

PIC Firmware Description – Version 4.1

When the IC706MkIIg is first turned on it applies +12 VDC to pin-3 of its tuner interface connector. The radio then checks to see if +12 VDC is present at the Start line (pin-2). If so, it assumes that a tuner is connected and activates that portion of the radio firmware that controls the tuner. If not, it assumes that a tuner is not connected and disables that portion of the firmware. Resistor R1 (10K) in the tuner interface pulls the Start line to +12 VDC in order to notify the radio that it is present.

When the LOCK switch is active it pulls the tuner's lock/reset line (pin-2 on the interface connector) to a positive voltage in order to prevent the tuner from retuning if it detects a high SWR. When power is first applied to the PIC processor it initializes and then disables the lock function for 100mS. This prevents the tuner from detecting a lock condition during its own power up and disabling its tune from memory function. After this has been completed, the processor re-enables the LOCK switch position and goes to sleep in order to ensure that it does not generate any noise that might be received by the radio.

The start line from the radio normally sits at +12 VDC. The radio signals the interface by pulling this line down to zero volts. A short pulse (50 – 60mS wide) signals a request for a tuner reset to bypass mode. A long pulse (500 – 600mS wide) signals a request to tune the antenna. When the radio changes the start line, the PIC processor wakes up and begins processing the request. An on-board timer in the PIC is used to measure the width of the pulse. When the PIC wakes up, the first thing it does is disable the setting of the LOCK switch for the duration of the process. This ensures that the tuner is unlocked and able to retune if requested to do so. The firmware provides a minimum of 100mS delay between the end of a reset pulse and locking the tuner in order to prevent the tuner from disabling its tune from memory function. A function of the tuner is that it disables tune from memory if a lock condition occurs during or too soon after its power up or reset sequence.

It is always desirable to reset the tuner to bypass before processing a tune command in order to guarantee the best match and to ensure that the tuned line is inactive before starting the tune process. The interface therefore processes a reset as soon as it wakes up. The interface resets the tuner by pulling its lock/reset line (pin-2) to zero volts for 40mS. Before a reset is sent, the PIC always checks the current status of the tuner's tuned line (pin-1). If this line is at a positive voltage, signaling that the tuner is already in a bypass condition, an additional reset is not sent. This is done to prevent the possibility of confusing the processor in the tuner with too many resets. Because the radio sends a reset when changing bands, it is possible that rapidly switching through memories loaded with frequencies on different bands could generate a sting of resets.

If the start pulse was a short duration then it was only a reset request so the PIC waits 100mS and then re-enables the LOCK switch setting and goes back to sleep mode awaiting the next change on the start line. The 100mS delay is needed to prevent the tuner from sensing the return of lock to soon after the reset and disabling its tune from

memory feature. If the start pulse was a long duration then the PIC goes into its tune mode.

In tune mode, the first thing the interface does is to pull the radio's TKEY line (pin-1) to zero volts. This causes the radio to flash its TUNE button LED, emit a tone in the speaker, and transmit a 10-watt RF carrier for the tuner to use in finding a match. As soon as the tuner finds a match, it signals the interface by pulling the tuned line to zero volts. This extinguishes the FAUT LED in the interface and signals the PIC to release the TKEY line. The radio then goes back to its previous mode of operation and lights its TUNE button LED.

In the Icom mode (OPT-B open) the interface waits to release the TKEY line until the radio has released the STRT line so that the radio does not get confused by a tuner that finishes too quickly. This can happen in modes like RTTY that output a carrier as soon as the PTT is pressed. The tuner will begin tuning on the carrier and finish before the radio has switched into tune mode. This problem does not occur on SSB mode because the radio does not output signal until you speak into the microphone or it enters the tune mode.

In the Alinco mode (OPT-B jumper in place) the interface releases the TKEY line as soon as the tuner reports a matched condition. This is necessary because the Alinco radios hold the STRT line low until the TKEY line has been released or until a 30 second timeout occurs. In the Icom mode, an Alinco radio would be locked in tune for 30 seconds even though the tuner has reported a tuned condition.

If the tuner is unable to find a match after attempting all possible combinations of L and C, it signals the interface by pulsing the tune line (originally intended by SGC to signal the operator by flashing the tuned LED on their SmartLock interface). When the PIC senses this it places the appropriate 200mS wide pulse on the radio's TKEY line which causes the radio to return to its previous mode with its TUNE button LED extinguished.

If during the tuning process the operator again presses the radio's TUNE button, the start line will return to zero volts. The PIC detects the low state of this line before the tuning is complete and cancels the tune operation. The radio's start line is released and the tuner is placed in bypass mode.

As an added precaution, the PIC runs a 30-second fail-safe timer during the tuning process. If the tuner does not signal either a tuned condition or a failed condition within 30-seconds then the PIC cancels the tuning process, un-keys the radio, and resets the tuner to bypass.

Version 4.1 includes a self test function which is activated by holding OPT-A grounded during power up. The test functions with an automated test fixture in order to improve production testing by exercising all of the interface's inputs and outputs.