KO6YD Designs
Where Ideas and Technology Meet

Autoshift 706™

Assembly & Users Guide

Rev. 2.1
Ver. (1.5R)

Notice

KO6YD Designs assumes no responsibility for damage caused by the improper installation or operation of the Autoshift 706 kit. Construction, installation and use of the Autoshift 706 kit is at the builder's and user's own risk. If you do not agree to these terms, you may return the unassembled kit for full refund.

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1. Introduction

These instructions are for the assembly and installation of the Autoshift 706 from KO6YD designs. These apply for both the IC-706 and the newer IC-706 Mk-II.

The ICOM IC-706 radio provides many features in a small package. The IC-706 requires you to calculate the repeater offsets and enter them manually. Most VHF radios have a basic band plan "programmed" into them and will perform the repeater offset calculation for you. The Autoshift 706 will add this missing feature to your radio. The ARRL 2/6/10m band plan has been programmed into the Autoshift system. When enabled, the Autoshift 706 will automatically set the transmit frequency as you tune the receive frequency.

1.1. Circuit Overview

The Autoshift unit consists of a small printed circuit board (PCB), and Autoshift processor and a few support components. The Autoshift processor is a PIC12C508 which is a small programmable microcontroller that has been programmed to interface to the IC-706 via the CI-V computer control port. The CI-V port is an RS232 port with TTL signal levels and the Autoshift will interface with it directly.

1.2. Band Plans

The Autoshift is programmed according to the standard ARRL Band Plan for repeater offset direction as listed in the following tables.

144-145.1	145.1-145.5	145.5-146	146-146.4	146.4-146.6	146.6-147	147-147.4	147.4-147.6	147.6-148
S	-	S	+	S	-	+	S	-

Autoshift Program for 2m band

50-51.62	51.62-52	52.1-52.5	52.5-53	53-54
S	- (500)	S	- (500)	- (1MHz)*

OPTION 1: Autoshift Program for 6m band
* 53.525 & 53.9 (Simplex)

50-51.62	51.62-52	52.1-52.56	52.5-53	53-53.5	53.5-54
S	- (500)	S	- (500)	S	- (500)*

OPTION 2: Autoshift Program for 6m band (ARRL Plan) [Default via Jumper]
* 53.9 (Simplex)

28-29.61	29.61-29.69	29.7-30
S	- (100)	S

Autoshift Program for 10m band

1.2.1. Special Note on 6 Meters

The 6m band has two options that can be set via a jumper . The problem with the 6m band is there is not a standard followed for 6m repeaters. When I inquired the ARRL about this, they also confirmed that the 6m band varies from area to area. When developing the Autoshift for 6m I chose a plan that seemed to fit "most" areas. Most of the time when a 6m repeater output is in the 53 MHz part of the band, the split is (-) 1MHz. However, when a repeater is in the 51 and 52 MHz area, it tends to use a (-) 500kHz offset per the ARRL band plan. However, there are also some that operate at odd splits as well as 1700 kHz. The 1700kHz splits are not supported by the Autoshift.

1.3. Installation Options

The Autoshift unit has two installation options.

1.3.1. Internal Mounting

The easiest is the internal mounting option. The advantage of internal mounting is easy access to power and CI-V connections within the IC-706. The disadvantage to internal mounting is it may void the warranty. With this mounting option, the Autoshift requires 3 simple connections to be made within the IC-706 and requires no modifications to the IC-706. The Autoshift board is small enough to fit completely within the IC-706.

1.3.2. External Mounting

The external option requires you to supply power to the Autoshift board as well as wire a 3.5mm phone connection to a jack on the back of the IC-706. Also, you may want to put the Autoshift 706 into a project box. For power, you may want to run separate power wires from the 12VDC source you are using to power the radio. You can also power it from a small 9v. If you choose to power the Autoshift unit with a 9V battery, you may want to install a small switch so you can turn the unit off and lower drain on the battery. The Autoshift draws about 3ma so the drain on an automobile installation would be minimal. Instructions for external mounting are at the end of this document.

2. Assembly

Before beginning assembly, verify that you have all the proper parts and tools. These instructions will guide you through building the Autoshift 706 circuit.

2.1. Tools

To build the Autoshift 706, you will need the following tools:

- Soldering Iron
- Electronic Solder
- Needle-nose pliers (or other method to bend component leads)
- Electrical Tape and Foam mirror mounting tape

2.2. Parts List

The Autoshift 706 kit consists of the following parts:

- AS706 Printed Circuit Board
- 8 Pin Dip socket
- Autoshift Processor (12C508 8 pin DIP)
- 78L05 +5V Voltage Regulator
- 10uf Electrolytic Capacitor
- .01uf Ceramic Disc Capacitor
- 1N419 Diode
- 4MHz Ceramic Resonator
- 3 Connection Wires

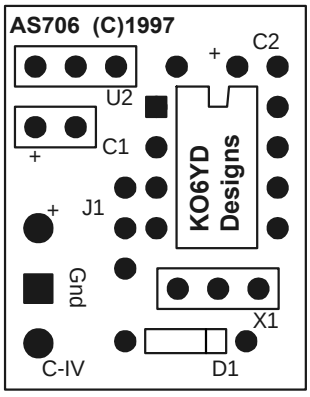

Figure 1
(AS706 / Top Side)

2.2.1. AS706 Board Assembly

The Autoshift 706 is based on the AS706 PCB (Figure 1). The board contains a 5 volt regulator circuit and an 8 pin DIP holes for the PIC 12C508 processor.

All assembly instructions will assume you are looking at the board from the component side as shown in Figure 1.

NOTE: If you wish to use the ARRL band plan option for 6m, you will need to install a jumper at assembly time. See Section 5 for more information.

2.3. Assembly Instructions

Follow the assembly steps below, insert the part, solder and trim component leads. Be careful to observe the correct polarity for C1, C2 and the Diode. The following figures represent component areas on the AS706 (Figure 1) board.

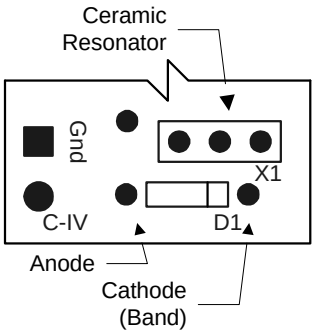

Figure 2

☐ 1. Install the diode. Locate the area on the board marked D1 (Figure 2). Install the diode so the cathode (Black Band) is facing the hole on the right as indicated in Figure 2.

☐ 2.Locate the Ceramic Resonator. It is the white, rectangular, three pin component. The resonator is installed on the board in the location marked X1 (Figure 2). The resonator polarity does not matter. That is, you can install the resonator in any direction at location X1.

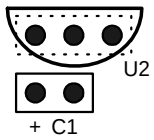

Figure 3

☐ 3 . Install the voltage regulator. Locate the area on the board marked U2 (Figure 3). Install the LM78L05 (Voltage Regulator) as indicated. The flat part of the device should be facing the top edge of the AS706 Board.

☐ 4. Install the 10uf electrolytic capacitor (C1). Locate the area marked C1 just below the regulator (U2). The positive lead of the cap. is indicated in Figure 3.

Note: The capacitor has a mark denoting the negative lead.

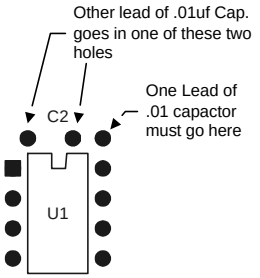

Figure 4.

☐ 5. Install the .01uf capacitor (C2). Refer to Figure 4. C2 has two mounting options depending on the lead spacing of the capacitor. It is important that one lead be put into the right-hand hole and the other lead to one of the two holes to the left.

☐ 6. Install the chip socket. A socket was provided for easy installation of the Autoshift processor and reduce the handling of the chip during installation. It will also allow future enhancements to be made by replacement of the processor chip. Install the socket in the location marked U1 on the board.

☐ 7. Remove the Autoshift processor (8 pin DIP) from it's protective foam pad and install it into the socket at U1. PIN one of U1 is in the upper left corner (Square Pad) and the notch on the processor should be facing the top edge of the board. (See Figure 4).

CAUTION: The Autoshift Processor is sensitive to static electricity, please take precautions to avoid a static discharge when handling.

2.4. Congratulations !

You are now ready to install the Autoshift 706 unit into your radio.

3. Installation

Installation of the Autoshift unit inside the IC-706 is simple. However, since it could invalidate the warranty, you may want to use the external mounting option.

The Autoshift unit requires 3 connections to the IC-706. They are:

- +8 to +15 VDC
- Ground
- CI-V Data

3.1. Internal Mounting

The following steps will guide you through internal installation of the Autoshift 706. With this installation option, the Autoshift board will be mounted within the case and the three connections (Power, Ground and CI-V Data) will be made to the filter PCB in the IC-706. Three colored connection wires are included in the kit.

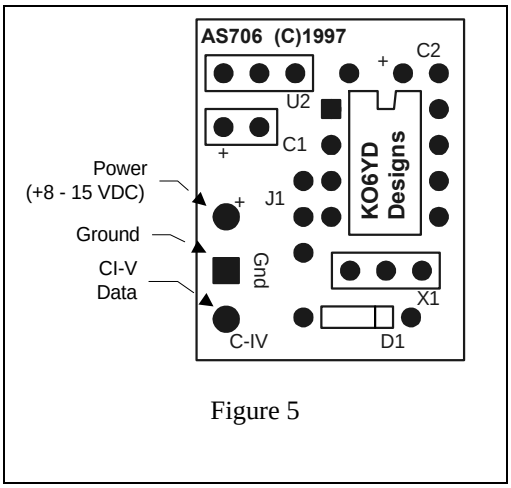

Figure 5

Before you begin, locate the power and ground connections which are the larger round and square pads located on the left edge of the board. The square pad is the ground connection and the round one above it is the power (+8 to 15vdc) connection. The CI-V data connection is the pad just below the ground connection. Refer to Figure 5 to locate the Power, Ground and CI-V Data connections on the Autoshift board.

☐ 8 . Strip about 1/8" of insulation and tin both ends of each wire.

☐ 9 . Connect each wire to the Autoshift board to the connection points indicated in Figure 5.

CAUTION

Disconnect power before removing the top cover of the IC-706 unit

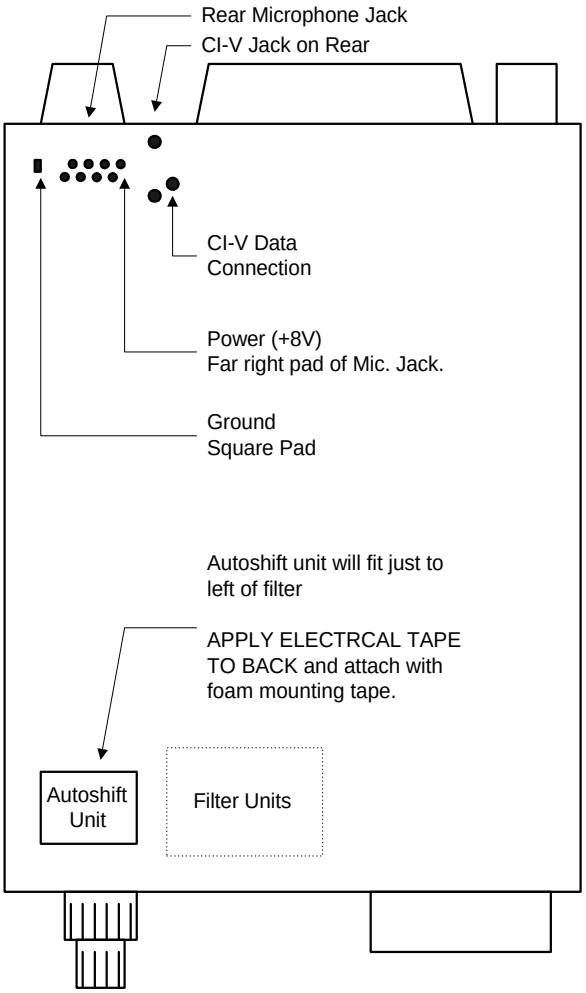

Figure 6
(Top view / Cover Removed)

**** DO NOT PUT THE AUTOSHIFT INTO THE RADIO YET ****
Until you have some form of insulation on the back of the Autoshift board, it could short out the radio when placed inside.

☐ 10. Cut a 1" piece of 3/4" electrical tape and apply to the back (Solder Side) of the Autoshift circuit board. This is required to prevent the solder connections on the back of the board from shorting out when placed into the IC-706.

☐ 11. With IC-706 power disconnected, remove ALL connections on the back. Then, remove the TOP cover of the IC-706 as described in the 706 instruction manual.

The Autoshift unit can be mounted in the area just to the left of the optional filter modules in the front left of the radio. Refer to figure 6 and carefully follow the steps to solder the three wires from the Autoshift unit to the Power, Ground and CI-V data areas on the IC-706 board. Use caution since you are "tacking" these wires onto existing connections. Do not overheat the connection or create a "solder bridge" to another pad. Also, make sure to trim the tinned wire a short as you can before making the connection to reduce the chance of any bare wire shorting out the radio.

☐ 12. Connect the Power Wire. The Autoshift unit will obtain power from the IC-706 board connection for the rear microphone jack. Refer to figure 6 to find the location of this area on the 706 board. The rear microphone. jack can be identified by 8 solder pads at the left rear of the 706 filter unit board. These are identified as 2 rows of 4 pads directly behind the rear modular microphone jack. The pad on the upper right is 8 VDC power at 10ma which is more than enough since the Autoshift draws about 2ma. Carefully solder the power wire from the Autoshift 706 to this solder pad.

☐ 13. Connect the Ground. The ground wire connection will be made to a rectangular solder pad just to the left of the microphone connections.

☐ 14. Connect the CI-V data wire. The CI-V data connection is made to the IC-706 board connection pads for CI-V jack on the rear panel. These are located just to the right of the microphone connections on the IC-706 board. Directly behind the CI-V jack on the rear of the IC-706 you will see a larger solder pad and another 3/8" toward the front of the IC-706 in line with first one. Just to the right and slightly to the rear of this second pad you will see another pad of the same size as these other two. This third pad will be the connection point for the CI-V data wire.

☐ 15. Install the Autoshift board. You may wish to cut a small (1/2" by 1/2") piece of foam mounting tape (sometimes called mirror mounting tape). Attach this to the back of the Autoshift board then attach the board to the main board in the IC-706. A piece of folded electrical tape will also work. The main goal is to keep the Autoshift board from moving around within the radio.

☐ 16. Route the wires so they will not be pinched or catch on anything when the top cover is reinstalled.

☐ 17. Reinstall the top cover on the IC-706 and attach other connections and power.

4. Setup and Operation

4.1. Initial Set Mode settings

In order for the Autoshift module to operate properly, some Initial Set Mode options must be set. To enter the Initial Set Mode, press and HOLD the [LOCK] button while turning on the power. Refer to your IC-706 users guide to select and set the following settings:

Setting	Indication	Description
CI-V ADDRES	48h	CI-V address of IC-706
CI-V BAUD	9600	CI-V baud rate
CI-V TRN	on	CI-V TRN (Transceive Mode)
CI-V 731	off	CI-V 731 Address Mode

4.2. Using the Autoshift

Once installed and the Initial Set Mode options have be configured, the unit is ready for operation. The Autoshift will operate only when the IC-706 is in FM mode (Not FM-W) and the Narrow filter has been selected. Selection of the Narrow filter option when in FM mode of the 2/6/10m band is used to enable the Autoshift unit.

To operate the Autoshift, you must be in VFO mode. Select VFO-A mode by pressing the **[V/M]** as necessary. Then, via the menu, select the NAR (Narrow) filter. The [**NAR**] or [**N**] **(MKII)** indicator should appear in the upper left of the display. At this point the Autoshift system should be active. Turn the VFO knob to a frequency within an FM repeater sub-band. Once you stop turning the knob for about 2 seconds, you may notice a quick flash on the display and the [**SPLIT**] or **[SPL] (MKII)** indicator in the upper right of the display should be on. If you then re-tune the VFO, the [**SPLIT**] will go off as soon as you change frequency. This will be your indication that the Autoshift system is working. Again, after you stop on a frequency for 2 seconds, the [**SPLIT**] will come back on. At this time, the VFO-B will contain the proper repeater offset and the system should be in split (Duplex) mode.

Note that even within simplex areas of the bands, the [**SPLIT**] indicator will come on. However, the Autoshift will have set VFO-A and B to the same frequency which will provide the same transmit and receive frequency.

IMPORTANT !

Before you transmit, you must disable the Autoshift unit by turning off the NAR mode or use the Alternate Autoshift Disable feature described below. This must be done because as soon as you transmit, the VFO would change to VFO-B (Split operation) and the Autoshift would be confused in thinking you are changing the frequency and reactivate.

Also, the unit will be operational in the memory mode (if the Narrow filter is enabled). Make sure that Narrow filter is off or the unit is disabled as described below while in memory mode.

If you do anything that will change the displayed frequency (Transmit, press VFO / Memory key, XFC, A/B, etc.) while the Autoshift is enabled, the Autoshift will activate and may "get in your way". Before performing these functions, disable the Autoshift by turning off the [**NAR**] (Narrow) option or use the Alternate Disable Feature.

Alternate Autoshift Disable Feature

Under normal operation, the Autoshift unit is enabled and disabled using the Narrow FM filter settings. In this mode of operation you must turn off the Narrow filter before you can transmit. If you don't, the Autoshift see the frequency change when you transmit (Split operation) and become active (i.e., It will turn off the split and wait 2 secs, etc.). A second method is provided to completely disable the Autoshift unit allowing you to keep the Narrow filter for FM operation enabled and not have the Autoshift unit inhibit operation. When disabled using this procedure, the Autoshift will no longer perform any operations until re-enabled using the same procedure.

1. Insure the Autoshift is activated by enabling the Narrow [NAR] filter mode in FM Mode in the (10,6 or 2M band)

2. Press and hold the [MODE] button to place the IC-706 into wide FM mode. You will notice the 706 display will flash into wide FM for an instant then return back to standard FM mode. This is your indication that the Autoshift has been disabled. You may now operate the 706 with Narrow filter enabled in FM mode.

3. You may re-enable the Autoshift by following steps 1 and 2 again. The MODE key will operate as normal, allowing WFM mode, when the Narrow FM filter are off.

5. Options

The Autoshift has a few options relating to it's mounting and operation.

5.1. External Mounting

You may mount the Autoshift 706 unit externally. You may want to choose this option if your unit is still under warranty. With this mounting option, there are no internal connections required to the IC-706 thus the top cover of the radio need not be removed.

The connection of the Autoshift 706 will be made via the CI-V jack on the back of the IC-706. Refer to your IC-706 users guide to locate the CI-V jack.

5.1.1. Parts

You will need the following parts to mount the Autoshift 706 externally.

- Mini (3.5mm) phone plug
- Two conductor shielded cable
- Power connection (9v Battery clip or other method to obtain power)

Refer to Figures 7 and 8.

When mounting the Autoshift unit externally, you will need to wire the CI-V Data and Ground from the Autoshift board to a 3.5mm plug. You will note that both the power ground and signal (CI-V) ground are wired into the same solder pad. The 3.5mm plug will be inserted into the CI-V jack on the back of the IC-706. Power for the Autoshift can be obtained from a 9v battery or directly from the 12V source used to run the IC-706. In the case of a small battery, you may wish to use an on/off switch to help save the battery life.

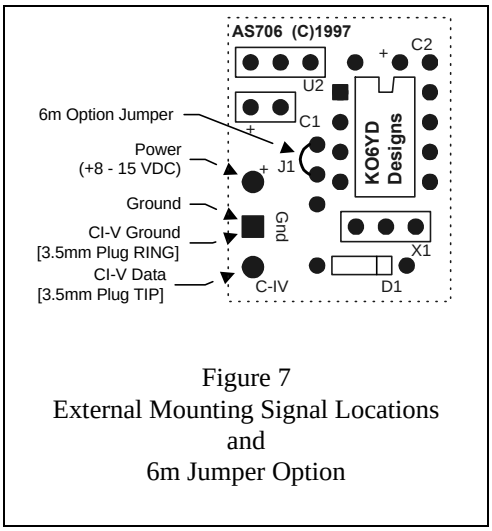

Figure 7
External Mounting Signal Locations
and
6m Jumper Option

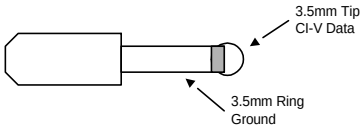

Figure 8
3.5 mm Phone Plug

5.2. 6m Offset Program

By default, the 6m repeater offset will be set as given in Option 1 in section 1. You may install a jumper on the AS706 board that will cause it to use the ARRL band plan listed in Option 2. Refer to figure 7 for the location of the option jumper. Install a wire jumper between the upper two pads of J1.