## A800-SIM3a System Splitting

**Issue No.:**    AN003-2

**Author:**        TEA Engineering

## General

System splitting on the A800-SIM allows ports 4, 5 & 6 to be split (disabled) from ports 1, 2, 3, 7 & 8, by sending selcall tones.  The functions of system splitting are provided by the use of a Sigtec S1530 Multi-Variable Signalling Encoder/Decoder selcall module.  Using the features of a Sigtec S1530, the A800-SIM3a can receive Selcall tones from the radio repeaters and links connected to any of the SIM ports.  By sending different selcall codes, it is possible to either link all the ports together or split ports 4, 5 & 6 from the other ports.

The A800-SIM System Splitting relies on a few things to operate correctly.  The first is the use of the RX Disable signal on ports 4, 5, & 6.  This signal is used to inhibit the T8X5 receiver modules audio output and its CTCSS decode output on pin 12.  The second thing is that it requires the T8X5 receivers RX Gate output on ports 4, 5, & 6 pin 11 to continue to operate.  These signals are used to control relays in the A800-SIM which switch audio to the S1530 selcall module, allowing it to receive selcall sequences even when 'Split'.  Because of these two points detailed above, it is not possible to connect equipment other than T8X5 receiver modules, unless the same behaviour can be emulated.

**Note:**

This job instruction is only applicable to A800-SIM version A8-SIM3a  PCB rev. # A8-SIM3a 23-09-98.  This job instruction assumes the technician has a sound working knowledge of the Tait A800-SIM, Tait T800 modules, Sigtec S1530 Selcall modules, and Sigtec S1530 programming software.  For more information on these products, refer to the relevant service manuals.

## Parts

The parts required for standard A800-SIM System Splitting (without any Options) are as per Table 1.

**Table 1.**

| Part No. | Description | Supplier | Qty. |
|---|---|---|---|
| A800-SIM | A800-SIM version A8-SIM3a (A800-SIM3a) | Tait | 1 |
| S1530 | Sigtec multi-variable signaling board | Sigtec | 1 |
| 179-351 | Relay, DPDT, 12Volt Coil | Farnell | 7 |
| 368-106 | Diodes, IN4148 | Farnell | 3 |
| Misc. | Miscellaneous workshop consumables, e.g. solder, wire, silicon tubing, etc. | N/A | - |

## Equipment Required

Some of the equipment that may be required is as per Table 2.  Other test equipment may also be required depending on individual system set ups and installations.

**Table 2.**

| Description |
| --- |
| Sigtec S1530 Programming Kit (inc. Sigtec S1530 Programming Software) |

For more information on the Sigtec S1530 and Sigtec S1530 Programming Kit and Programming Software, refer to the Sigtec S1530 documentation. The Sigtec 1530-10/21 Issue A S1530 Installation Instructions can be found at the rear of this application note.

## Procedure

1.  All T800 modules must be modified as per the current A800-SIM Service Manual (AM8-SIM).  This will ensure that the T8X5 Receiver modules RX Disable function is operating correctly.  The RX Disable function is used for the A800-SIM System Splitting operation.

2.  Cut the S1530 looms to approximately 50 mm long.  Fit the S1530 looms to SIM PCB (PL1 & PL2). Loom PL1 has 14 wires and loom PL2 has 13 wires.  Refer to the S1530 documentation to identify pin 1 of PL1 & PL2.

3.  Program the S1530 module.  Refer to the section 'S1530 Programming' for more information.

4.  On the A800-SIM3a PCB, remove links LK1, LK2 and LK3.

5.  On the A800-SIM3a PCB, set LK4 for the desired default power up split status of the SIM. The normal setting for most systems is for a default power up status of un-split (joined) which is a setting of LK4 1-2.

**Table 3.**

| LK4 Setting | Default Power Up Split Status |
| --- | --- |
| *1-2* | *Un-Split (Ports 4, 5 & 6 Connected)* |
| 2-3 | Split (Ports 4, 5 & 6 disabled) |

6.  The RX Ports that are split (ports 4,5 or 6) have to be CTCSS decode guarded.  Setting links LK74, LK75 and LK76 to 2-3 does this.

7.  Remove the A800-SIM3a PCB from its A800-SIM 2RU 19" rack enclosure.  This is done by unplugging the 16 way ribbon cables from ports RX1 to RX8 and TX1 to TX8.  Then remove the six M3 x 6mm Pan Pozi screws holding the PCB down.

8.  On the A800-SIM3a  PCB, fit the following seven relays: #RL1, #RL2, #RL3, #RL4, #RL10, #RL11, #RL24.

9.  On the top of the PCB, cut the three tracks shown in Fig. 1.
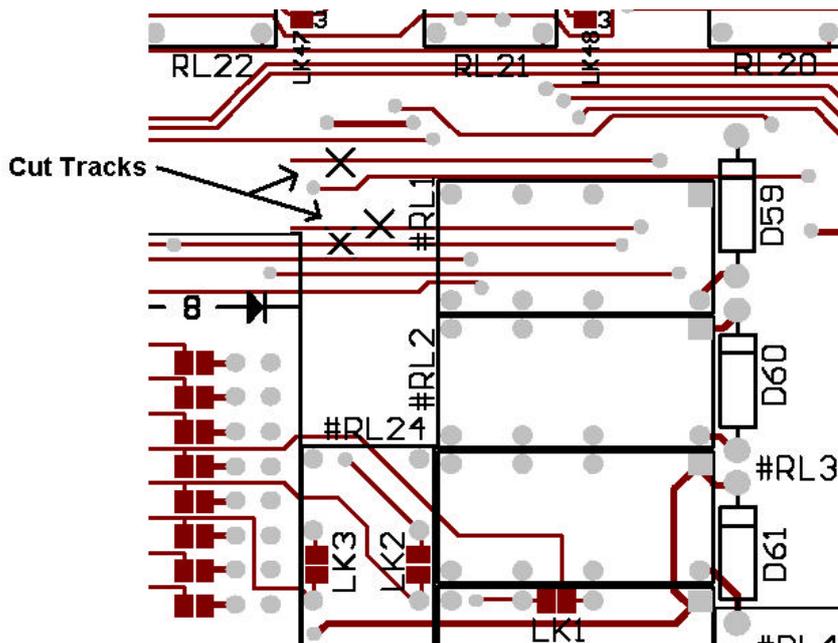


Fig: 1.

10. On the A800-SIM3a  PCB, place the wire jumpers as shown in Fig 2.  These links connect the coils of relays RL1, 2 & 3 to the RX Gate inputs on pin 11 of ports 4, 5 & 6, which allows the RXGATE inputs to directly control these relays and switch audio to the S1530 selcall module.  Connections should be made on the solder side.  These links are equivalent to making connections between the following points;

- RX4/11 to the anode of D59

- RX5/11 to the anode of D60

- RX6/11 to the anode of D61
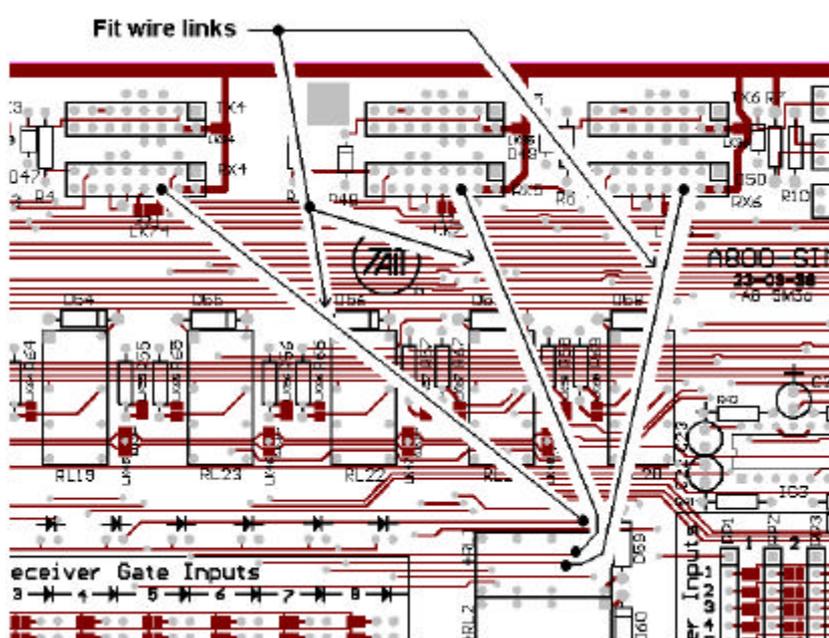


Fig 2.

11. On the bottom of the A800-SIM3a PCB, cut the three tracks and add the three diodes as indicated in Fig 3. This isolates the Port 4, 5, & 6 RX Disable lines from each other and the system splitting circuity. This is important if any of these ports need to have their RX Disable active for other purposes.
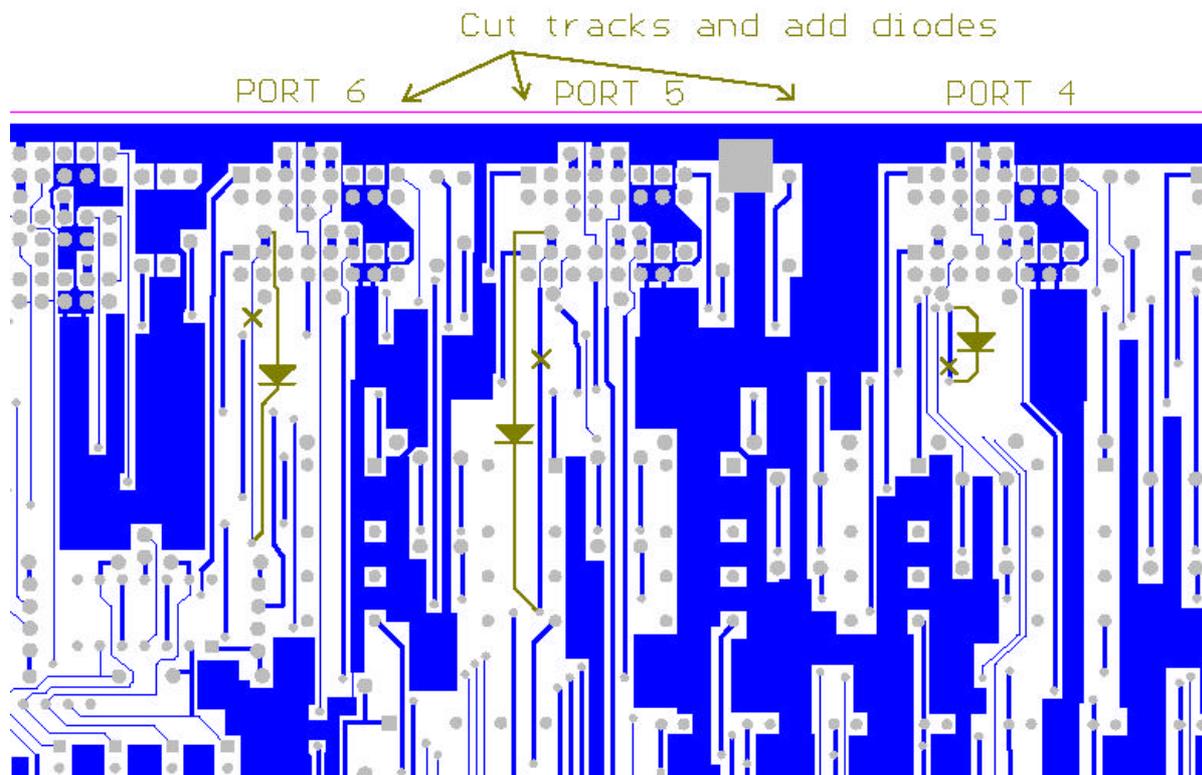


**Fig 3.**

12. Refit the A800-SIM3a PCB to the A800-SIM 2RU 19" rack enclosure, in the reverse sequence to Step 7.

13. Connect the programmed S1530 module to the connectors installed in Step 2, and using the double-sided tape provided with the S1530, attach the module to the space provided on the A800-SIM3a PCB. Refer to Fig 4.
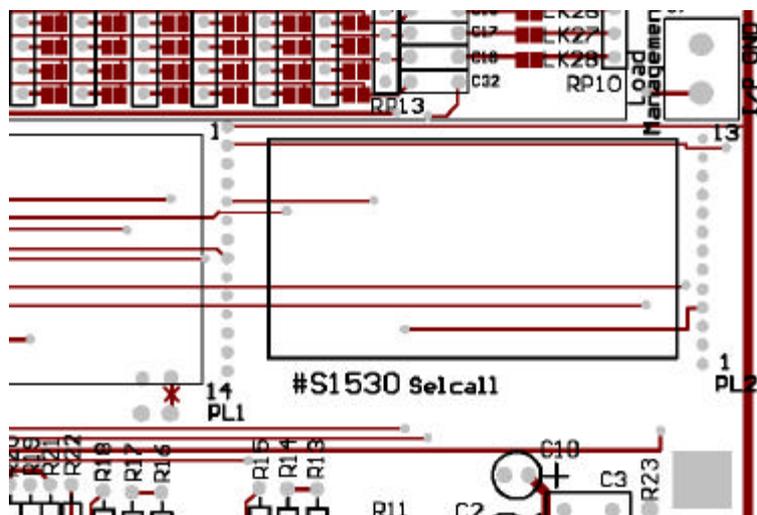


Fig 4.

## S1530 Programming

This section is to detail the various programming option and the configuration for the S1530 module. It does not describe any of the processes involved in the actual programming procedure. For more information on the programming of S1530 modules, refer to Sigtec S1530 documentation.

The Sigtec S1530 module Auxiliary Interface connector connects to the A800-SIM PCB. This is at PL2 on the S1530 and the A800-SIM PCB. Refer to Table 4 for a description of each of the S1530 PL2 connections and the effects on the A800-SIM.

**Table 4**

| Hex Port | S1530 Program Hex Port Digit | PL2 Pin | S1530 Input/Output | Controls in A800-SIM | A800-SIM Function |
|:---:|:---:|:---:|:---:|:---:|:---:|
| 2 | I | 8 | Output | Splitting | Depends on LK4 |
| 2 | I | 7 | Output | External System Splitting Input (Load Management) | Hi = Ext Enabled |
| 3 | J | 4 | Input | N/A | N/A |
| 3 | J | 3 | Input | N/A | N/A |

Included with this application note should be a file named AN003-02.zip, which contains example programming files for the Sigtec S1530 Selcall module, and the Tait T2020. You will require a program such as Winzip to unzip these files. Winzip can be obtained from http://www.winzip.com. If you did not receive the file AN003-02.zip, you can obtain a copy by visiting the Tait Australia web site at http://www.taitworld.com/australia/ or contacting your local Tait representative.

The example Sigtec S1530 programming file is AN003-02.set. The example Tait T2020 programming file is AN003-02.dat.

If you refer to the S1530 programming file, you will see an example of one possible set up for the S1530 module.

If you refer to the T2020 programming file, you will see how Alpha Symbols and Status Labels have been employed to simplify control of the A800-SIM splitting mode. With this type of set up, an Alpha Symbol can simply be accessed and sent to set the mode of the A800-SIM. If a 'Status' Alpha Symbols is sent, the S1530 will acknowledge with the current status of the A800-SIM System Splitting.

Table 5 and Table 6 list the functions of each A800-SIM Splitting Modes.  This is only an example of one possible operation of the A800-SIM System Splitting.  As stated, the actual operation will depend on the programming of the S1530 module.  For more information on the S1530, refer to the Sigtec S1530 documentation.

### Table 5 - LK4 Set to 1-2  Default Un-Split

| Label | Function | Code | S1530 Example |
|-------|----------|------|---------------|
| Un-Split | A800-SIM has Port 4, 5, & 6 joined to all other Ports.  External System Splitting Input (Load Management) is disabled. | XXXX0 | 4091I<br><br>I = Hex Port 2 |
| Split | A800-SIM has Port 4, 5, & 6 split from all other Ports. External System Splitting Input (Load Management) is disabled. | XXXX1 | 4091I<br><br>I = Hex Port 2 |
| Auto | A800-SIM has its External System Splitting Input (Load Management) is enabled.  A800-SIM Split status will depend of this input.  Hi (O/C) = Un-Split.  Low (pulled to ground)= Split. | XXXX2 | 4091I<br><br>I = Hex Port 2 |
| Status | A800-SIM replies with its 'Individual' decode code, with a Status digit on the end.  The Status digit tells the current A800-SIM Split Status, as per the code suffixes listed above. | XXXXX | 40001J<br><br>J = Hex Port 3 |

**Note**:  All other selcall code suffixes are invalid.

### Table 6 - LK4 Set to 2-3  Default Split

| Label | Function | Code | Code |
|-------|----------|------|------|
| Split | A800-SIM has Port 4, 5, & 6 split from all other Ports.  External System Splitting Input (Load Management) is disabled. | XXXX0 | 4091I<br><br>I = Hex Port 2 |
| Un-Split | A800-SIM has Port 4, 5, & 6 joined to all other Ports. External System Splitting Input (Load Management) is disabled. | XXXX1 | 4091I<br><br>I = Hex Port 2 |
| Auto | A800-SIM has its External System Splitting Input (Load Management) is enabled.  A800-SIM Split status will depend of this input.  Hi (O/C) = Split. Low (pulled to ground)= Un-Split. | XXXX3 | 4091I<br><br>I = Hex Port 2 |
| Status | A800-SIM replies with its 'Individual' decode code, with a Status digit on the end.  The Status digit tells the current A800-SIM Split Status, as per the code suffixes listed above. | XXXXX | 40000J<br><br>J = Hex Port 3 |

**Note**:  All other selcall code suffixes are invalid.

## Testing

To test an A800-SIM which has been set up for System Splitting, it is necessary to be able to send the correct selcall sequences to the unit. This can be achieved in a number of ways. The primary method of doing this is to use a Signal Generator that is capable of generating selcall tone sequences. The signal generator can then be connected to any of the receivers connected to any of the A800-SIM ports, and used accordingly. An alternative method could be to use a Tait T2020 mobile radios suitably programmed with the required selcall codes and set to the same frequencies as one of the bases connected to the A800-SIM.

The testing of an A800-SIM with System Splitting will somewhat depend on the programming of the S1530 module and the setting of the A800-SIM link LK4. As such, you should keep this in mind when completing any of the following steps. Refer to the section 'S1530 Programming' for more information.

1. Set up the A800-SIM for testing. This means connect power to the A800-SIM, and whatever other radio modules, test equipment, etc, that you are going to use.

2. Test that the A800-SIM is operating in a normal manner. Refer to the A8M-SIM service manual for standard information on the A800-SIM.

3. Generate a selcall sequence for a 'Split' command to the A800-SIM via ports 1, 2, 3, 7, and 8.

4. Test that the A800-SIM has now disabled any T800 modules connected to ports 4, 5 or 6.

5. Test that any T800 module connected to ports 1, 2, 3, 7, and 8 is working normally.

6. Generate a selcall sequence for a 'Un-Split' command to the A800-SIM via ports 1, 2, 3, 7, and 8.

7. Test that the A800-SIM is operating in a normal manner.

8. Generate a selcall sequence for a 'Split' command to the A800-SIM via ports 4, 5, & 6.

9. Test that the A800-SIM has now disabled any T800 modules connected to ports 4, 5 or 6.

10. Test that any T800 module connected to ports 1, 2, 3, 7, and 8 is working normally.

11. Generate a selcall sequence for a 'Un-Split' command to the A800-SIM via ports 4, 5, & 6.

12. Test that the A800-SIM is operating in a normal manner.

13. Generate a selcall sequence for a 'Un-Split' command to the A800-SIM via ports 1, 2, 3, 7, and 8.

14. Generate a selcall sequence for a 'Auto' command to the A800-SIM via any port.

15. Connect the External System Splitting Input (Load Management) to ground.

16. Test that the A800-SIM has now disabled any T800 modules connected to ports 4, 5 or 6.

17. Remove the ground from the 'Load Management' External System Splitting Input.

18. Test that the A800-SIM is operating in a normal manner.

## Options

The following are optional configurations that can be set up on a A800-SIM with System Splitting. When an A800-SIM is being configured for System Splitting by the Tait Workshops, none of these options will be included unless specified on the purchase order, and suitable time allocated to complete the modifications.

### Improved S1530 Selcall Decoding

When an A800-SIM is set up for System Splitting, the Sigtec S1530 module provides selcall encoding and decoding for all of the A800-SIM ports. As such, the S1530 can receive audio from up to eight different sources (ports 1 to 8). When an A800-SIM has multiple receivers connected to its ports, audio can come from multiple sources at once. If the S1530 is receiving audio from multiple sources, it can sometimes have trouble decoding. This is most evident with audio from ports 4 to 6, as this audio normally comes from the receivers discriminator and has CTCSS tone on it. When this tone is present (along with other possible in-band audio), the S1530 module may not decode selcall every time. This does not normally pose a problem, as a selcall not acknowledged can always be resent.

If you wish to improve the S1530's decoding, a modification can be carried out in the T800 receiver modules connected to the A800-SIM ports 4, 5, & 6. This modification changes the audio supplied to the A800-SIM from discriminator audio to clean audio. This is to improve the S1530 Selcall module decoding, even if other receivers on the A800-SIM are currently receiving a carrier.

For information on the T8X5 Receivers, refer to the relevant service manuals.

### Table 7 – Parts (Per T8X5 Receiver).

| Part No. | Description | Supplier | Qty. |
|----------|-------------|----------|------|
| 228-618 | 10uF 35V Electrolytic Capacitor | Farnell | 1 |
| Misc. | Miscellaneous workshop consumables, e.g. solder, wire, silicon tubing, etc. | N/A | - |

1. In the T8X5 Receiver module, lift pin6 on the 1st D Range.

2. Connect the positive leg of a 10uF 35V electrolytic capacitor to the now disconnected pin 6 of the 1st D Range.

3. Connect a wire to the negative leg of the 10uF capacitor from Step 2. Insulate the connection with silicon tubing.

4. For a T800 Series II T8X5 Receiver, connect the other end of the wire to pad P256 (speech no tone).

5. For a T800 Series I T8X5 Receiver, connect the other end of the wire to AUDIO2 pad PAD122 (speech no tone).

6. Fully test the operation of the A800-SIM and its System Splitting. Refer to the section 'Testing'.

### Front Panel Visual Indicator for System Split Status

This details how to install a LED to the front of the A800-SIM to provide a visual indication of the current status of the A800-SIM splitting.  The exact details of this modification are left up to the technician installing it, as it somewhat depends on the parts being used.

1.  Dismantle the A800-SIM.

2.  Drill a suitably sized hole in the front on the A800-SIM to mount a LED bezel.

3.  Install the LED bezel and fit a LED to it.

4.  Connect a wire to the cathode of the LED.  Insulate the connection with silicon tubing.  Connect the other end of the wire to ground on the A800-SIM PCB.  Refer to Fig 5.

5.  Connect the anode of the LED to a 1K8 resistor.

6.  Connect a wire to the other side of the 1.8K resistor.  Insulate the connection with silicon tubing. Connect the other end of the wire to the through hole via to the right of #RL13.  Refer to Fig 5.



LED Anode via 1.8K Res.    LED Cathode
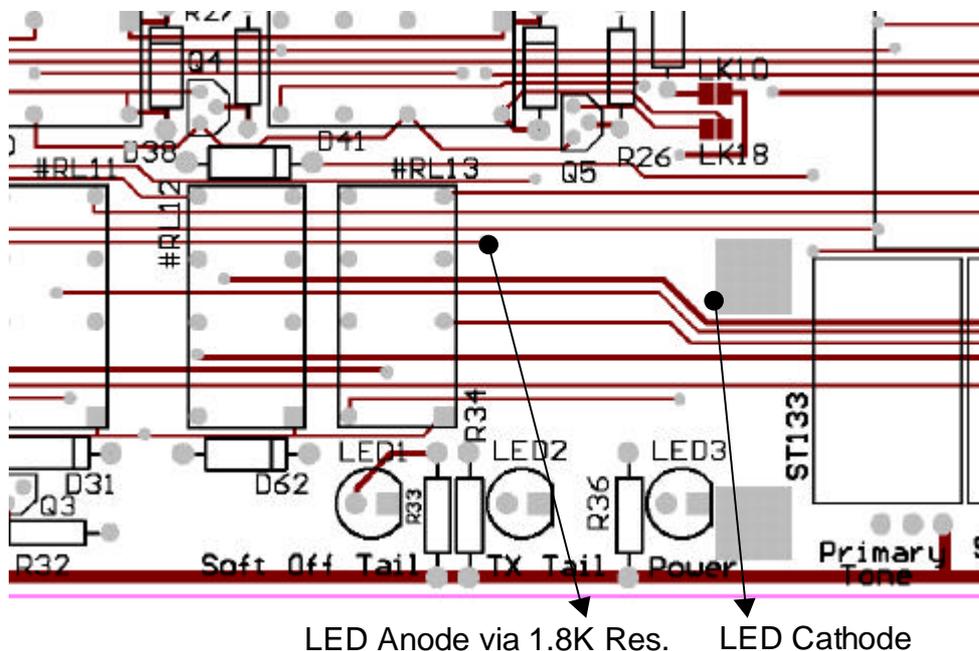
**Fig 5.**

7.  On the front of the A800-SIM, adjacent to the installed LED, fit a label with the words:

SYSTEM UN-SPLIT

8.  Fully test the operation of the A800-SIM and its System Splitting.  Test the A800-SIM in split and un-split modes to ensure correct operation of the LED.  The LED should be on when A800-SIM is un-split.  Refer to the section 'Testing'.

### Enable/Disable the TX Tail & Vote Pulse Timer in Sympathy with System Splitting.

This section details modifications to enable/disable the TX Tail & Vote Pulse timer in sympathy with system splitting. This modification is to allow an A800-SIM to effectively assume a hub mode of operation when it is split off from the systems real hub/master site. In other words, the TX Tail Timer & Vote Pulse Generator would not work if the A800-SIM was linked, but would work if it was split.

An important thing to understand with a system that would operate as described above, is that there may be some strange effects on mobile that are voting. If a mobile is in a vote group of all of the channels in a system, and the system is split into two separate parts, the mobile will not necessarily vote onto the correct part of the system. Each mobile would need to be changed from that vote group to a different channel or vote group to keep operating in a controlled fashion.

If the A800-SIM to be modified will operate as a stand alone site once it is split then it is not necessary to do the part of the modification for the vote pulse timer.

### Table 8 – Parts

| Part No. | Description | Supplier | Qty. |
|---|---|---|---|
| 368-106 | IN4148 Diode | Farnell | 2 |
| Misc. | Miscellaneous workshop consumables, e.g. solder, etc. | N/A | - |

The following steps assume the link LK4 is set 1-2 position and refer to connections made to LK4 pad 3. If the link LK4 is set to 2-3 position, make all connections to LK4 pad 1 instead. For more information on LK4, refer to the A800-SIM service manual.

1.  Add a diode to the top of the A800-SIM PCB, cathode to link LK4 pad 3 and the anode to D28 anode. Refer to Fig. 6. Adding this diode makes the splitting relay #RL10 control the relay RL8. When #RL10 is inactive (system un-split) it pulls relay RL8 on permanently via the diode. While relay RL8 is on the SIM TX Tail circuits are disconnected from the PTT Outputs.

2.  Add a diode to the top of the A800-SIM PCB, cathode to link LK4 pad 3 and anode to D39 anode. Refer to Fig. 6. Adding this diode makes the splitting relay #RL10 control the voting pulse timer reset line. When #RL10 is inactive (system un-split) its normally closed contact pulls the voting pulse timer reset line permanently low via the diode. This prevents the vote pulse timer from generating voting pulses.
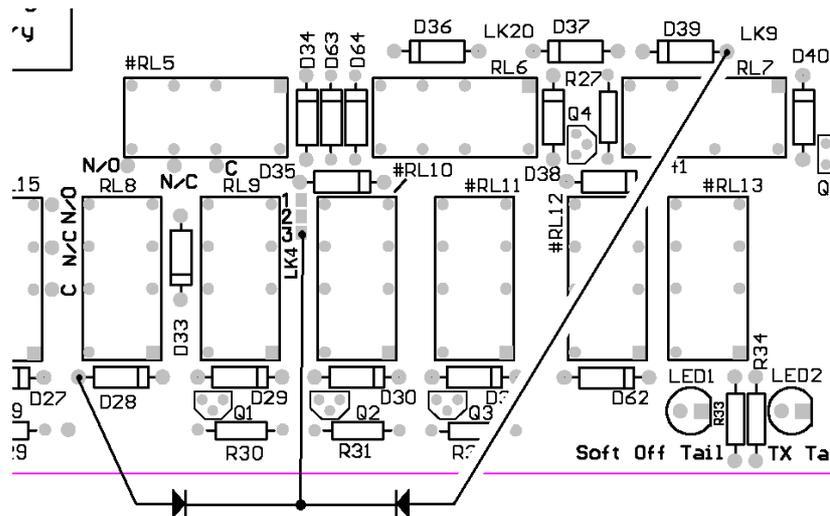


**Fig 6**

3.  Configure the A800-SIM as a hub system, i.e. setup the links for TX Tail operation and if required, for voting pulses. For information on setting up the A800-SIM, refer to the A800-SIM service manual AM8-SIM.pdf.

4.  Fully test the operation of the A800-SIM and its System Splitting. Refer to the section 'Testing'.

**Enable System Split Link to Operate as Carrier Gate in System Linked Mode**

Under some circumstances, it may be necessary to make a link connected to one of the splitting ports (ports 4, 5, & 6) to operate in carrier mode, as opposed to CTCSS tone guarded mode as described in the section Procedures Step 6.  For example, when system splitting is used, the soft off from a remote hub site will not pass through a split link (ports 4, 5, or 6), even when the A800-SIM splitting is in Un-Split mode.  This is because the split link is setup as CTCSS tone guarded, so it will not pass carriers without CTCSS.

If it is imperative that a split link needs to operate in carrier mode, carry out the following steps for the port that that link is connect to.  The following steps assume the use of port 4.  If ports 5 or 6 are to be used instead, then substitute the appropriate links etc for those ports.

1.   In the A800-SIM, remove all solder links from the link LK74  (LK75 for port 5, LK76 for port 6).

2.   Remove the A800-SIM3a PCB from its A800-SIM 2RU 19" rack enclosure.  This is done by unplugging the 16 way ribbon cables from ports RX1 to RX8 and TX1 to TX8.  Then remove the six M3 x 6mm Pan Pozi screws holding the PCB down.

3.   On the bottom of the A800-SIM PCB, solder a wire from port 4 RX4 pin 11.  This is the RXGATE input for port 4, and is equivalent to LK74 pad 1.

4.   Connect the other end of this wire to RL10 N/C2.  Refer to Fig 7.

5.   On the bottom of the A800-SIM PCB, solder a wire to the anode of the diode D54.  This is equivalent to LK74 pad 2.

6.   Connect the other end of this wire to RL10 C2.  Refer to Fig 7.

7.   Refit the A800-SIM3a PCB to the A800-SIM 2RU 19" rack enclosure, in the reverse sequence to Step 2.

8.   Fully test the operation of the A800-SIM and its System Splitting.  Refer to the section 'Testing'.

**RL10**

N/O2

N/C2

C2
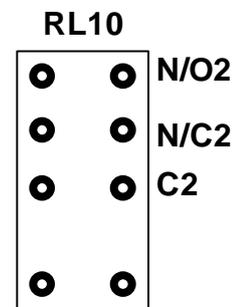
**View from top of PCB**

**Fig 7.**

### S1530 Selcall Acknowledge Tones on Split Links

This allows the Sigtec S1530 selcall board to send back it's acknowledge tones on any of the A800-SIM ports whenever an Un-Split or Split selcall command is issued to the A800-SIM. This acknowledgment is an indication that the command has been performed correctly.

As standard the A800-SIM only routes the TX Key signal from the S1530 Selcall module to the TX Tail Timer & Soft Off Timer circuits. As such, this signal will only apply a TX Key signal to any of the A800-SIM ports if they are selected on the PTT Outputs (Tail) matrix. Ports are only normally selected on the PTT Outputs (Tail) matrix at hub sites.

As such, this modification can be carried out for any A800-SIM port that has equipment connected to it, and is not selected on the PTT Outputs (Tail) matrix.

The following steps describe the modification for port 4. To modify other ports, substitute the appropriate points for those ports.

### Table 9 – Parts (Per A800-SIM port being done)

| Part No. | Description | Supplier | Qty. |
|----------|-------------|----------|------|
| 368-106 | IN4148 Diode | Farnell | 1 |
| Misc. | Miscellaneous workshop consumables, e.g. solder, etc. | N/A | - |

1. Remove the A800-SIM3a PCB from its A800-SIM 2RU 19" rack enclosure. This is done by unplugging the 16 way ribbon cables from ports RX1 to RX8 and TX1 to TX8. Then remove the six M3 x 6mm Pan Pozi screws holding the PCB down.

2. On the bottom of the A800-SIM PCB, connect the cathode of a 1N1848 diode to the cathode of diode D41. The diode D41 can be found just behind the relay #RL12.

3. Connect a wire to the anode of the diode. Insulate the connection with silicon tubing.

4. Connect the other end of the wire to port 4 TX4 pin 13 TXKEY.

5. Parallel diodes can be installed from D41 to any of the other A800-SIM ports where acknowledgment tones are required. Standard procedure is to send selcall acknowledgments on all used ports of the A800-SIM.

6. Refit the A800-SIM3a PCB to the A800-SIM 2RU 19" rack enclosure, in the reverse sequence to Step 1.

7. Fully test the operation of the A800-SIM and its System Splitting. Refer to the section 'Testing'.


## Attachments

A8-SIM3a-05-01_AN003.pdf          A800-SIM3a Circuit 5. With AN003 Procedure steps shown.

A8-SIM3a-06-01_AN003.pdf          A800-SIM3a Circuit 6. With AN003 Procedure steps shown.

1530-10/21 Issue A          Sigtec S1530 Installation Instructions

**Description**

**Circuit Reference Symbols**

X Y Z

- Sheet Reference Horizontal (1 to 8)
- Sheet Reference Vertical (A to D)
- Circuit Sheet Number (Sheet 1 to 8)

Example     3 A 4

- Sheet Reference Horizontal 4
- Sheet Reference Vertical A
- Circuit Sheet Number 3

## PORT 3

A800-SIM Rear Panel
D-range Connector

A800-SIM PCB 16 Way
IDC Header & Plug

RX3 DB15F
16 Way IDC Cable
RX3 IDC16

RXAF — 9
+13.8V Out — 2
RXDISABLE — 10
+13.8V Out — 3
N/C — 11
RXGATE — 4
GND — 12
RXDEC — 5
N/C — 13
RELAY GND — 6
N/C — 14
GND — 7
RXAF_TONE — 15
GND — 8
SPEAKER_AF — 16

+12   D53   RL18   D167

LK73   RXGATE_3 Souce

LK63   RXAF_TONE_3 Level
R63   3K3
R3   100K

RXAF_3 → 3C8   **RX Line 3 Audio Signal to Audio Matrix**
RXGATE_3 → 2D8   **RX Gate 3 Signal to Gate Matrix**
VOTE_RESET → 1B3 4D5 6D5 7D5 8D5   **Reset Line to Vote Pulse Generator**
RXAF_TONE → 1D4 4D5 6D5 7D5 8D5   **Received CTCSS Audio to CTCSS Relay**
RXDEC_3 → 1C1 3B1   **RX Decode 3 Input to Receiver Primary Tone Input Diode Matrix**
SPEAKER_AF → 3A5 4D5 6D5 7D5 8D5   **RX Speaker Input to Speaker Amp**

TX3 DB15F
16 Way IDC Cable
TX3 IDC16

TXAF — 1
+13.8V Out — 9
MIC_PTT — 2
+13.8V Out — 10
N/C — 3
N/C — 11
GND — 4
N/C — 12
TXENABLE — 5
TXKEY — 13
AUDIO1 — 6
GND — 14
AUDIO2 — 7
GND — 15
ENC_TONE — 8

+12 LK33   TX3 Power Link   D46

TXAF_TONE_3 Level
LK53   LK43
R53 3K3
TXAF_TONE_3 Source

TXAF_3 → 3D8   **TX Line 3 Audio Signal from Audio Matrix**
TXKEY_NOTAIL → 1C4 4C5 6C5 7C5 8C5   **Local Microphone PTT Input to TX Tail Circuit (Keys TX with CTCSS Tone)**
TXKEY_3 → 1C8 2D1   **TX Key 3 Signal from Gate Matrix & TX Tail Circuit**
ENC_TONE_A → 1C5 4C5 6C5 7C5 8C5   **CTCSS Encode Tone A from CTCSS Relay**
ENC_TONE_B → 1D4 4C5 6C5 7C5 8C5   **CTCSS Encode Tone B from CTCSS Relay**

A800-SIM Rear Panel
D-range Connector

A800-SIM PCB 16 Way
IDC Header & Plug

Diode Added Step 11

D168

RXAF_4 → 3C8   **RX Line 4 Audio Signal to Audio Matrix**
RX_DIS → 2B1 6D5   **RX Disable to Splitting Circuit**

## PORT 4

RX4 DB15F
16 Way IDC Cable
RX4 IDC16

RXAF — 9
+13.8V Out — 2
RXDISABLE — 10
+13.8V Out — 3
N/C — 11
RXGATE — 4
GND — 12
RXDEC — 5
N/C — 13
RELAY GND — 6
AUDIO 1 — 14
GND — 7
RXAF_TONE — 15
GND — 8
SPEAKER_AF — 16

+12   D54   RL19   Track Cut Step 9   D59   +13.8   #RL1

* LK74
RXGATE_4 Source
Wire Link Step 10

LK64   RXAF_TONE_4 Level
R64   3K3
R4   100K

RXGATE_4 → 2D8   **RX Gate 4 Signal to RX Gate Matrix**
RX_DISC_4 → 3D8   **RX Discriminator Audio 4 Signal to Secall Circuit**
RXDEC_4 → 1C1   **RX Decode 4 Input to Receiver Primary Tone Input Diode Matrix**

TX4 DB15F
16 Way IDC Cable
TX4 IDC16

TXAF — 1
+13.8V Out — 9
MIC_PTT — 2
+13.8V Out — 10
N/C — 3
N/C — 11
GND — 4
N/C — 12
TXENABLE — 5
TXKEY — 13
AUDIO1 — 6
GND — 14
AUDIO2 — 7
GND — 15
ENC_TONE — 8

+12 LK34   TX4 Power Link   D47

TXAF_TONE_4 Level
LK54   LK44
R54 3K3
TXAF_TONE_4 Source

TXAF_4 → 3D8   **TX Line 4 Audio Signal from Audio Matrix**
TXKEY_4 → 1C8 2D1   **TX Key 4 Signal from Gate Matrix & TX Tail Circuit**

**Note:** Components marked # are not normally fitted.
Solder links shown in their default positions.
The pin out patterns for the 16 Way IDC Connectors show a non standard pin layout to suit DB15 Connector Pin Layout.

**A800-SIM Rear Panel D-range Connector**

**A800-SIM PCB 16 Way IDC Header & Plug**

Diode Added Step 11

**PORT 5**

RX5 DB15F / RX5 IDC16

Track Cut Step 9

Wire Link Step 10

RXGATE_5 Souce

LK65 RXAF_TONE_5 Level

R65 3K3 / R5 100K

TX5 DB15F / TX5 IDC16

LK35 TX5 Power Link

TXAF_TONE_5 Level LK55 LK45

R55 3K3

TXAF_TONE_5 Source

**PORT 6**

Diode Added Step 11

RX6 DB15F / RX6 IDC16

Track Cut Step 9

Wire Link Step 10

RXGATE_6 Source

LK66 RXAF_TONE_6 Level

R66 3K3 / R6 100K

TX6 DB15F / TX6 IDC16

LK36 TX4 Power Link

TXAF_TONE_6 Level LK56 LK46

R56 3K3

TXAF_TONE_6 Source

**Description**

| Signal | Ref | Description |
|---|---|---|
| RXAF_5 | 3C8 | RX Line 5 Audio Signal to Audio Matrix |
| RX_DIS | 2B1 | RX Disable to Splitting Circuit |
| RXGATE_5 | 5B5 2D8 | RX Gate 5 Signal to Gate Matrix |
| VOTE_RESET | 1B3 | Reset Line to Vote Pulse Generator |
| RXAF_TONE | 4D5 5D5 7D5 8D5 1D4 4D5 5D5 7D5 8D5 | Received CTCSS Audio to CTCSS Relay |
| RXDEC_5 | 1C1 3B1 | RX Decode 5 Input to Receiver Primary Tone Input Diode Matrix |
| RX_DISC_5 | 3D8 | RX Discriminator Audio 5 Signal to Secall Circuit |
| SPEAKER_AF | 3A5 4D5 5D5 7D5 7D5 | RX Speaker Input to Speaker Amp |
| TXAF_5 | 3D8 | TX Line 5 Audio Signal from Audio Matrix |
| TXKEY_NOTAIL | 1C4 4C5 5C5 7C5 7D5 | Local Microphone PTT Input to TX Tail Circuit (Keys TX with CTCSS Tone) |
| TXKEY_5 | 1C8 2D1 | TX Key 5 Signal from Gate Matrix & TX Tail Circuit |
| ENC_TONE_A | 1C5 4C5 5C5 7C5 8C5 | CTCSS Encode Tone A from CTCSS Relay |
| ENC_TONE_B | 1D4 4C5 5C5 7C5 8C5 | CTCSS Encode Tone B from CTCSS Relay |
| RXAF_6 | 3C8 | RX Line 6 Audio Signal to Audio Matrix |
| RXGATE_6 | 2D8 | RX Gate 6 Signal to RX Gate Matrix |
| RX_DISC_6 | 3D8 | RX Discriminator Audio 6 Signal to Secall Circuit |
| RXDEC_6 | 1C1 | RX Decode 6 Input to Receiver Primary Tone Input Diode Matrix |
| TXAF_6 | 3D8 | TX Line 6 Audio Signal from Audio Matrix |
| TXKEY_6 | 1C8 2D1 | TX Key 6 Signal from Gate Matrix & TX Tail Circuit |
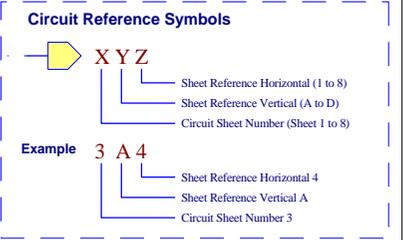
**Circuit Reference Symbols**

X Y Z

Sheet Reference Horizontal (1 to 8)
Sheet Reference Vertical (A to D)
Circuit Sheet Number (Sheet 1 to 8)

Example 3 A 4

Sheet Reference Horizontal 4
Sheet Reference Vertical A
Circuit Sheet Number 3

**Note:** Components marked # are not normally fitted.
Solder links shown in their default positions.
The pin out patterns for the 16 Way IDC Connectors show a non standard pin layout to suit DB15 Connector Pin Layout.

**Tait Electronics (Aust) Pty Ltd**

Title: **Chan Ports 5 & 6 with AN003 System Splitting**

| Size: A3 | Number: **A800-SIM SHEET 6** | Revision: 3a |
|---|---|---|
| Drawn By: M.O'B | Checked By: M.O'B | |
| Date: 21-12-99 | Sheet 6 of 8 | |
| File: A8-SIM3a-06-01_AN003.sch | | |

# ⬛ S1530/20 Series   *Installation Instructions*

# S1530/2x MULTI-VARIABLE SIGNALLING (MVS) ENCODER/DECODER

## 1.0 INTRODUCTION

The S1530/20 Series is a range of miniature, tone-sequential encoder/decoders designed for use in portable and mobile radios. They provide multiple-calling facilities with the use of keypad or BCD switches. They also provide multiple sequence decoding.

The S1530/21 and /24 are provided with two wiring looms matching the on-board connectors. The 14-way wiring loom provides the interface to the radio. The 13-way wiring loom provides the interface for the various multiple-calling options and auxiliary inputs and outputs. The S1530/26 is provided with a single 14 way board to board connector which may be used to plug the S1530 on to a mother board. The S1530/27 is provided with a 14 way and a 13 way board to board connector to allow the module to be plugged on to a motherboard.

The S1530/2x modules function in exactly the same way as the original S1530 series. They are approx. 6mm longer but include a full complement of pull-up resistors on the auxiliary connector PL2

All functional parameters are electronically programmable. This document specifies connections, adjustments, programming and mounting details to ensure correct operation of the S1530. Please refer to the S1530 Product Support Disk for more detailed product information..

**Figure 1: Component Layout - Side 1**
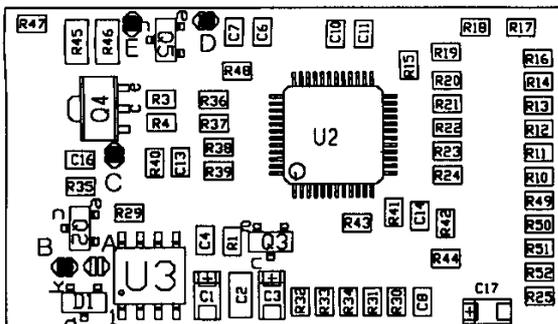


**Figure 2: Component Layout - Side 2**
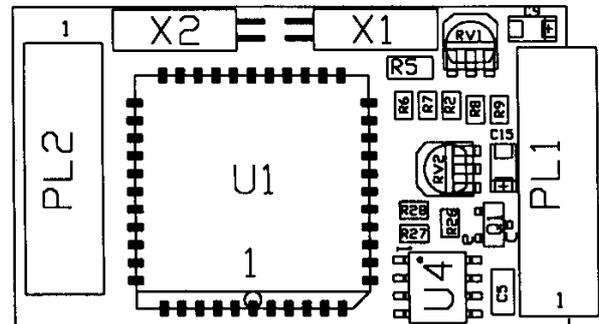


## 2.0 RADIO INTERFACE (14-WAY)

The 14-way wiring loom connects the S1530 to the radio circuitry via the 14-pin radio interface connector, PL1. Please refer to Figure 3 for typical radio connection details. Note: There are two BLUE wires in this loom (pins 5 and 14).

### RED (1) -- Vin

Connect the RED wire to the positive supply input after the ON/OFF switch and DC input filters. Where possible, connect the RED wire to a regulated supply voltage.

### BLACK (2) -- GND

Connect the BLACK wire to a 0 volt point in the radio.

### YELLOW (3) -- TXON OUTPUT

Break the path between the PTT switch and the radio's transmitter. Connect the YELLOW wire to the transmitter side of this break. (See also connection details of the GREEN wire and Uninterrupted PTT mode - Section 6.0).

## ORANGE (4) -- MUTE CONTROL OUTPUT

Connect the ORANGE wire to the radio's mute control circuitry (squelch gate). This output will inhibit the loudspeaker audio when the radio is in the Quiet (muted) State.

## BLUE (5) -- SELCALL TONE OUTPUT

Connect the BLUE wire prior to the clipper-filter stage of the transmitter's audio-processing circuit. When encoding, the output impedance of the S1530 is low (approximately 350 Ohms). Microphone muting will be achieved if the BLUE wire is connected to a high impedance point, thus reducing distortion of the tones due to speech. The radio's microphone input is usually a suitable connection point.

RV2 - The output level of the selcall tones may be adjusted using RV2. The best modulation level is determined by system performance and local regulatory requirements. We recommend a modulation level of approximately 80% of the maximum possible modulation.

## TURQUOISE (6) -- LED OUTPUT

The TURQUOISE wire is used to activate a LED. The LED can be programmed to indicate whether the radio is in the Quiet or Open State and whether the radio has been called. The LED can also indicate when the radio is transmitting and/or Busy. These options are programmable. The TURQUOISE wire can be connected directly to a LED.

## BROWN (7) -- ALERT OUTPUT

The BROWN wire may be connected to two alternative points in the radio. If the radio's audio amplifier operates in a shut-down mode (i.e. if it is always muted unless a carrier is being received), connect the BROWN wire directly to the radio's loudspeaker. For all other cases, connect the BROWN wire to the input of the radio's audio amplifier. (See also Section 4.5).

## WHITE (8) -- SIGNAL INPUT

Connect the WHITE wire to the output of the radio's demodulator before the radio's squelch gate.

### Figure 3: Typical Radio Connection
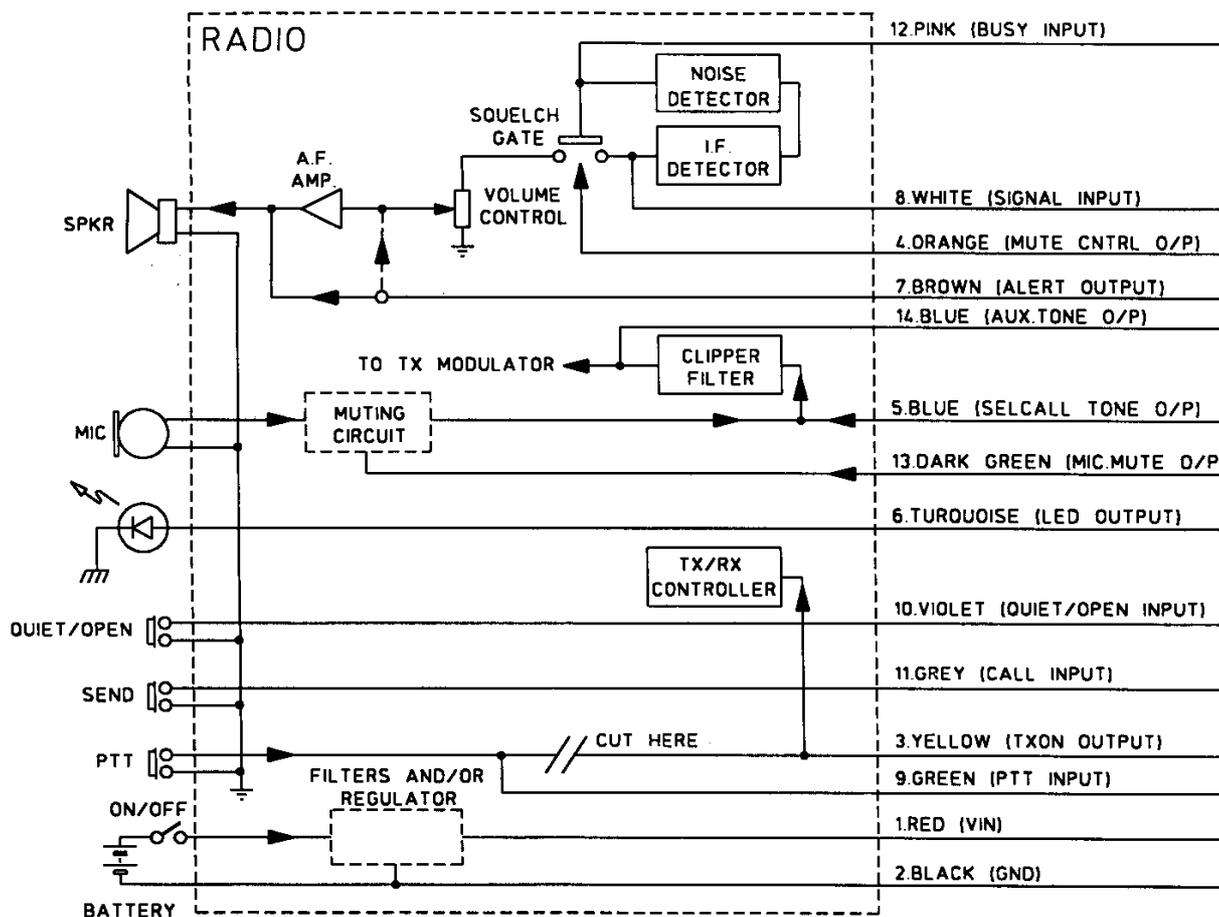
### GREEN (9) -- PTT INPUT

The path between the PTT switch and the radio's transmitter should be cut. Connect the GREEN wire to the PTT switch side of this break. See also connection details of the YELLOW wire and Uninterrupted PTT mode - Section 6.0.

### VIOLET (10) -- QUIET/OPEN INPUT

Connect the VIOLET wire to a momentary action push-button switch or the microphone hook switch. See Single Button Operation - Section 7.0.

### GREY (11) -- CALL INPUT

Connect the GREY wire to a momentary action push-button switch. See Single Button Operation - Section 7.0.

### PINK (12) -- BUSY INPUT

The PINK wire must be connected to prevent transmitting over a busy channel. Connect the PINK wire to the receiver's squelch control output or channel busy signal.

### DARK GREEN (13) -- MIC MUTE OUTPUT

This output is used to inhibit audio signals picked up by the microphone. Connect to the microphone amplifier stage prior to the Selcall Tone Out connection point.

### BLUE (14) -- AUXILIARY TONE OUTPUT

Nominally used for CTCSS tone encoding. Connect to the radio manufacturers recommended injection point for CTCSS tones.

RV1 - Auxiliary Tone Output Adjustment. The auxiliary tone output can be programmed to produce a sub-audible tone output with a frequency between 50 Hz and 300 Hz. The output level may be adjusted using RV1, to set the required radio modulation level.

## 3.0 S1530 AUXILIARY INTERFACE OPTIONS

Table 1 (below) lists the five different auxiliary interface options available. The configuration which best suits your needs must be chosen when programming the S1530.

Figure 4: Keypad Layout



\* - CALL (WITH OPTIONAL QUIET/OPEN)
\# - GROUP TONE
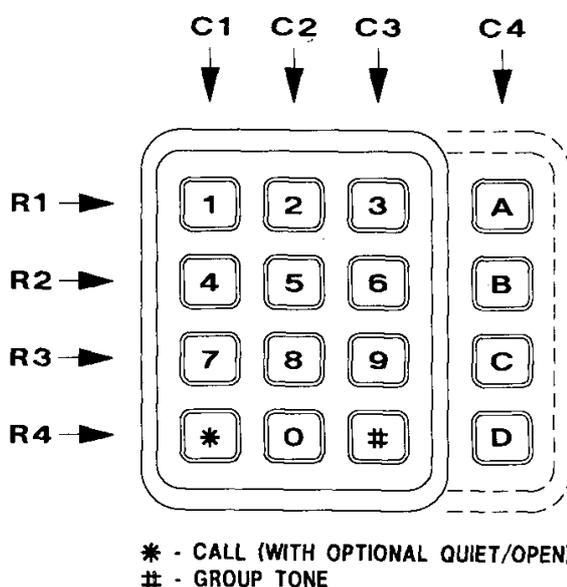
### Table 1: Auxiliary Interface Connections

| Pin (Colour) | Configuration A | Configuration B | Configuration C | Configuration D | Configuration E |
|---|---|---|---|---|---|
| 1-Red | Hex input 3-8 | Hex input 3-8 | Ext. alert output | Ext. alert output | Ext. alert output |
| 2-Black | Hex input 3-4 | Hex input 3-4 | Covert mic enable | Covert mic enable | Covert mic enable |
| 3-Yellow | Hex input 3-2 | Hex input 3-2 | Alarm input | Alarm input | Keypad column 4 |
| 4-Orange | Hex input 3-1 | Hex input 3-1 | Out of vehicle input | Out of vehicle input | Keypad column 3 |
| 5-Blue | Hex input 2-8 | Keypad column 4 | Keypad column 4 | Hex input 2-8 | Alarm input |
| 6-Turquoise | Hex input 2-4 | Keypad column 3 | Keypad column 3 | Hex input 2-4 | Out of vehicle input |
| 7-Brown | Hex input 2-2 | Keypad column 2 | Keypad column 2 | Hex input 2-2 | Keypad column 2 |
| 8-White | Hex input 2-1 | Keypad column 1 | Keypad column 1 | Hex input 2-1 | Keypad column 1 |
| 9-Green | Hex input 1-8 | Keypad row 4 | Keypad row 4 | Hex input 1-8 | Keypad row 4 |
| 10-Violet | Hex input 1-4 | Keypad row 3 | Keypad row 3 | Hex input 1-4 | Keypad row 3 |
| 11-Grey | Hex input 1-2 | Keypad row 2 | Keypad row 2 | Hex input 1-2 | Keypad row 2 |
| 12-Pink | Hex input 1-1 | Keypad row 1 | Keypad row 1 | Hex input 1-1 | Keypad row 1 |
| 13-Dark Green | Common | Common | Common | Common | Common |

## 3.1 CONFIGURATION A

This option allows 3 hexadecimal or BCD switches to be used as inputs to the module. The "common" inputs to the switches must be joined together and wired to pin 13, the common (0V) input on PL2 of the S1530. The inputs for the Hex switches have internal pull-ups.

Access to these switches is enabled when programming the S1530. These switches 1, 2 and 3 are referred to respectively as H, I and J in the S1530 Product Support Disk.

## 3.2 CONFIGURATION B

This option allows for the use of a standard keypad having 4 rows and 4 columns. The keys 0 to 9, A,B,C and D are used for tone number entry. The # key enters the group tone. The * key will initiate the CALL. If single button operation is programmed, the * key will change the mute state of the radio, and initiate CALLS.

The Hex switch 3 is also available and functions as described in section 3.1.

## 3.3 CONFIGURATION C

This option allows the use of a standard keypad having 4 rows and 4 columns as described in section 3.2. Two extra inputs and two extra outputs are also available. These are:

*Pin 1:*
The *auxiliary 1* output usually operates as an *external alert* output. In this mode it will go active after a call has been decoded, provided that it is not inhibited by the state of the *auxiliary 4* (out of vehicle) input.

This output can also be turned on and off independently by transmitting a sequence to the S1530 with the appropriate address and command tone.

*Pin 2:*
The *auxiliary 2* output can operate as a *covert microphone* enable output when the S1530 module is operating in the emergency mode. This output and the TXON output will be simultaneously cycled on and off during emergency procedures, to enable a microphone and key up the radio transmitter.

This output can also be turned on and off independently by transmitting a sequence to the S1530 with the appropriate address and command tone.

*Pin 3:*
The *auxiliary 3* input is used to trigger an *alarm* sequence, or can be programmed as an alternative CALL input.

*Pin 4:*
The *auxiliary 4* input is used as an *Out of Vehicle* input which enables/disables the external alert output. It can also be used as an alternative CALL input and is capable of sending a unique tone sequence when going active and when going inactive.

## 3.4 CONFIGURATION D

This option allows 2 Hex switches to be used in conjunction with 2 auxiliary outputs and 2 auxiliary inputs. The Hex switches function as described in section 3.1, the auxiliary inputs and outputs function as described in section 3.3.

## 3.5 CONFIGURATION E

This option allows the SIGTEC KP9939 Keypad to be plugged into the module. The auxiliary outputs are still available as described in section 3.3. The auxiliary inputs are also available but they are relocated to pins 5 and 6 instead of pins 3 and 4.

# 4.0 SOLDER LINK SELECTION

The S1530 has 5 features which are controlled by solder bridges, located as shown in Figures 1 and 2.

## 4.1 SOLDER LINK A (INPUT VOLTAGE)
* **FACTORY SETTING = UNBRIDGED**

If the supply voltage is greater than 7V, leave this link unbridged. Bridge this link only if the module is required to function with a supply voltage of less than 7V. Note that when 'A' is bridged the module is not protected against reverse polarity connection i.e. the unit may be permanently damaged if the +12V and ground lines are connected incorrectly.

## 4.2 SOLDER LINK B (MUTE CONTROL OUTPUT)
* **FACTORY SETTING = BRIDGED**

Unbridge this solder link if the Mute Control Output is required to source current when the mute control goes active.

## 4.3 SOLDER LINK C (TONE OUTPUT LEVEL)
* **FACTORY SETTING = BRIDGED**

Unbridge this link to obtain a greater output level from the Selcall Tone Output. Note this also increases the output impedance.

## 4.4 SOLDER LINK D (MIC. MUTE OUTPUT)
* **FACTORY SETTING = BRIDGED**

Unbridge this link only if the Microphone Mute Output is required to source current when the Microphone Mute Output goes active.

### 4.5 SOLDER LINK E (ALERT OUTPUT IMPEDANCE)
  • FACTORY SETTING = BRIDGED

This output has an impedance of approximately 20 Ohms and is intended to drive a radio loudspeaker directly. Unbridge this link to obtain an output impedance of 100K when driving the input of an amplifier.

## 5.0 SELECTING INPUT POLARITY

The PTT, CALL, QUIET/OPEN, BUSY and AUXILIARY inputs include pullup or pulldown resistors and should be programmed as required. The polarity of each input may be programmed independently to suit the application. See the Product Support Disk.

## 6.0 UNINTERRUPTED PTT MODE

In some radios it may be physically difficult to cut the PTT line. In this situation the module can be programmed to operate in the Uninterrupted PTT mode. Both the PTT input and TXON output can be connected to the same point in the radio. All PTT functions will function correctly with the exception of transmit inhibit. In this mode only tone transmissions can be inhibited when *Quiet* or *Busy*. Voice transmission cannot be inhibited.

In this mode it is strongly recommended that programming via the PTT is not attempted due to the risk of accidentally keying up the transmitter.

## 7.0 SINGLE BUTTON OPERATION

If only one momentary action push button switch is available on the radio's front panel, the Quiet/Open input can be configured for Single Button Operation. If the radio is in the *Open* state a short press on the switch will mute the radio (a low pitch beep will be heard). Another short press will unmute the radio (two high pitch beeps will be heard). In the Open state, holding the switch depressed for more than 1 second will initiate a CALL sequence. In Single Button Operation, the Quiet/Open input, the CALL input and the Keypad CALL Key will all operate in the same way.

## 8.0 MOUNTING DETAILS

Double-sided tape is provided to secure the S1530 into the radio. Keep the module clear of high-energy RF fields and sensitive RF/IF receiving stages. When securing the module into position press down firmly to ensure good adhesion.

Also supplied is a piece of insulation material to insulate the S1530 from other components in the radio, and adhesive labels to help identify the module after programming.

## 9.0 SPECIFICATIONS
Operating Voltage: .......................... 7 to 18 V DC
Operating Current:
    Channel Busy Power Save On: ........ < 6 mA (typ.)
    Channel Busy Power Save Off: ..... < 12 mA (typ.)
Operating Temperature: ......... -30 to +80 degrees C
Alert Output Level: .......... 500mV RMS into 8 Ohms
Input Sensitivity: ............................. < 20mV RMS
Input Impedance: .............. > 100 kOhms at 1 kHz
Selcall Tone Output Level:
    .............. Adjustable up to 220mV into 2k2 Ohms
Selcall Tone Output Impedance:
    Encoding: ..................................... < 350 Ohms
    Standby: ..................................... > 100 kOhms
Auxiliary Tone Output Level:
    ......................................Adjustable up to 500mV
Mute Control and Mic Mute Outputs:
    Sink current: ................................. 50mA (max.)
    Source current: .............................. 40µA (max.)
TXON output sink current: .................. 50 mA (max.)
LED output source current: ................. 12 mA (typ.)

## 10.0 PROGRAMMING THE S1530

The S1530 is programmed using the P9942 Programming Interface and an S1530 Product Support Disk, in conjunction with an IBM-compatible Personal Computer (PC) and a 12 Volt DC Power Supply.

The Programming Interface includes a DB25 connector suitable for connection to the RS232 serial communication port of a PC and a 9 to 25 pin adaptor. The Product Support Disk package includes 5.25" and 3.5" disks, and the software may be installed on a hard disk for convenience.

## 11.0 WARRANTY

Our products are warranted for a period of 24 months from the date of purchase against faulty materials and workmanship. Should any fault occur the unit should be returned to the Vendor, freight pre-paid. Please include a brief description of the fault to assist with prompt return. Any unauthorised alterations or repairs will invalidate the warranty.

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