

Technical description of MINI automatic tuner board

Upgraded version of N7DDC.

Suitable for CGJ-100 / CGJ-100Q

The panel is marked 1-30mhz (actually it can be tuned to 1-50mhz)

purpose

The device is intended to be used as a component of an amateur radio device, as part of an amplifier or transceiver, or as a separate device that performs the function of matching the output impedance of a power amplifier (PA) to an antenna feeder.

Unlike the mini board, the device can contain a set of 5 to 7 inductors and 5 to 7 capacitors, which allows it (in the maximum configuration) to work effectively in a wide frequency band. The overlapping amateur radio HF range is 1.8 MHz to 50 MHz

The multiple algorithm settings available to the user allow the use of microprocessors and control circuits in other auto-tuner projects in various variations. Nevertheless, the author still followed the concept of the basic scheme.

According to the author, the basic model contains a set of 7 switching inductors with uneven spacing from $0.05\mu\text{H}$ to $4.5\mu\text{H}$, and a set of 7 capacitors with uneven spacing from 10 pF to 1 nF. The parameters used by default guarantee the reliable operation of the equipment in the basic version and are the main parameters for the author to test during software development. Users can change many parameters by themselves, which may change the behavior of the device or even make it unusable. Please read the instructions carefully before making any changes.

Use "Basic Model"

The author assumes that the device can be used in two situations: as an add-on module as part of the transceiver and amplifier, or as a standalone device (with or without instructions) on its own. No need to redo. Both the button for manually starting tuning and the control signal output from the control processor of the transceiver or amplifier can be connected to the control connector.

When all inductances and capacitors are turned off, whether by a button or a control signal, a brief impact (less than 250 ms) on the control line will cause the tuner element to reset to its original state.

Holding the control signal for a longer time will trigger the start of the setting process. The results of each configuration process are stored in the device's non-volatile memory and restored after turning off the power.

Other signals can be obtained from the RA7 and RA6 microprocessor connectors to better integrate with existing equipment. This is the Tx_request signal (carrier request for tuning) in forward and reverse form. This signal is sent by the device's processor for the time required for tuning. During this period, the transmitter must provide a continuous carrier with suitable power. When the user does not need to perform other operations (except how to press the TUNE button), it can be used to automate the configuration process. This is not necessary because the device allows tuning with any input signal with sufficient power (such as voice), through any type of modulation, telegraph packets and even noise-like signals using RF signals for modulation. When the input signal is low, the tuning will stop and resume when it appears. That is, the adjustment can occur directly in the normal operation of the device.

However, in order to make the device operate reliably, it is recommended to use this signal to reduce the signal power of the

transmitter to the device value during tuning safely, for example, by acting on the ALC loop.

The Tx_request signal can also be used to connect to an LED, which will indicate the adjustment process and activities when the LCD indicator is not expected or cannot be used.

Indications

Generally, the device can be used without display elements, and to monitor the operation of the device, you can use a scale such as an SWR meter built into the transceiver or a separate external SWR meter. Of course, when using the auto-tuner as a separate device in your own case, it is very convenient to have your own display to monitor the operation, and the device is configured with SSD1306 controller by default, with a resolution of 128x32 pixels and a diagonal of 0.91 inch.

The left side of the indicator shows the power output and SWR. Using the peak detector mode, it can accurately measure the signal power of the transmitter when various types of modulation are used.

The right side shows the inductance and capacitance values

set by the device due to the last adjustment process. In the first row and the second row, instructions are made, and the instructions L and C are interchangeable. According to the classic L-shaped scheme, it is used to display the connection point of the capacitor. Therefore, if the inductance is at the top, it is assumed that the capacitor of the tuner is connected behind it, that is, connected to the output. If the inductance value is displayed on the bottom row below the capacitance value, it means that the capacitance is connected before the inductance, that is, connected to the input.

The display can also briefly display some inscriptions describing the current operating mode of the device. They are TUNE, RESET, OVERLOAD (when a signal with a power exceeding 150 watts is applied to the device).

Additional button

The device also allows you to connect two additional buttons that extend basic functions. These are the "bypass" and "auto" buttons.

Pressing the "Bypass" button will temporarily turn off all capacitors and inductances on the signal path from input to output. This mode has a corresponding indication in the form of an underline

on the LCD display. If the automatic mode is activated, its operation will temporarily stop when the bypass mode takes effect. Pressing the button again will turn off the "bypass" mode, and the device will reconnect the capacitors and inductors installed at the end of the last adjustment process. If automatic mode was previously activated, it will also be restored.

Press the automatic button to activate the automatic mode of the device, which is shown as a dot on the display. The device will remember that the automatic mode is turned on, and will remain in the automatic mode even after the power is turned off, until it is turned off by pressing it again. The automatic mode can also be activated by changing the parameters during the firmware installation process (will be explained below).

Automatic mode

The automatic operation mode provides users with a unique opportunity to use the device without pressing buttons and connecting any external controls.

The device can be designed without buttons and instructions, and will perform its function to match the resistance of the antenna

power line.

The algorithm uses the following: If the current SWR exceeds 1.3 and the value recorded after the previous adjustment process has become (1.3-1), the adjustment mode is active. Usually, when the frequency band changes, this condition is easily met, which will immediately trigger a new tuning process.

Special operating mode

The device has several special operating modes designed to simplify the process of assembly, commissioning or troubleshooting.

When all three buttons **Tune (BOT)**, **Bypass (BYP)** and **Auto** are pressed to power on the device, the quick test mode will be activated. In this mode, the device supplies power to all relays, which allows you to quickly identify faults related to transistor switching or welding faults.

When pressing the "Bypass" and "Auto" buttons to power on the device, the device will enter a simple test mode. In this mode, you can manually, step by step, use the "Bypass" and "Auto" buttons to change the capacitance or inductance value. A long press of the "Tuning" button allows you to select the element that will be moved at the

moment, and a short press to change the connection point of the capacitor. In this mode, input power and SWR can be measured online. The whole process is accompanied by clear instructions.

POW=Power switch key, long press the switch (the second indicator light is on), double-click quickly to shut down.

P=Charging and discharging indicator light, when the battery is not connected, the light is normally flashing

W=Work indicator, always on when power on

Technical characteristics

«Basic model»

Allowable power supply voltage range: **TYPE-C 5VDC(1A)**

Maximum current consumption: 400 mA *

Maximum working throughput: 100 watts (**CGJ-100Q_40W**)

Maximum possible measurement power: 150 watts

Minimum power required to start tuning: 5 watts**

(CGJ-100Q_1W)

Minimum possible measurement power: 0.1 watts

Measurement step size for power up to 10 Wh: 0.1 W

Measurement procedure for power higher than 10 watt hours: 1

watt

Power measurement accuracy: 10%

Maximum installation inductance: 8.53 μ H

Minimum installation step length of inductance: 0.05 μ H

Maximum installation capacity: 1869 pF

Minimum capacitance installation steps: 10 pF

*Typical consumption 150-200 mA

**If necessary, some parameters may be changed.

caveat! Do not touch the antenna during the transmission test of this equipment, otherwise it may cause an accident.

Precautions!

1. Please do not switch the machine or power off this product during transmission
2. This product has a built-in charging chip and a reserved battery interface (remember not to reverse the battery power supply, or you will burn the power chip), the battery voltage is 3.7V4000mah, and the capacity can be increased according to your needs.

Wish all HAM have a good time!

by 73