

Sequencer with CW memory keyer

User manual

FW version 1.20.0504

Sequencer with CW memory keyer (later in text sequencer) combines functionality of the automatic CW keyer, 4 channel sequencer and simple computer interface for PTT switching and CW manipulation.

Table 1 Specifications

Parameter	Value
Keyer speed	5..40/320 ¹ WPM
Dot/dash ratio	1:2..1:4 with 0.25dot step
Memory channels number	4
Max channel text length	100 characters
Sequencer channels number	4
Sequencer signal delays	0..500ms, programmable with 1ms step
Relay output (CH1)	2A 30VDC
Solid state switch (CH2..CH4 and CW keying)	30mA 30VDC
Timing precision	±3% at 25C ±4% at -10..+60C
Power supply voltage ²	+8..15VDC
Power supply current ²	0.1A
Dimensions	115x46x64mm (WxHxD)
Weight	200g

¹ when the memory channel text being sent

² sequencer can be powered from the computer USB port or from the external power supply

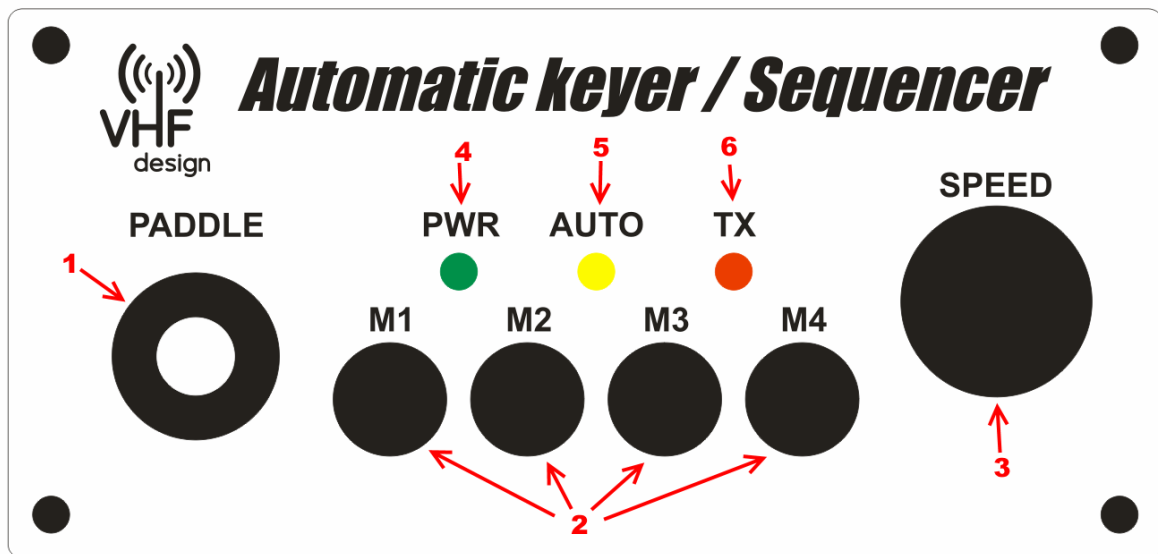
Keyer features includes:

- iambic keyer with one element memory
- reversible paddle orientation
- programmable dot/dash weight (from 1:2 to 1:4)
- programmable auto character spacing (ACS)
- programmable CW VOX function
- 5 to 40WPM front panel adjustable keyer speed when keying from the paddle
- 5 to 320WPM keying speed for the memory keying
- 4 memory channels up to 100 characters each

Sequencer features includes:

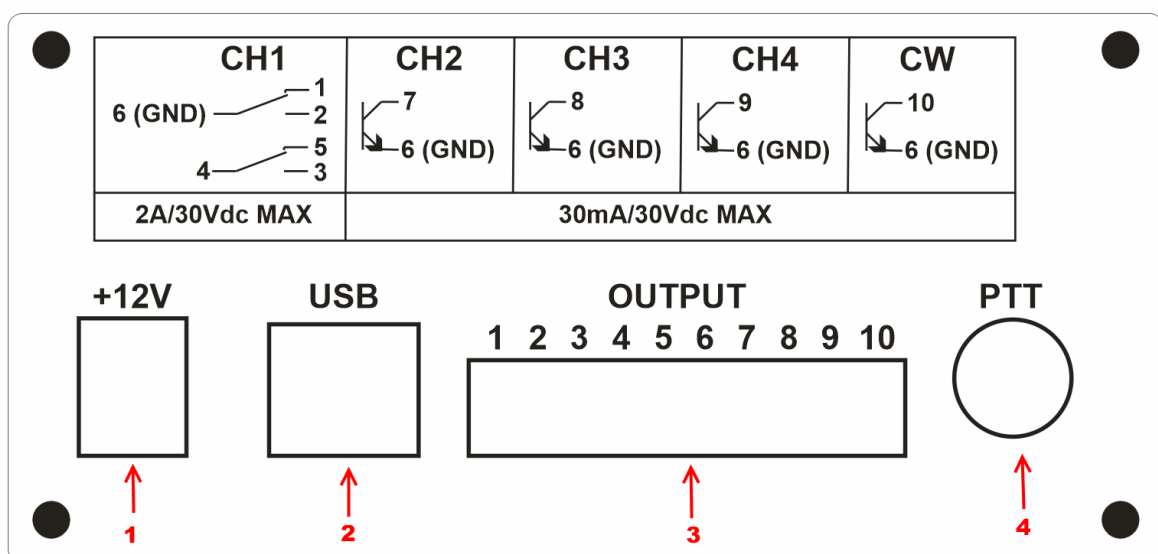
- 4 channels
- programmable delay (0..500ms) and polarity
- one channel (CH1) with relay output (DPDT relay) and 2A/30VDC rating
- three channels (CH2..CH4) with 30mA/30VDC solid state switch
absolute timings precision is ±3% at 25C and ±4% at -10..+60C
- CW signal can be generated using the keyer, DTR or RTS line of the virtual COM port
- TX/RX switching can be initiated by external PTT signal, internal memory keyer, DTR or RTS line of the virtual COM port

Front Panel



1. **Paddle jack** - standard 6.3mm banana jack, dash and dot lines can be reversed using the sequencer control program.
2. **M1..M4 memory keyer buttons** - press button to send the content of the corresponding memory channel. The TX/RX switching will be done automatically. The transmission can be interrupted by pressing on paddle.
3. **Keyer speed** - the keyer speed can be set from 5 to 40WPM using this control. You can also use macros for the memory channels to speed up sending up to 8 times.
4. **Power LED** - lits when USB power or external power is applied.
5. **Auto LED** - lits when memory keyer is sending CW.
6. **TX LED** - indicates that sequencer was switched to TX state.

Rear Panel



1. **+12V external power jack** - you can apply +8..15VDC for stand alone operation without connection to the computer. The center conductor is "+" the outer ring is "-". If sequencer is connected to computer it will be powered from the USB.

2. **USB** - USB port for sequencer programming, computer interface (PTT/CW) and firmware update.
3. **Sequencer outputs**
4. **PTT** - footswitch input (active to ground)

Sequencer operation

Sequencer can be switched to transmit by the following signals:

- Footswitch (or other signal, active to ground, connected to PTT jack)
- Internal keyer VOX (when the VOX function is active)
- Internal memory keyer (always active)
- USB computer interface (when this function is active)

All those signals are combined by the logical OR function. So, when any signal is active the sequencer will switch to transmit. All signals should become inactive to switch sequencer to receive.

When transmit event is detected sequencer will start timer and will generate signals at channel 1 ... channel 4 according to the programmed delays (the delays can be adjusted in the control program from 0 to 500ms of the total delay). The CW keying is blocked until switching cycle is over. Additional delay can be specified for the CW signal. The CW signal delay line delays CW keying, so the first CW characters will be transmitted after the RX to TX switching cycle is over.

When transmit signal is released sequencer will block CW keying immediately and initiate TX to RX switching cycle deactivating signals according to the programmed delays (the delays can be adjusted in the control program from 0 to 500ms of the total delay).

CW keying can be done by the internal keyer (either semiautomatic or memory) and computer interface. Those signal are combined by the logical OR function. Sequencer blocks CW keying until it is not fully switched to transmit.

There is an adaptive delay line in the CW keying path. This delay line ensures correct CW signal generation even when CW keying starts with no delay regarding PTT signal, or when TX switching is activated by the CW VOX function. You do not need to add additional delay in your logger, everything will be done by the sequencer automatically. When you use VOX function the delay will be dynamically adjusted by the sequencer to minimize keying delay for less operator fatigue when switching requires substantial time.

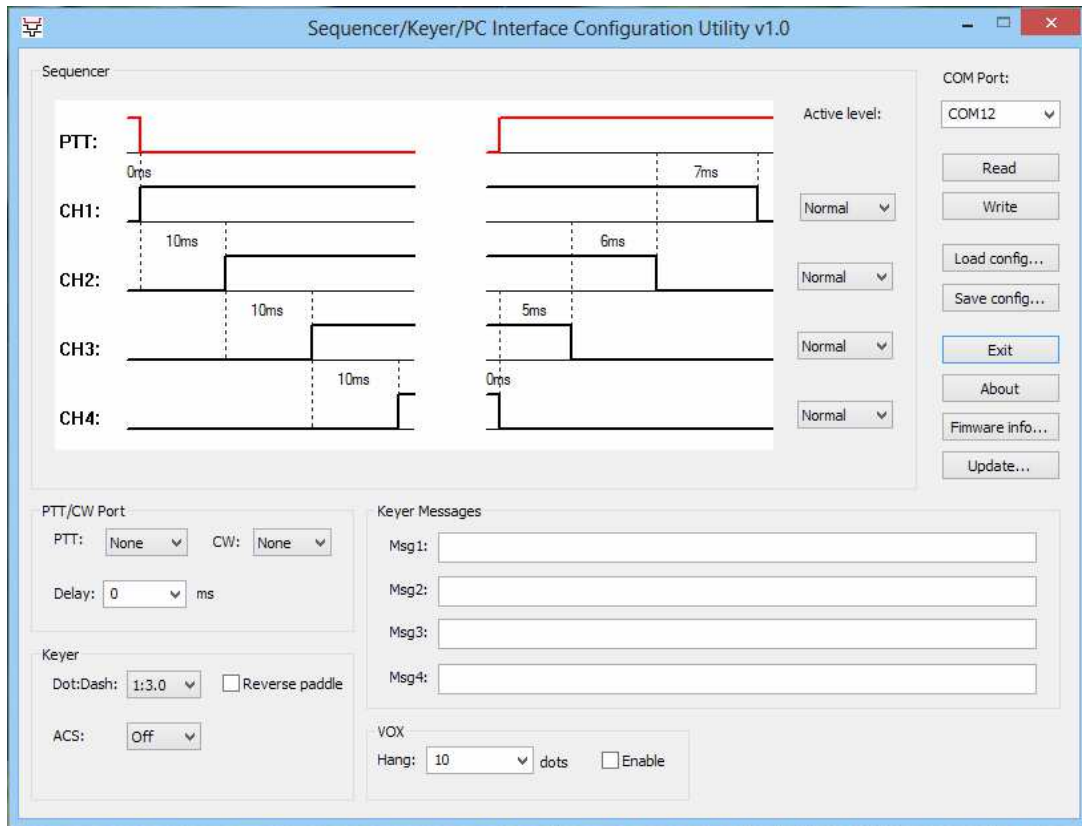
The VOX hang time can be tuned in the control program. Hang time depends of keyer speed (it is specified in the CW 'dots' time units).

Sequencer setup

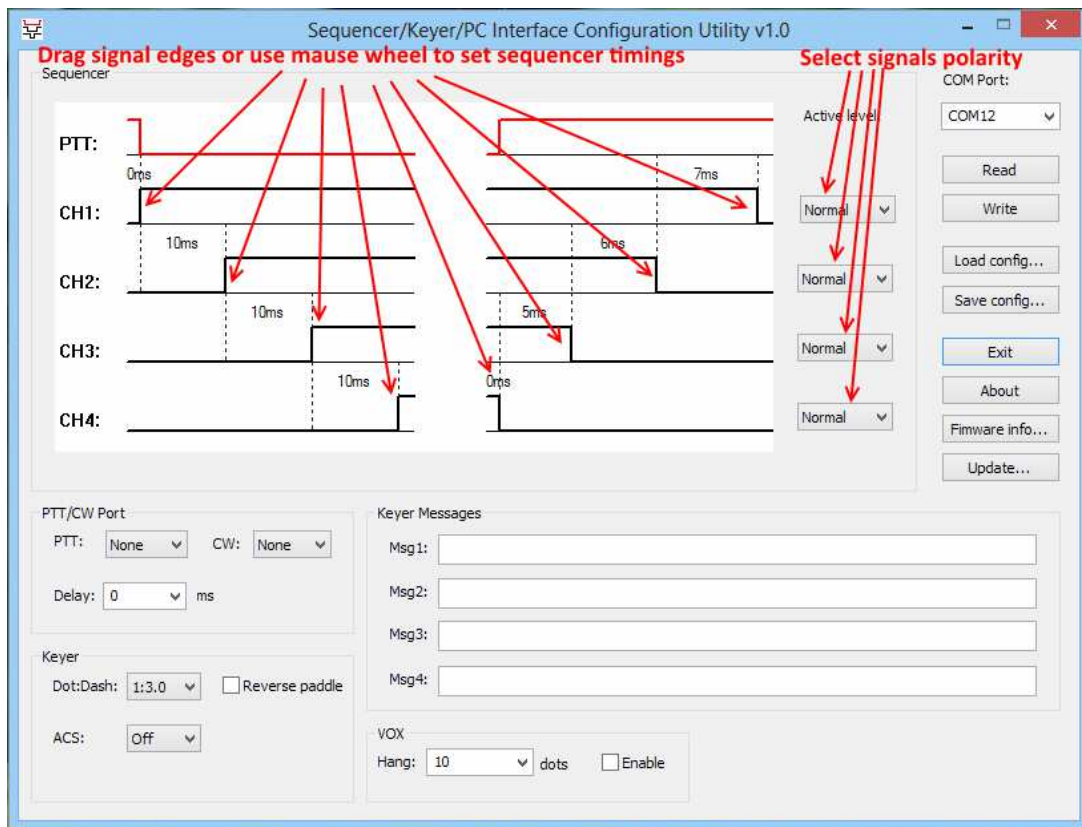
You should program the necessary delays/polarity and keyer parameters to the sequencer before using it.

Attach the USB cable to the module and plug the USB cable to the USB port of the PC. The PC should find the STMicroelectronix Virtual COM Port and install drivers for it automatically. You can also download and install driver manually from here <https://vhfdesign.com/data/zip/en.stsw-stm32102.zip> or here <http://www.st.com/en/development-tools/stsw-stm32102.html> in case of any difficulties.

When the drivers are installed and sequencer is attached to the PC USB port run sequencer configuration PC software Sequencer.exe (the program can be downloaded from this page <https://vhfdesign.com/other/cw-key-sequencer.html>). You should see the following main program dialog on start up:



The necessary timing can be set by dragging the signal edges on the diagram or by using the mouse wheel (hover the mouse cursor over the signal you want to change and use mouse wheel to adjust it). The signal active level can be set to Normal or Inverted using the **Active level** dropdown lists. The high level on the diagram corresponds to closed relay contacts or solid state switch:



The PTT/CW computer interface can be configured by the **PTT/CW Port** control group. Select the desired virtual COM port line to control the PTT and CW signals respectively. Use the same settings in you logger software (or other program that you use to control your radio).

You can specify an additional delay that will be applied to the CW keying after the RX to TX switching cycle is over (CH4 line activated) using the **Delay** field.

Put the keyer messages into the **Msg1..Msg4** fields. You can use English and Russian letters, digits, space and , . = / ? symbols in the message text. There are also several special commands:

1. **@XY** sends two characters after the @ symbol without standard character pause. For example **@DN** will send the / symbol.
2. **+** restarts message transmission, so the text will be sent continuously until interrupted by pressing the paddle
3. **<** decreases transmission speed (this command can be repeated several times to set the necessary speed).
4. **>** increases transmission speed (this command can be repeated several times to set the necessary speed).
5. **#xxxx** sends the tone with **xxxx** milliseconds duration (add space after the delay number as a separator, it will not be sent, for example **#5000** will send tone for the 5000ms)
6. **&xxxx** sends the pause with **xxxx** milliseconds duration (add space after the delay number as a separator, it will not be sent, for example **&1000** will send pause for the 1000ms)

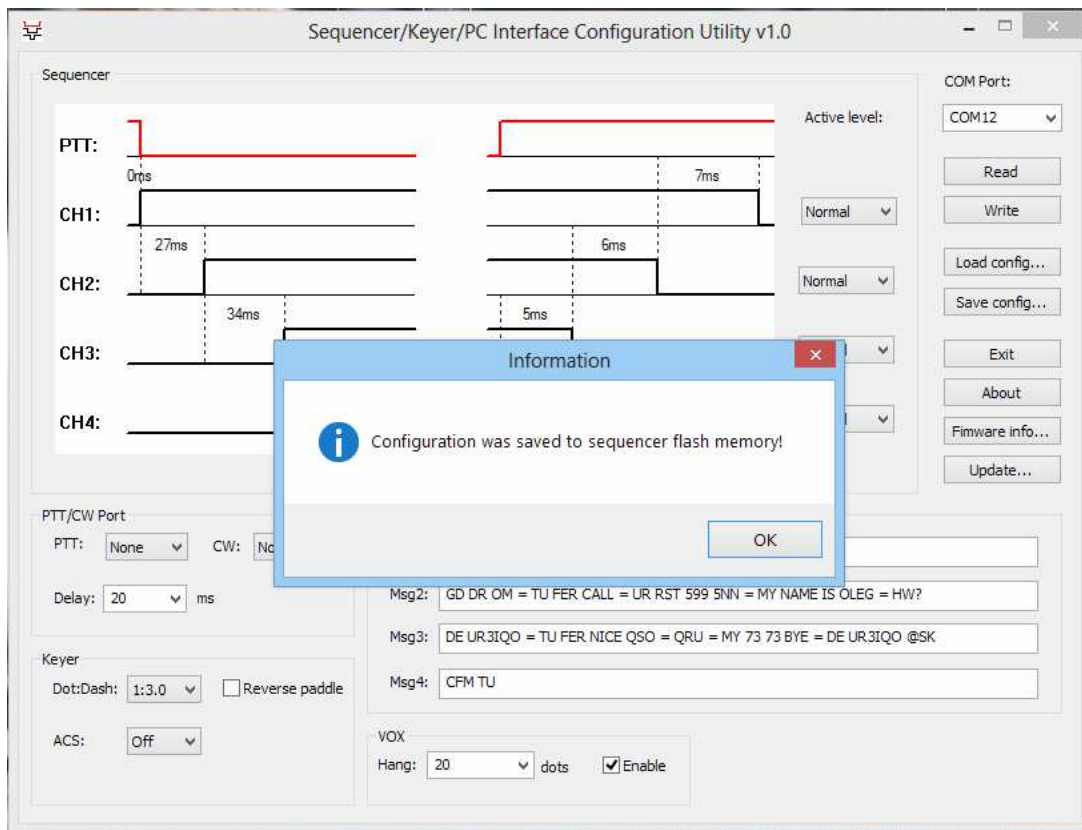
Configure keyer using **Keyer** controls group. You can set dot/dash ratio using the **Dot:Dash** control. You can reverse dash and dot paddle lines by checking the **Reverse paddle** checkbox. Also you can tune ACS or turn it Off using the **ACS** control.

The ACS feature will elongate the pause between CW elements if the pause after current element reached ACS setting. So if you choose 1.5dots in **ACS** control the keyer will consider

any pause between elements greater than 1.5dots as character or word space and will force it to at least 3 dots, so the perfect CW will be generated if you tend to shorten the character spacing.

The VOX function can be activated by the **Enable** checkbox in the **VOX** control group. The VOX hang time can be selected in the **Hang** dropdown list or entered in the same field.

After you have tuned the configuration of the sequencer you have to write it to the sequencer flash memory. Select the sequencer virtual COM port in the **COM Port** list and press **Write** button. The program will report if the configuration was written successfully:



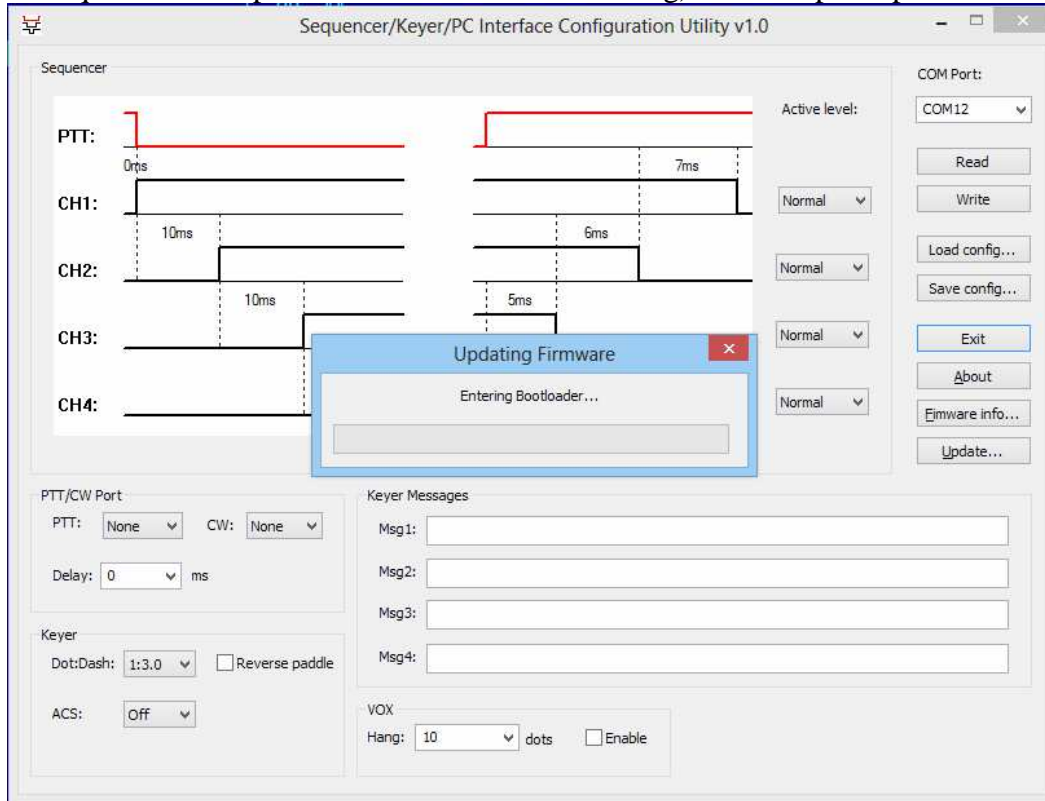
If you need to correct the configuration of the sequencer you can read its current configuration. Select sequencer virtual COM port in the **COM Port** list and press **Read** button.

You can also save configuration for the further use to the file using the **Save config** button and load it later using **Load config** button if needed.

Firmware update

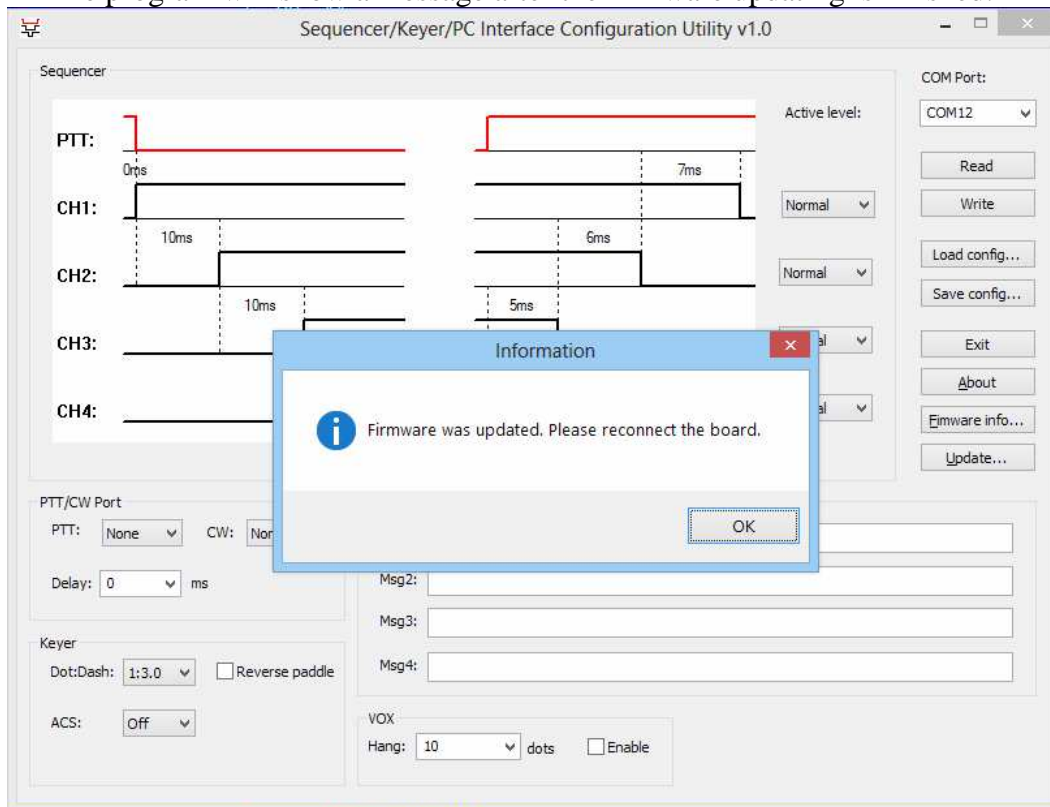
Sequencer firmware is user upgradable and can be updated if needed. You have to download firmware image file (you can download firmware images from this page <https://vhfdesign.com/other/cw-key-sequencer.html>). Connect sequencer to the computer, run Sequencer.exe utility, select correct COM port and read sequencer configuration. Now save your sequencer configuration to the file using the **Save config** button (sequencer configuration will be overwritten during firmware update). Then press **Update** button.

Select firmware image file. Sequencer will enter bootloader mode (the yellow Auto LED on the sequencer front panel will start heartbeat flashing) and the update process will be started:



Do not disconnect module, power off the computer or terminate Sequencer utility during firmware update!

The program will show a message after the firmware updating is finished:



Now you should disconnect the sequencer from the computer USB port. Reconnect sequencer to the computer, restore saved configuration (using the **Load config** button) and save it to the module flash memory (using the **Save** button). Now sequencer is ready to use updated firmware.

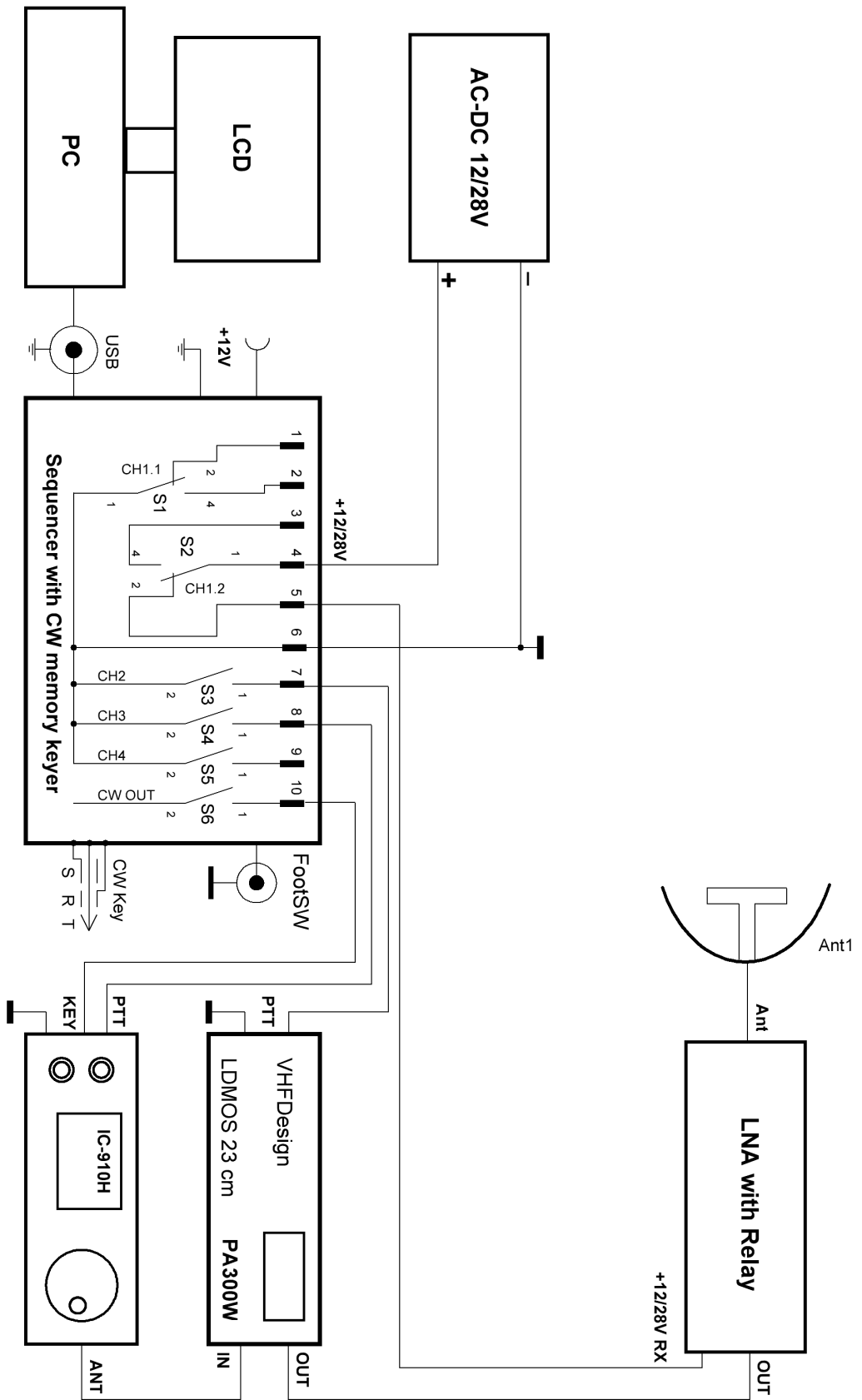
"Debricking" the sequencer

When you power up sequencer it will check the firmware integrity and will stay in the bootloader mode if the firmware does not pass integrity test (the bootloader mode is indicated by heartbeat yellow LED flashing). If it happened (probably as a result of the unsuccessful firmware update) the sequencer firmware can be repaired. You should follow the instructions in the ***Firmware update*** section, but do not save sequencer configuration cause it will not be possible because of the damaged sequencer firmware.

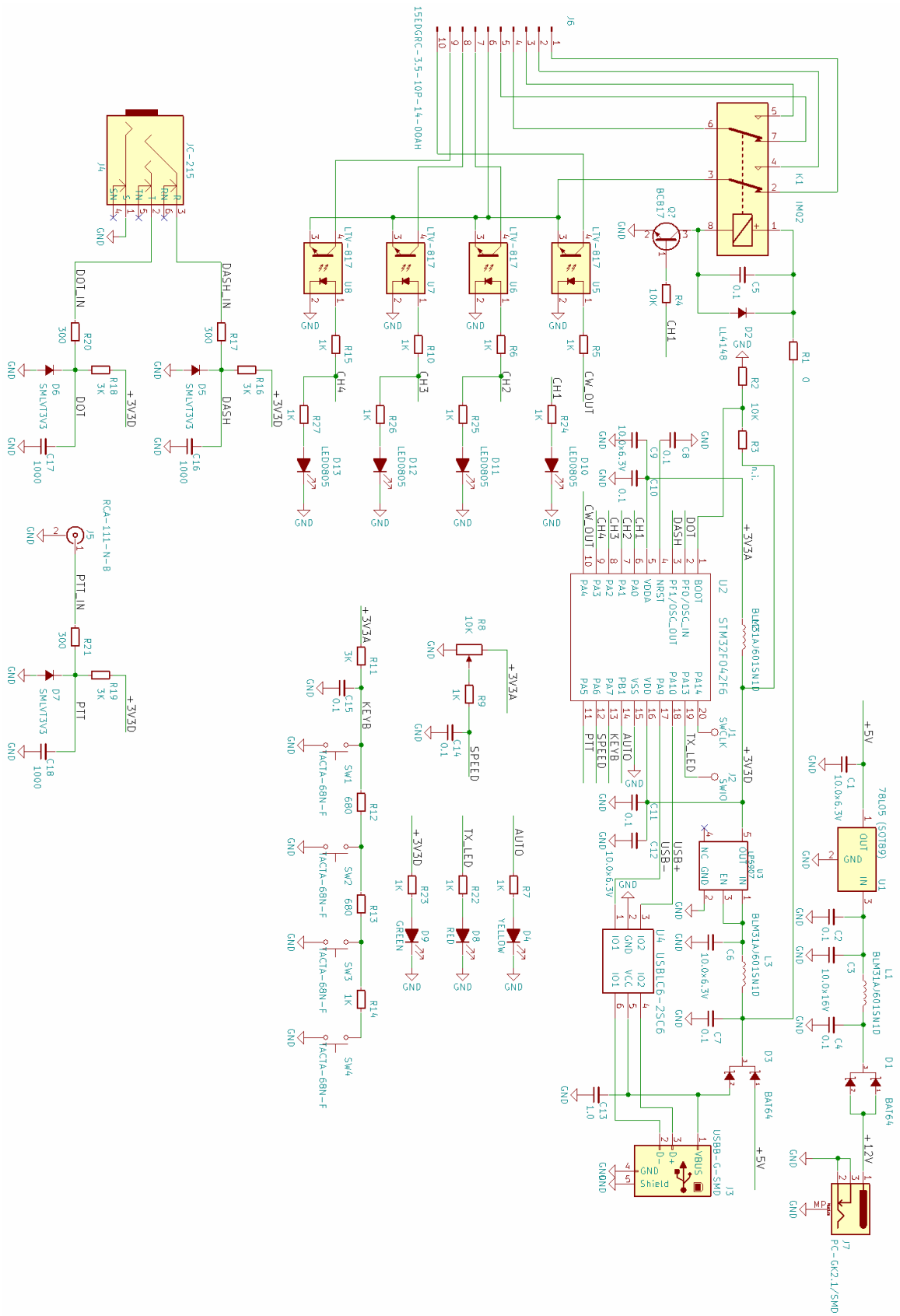
Forcing bootloader to activate

If the sequencer firmware does not work properly or you can not update firmware using standard method the bootloader mode can be activated manually. You have to disconnect sequencer and push M4 button. Hold that button and connect sequencer to the USB port. Sequencer should enter bootloader mode (the bootloader mode is indicated by heartbeat yellow LED flashing). Now use the instructions for the "debricking".

Appendix A Connection diagram



Appendix B Sequencer schematic



Appendix C Board layout

