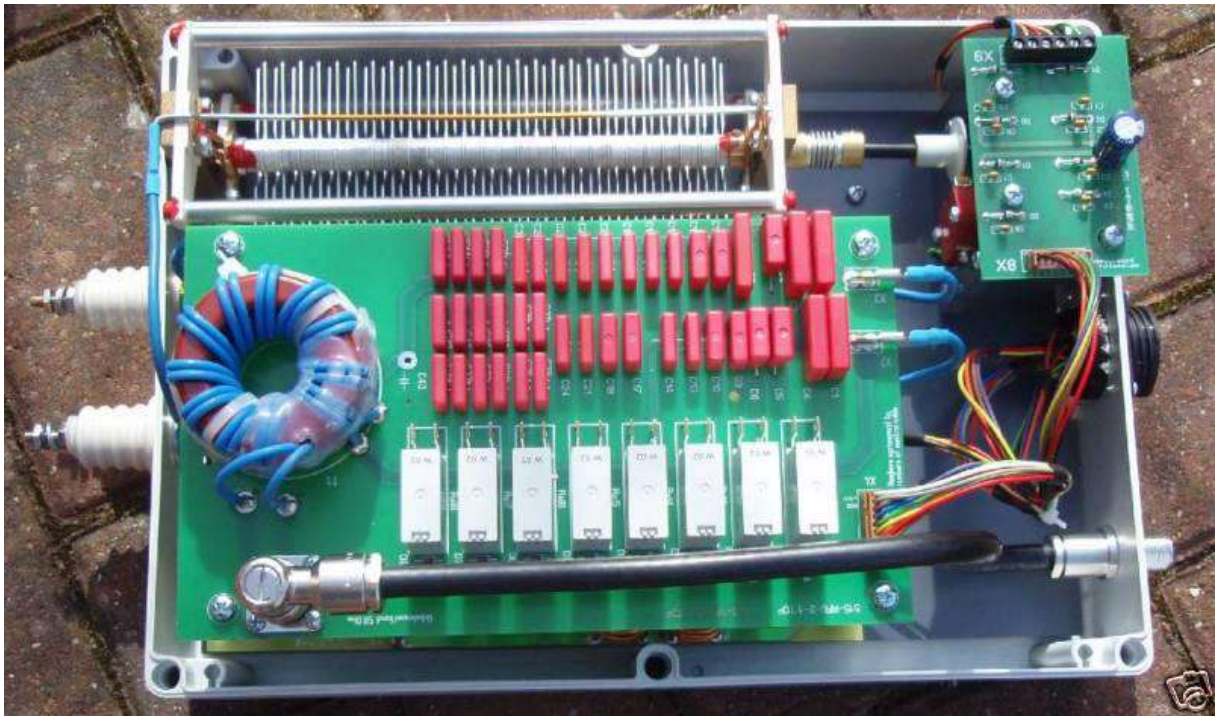


# hamware.de AT-615B

## Firmware with transceiver interface

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## Change log

| Version | Date | Who | Changes |
|---|---|---|---|
| **1.0** | 05.01.2023 | DL2SBA | First version from AT-515 manual |
| **1.1** | 13.01.2023 | DL2SBA | Supplement Chapter "New calibration of the stepmotors"<br>Expansion of the table in the "Configuration Mode" |

**Note: All changes you perform on the AT-615B control unit are at your own risk.**

**Please definitely observe the general guidelines for handling sensitive electronic equipment and components.**

**The firmware cannot be provided in the form of an Intel HEX file.**

**The µController contains code that is copyright protected. Please respect this!**

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## Introduction

The original firmware of the control unit of the HAMWARE tuner AT-615B has a function built in that, based on a transmitted carrier, attempts to determine the current operating frequency and select the corresponding memory.

This works relatively well for CW; in SSB operation this method is not optimal. The biggest disadvantage, in my opinion, is that you must first transmit a carrier to set the frequency.

If you want to switch from 80m to 10m, that means:

- Set the frequency on the transceiver
- Reduce the transmit power on the transceiver to, for example, 10 W
- Transmit a carrier
- Wait 1-2 seconds until the frequency is detected and the memory is selected
- Increase the transmit power on the transceiver again
- Sparks ...

I have now developed a new firmware for the control unit that utilizes the transceiver's computer interface to select the appropriate memory. Typically, the transceiver must be connected to a logging program for this; then the firmware can read the exchanged information and respond accordingly. Thus, a frequency change on the connected transceiver leads to the selection of the correct memory of the AT-615B and thus to the proper alignment of the antenna.

The firmware provides, as the original firmware also does, a possibility to select the relevant memory manually.

In addition, the reading of the rotary encoders as well as the stepper motor control has been improved. The control unit also performs a re-calibration of the 0-position of the output tuning capacitor after a configurable number of stepper motor movements. This reduces step losses caused by mechanical inaccuracies.

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## Supported control units

Currently the firmware has been tested with the AT-615B control unit.

## Supported logging programs

Currently I have tested the integration of the AT-615B with the following programs:

- Swisslog
- RUMLOG
- N1MM

## Supported transceivers

Currently the firmware supports the following protocols:

- ICOM serial (also known as CI-V protocol)
- KENWOOD/ELECRAFT serial
- TenTec Orion serial
- Yaesu FT890
- Yaesu FT847
- Yaesu FTDX5000

The settings used can be found in chapter “Configuration Mode” on page 15.

## Delivery

The firmware is provided in the form of a programmed microcontroller of type ATMEL ATMEGA32.

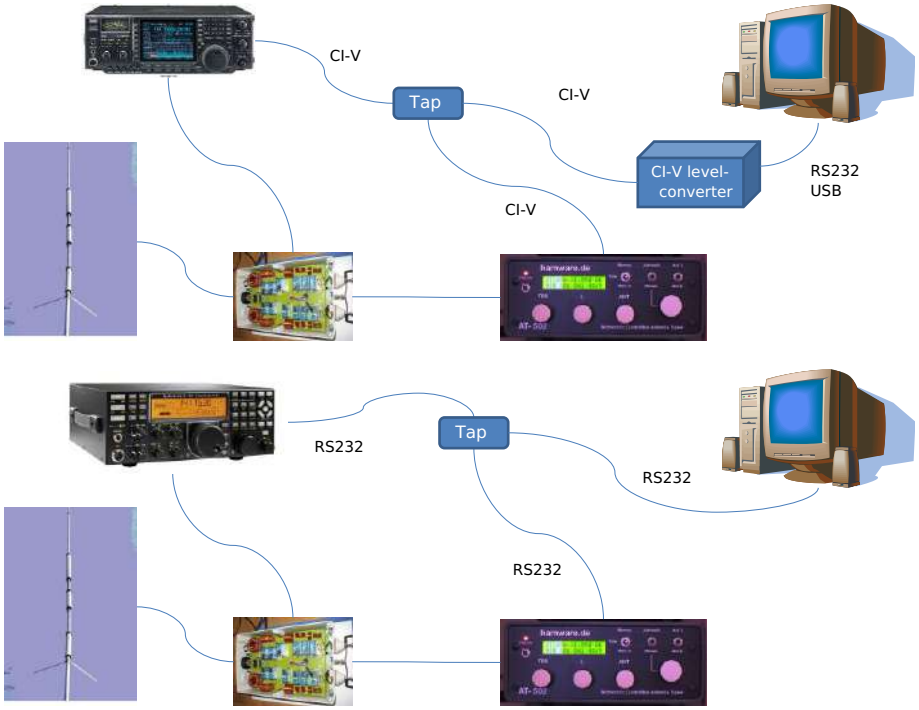
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## Serial interface

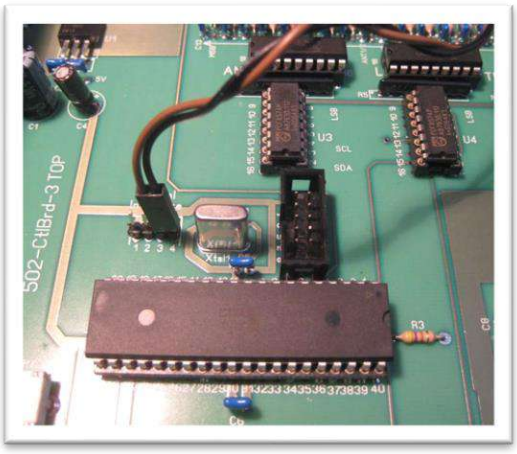
### Hardware

The control unit is connected to the transceiver's computer interface via an interface adapter. If a computer is already connected there, the control unit is connected in parallel to the existing connection.

Here are examples of ICOM CI-V interfaces or RS232 interfaces.




The AT-615B control unit conveniently exposes the serial interface of the used microcontroller to a 4-pin pin header, so no modifications need to be made on the main board.

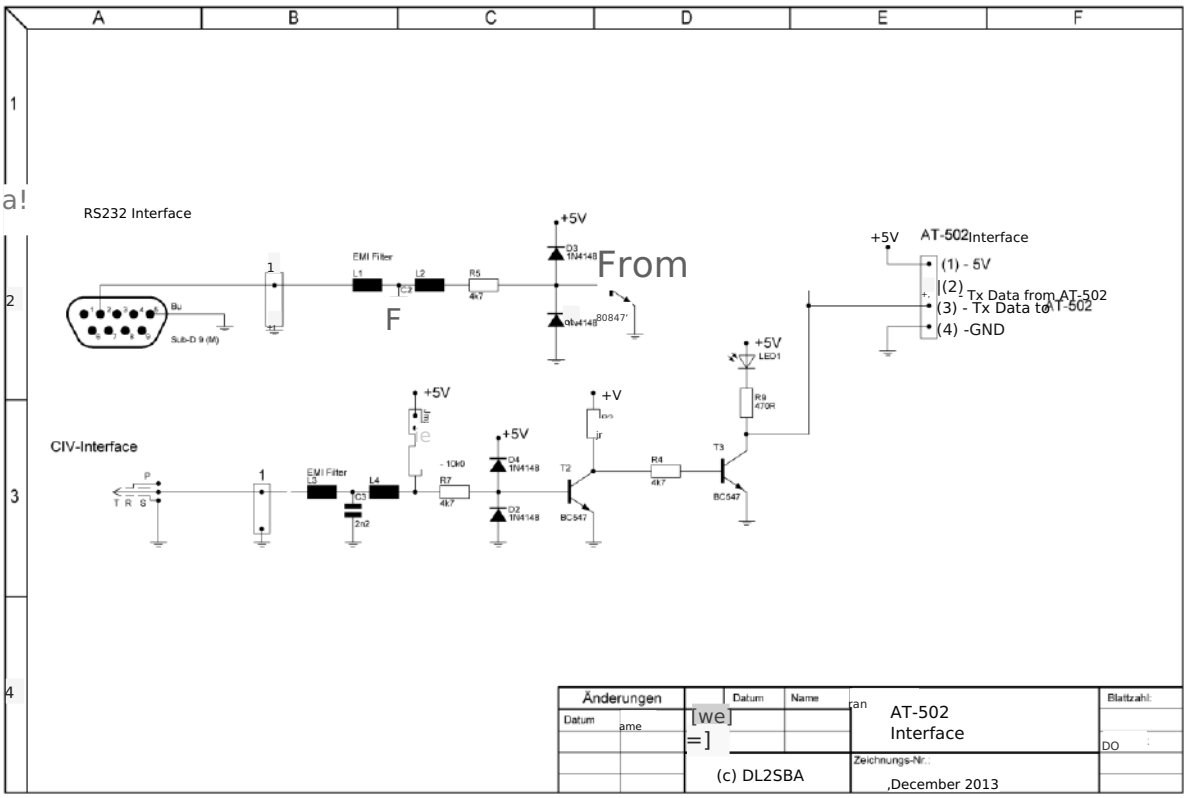


A suitable cable is simply plugged into this pin header and connected to the internal interface converter.

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ATTENTION: The interface of the control unit now tolerates 5-volt levels – it is not RS-232 Interface.

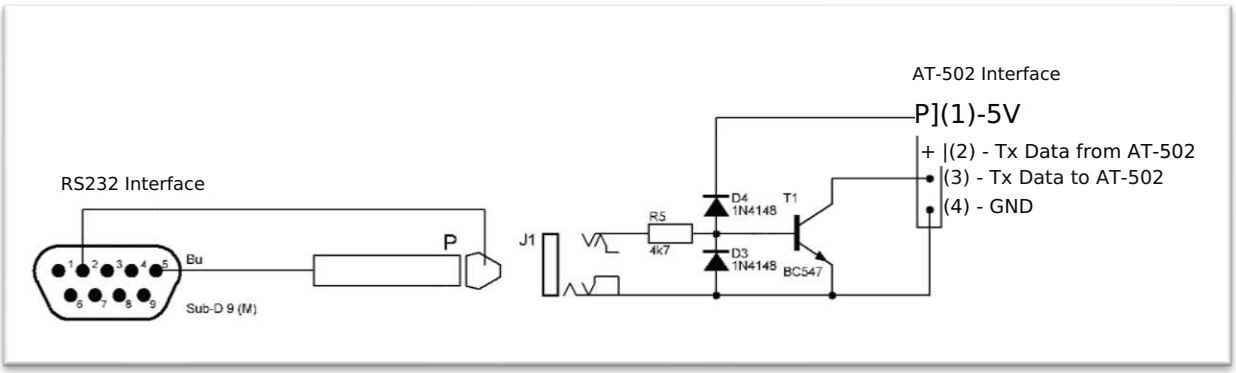
Below is a simple interface translator for the serial RS-232 interface of the ELECRAFT K3 and for the serial CIV interface of the ICOM IC-756 PRO 3:




Note: If the CI-V interface does not work immediately (LED not blinking) then the JMP1 should be closed, which activates a pull-up resistor on the CI-V bus.

The EMI filters can be obtained, for example, from Reichelt ( http://www.reichelt.de ) (Article number DSN6 NC51H 222).

Since I currently have only the K3 connected, I have built a minimal interface adapter for RS232. Certainly not the standard-compliant solution, but in my shack with 100W output power I cannot notice any problems. Here is the circuit diagram:



As the connector on the control unit I chose a 6.3 mm jack socket since I soldered it directly to the stable internal contacts of the interface converter.




Here it is, for example, also possible to install the combined interface converter and use the two poles of the 3.5 mm jack for the ICOM and KENWOOD interfaces. Then by simply changing cables you can switch from the ICOM interface to the KENWOOD interface.

be switched.

Anyone who wants to avoid drilling altogether can also operate the interface converter externally with a short cable through the large ventilation hole on the back of the control unit.

For the 'tap' of the K3 computer interface I have soldered a 1:1 cable for the 9-pin D-SUB connectors, from which pins 2 and 5 are tapped to the jack plug for the control unit.

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### Software

Currently the ICOM and Kenwood protocols are supported.

Successful tests were conducted with the following transceivers:

- ICOM
  - o IC-756 PRO III
  - o IC-7300
  - o IC-7400
  - o IC-7600
  - o IC-7610
  - o IC-7700
  - o IC-706 MKII
- ELECRAFT
  - o K2
  - o K3
  - o KX3
- Kenwood
  - o TS-2000
  - o TS-2000 with W4MQ Software
- TenTec
  - o TenTec Orion 565
- Yaesu
  - o FT 847
  - o FT 890
  - o FTDX 5000

The current firmware operates in passive mode. This means that data traffic between the transceiver and the computer on the monitored interface is assumed, from which the frequency information can be obtained. If a logging program is used on the connected computer, this is given, as they typically query the transceiver settings regularly.

If no such program is used, then the transceiver must send these informations on its own. This is currently supported only by ICOM transceivers and ELECRAFT transceivers.

K3 and KX3.

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## Firmware upgrade

Switching to the new firmware is easily possible:

1. Write down all your current memory settings in a table (memory- number, values of TRX, L, ANT)
2. Switch off the control unit
3. Remove all connected cables from the control unit
4. Remove the old µController (watch out for static charge!!!)
5. Install an interface converter into the device.
6. Insert the new µController. Pay attention to the polarity (notch symbol on the PCB) and make sure that no pins are bent
7. Reconnect the power supply to the control unit
8. Start the control unit in configuration mode (see chapter „Configuration mode“ on page 15)
9. Set the desired mode and parameters according to your transceiver (see chapter Configuration mode on page 15)
10. Save the configuration (see chapter Memory of the configuration on page 16)
11. Switch the control unit off and back on.
12. Go into the tuning mode and set all memories according to your table
    Repeat step 1 (see chapter „Tuning mode“ on page 13)
13. Press the memory button on the back of the control unit
14. Switch off the control unit
15. Connect the external tuner and the data interface of the transceiver to the control unit
16. Switch the control unit back on
17. Go into automatic mode (see chapter „Automatic mode“ on page 12)
18. Set the corresponding parameters on your transceiver (see chapter „Configuration mode“ on page 15)
19. Change the frequency on the transceiver
20. ... enjoy ...

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## Operation

The operation is modeled after the original firmware's operation. When the control device is switched on, a brief message is displayed as usual:




Depending on the mode of operation, either the already known memory and tuner data is then shown or the configuration settings.

The firmware has two main operating modes:

- Normal mode
- Configuration mode

## Normal mode

The mode is normally controlled via the two toggle switches Memory-Tune-MemIn and Automatic-Manual

In the first display line, in the far-right position, it shows whether the tuner is in the mode for

- KENWOOD (K)
- ICOM mode (I)
- Yaesu FT-847 (7)
- Yaesu FT-890 (0)
- Yaesu FTDX-5000 (5)
- TenTec Orion (o)

is located. This can be set via configuration (see chapter "Configuration mode" on page 15.

### Automatic mode

This mode is selected when the switch Automatic-Manual is set to Automatic. In the display, this operating mode is shown by the letter A in the right part of the first display line:




In this position, all knobs have no function; the memory channel is controlled by interface data from the connected transceiver.

### Memory mode

This mode is chosen when the Automatic-Manual switch is set to the position **Manual** and the **Memory-Tune-MemIn switch is set to Memory. In the display this operating mode is shown by the letter M in the right part of the first display line:**




In this position only the right encoder Manual is active. Through this one the desired Speicher is selected. The stored positions of the encoders TRX, L and ANT as well as the selected save number are displayed in the lower display line.

#### Tuning mode

This mode is selected when the Automatic-Manual switch is set to Manual and the Memory-Tune-MemIn switch is set to Tune. In the display this operating mode is shown by the letter T in the right part of the first display line.




In this mode the components of the tuner are adjusted with the encoders TRX, L and ANT. With the Manual turn of the knob you can select the desired storage channel into which the encoder data are written to MemIn when the Memory-Tune-MemIn switch is pressed. The configuration data for storage awaiting is visualized by the display of the letter M.

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### Automatic saving of configuration

Were configuration data such as

- selected save number in manual mode
- Values of the capacity decades ANT and TRX
- Value of the inductance decade L

changed, so an M is shown in the lower display line instead of an m. This indicates that the current configuration has been changed but not yet saved.

The saved data are stored after the time set in the configuration parameter AUTOSAVE, so that they are available again after the device is powered on again. Saving is indicated by the following display indication:




### Recalibration of the stepper motor

The recalibration of the stepper motor can also be triggered immediately by pressing the button on the rear of the device labeled Erase Memory, bandwise:




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## Configuration Mode

Enter the configuration mode by holding the MEM IN button on the front panel of the control unit during power-up until the startup message appears.

The following configuration parameters are available:

| Parameter | Meaning |
|---|---|
| **Autosave** | Specifies the time in minutes after changing the saved number in the Memory mode or when changing the contents of a memory, the data in the permanent storage are copied into the permanent data storage. |
| **Mode** | Here you can set the mode of the computer interface. The following are available: the modes KENWOOD, ICOM, TenTec Orion, Yaesu FT-847, Yaesu-890 and Yaesu FTDX5000 to choose from. |
| **Baud rate** | Here one of the supported baud rates of the serial interface can be selected: to be selected:<br><br>1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200 |
| **Icom Address** | See details in the chapter “Example configurations” on page 18.<br><br>Input in decimal. For conversion from decimal to hexadecimal see the "Table" Decimal-Hadecimal on page 19. |
| **Icom Command** | See details in the chapter “Example configurations” on page 18.<br><br>Input in decimal. For conversion from decimal to hexadecimal see the "Table" Decimal-Hexadecimal on page 19. |
| **PTT pre-delay** | Time waited after the PTT line is interrupted until the tuning process begins. |
| **PTT post-delay** | Time waited until the PTT line is reconnected after the tuning process has finished. |
| **Recalib. after** | This indicates the number of stepper motor actions performed until an automatic re-calibration occurs.<br><br>If the tuner’s repeat accuracy is good, this value can be increased.<br>If it is found that the stepper motor loses steps, this value should be reduced.<br>this value should be reduced.<br>**Default: 50**<br><br>See also the chapter “Recalibration of the stepper motor” on page 14. |
| **Speed Normal** | This specifies the time in milliseconds between two steps of the stepper motor is waited. |

| Parameter | Meaning |
|---|---|
| | **Default: 4ms** |
| **Speed Slow** | This specifies the time in milliseconds between two steps of the step-motor that is waited when it is in the start or stop phase.<br>**Default: 10ms** |
| **Speed Sync** | This specifies the time in milliseconds between two steps of the step-motor that is waited when it is in calibration mode.<br>**Default: 10ms** |
| **Wait after Enable** | This specifies the time in milliseconds between enabling the power-supply for the stepper motor and the first step to be waited.<br>**Default: 4ms** |
| **Wait after Clock** | This specifies the time in microseconds that the clock signal for the stepper motor is held LOW.<br>**Default: 10µs** |
| **Wait before Disable** | This specifies the time in milliseconds after the last executed step that the power supply of the stepper motor is switched off.<br>**Default: 20ms** |
| **Wait after Disable** | This specifies the time in milliseconds after the power supply-off of the stepper motor is waited until new actions are carried out. done.<br>**Default: 4ms** |

With the knob Manual the respective configuration parameter can be selected.

With the knob ANT the value of the chosen configuration parameter can then be changed.

Note: If it is detected that the stepper motor loses steps, the above parameters should be experimented with. First increase the parameters "Speed Normal" and "Speed Slow". If steps are still lost over time, reduce the parameter "Recalib. after" to enable more frequent automatic re-calibration of the stepper motor.

### Storage of the configuration

If the configuration should be saved, press the Memory-Tune-MemIn switch to MemIn.

After successful writing of the configuration, the control unit restarts and returns to normal mode.

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### Split operation

With the ICOM protocol, the transmit frequency is transmitted via the interface. That is, in split operation the tuner is always tuned to the transmit frequency.

With the Kenwood protocol, the frequency of VFO A is always sent in the IF command, i.e. in split operation the tuner is thus always tuned to the receiving frequency. This must be taken into account especially in the lower frequency bands when the transmit frequency lies at a memory boundary. If necessary, set the tuner to Memory mode and select the appropriate memory.

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## Example configurations

Below are the tested transceiver settings:

| Transceiver Type | Transceiver Parameter | Value | Control unit Parameter | Value |
|---|---|---|---|---|
| **ICOM IC-756 PRO 3**<br>**ICOM IC-7700** | CIV Baud rate | 9600 | Mode | ICOM |
| | CIV-Transceive ON | | Baud | 9600 |
| | | | Icom-Cmd | 00 |
| | | | Icom-Adr | 174dez<br>6Ehex |
| **ICOM IC-7610** | CI-V Baudrate | 9600 | Mode | ICOM |
| | CI-V Address | 98 | Baud | 9600 |
| | CI-V Transceive | ON | Icom-Cmd | 00 |
| | CI-V Output | OFF | Icom-Adr | 152dez<br>98hex |
| **ICOM IC-7300** | CIV-Baudrate | 9600 | Mode | ICOM |
| | CIV-Transceive ON | | Baud | 9600 |
| | | | Icom-Cmd | 00 |
| | | | Icom-Adr | 148dez<br>94hex |
| **ELECRAFT K3** | RS232 | 38400 b Mode | | KENWOOD |
| | AUTOINFO | Auto 1 | Baud | 38400 |
| **ELECRAFT KX3** | RS232 | 38400 b Mode | | KENWOOD |
| | AUTOINFO | ANT CTRL Baud | | 38400 |
| **YAESU FT 8901** | Baud rate | 4800 b | Mode | FT890 |
| | | | Baud | 4800 |

1 Since only the Yaesu- and Kenwood transceivers can’t send data by themselves, the interface of the AT-615B for other transceivers only works if a logbook program permanently queries the transceiver status. The interface was tested with UCXLOG, SWISSLOG and RUMLOG.

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# Appendix

## Table Decimal-Hexadecimal

| Dec | Hex | Dec | Hex | Dec | Hex | Dec | Hex |
|---|---|---|---|---|---|---|---|
| 0 | 00 | 64 | 40 | 128 | 80 | 192 | C0 |
| 1 | 01 | 65 | 41 | 129 | 81 | 193 | C1 |
| 2 | 02 | 66 | 42 | 130 | 82 | 194 | C2 |
| 3 | 03 | 67 | 43 | 131 | 83 | 195 | C3 |
| 4 | 04 | 68 | 44 | 132 | 84 | 196 | C4 |
| 5 | 05 | 69 | 45 | 133 | 85 | 197 | C5 |
| 6 | 06 | 70 | 46 | 134 | 86 | 198 | C6 |
| 7 | 07 | 71 | 47 | 135 | 87 | 199 | C7 |
| 8 | 08 | 72 | 48 | 136 | 88 | 200 | C8 |
| 9 | 09 | 73 | 49 | 137 | 89 | 201 | C9 |
| 10 | 0A | 74 | 4A | 138 | 8A | 202 | CA |
| 11 | 0B | 75 | 4B | 139 | 8B | 203 | CB |
| 12 | 0C | 76 | 4C | 140 | 8C | 204 | CC |
| 13 | 0D | 77 | 4D | 141 | 8D | 205 | CD |
| 14 | 0E | 78 | 4E | 142 | 8E | 206 | CE |
| 15 | 0F | 79 | 4F | 143 | 8F | 207 | CF |
| 16 | 10 | 80 | 50 | 144 | 90 | 208 | D0 |
| 17 | 11 | 81 | 51 | 145 | 91 | 209 | D1 |
| 18 | 12 | 82 | 52 | 146 | 92 | 210 | D2 |
| 19 | 13 | 83 | 53 | 147 | 93 | 211 | D3 |
| 20 | 14 | 84 | 54 | 148 | 94 | 212 | D4 |
| 21 | 15 | 85 | 55 | 149 | 95 | 213 | D5 |
| 22 | 16 | 86 | 56 | 150 | 96 | 214 | D6 |
| 23 | 17 | 87 | 57 | 151 | 97 | 215 | D7 |
| 24 | 18 | 88 | 58 | 152 | 98 | 216 | D8 |
| 25 | 19 | 89 | 59 | 153 | 99 | 217 | D9 |
| 26 | 1A | 90 | 5A | 154 | 9A | 218 | DA |
| 27 | 1B | 91 | 5B | 155 | 9B | 219 | DB |
| 28 | 1C | 92 | 5C | 156 | 9C | 220 | DC |
| 29 | 1D | 93 | 5D | 157 | 9D | 221 | DD |
| 30 | 1E | 94 | 5E | 158 | 9E | 222 | DE |
| 31 | 1F | 95 | 5F | 159 | 9F | 223 | DF |
| 32 | 20 | 96 | 60 | 160 | A0 | 224 | E0 |
| 33 | 21 | 97 | 61 | 161 | A1 | 225 | E1 |
| 34 | 22 | 98 | 62 | 162 | A2 | 226 | E2 |
| 35 | 23 | 99 | 63 | 163 | A3 | 227 | E3 |
| 36 | 24 | 100 | 64 | 164 | A4 | 228 | E4 |
| 37 | 25 | 101 | 65 | 165 | A5 | 229 | E5 |
| 38 | 26 | 102 | 66 | 166 | A6 | 230 | E6 |
| 39 | 27 | 103 | 67 | 167 | A7 | 231 | E7 |
| 40 | 28 | 104 | 68 | 168 | A8 | 232 | E8 |
| 41 | 29 | 105 | 69 | 169 | A9 | 233 | E9 |
| 42 | 2A | 106 | 6A | 170 | AA | 234 | EA |
| 43 | 2B | 107 | 6B | 171 | AB | 235 | EB |
| 44 | 2C | 108 | 6C | 172 | AC | 236 | EC |
| 45 | 2D | 109 | 6D | 173 | AD | 237 | ED |
| 46 | 2E | 110 | 6E | 174 | AE | 238 | EE |
| 47 | 2F | 111 | 6F | 175 | AF | 239 | EF |
| 48 | 30 | 112 | 70 | 176 | B0 | 240 | F0 |
| 49 | 31 | 113 | 71 | 177 | B1 | 241 | F1 |
| 50 | 32 | 114 | 72 | 178 | B2 | 242 | F2 |
| 51 | 33 | 115 | 73 | 179 | B3 | 243 | F3 |
| 52 | 34 | 116 | 74 | 180 | B4 | 244 | F4 |
| 53 | 35 | 117 | 75 | 181 | B5 | 245 | F5 |
| 54 | 36 | 118 | 76 | 182 | B6 | 246 | F6 |
| 55 | 37 | 119 | 77 | 183 | B7 | 247 | F7 |
| 56 | 38 | 120 | 78 | 184 | B8 | 248 | F8 |
| 57 | 39 | 121 | 79 | 185 | B9 | 249 | F9 |
| 58 | 3A | 122 | 7A | 186 | BA | 250 | FA |
| 59 | 3B | 123 | 7B | 187 | BB | 251 | FB |
| 60 | 3C | 124 | 7C | 188 | BC | 252 | FC |
| 61 | 3D | 125 | 7D | 189 | BD | 253 | FD |
| 62 | 3E | 126 | 7E | 190 | BE | 254 | FE |
| 63 | 3F | 127 | 7F | 191 | BF | 255 | FF |

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### Links

| | |
|---|---|
| http://hamware.de | Manufacturer of the tuner |
| http://www.plicht.de/ekki/civ/index.html | A very good summary of the CI-V protocol |
| http://www.dl2sba.de | Manufacturer of this firmware |
| http://www.elecraft.de | Information about the KENWOOD protocol of the K3 |
| http://winavr.sourceforge.net/ | C compiler for the ATMEL µController |
| http://homepage.hispeed.ch/peterfleury/ | Excellent libraries for the µController |
| http://www.umlet.com/ | Drawing of state charts |
| http://www.dl2rum.de/rumsoft/RUMLog.html | Logbook program for MAC |
| http://www.informatix.li/english/Frame_EN.htm | Logbook program for Windows |
| http://www.w4mq.com/ | Internet Remote Base Software |
| http://n1mm.hamdocs.com/tiki-index.php | N1MM logging software |

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