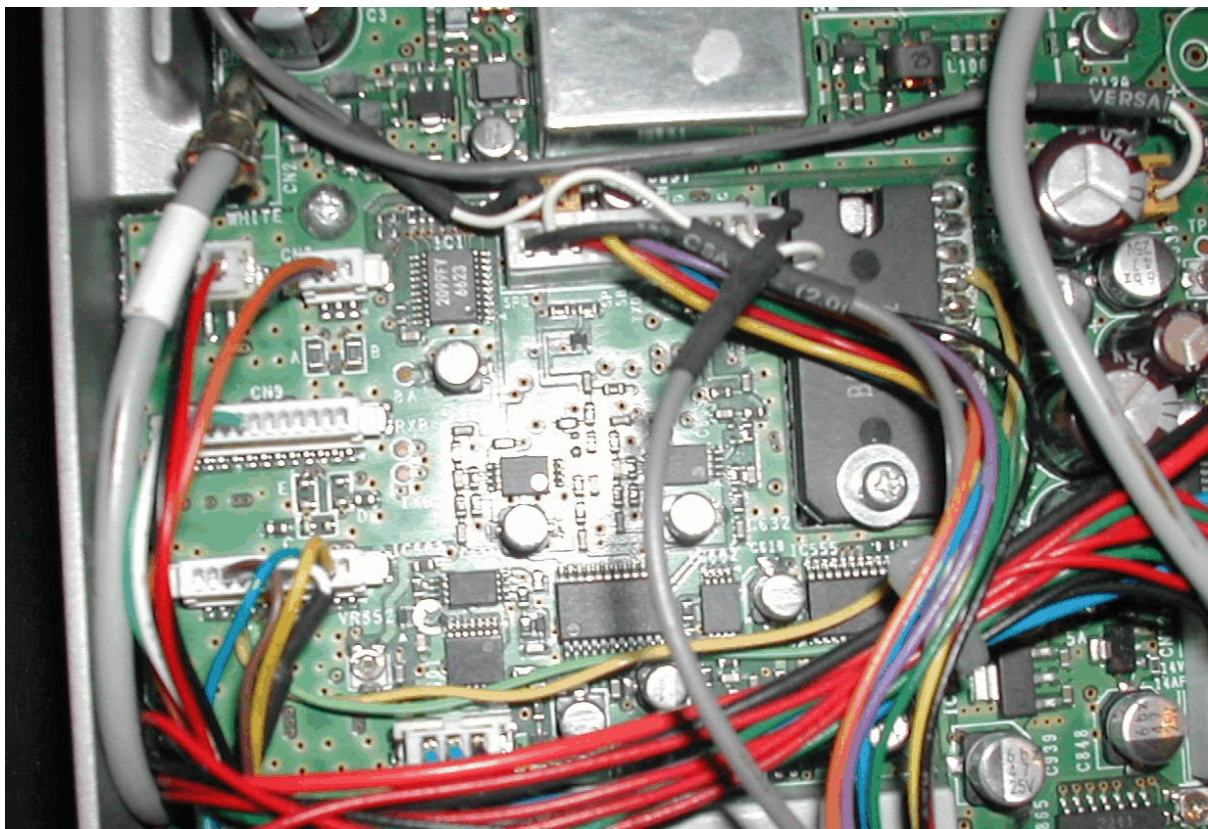
10) Plug the small 9 way connector of the GPS/RS232 cable into the 9 way connector on the SC90 board Making sure the wires will not be trapped by the cover when it is replaced.
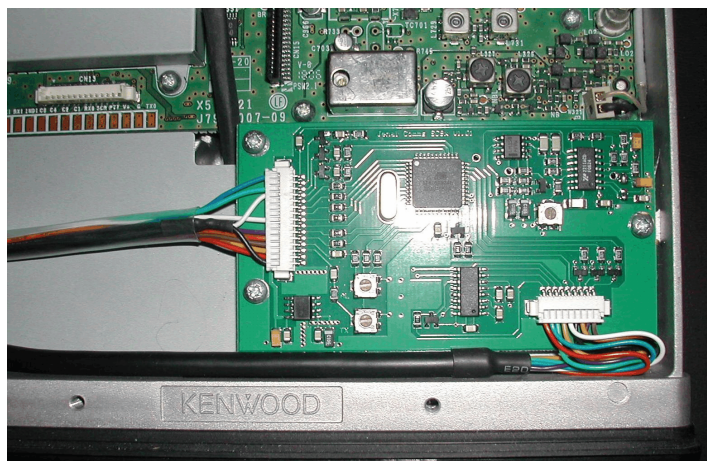
Run this cable down the left hand side of the radio to exit through the rear panel of the TK-90 (remove the exit hole sticky cover - item 23 - see Exploded View in the TK-90 Technical Manual). Ensure the cable tie on this cable is on the inside of the rear panel for strain relief purposes.
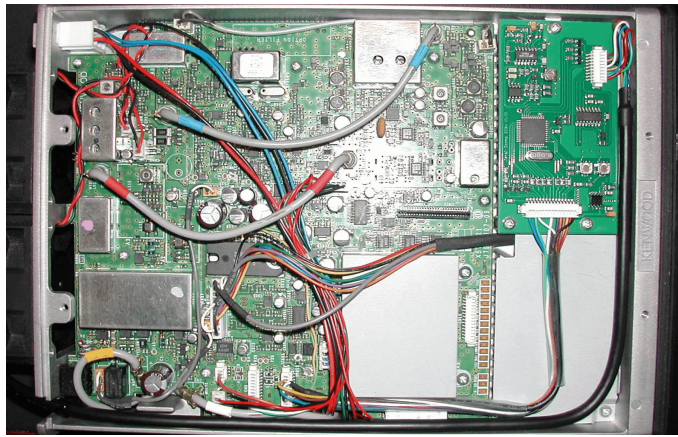
11) Power on the radio and wait until the message "SELF ID NNNN" displays and then clears. Set the Alarm Audio Level by adjusting VR3 (marked AL on the SC90 PCB) to give a suitable level when pressing keys on the microphone.

12) To set the Selcall Transmit Audio Level, connect a suitable power meter and dummy load to the antenna connection of the TK-90 then send a Selcall (see operating instructions). While a Selcall is being transmitted adjust VR2 (marked TX on the SC90 PCB) so that the power meter reads (preferably) between 30% and 40% of full power output for the selected channel transmit power (for example 1.5w to 2w on the 5w range, or 30w to 40w on the 100w range). Check the range of channels and power levels available to make sure that the output power is preferably not over 50% on any. If it is then reduce the Transmit Audio Level to below 40% and recheck.

Note that selcalls will get through even when voice calls will not so a low selcall power level is quite acceptable.

The SC90 is now ready to be programmed for use.

Programming the SC90

The SC90 is programmed using a PC running the SC90 programming software. All communication between the PC and the SC90 is by using RS232 serial data via the GPS/RS232 port on the SC90 and a serial port on the PC

Note: Before connecting the PC to the SC90 make sure that the Chassis of the TK-90 is connected to the Ground/Chassis of the PC - this will reduce the risk of damage by static discharge.

If using an USB to RS232 converter, please be aware that some do not work very well or may require other connections on their RS232 port to function successfully.

Connect the PC serial port to the SC90 GPS/RS232 port using a cable wired as follows:

```
              SC90                              PC
                2 ------------------------ 2
        DE9 Male    3 --------------------------- 3      DE9 Male
                5 ------------------------ 5
OR
              SC90                              PC
                2 ------------------------- 2
        DE9 Male    3 --------------------------- 3      DB25 Female
                5 ------------------------- 7
```
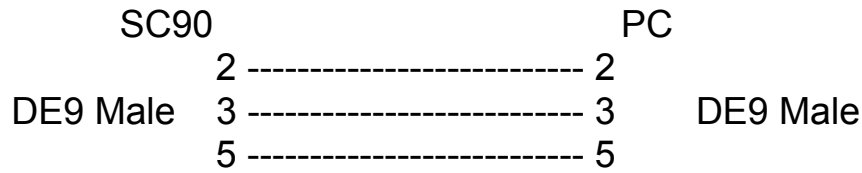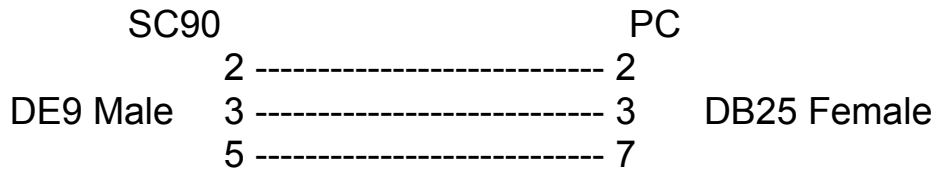
Do not make any other connections!

Run the SC90P100SETUP.EXE (or similar) programme to install the Jenal SC90 programming software on your PC.

Switch on the TK-90 and wait for the "SELF ID NNNN" message to be displayed and cleared. Run the SC90 programming software (similar to - Start > Programs > Jenal > SC90p100 > SC90p100), select the appropriate Com port on the PC and then click "Connect". If all is well the PC software will connect to the SC90, download it's settings and display them.

Change the settings to what you require (for example Selcall ID, Format, etc.) and then click on "Programme". The software should write the new information to the SC90 and verify it, and then show either a success message or an error message.

The verify button allows you to check that what is shown on the screen matches what is programmed in the SC90.

Once the SC90 is successfully programmed click on the exit button to exit the programme. This will also reset the SC90 board which will then generate a tone and show it's self ID on the TK-90 display.

Remove the SC90 GPS cable if not required for normal operation and replace the TK-90 top cover. The SC90/TK-90 is now ready for operation.

External Interface Connector

The external interface connector is a female 9 way D connector. This is used for the following:

> a) Connecting to a PC for programming the SC90
> b) Connecting to an external GPS unit (RS232 or TTL levels)
> c) Driving external indicators (or relays) for the Horn and Latch alarms
> d) Connecting to a push button or switch for sending emergency alarms (external emergency switch)

The following connections (pin numbers) are available on the female 9 way D connector:

> 1) TTL level input (see below)
> 2) RS232 output (transmit data from the SC90)
> 3) RS232 input (receive data into the SC90)
> 4) TTL>RS232 output (see below)
> 5) Ground
> 6) External Emergency switch input
> 7) Latch Alarm output
> 8) Horn Alarm output
> 9) Spare output

Connecting to a PC for programming the SC90

See page 6.5 for cable connections to a PC for programming.

Connecting to an external GPS unit (RS232 or TTL levels)

When using a GPS unit with RS232 output connect the ground to pin 5 of the 9 way D connector and the received data to pin 3.

When using a GPS unit with TTL level output connect the ground to pin 5 of the 9 way D connector and the received data to pin 1. Then connect pins 3 and 4 of the 9 way D connector together.

Driving external indicators (or relays) for the Horn and Latch alarms

Both these outputs are open-collector outputs rated at 30v DC 100mA.

Latch Alarm - Connect a relay or indicator between pin 7 of the 9 way D connector and a positive supply. Connect a protection diode across any

inductive load (for example a relay). The Latch Alarm is operated when a successful incoming call is received and remains operated until the alarm is cancelled by the operator. It is not activated by incoming emergency calls.

Horn Alarm - Connect a relay or indicator between pin 8 of the 9 way D connector and a positive supply. Connect a protection diode across any inductive load (for example a relay). The Horn Alarm is operated at the same time as the audio alarm sounds on the radio. It is not activated by incoming emergency calls.

External emergency switch

Connect either a push button or a toggle (on/off) switch between pin 6 of the 9 way D connector and ground (pin 5). The External Emergency Switch option has to be enabled in the programming to allow the use of the external switch.

If a push button is used then it has to be pressed for at least two (2) seconds to initiate the emergency call. The push button has to be pressed (for at least two (2) seconds each time) to re-send the emergency call.

When a toggle (on/off) switch is used then the operator must set the switch to "on" to initiate the emergency sequence. The SC90 will send a total of three (3) emergency calls with a silent period between calls of approximately thirty (30) seconds . To repeat this sequence the operator must set the switch to "off" and then back to "on".

The SC90 will send a GPS Emergency Call, if a functioning GPS unit is attached, otherwise it will send an Emergency Selcall.

Note that the radio is "silent" when an emergency call is sent using the external emergency switch (that is no tones are heard while the call is being sent).
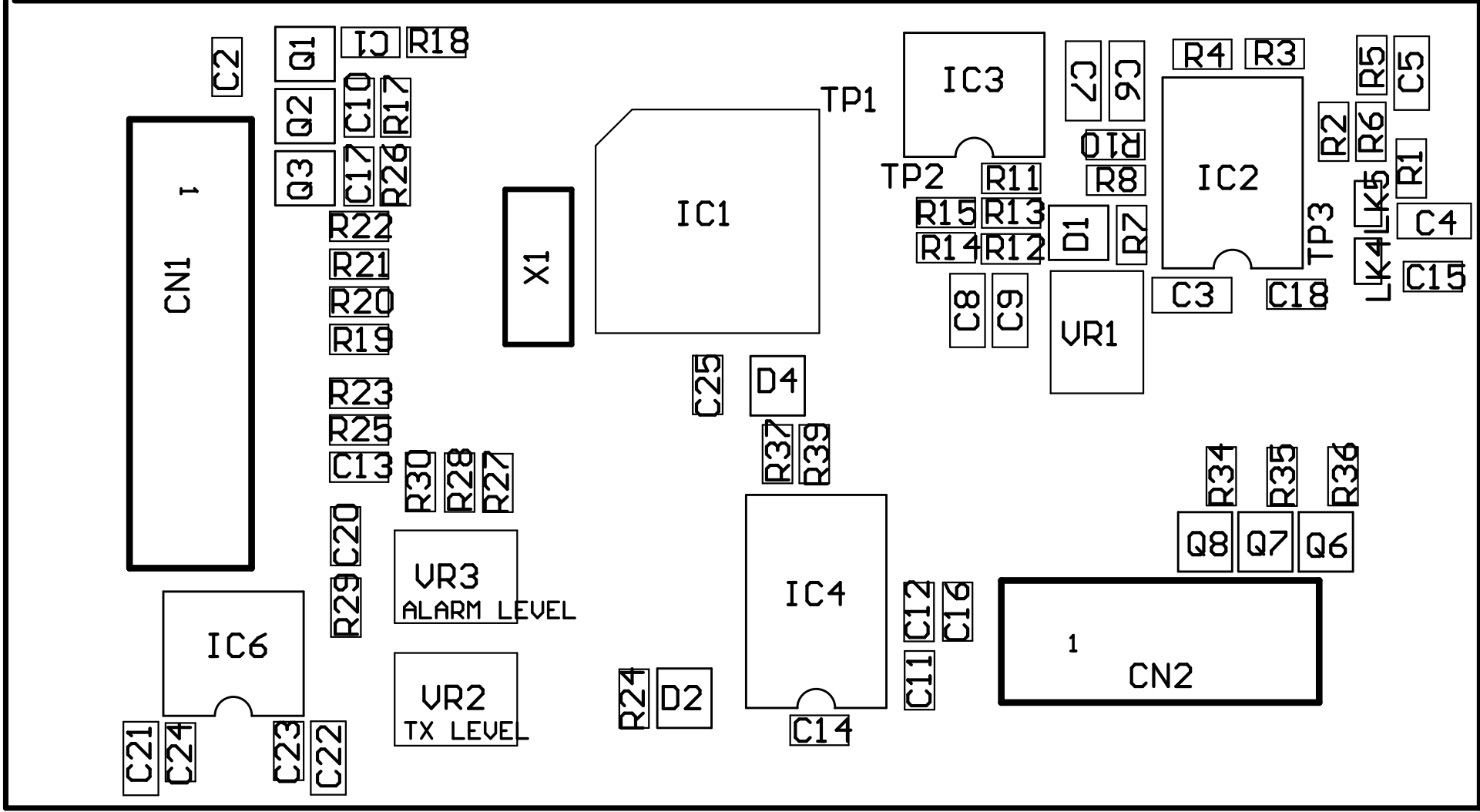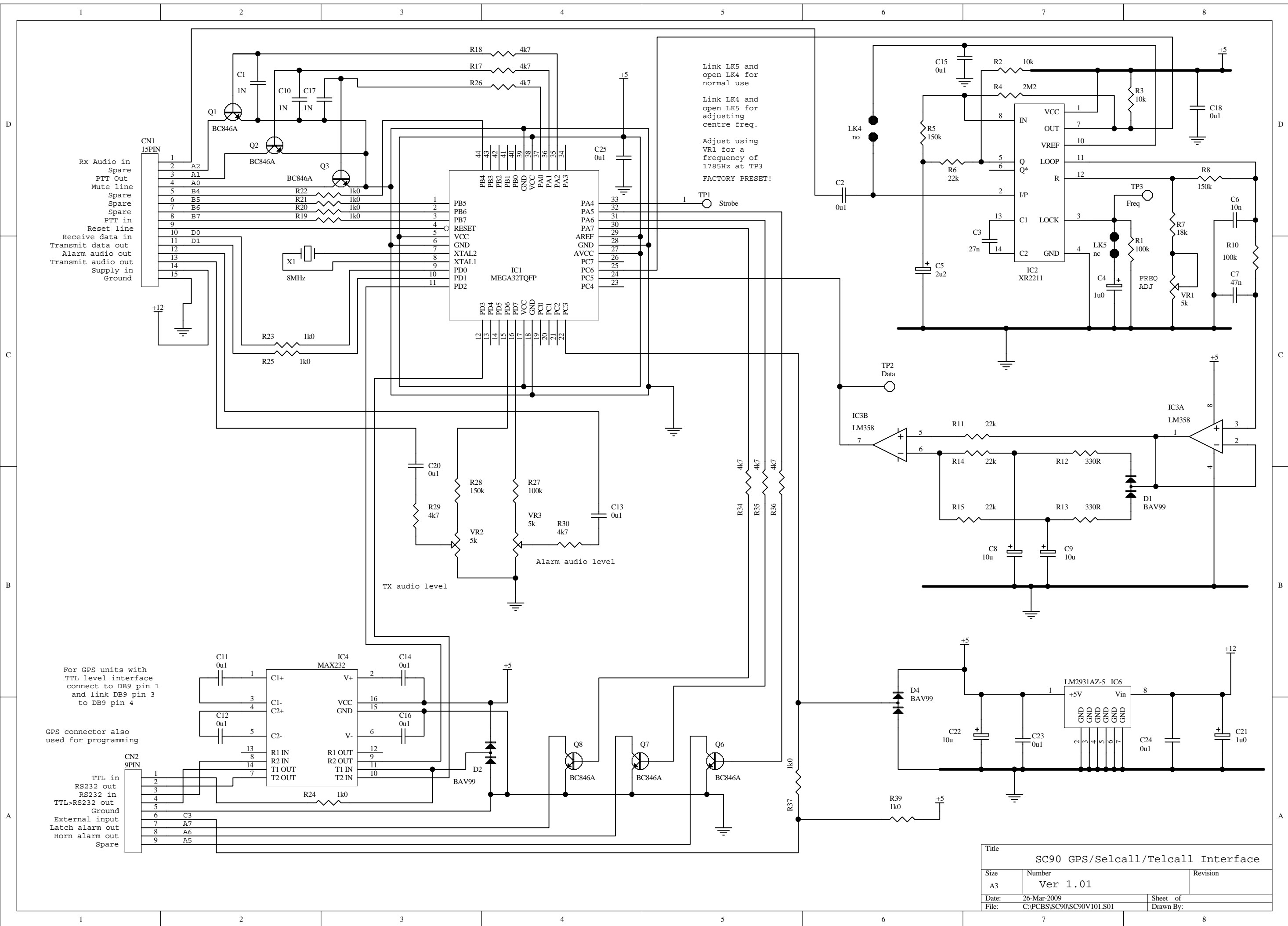
Link LK5 and open LK4 for normal use

Link LK4 and open LK5 for adjusting centre freq.

Adjust using VR1 for a frequency of 1785Hz at TP3

FACTORY PRESET!

CN1
15PIN

Rx Audio in — 1 — A2
Spare — 2 — A1
PTT Out — 3 — A0
Mute line — 4 — B4
Spare — 5 — B5
Spare — 6 — B6
Spare — 7 — B7
PTT in — 8
Reset line — 9
Receive data in — 10 — D0
Transmit data out — 11 — D1
Alarm audio out — 12
Transmit audio out — 13
Supply in — 14
Ground — 15

+12

C1 1N
C10 1N
C17 1N

Q1 BC846A
Q2 BC846A
Q3 BC846A

R18 4k7
R17 4k7
R26 4k7

R22 1k0
R21 1k0
R20 1k0
R19 1k0

R23 1k0
R25 1k0

X1 8MHz

IC1 MEGA32TQFP

PB4 PB3 PB2 PB1 PB0 GND VCC PA0 PA1 PA2 PA3
44 43 42 41 40 39 38 37 36 35 34

PB5 1
PB6 2
PB7 3
RESET 4
VCC 5
GND 6
XTAL2 7
XTAL1 8
PD0 9
PD1 10
PD2 11

PA4 33
PA5 32
PA6 31
PA7 30
AREF 29
GND 28
AVCC 27
PC7 26
PC6 25
PC5 24
PC4 23

PD3 PD4 PD5 PD6 PD7 VCC GND PC0 PC1 PC2 PC3
12 13 14 15 16 17 18 19 20 21 22

C25 0u1
+5

TP1 — 1 — Strobe

C20 0u1
R28 150k
R29 4k7
VR2 5k
TX audio level

R27 100k
VR3 5k
R30 4k7
C13 0u1
Alarm audio level

R34 4k7
R35 4k7
R36 4k7

TP2 Data

LK4 no
C15 0u1
R2 10k
R4 2M2
R3 10k
C18 0u1
+5

R5 150k
R6 22k
C2 0u1

IC2 XR2211
VCC 1
OUT 7
VREF 10
IN 8
Q 5
Q* 6
LOOP 11
R 12
I/P 2
C1 13
C2 14
LOCK 3
GND 4

C3 27n
C5 2u2

TP3 Freq
R8 150k
R7 18k
R1 100k
LK5 nc
VR1 5k
FREQ ADJ
C4 1u0
R10 100k
C6 10n
C7 47n

IC3B LM358
R11 22k
R14 22k
R15 22k
R12 330R
R13 330R
D1 BAV99
IC3A LM358
+5

C8 10u
C9 10u

For GPS units with TTL level interface connect to DB9 pin 1 and link DB9 pin 3 to DB9 pin 4

GPS connector also used for programming

CN2 9PIN

TTL in — 1
RS232 out — 2
RS232 in — 3
TTL>RS232 out — 4
Ground — 5
External input — 6 — C3
Latch alarm out — 7 — A7
Horn alarm out — 8 — A6
Spare — 9 — A5

C11 0u1
C12 0u1
IC4 MAX232
C1+ 1
C1- 3
C2+ 4
C2- 5
V+ 2
VCC 16
GND 15
V- 6
R1 IN 13
R2 IN 8
T1 OUT 14
T2 OUT 7
R1 OUT 12
R2 OUT 9
T1 IN 11
T2 IN 10
C14 0u1
C16 0u1
R24 1k0
D2 BAV99

+5

Q8 BC846A
Q7 BC846A
Q6 BC846A

R37 1k0
R39 1k0
+5

D4 BAV99
C22 10u
C23 0u1
LM2931AZ-5 IC6
+5V
Vin
GND GND GND GND GND GND
C24 0u1
C21 1u0
+12

Title
SC90 GPS/Selcall/Telcall Interface

Size A3
Number Ver 1.01
Revision

Date: 26-Mar-2009
File: C:\PCBS\SC90\SC90V101.S01
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