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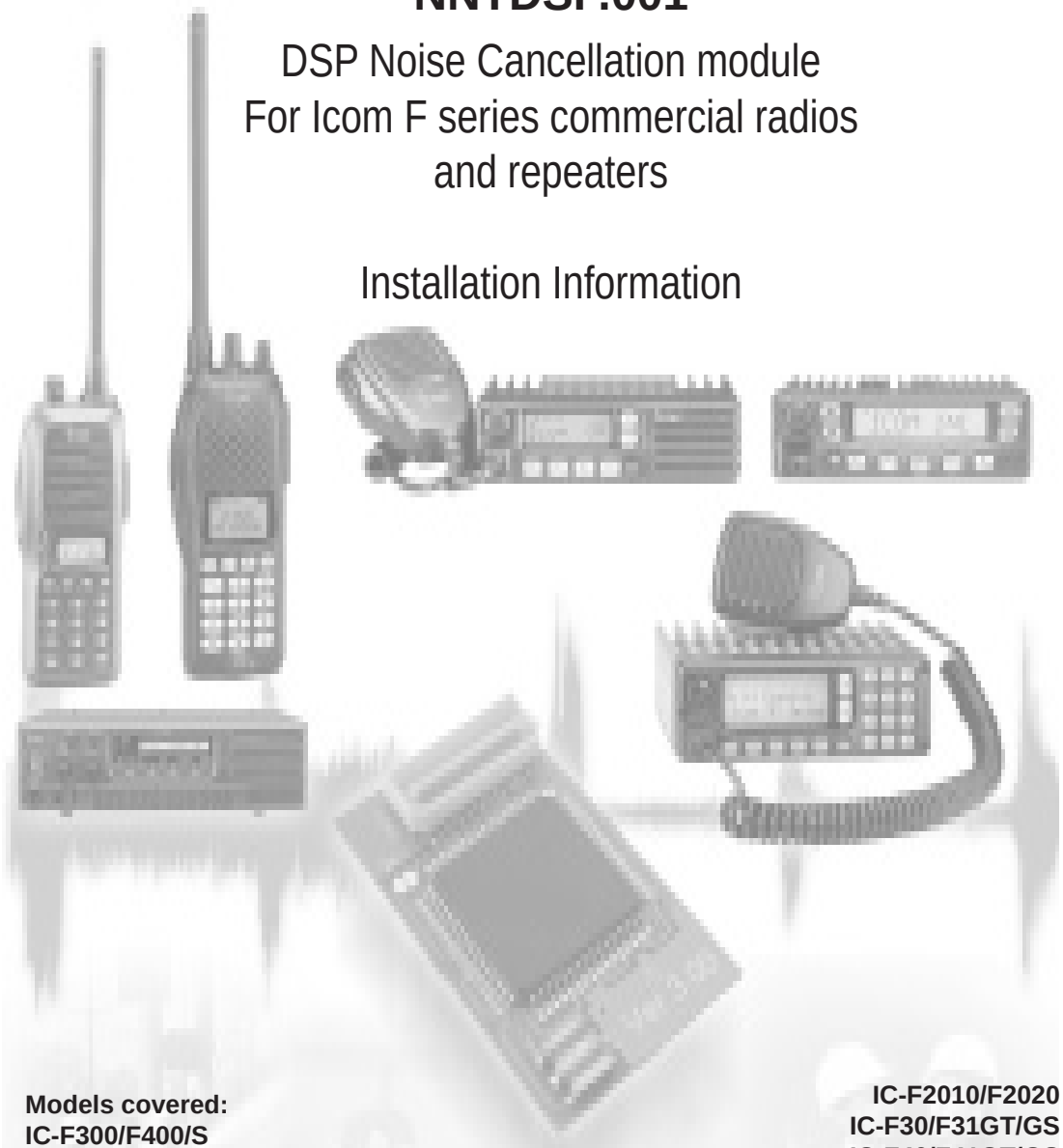
NNTDSP.001

DSP Noise Cancellation module
For Icom F series commercial radios and repeaters

Installation Information



Models covered:
IC-F300/F400/S
IC-F3/F4/S
IC-F3GT/GS
IC-F4GT/GS
IC-F1010/F1020
IC-F14 IC-F24
IC-F33GT/GS IC-43GT/GS

IC-F2010/F2020
IC-F30/F31GT/GS
IC-F40/F41GT/GS
IC-F510/F520
IC-F610/F620
IC-FR310/F4100 repeaters
IC-F15 IC-F25
IC-F34GT/GS IC-F44GT/GS

1063-101D
Issue F

Important Information

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The fitting of the bhi **NNTDSP.001** module may involve the removal of small surface mount components and cutting pads. This should only be carried out by a qualified engineer. bhi accepts no responsibility for the fitting or installation of the **NNTDSP.001** module and are not liable for any damage to equipment caused by its fitment. Fitting this module may invalidate your warranty.

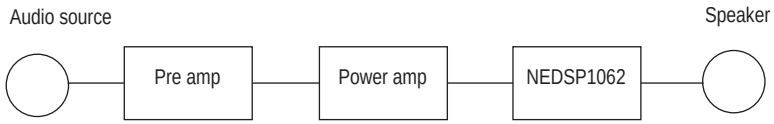
All attempts have been made to ensure that this information is up to date. It is possible that these instructions contain errors, or the equipment is slightly different to the one used to compile this information. In all cases it is up to the installer to ensure that the module is fitted correctly.

Please read these instructions thoroughly before attempting to fit the **NNTDSP.001** module.

By installing this module you are doing so at your own risk.

4.7 NEDSP1062 Amplified DSP module.

Amplifed DSP module for installation before the loudspeaker or audio output device. These modules are ideally suited for integration into the receiving side of communication equipment.



PCB version
NEDSP1062-PCB.

Basic amplified DSP module. Noise cancellation levels selectable from jumpers on the module. DSP functions are avaialble on the PCB pins to allow remote operation of the module.
Supplied with full fitting instructions.

Specification:

Noise cancellation levels	8
Noise cancellation	9 - 35dB
Tone reduction	4 - 65dB
Audio bandwidth	50 -4.3KHz
Max power	3 W(4R)
Power supply	12 - 18V
Current consumption	500mA
Size	37 x 50mm

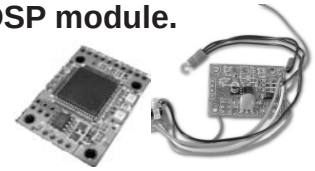
Keyboard version
NEDSP1062-KBD.

KBD version incorporates a dual button keyboard to control all functions of the module. Audio bypasses the module when power is removed, or switched off. The module is supplied complete with all mounting hardware, prewired power connector, labels and full fitting intructions. 4 or 8 noise cancellation levels can be selected.

Specification:

Noise cancellation levels	4/8
Noise cancellation	9 - 35dB
Tone reduction	4 - 65dB
Audio bandwidth	50 -4.3KHz
Max power	3 W(4R)
Power supply	12 - 18V
Current consumption	500mA
Size	37 x 50mm

4.6 NEDSP1061 Low level DSP module.



Low level signal DSP processor.
Inserts in to the audio path of problem signals to provide effective noise and interefence removal. This can be in the microphone path or receive path. The modules are suited for retrofitting or designing into new equipment. Input and output level controls allow the units to be easily incorporated into most equipment.

PCB version
NEDSP1061-PCB.

Basic DSP module. Noise cancellation levels selectable from jumpers on the module. DSP functions are available on the PCB pins to allow remote operation of the module.
Supplied with full fitting instructions.

Keyboard version
NEDSP1061-KBD.

KBD version incorporates a single button keyboard to control all the functions of the module. 4 DSP levels available.
Supplied with mounting hardware, labels and full fitting instructions.

Specification:	
Noise cancellation levels	8
Noise cancellation	9 - 35dB
Tone reduction	4 - 65dB
Audio bandwidth	50 - 4.3KHz
Power supply	5 - 15V
Current consumption	45mA
Size	27 x 36mm

Specification:	
Noise cancellation levels	4
Noise cancellation	11 - 35dB
Tone reduction	5 - 65dB
Audio bandwidth	50 - 4.3KHz
Power supply	5 - 15V
Current consumption	45mA
Size	27 x 36mm

Other bhi products

Contents

1. Introduction.

The unique **NNTDSP.001** noise eliminating DSP board will allow clear verbal radio communication from a user where there is high ambient noise, without the use of a full fleet of headsets, complicated programming or soldering.

The **NNTDSP.001** DSP board is ideal for a variety of environments including construction sites, motorsport, airports, noisy factories and dockyards, in fact anywhere there is high background noise. For example, on construction sites, loud noises are generated from various pieces of machinery such as site generators and pneumatic drills. The worker in this environment, using an Icom radio, transmits audio which has all the construction noises superimposed on it. On each of the receiving radios that have the DSP module fitted, the unwanted noise is removed and the user can hear clearly what is being said. Motor sport is another fantastic application for this product. At any track there are high levels of noise generated and no matter how you put a microphone into the headset of a driver, the noise gets transmitted and there's no way of stopping Wind noise, gearbox noise, engine noise, and tyre noise that get transmitted with the same signal. With the Icom radio, just press the assigned noise-cancelling button and the noise is removed.

The **NNTDSP.001** DSP board operates on most Icom 'F' series commercial radios and repeaters that have an internal accessory socket. This new device uses an innovative process of noise reduction that operates in the frequency domain. The pass-band of the digital signal processing (DSP) technology is subdivided into sub-bands. The system then works out whether the signal has speech or noise characteristics in the sub-band. If the signal has noise characteristics, the noise portion is removed from this sub-band, depending on the filter level used. If no noise is present the speech remains unchanged. The system is fully adaptive and adjusts itself continuously to changing environmental conditions. When the signal is first received the DSP automatically adjusts to the characteristics of the voice signal and noise within 1 second and then continuously removes the unwanted noise for the rest of the transmission.

The module is installed in the "Option" socket and a small modification is required in the radio to enable the module to work. This modification cuts the audio path of the loudspeaker and allows the insertion of the DSP board. The programming software is set up to

4.3 NEIM1031 In-line module.

The NEIM is a flexible in-line noise cancellation desk unit that connects easily betwen your equipment and extension speaker. It features both amplified inputs and outputs, along with line level signal processing. The unit also features an audio bypass when the unit is switched off, so there is no need to disconnect when not in use.

Features:

- Fully adaptive noise cancellation 9 -35dB
- 8 user selectable noise cancellation levels
- Mono earpiece socket
- Input sensitivity control
- Noise cancellation On/Off switch
- Line level in/out
- Input overload indication
- Power on/off with audio bypass.

4.4 NEIM1031 accessories.

LSPKR
20 Watt extension speaker for use with the NEIM1031. Fitted with a 3.5mm mono jack plug.

1031-STAND
Mounting stand for the NEIM1031. Holds the NEIM1031 vertically or horizontally.

1030-UKPA UK DC power adapter

1030-EUPA European DC power adapter

4.5 1042 switch box.

Allows up to 6 pieces of equipment to be connected to one speaker or inline module. 3 inputs loaded at 8 ohms.

4. Other bhi products

Other noise cancellation products from bhi. Visit www.bhi-ltd.co.uk for more information.

4.1 NES10-2MKII Noise Eliminating speaker.

DSP noise cancellation built into a compact speaker unit. the unit provides an easy to install solution to noise reduction

Features:

- Fully adaptive noise cancellation 9 -35dB
- 8 user selectable noise cancellation levels
- Mono earpiece socket
- Input sensitivity control
- Noise cancellation On/Off switch
- Power on/off/audio bypass
- LED indication of power and noise cancellation
- 12-24VDC operation
- Compact robust speaker unit.
- Greatly improved signal to noise ratio
- Easy to install with adjustable mounting bracket
- Optional extras available.

4.2 NES5 Noise Eliminating speaker.

Basic plug and go noise cancelling speaker preset to 20dB of noise reduction.

Features:

- Fully adaptive noise cancellation 20dB
- 12-24VDC operation
- Compact robust speaker unit.
- Greatly improved signal to noise ratio
- Easy to install with adjustable mounting bracket
- 2m audio lead

"enable OPT 1" on one of the assignable buttons such as P0 to P3 on the mobiles or if used with a handportable there are also the buttons above and below the PTT. Noise level is set at 6; this is adjustable by links on the module.

The following diagrams are taken from actual audio signals and illustrate how the signal is being processed.

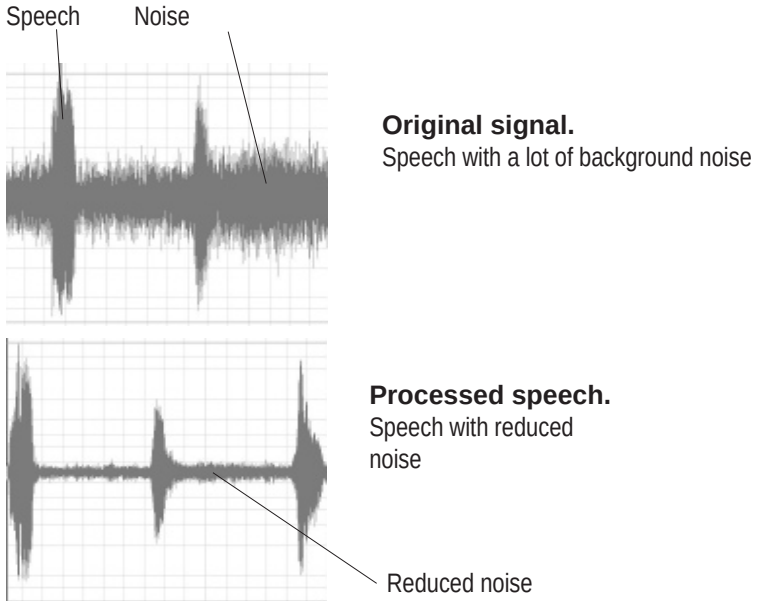


Figure 1. Noise cancellation.

2. DSP Module Overview.

2.1 Icom modification.

Before installing the board into your ICOM radio, a small modification must be made. This modification cuts the path of the loudspeaker audio signal and allows the insertion of the DSP board in the signal path.

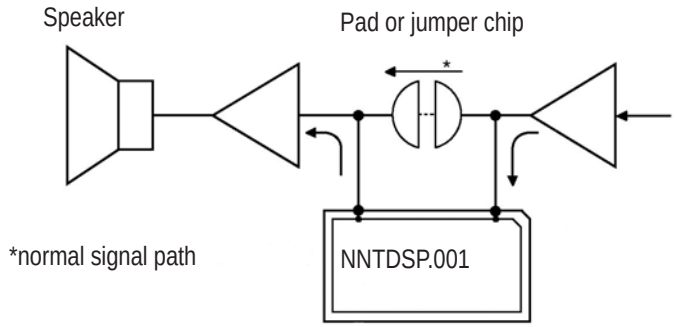


Figure 2. Block diagram of DSP module signal path.

Links are broken by desoldering, removing a jumper chip or cutting a printed circuit track.More information is given in the installation notes later in this manual.

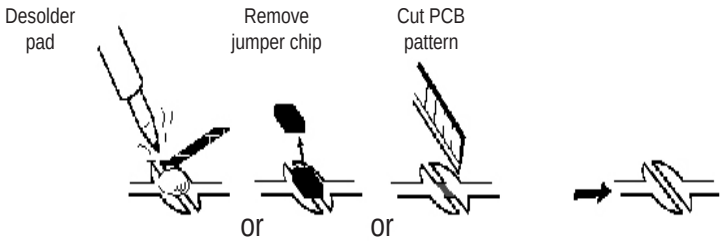
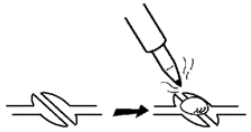


Figure 3. Icom pad modification detail.

Important Note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.

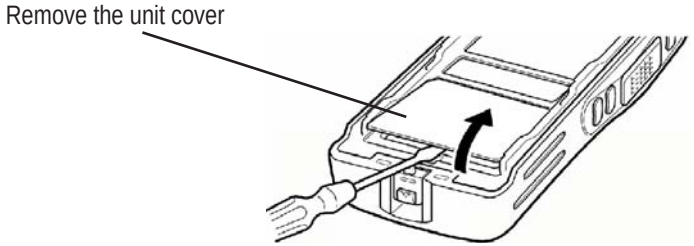


3.9 IC-F33/F34 F43/F44GT/GS:

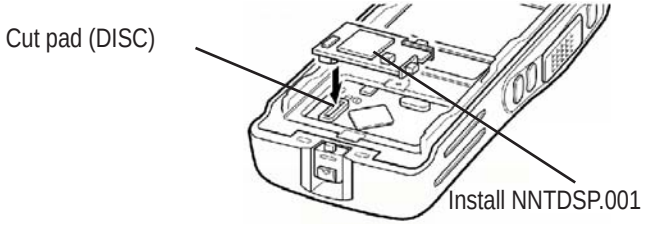
The following PCB modification is required when installing the DSP module.

- Rotate **[VOL]** to turn the power OFF, and remove the battery pack.
- Remove the unit cover.

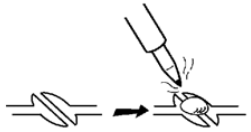
Note: Use a flat head screwdriver o r a similar flat instrument, and insert into the hollow of the chassis, then lift and take away the unit cover. Use the supplied spare unit cover. Do not use the cover that has been removed. Water of dust may get into the transceiver because the cover may be bent or has lost it's adhesion. This may result in the transceiver becom ing damaged.



- Cut the pattern on the PCB at the RX AF circuit (DISC) as shown below



Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



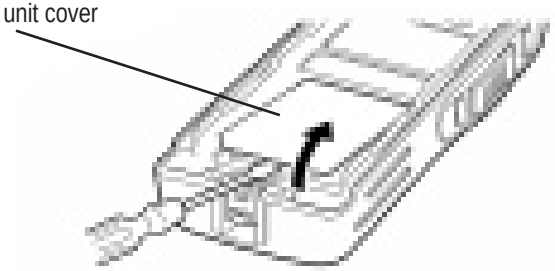
3.8 IC-F14/IC-F15/IC-F24/IC-F25:

The following PCB modification is required when installing the DSP module.

- Rotate **[VOL]** to turn the power OFF, and remove the battery pack.
- Remove the unit cover.

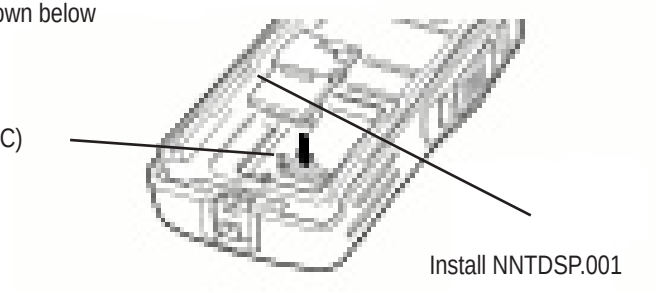
Note: Use a flat head screwdriver o r a similar flat instrument, and insert into the hollow of the chassis, then lift and take away the unit cover. (The removed cover cannot be re used).

Remove the unit cover



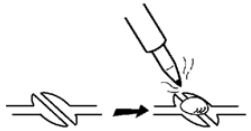
- Cut the pattern on the PCB at the RX AF circuit (DISC) as shown below

Cut pad (DISC)



Install NNTDSP.001

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



2.2 Changing the Board Default Settings.

The board has four control pads A to D, which allow the user to change some of the parameters. With the control pads, it is possible to change the noise filter level and to switch the noise cancellation permanently on.

2.3 Functions of the different control Pads.

The locations of the different control pads are shown in figure 5 on page 8, and their function given in table 1 below.

PAD	Function	PAD condition (closed=0; cut=1)			Description
A	Noise suppression permanently On	0 1			Noise controlled set by radio user Noise suppression permanently ON
B,C,D	Noise suppression level	**B** 0 0 0 0 1 1 1 1	**C** 0 0 1 1 0 0 1 1	**D** 0 1 0 1 0 1 0 1	Elimination level 1(weakest) Elimination level 2 Elimination level 3 Elimination level 4 Elimination level 5 **Elimination level 6 (default)** Elimination level 7 Elimination level 8 (strongest)

Table 1: Function of the different control pads.

2.4 How to modifiy the control pads.

In the above table a closed pad=0, and a open pad=1.

Pads can be opened by carefully cutting through the centre portion of the pad (where applicable). Pads can later be closed by bridging across the pad with a small blob of solder.

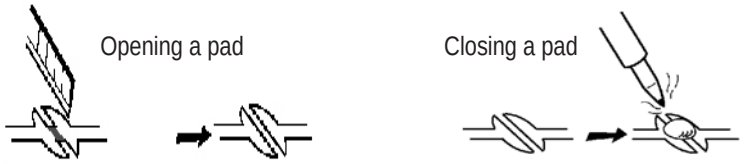


Figure4. Pad configuration.

2.5 Control Pad Locations.

The following diagram shows the locations of the control pads of the **NNTDSP.001**.

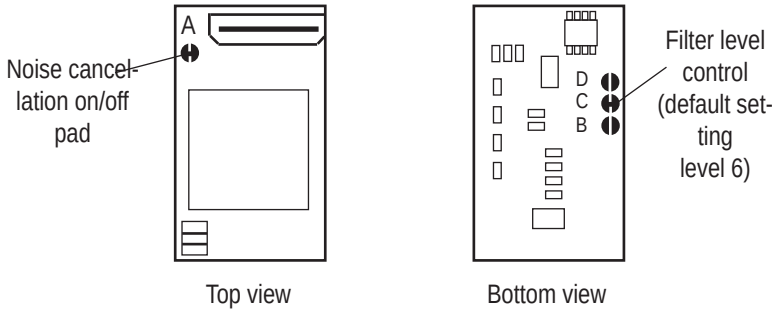


Figure 5. Control pad locations.

2.6 Important Fitting Information.

The **NNTDSP.001** must be installed using the supplied foam pads or alternatively using a non corrosive, non slumping silicone sealant to prevent the module from moving during operation.

Foam pads are to be attached as shown in the following diagram.

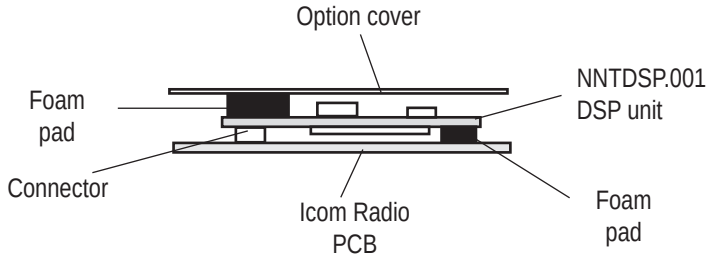


Figure 6. Fitting information.

2.7 Specifications.

Noise cancellation	9 - 35dB
Tone reduction	5 - 65dB
Supply voltage	4.2 - 15 VDC
Audio bandwidth	4KHz
System delay	33mS

Cut the pattern on the PCB at the AF circuit (CP1) on the LOGIC unit as shown on the right.
Link pin 28 & pin 29 (+5V) either on the DSP module or on the repeater itself (+5V is on pin 29 not the usual pin 28)

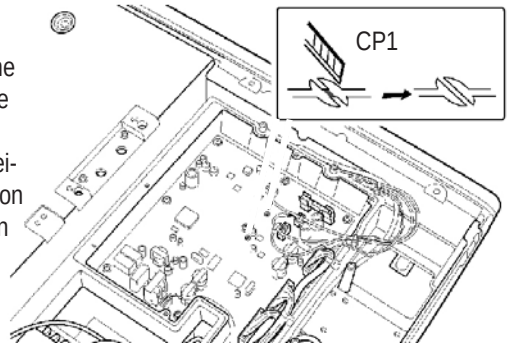


Figure 27. PCB modification detail.

Turn the repeater upside down and install the DSP module as shown.

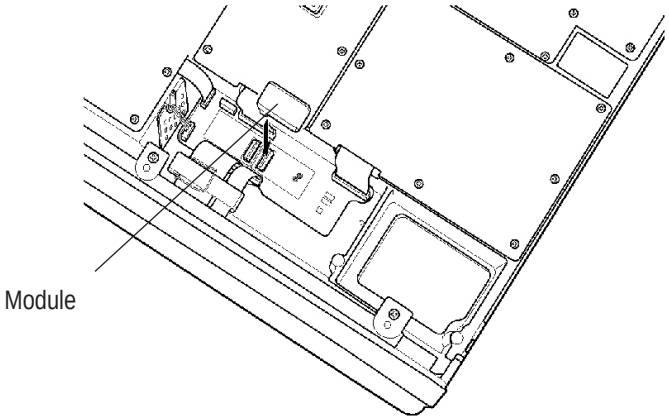
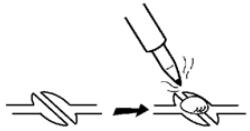


Figure 28 Installation of the DSP module

Return the LOGIC plate and top and bottom coevers to their orignal positions.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available. Also remove the link between pins 28 & 29 on the repeater or on the NNTDSP.001



3.7 IC-FR3100, IC-FR4100 Repeaters

Case opening procedure.

CAUTION: DISCONNECT the AC power cable and/or DC power cable from the repeater. Other-wise, there is danger of electric shock and/or equipment
damage.

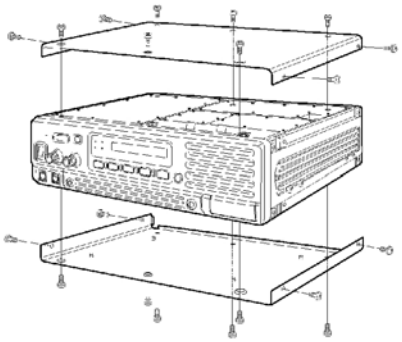


Figure 25. Repeater case disassembly detail.

- Remove 6 screws from the top of the repeater and 4 screws from the sides, then lift up the top cover.
- Turn the repeater upside down.
- Remove 6 screws from the bottom of the repeater, and 4 screws from the sides, then lift up the bottom

DSP module installation.

Remove the 8 screws from the LOGIC shielding plate, then remove the cover.

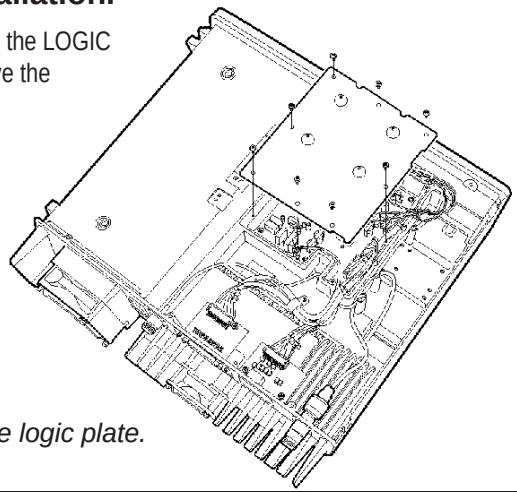


Figure 26. Remove the logic plate.

2.8 Connector Pin-out.

The following table identifies the pin-out of the **NNTDSP.001** module connector.

Pin	Signal	Remark
6	Busy/Power On	low = on, high = off
9	Noise Filter On/Off	low = off, high = on
22	Signal out	From Icom board
23	Signal in	To Icom board
28	+V Supply	
30	Ground	

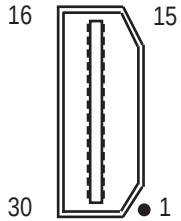


Table 2. NNTDSP.001 connector pin-out.

2.9 Physical dimensions.

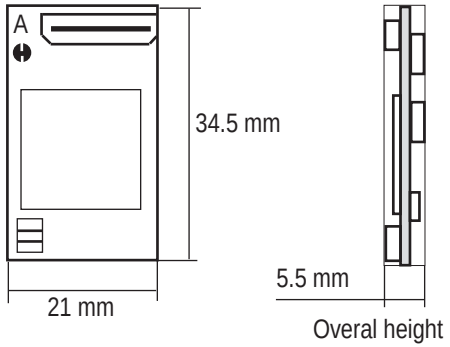
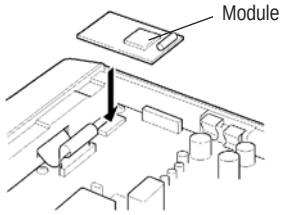


Figure 7. Physical dimensions of the NNTDSP.001 module.

3. Icom Fitting Instructions.

3.1 IC-F300/F400/S Series

- Turn power OFF, then disconnect the DC power cable.
- Unscrew the 4 screws, then remove the bottom cover.
- Cut or desolder the print pattern on the PC board at the AF circuit (B).
- Install the DSP unit as shown.
- Replace the bottom cover and screws, then the DC power cable.



NOTE:

Modification point is marked as B on the circuit board.

IC-F300/S series.

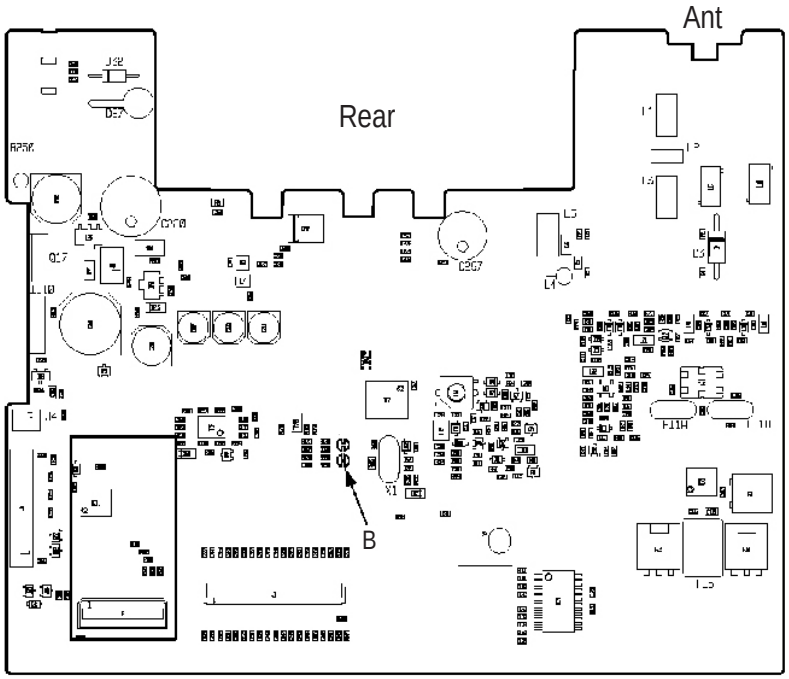
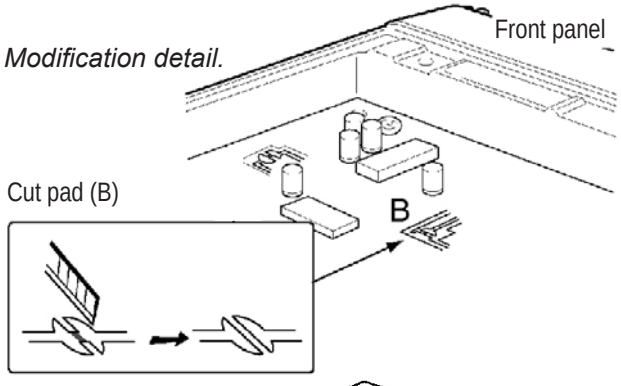


Figure 8. IC-300/S modification detail.

3.6 IC-F510/F520, IC-F610/F620 Series:

- Turn power OFF, then disconnect the DC power cable.
- Unscrew the 4 screws, then remove the bottom cover.
- Cut the print pattern on the PCB at the RX AF circuit (B) as shown in the following diagram.
- Install the DSP module as shown below.
- Replace the bottom cover and screws to their original position.

Figure 23. Modification detail.



Install DSP module as shown.

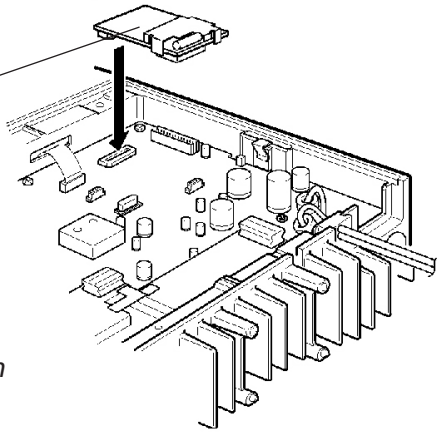
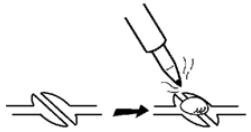


Figure 24. Module installation information.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



IC-F30/F31GT/GS, F40/F41GT/GS Series:

Cut the junction pattern A (AF line) on the MAIN unit.

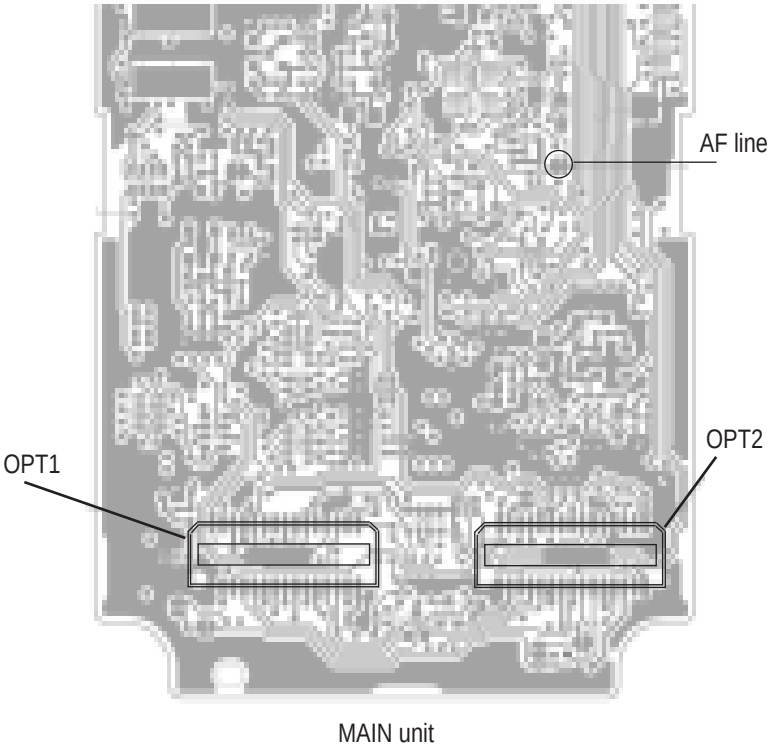
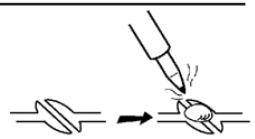


Figure 22. Module installation information.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



IC-F400/S series.

- Turn power OFF, then disconnect the DC power cable.
- Unscrew the 4 screws, then remove the bottom cover.
- Cut or desolder the print pattern on the PC board at the AF circuit (B).
- Install the DSP unit as shown on the previous page.
- Replace the bottom cover and screws, then the DC power cable.

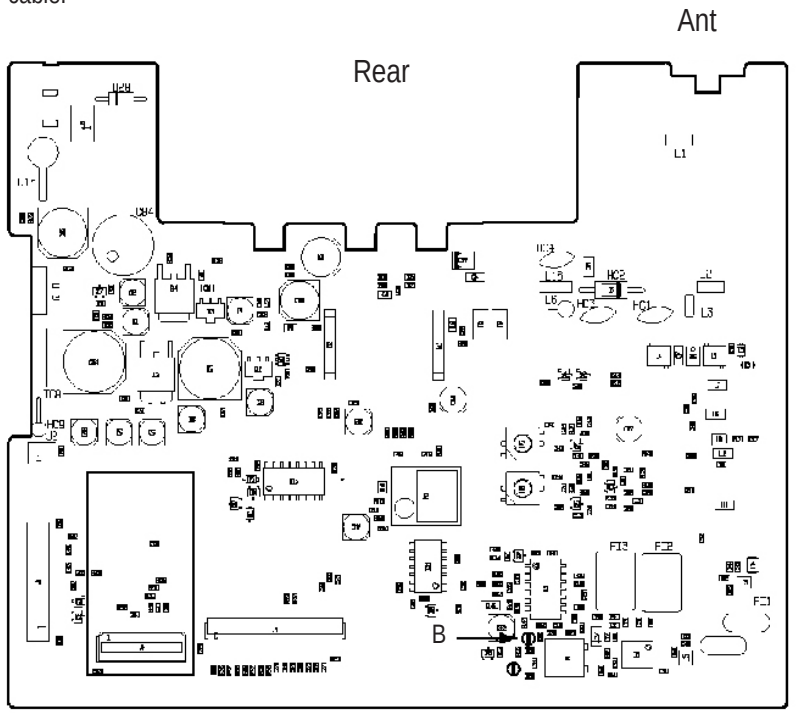
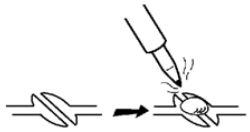


Figure 9. IC-400/S modification detail.

NOTE:
Modification point is marked as B on the circuit board.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



3.2 IC-F3/F4/S series.

IC-F3/F4/S series

There are 2 types of printed circuit board fitted to this series. Be sure to confirm the board type number in advance. The board number is printed on the PCB.

IC-F3/IC-F3S

- B4929E requires LCD side and CPU side modifications.
- B4929F*1 requires CPU side only.

IC-F4/IC-F4S

- B4923G LCD side and CPU side modifications.
- B4923H*1 requires CPU side only.

Fitting procedure:

Refere to figure 10.

- Remove the knob and unscrew the antenna connector screw.
- Unscrew the 2 screws, then remove the front panel.
- Remove the shield cover if necessary.
- Remove the jumper chip (**DET**)*2 or (**AF**)*2 on the
- LCD side of the PC board.
- Replace the shield cover to the original position.
- Remove the jumper chip resistor(s) on the CPU side
- of the PC board.
- Install the unit as shown in the instruction manual.
- Replace the front panel and screws.

NOTE:

**1 B4929F* and *B4923H's* modification points may be accessed through the service window without taking the unit apart.

*2 Modification points are marked **DET** or **AF** on the main board.

3.5 IC-F30/F31GT/GS IC-F40/F41GT/GS Series

Disassemble the unit as described below before fitting the DSP module.

- Unscrew nut (a), and remove the knobs.
- Unscrew screw (b) and 2 screws (c), then remove the multi-connector cover and rear panel.
- Unscrew 2 screws (d), then remove the multi-connector.
- Unscrew 2 screws (e), then take off the chassis front the front panel in the direction of the arrow.
- **Warning:**

Flat cable is connected between the MAIN unit on the chassis and the front panel.

- Install the DSP module in OPT1.

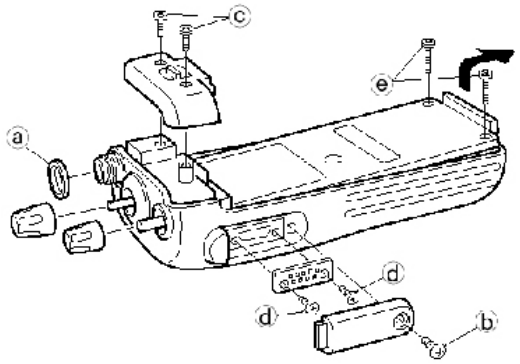
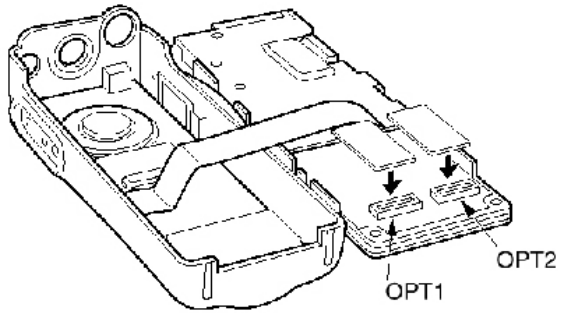


Figure 21. Module installation information.



3.4 IC-F1010/F1020/F2010/F2020 Series

- Turn power OFF, then disconnect the DC power cable.
- Unscrew the 4 screws, then remove the bottom cover.
- Cut the junction AFO on the main board.
- Install the unit as shown in the diagram on the right.
- Replace the bottom cover and screws, then the DC power cable.

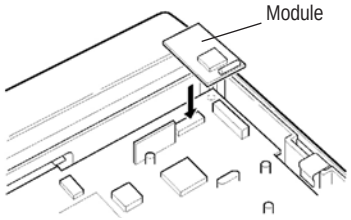


Figure 19. Module installation

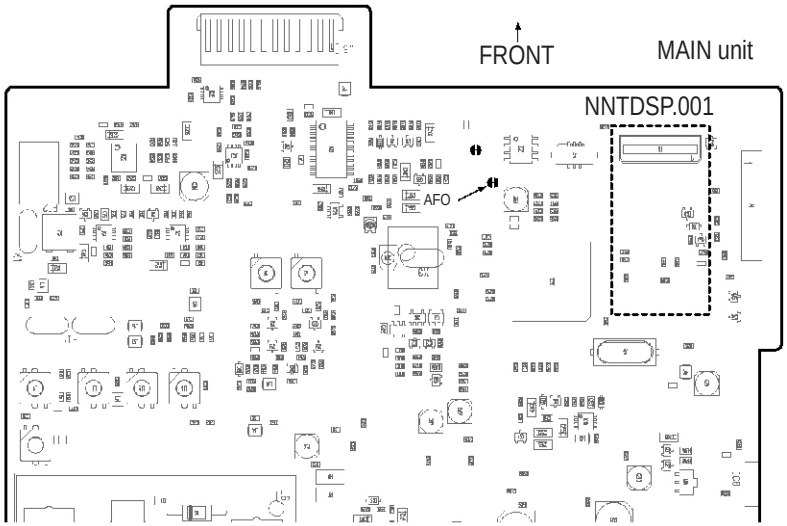
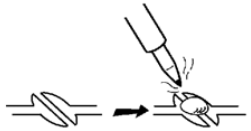


Figure 20. Main unit modification point.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



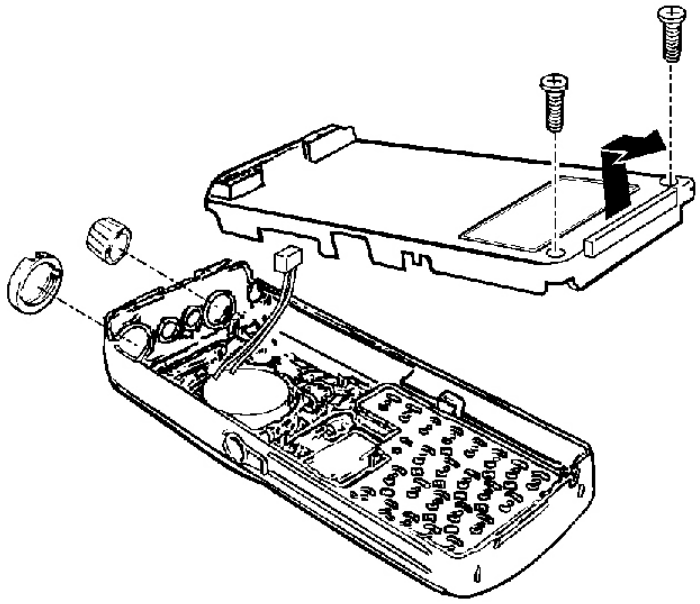


Figure 10. IC-F3/F4/S series dismantling procedure.

- Remove the service cover.
- Take out the protective sponge.
- This sponge is not used when options are installed.
- Connect the optional unit as shown.
- Replace the service cover.

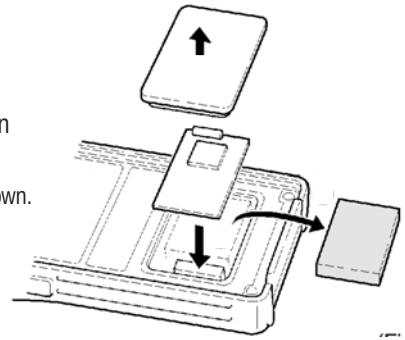
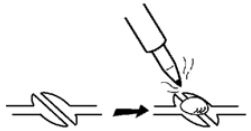


Figure 11. NNTDSP.001 installation.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



Model: IC-F3/IC-F3S

PCB No. B4929E Remove the LCD side jumper chip and the CPU side jumper chip (1).

B4929F Remove the CPU side jumper chips (1) and (2).

LCD side:(B4929E only).

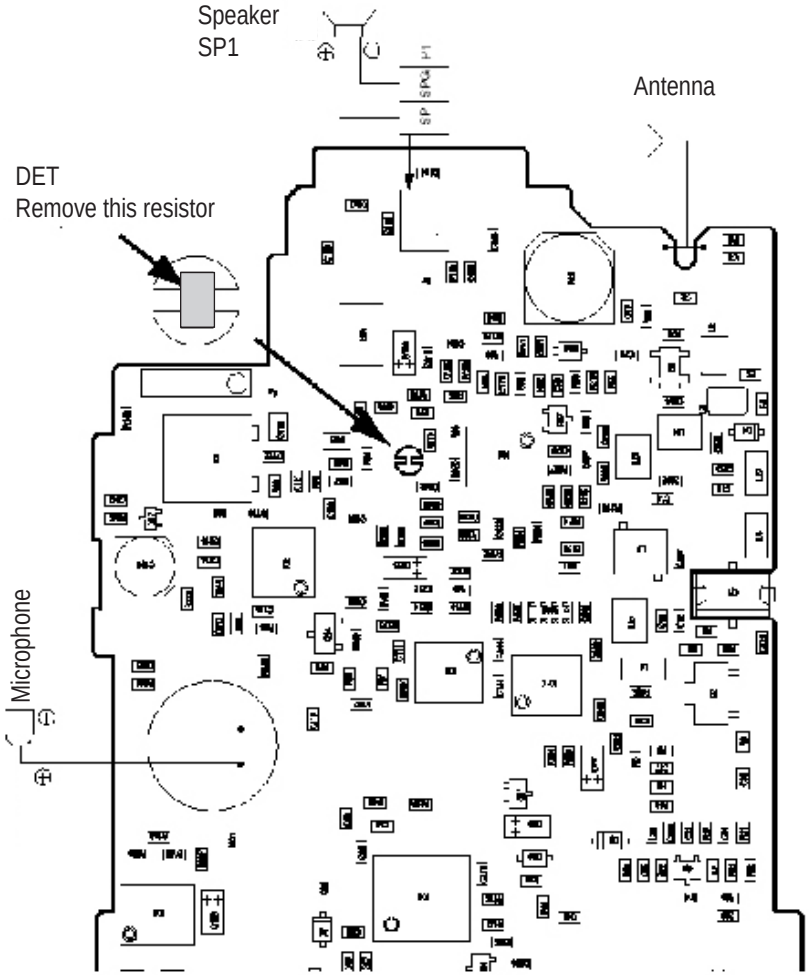


Figure 12. B4929E modification detail.

IC-F4GT/IC-F4GS

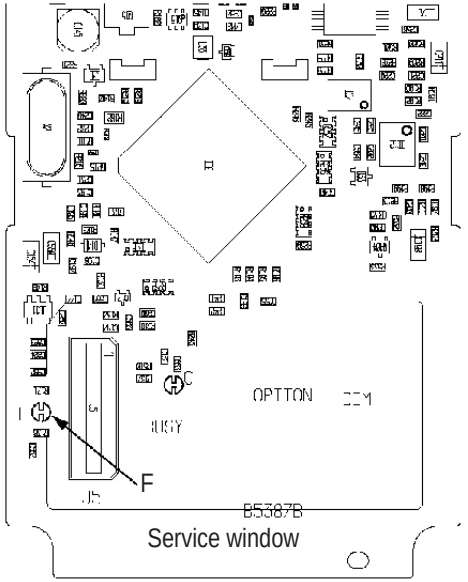
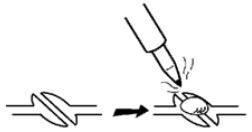


Figure 18. IC-F4GT/GS modification detail..

Cut the junction pattern F on the PC board.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



3.3 IC-F3GT/GS IC-F4GT/GS Series.

Cut the junction patterns before installing the DSP unit.

- Take off the optional connector access cover.
- Insert a screwdriver into the hollow of the chassis, then lift and take away the cover. (The cover cannot be used again).
- Cut the patten marked F.
- Install the unit as shown on the right.

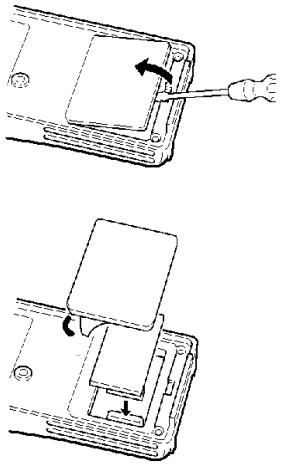


Figure 16. Access cover detail.

IC-F3GT/GS

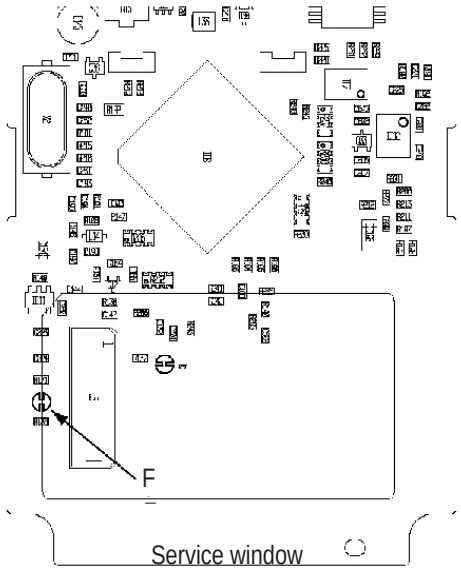


Figure 17. IC-F3GT/GS modification detail..

CPU Side modifications:

PCB No. B4929E Remove CPU side jumper chip (1).
B4929F Remove CPU side jumper chips (1) and (2).

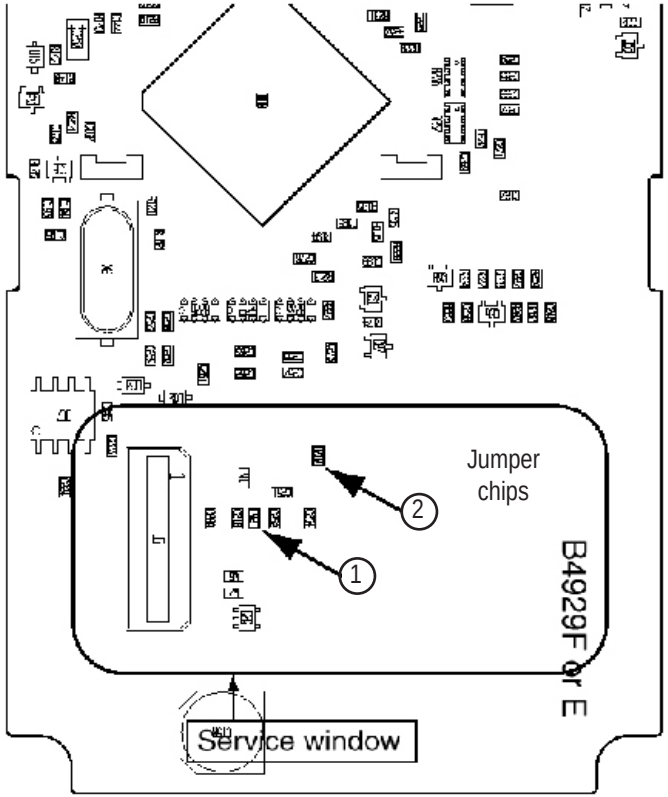
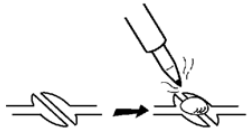


Figure 13. CPU side jumper chip locations.

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.



Model: IC-F4/IC-F4S

PCB No. B4923G Remove the LCD side jumper chip and the CPU side jumper chip (1).
B4923H Remove the CPU side jumper chips (1) and (2).

LCD side:(B4923G only).

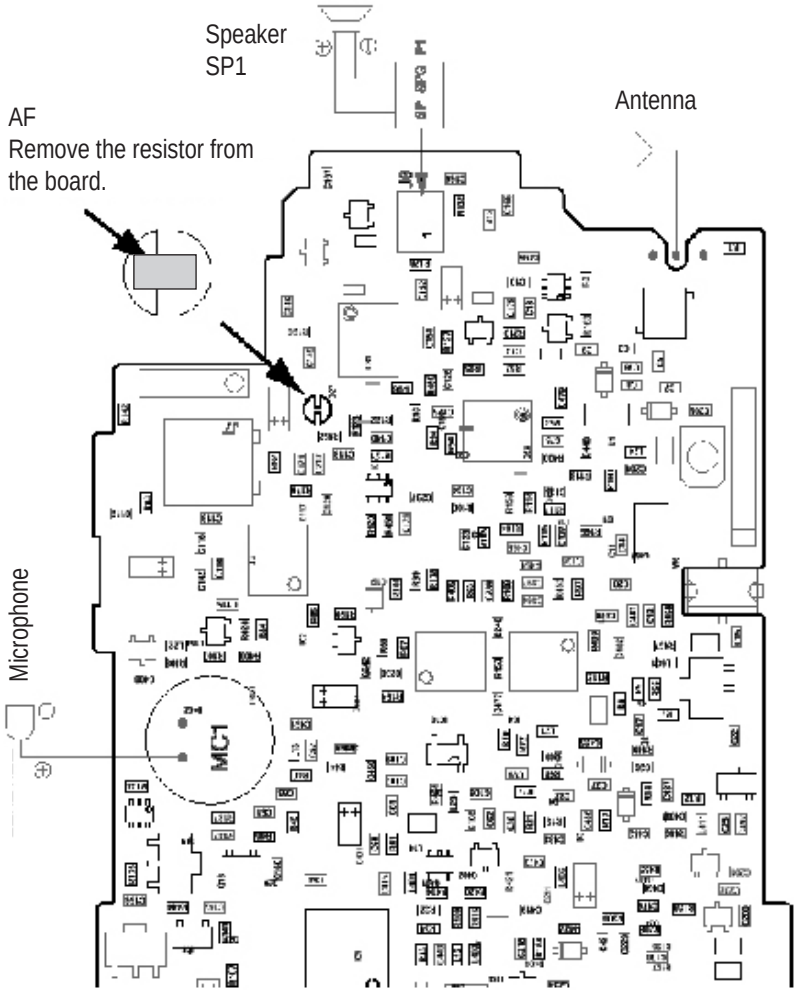


Figure 14. B4923G only modifications..

CPU Side modifications:

PCB No. B4923G Remove the CPU side jumper chip (1).
B4923H Remove the CPU side jumper chips (1) and (2).

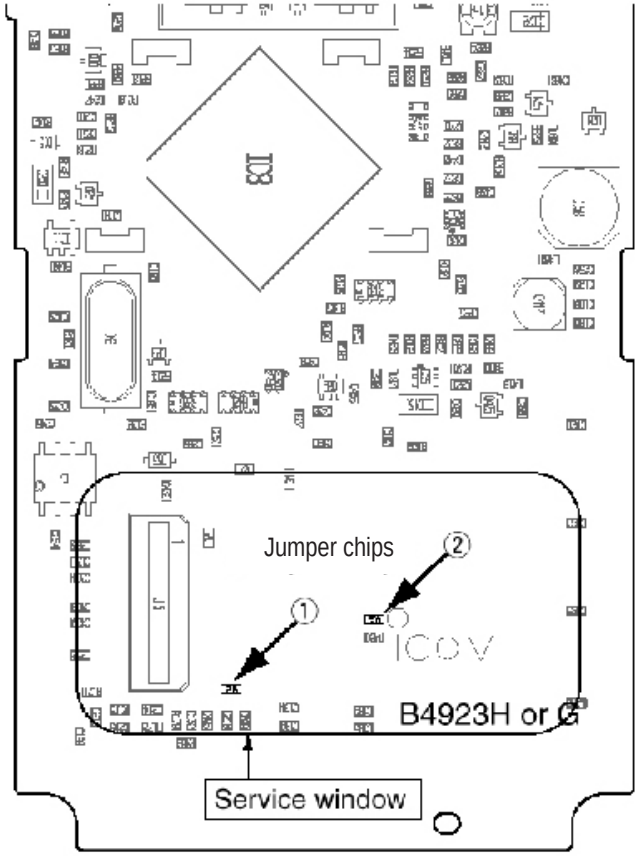


Figure 15. CPU side jumper chip locations..

Important note: Be sure to re-solder the disconnected point, if the DSP module is removed from the equipment, otherwise no AF output will be available.