Bernhard Hochstätter
Zur Steige 7
97522 Sand am Main

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FROG-3
CW-Keyer / CW-Commander with Microcontroller PIC 18F26K20

FROG-3 was developed on the base of my smaller FROG-2, but he does not replace him. The philosophy of the two Keyers is different.

The PIC 18F26K20 opens new opportunities in a wide field for experimentation. Whoever is interested in technical developments in addition to pure CW operation technique should read on.

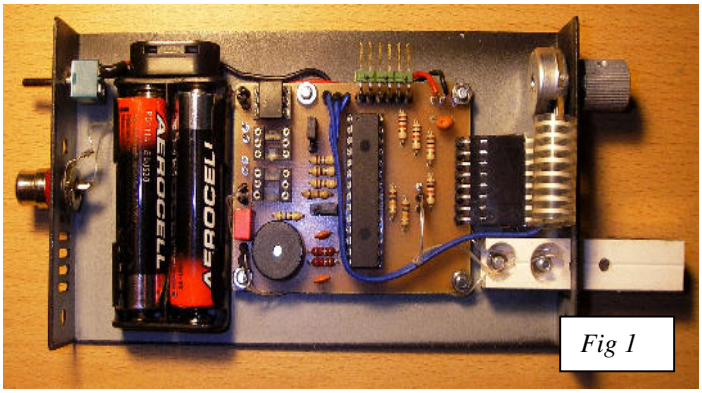


Fig 1

Fig 2

The challenge for design and board was "not all aboard" like FROG-2. The hardware is designed for individual use.

Since February 2015 a sensor prototype is in practical use in my shack.
The firmware is continually evolving

If you want to constructively contribute to this project, you are invited to bring your experience, ideas and wishes!

The firmware as HEX file is free, contact me at ***dl6nbs@darc.de***

Unfortunately I can not provide printed circuit boards since I customize this only as individual pieces. Against reimbursement of my expenses, I can send you a programmed PIC with the latest firmware. It requires very few components, a breadboard is sufficient for the realization. Nevertheless, the description includes a PCB layout.

73 +55 de DL6NBS
Bernd / Sand

INHAL TABLE OF CONTENTS

1. Features FROG-3

- Paddle and sensor firmware are implemented and switchable in real time.
- Three signal-outputs Keyer, Dash, Dot
- The speed is adjustable between < 5 Wpm and HSC
- Favourite CW-speed stored for retrieval at the low position of the speed potentiometer
- Direct CW-rate input from 15 to 30 WPM, also direct input on the numpad
- The 16-Key-Pad allows fast access to all important functions
- Optical coupling to the TX and GAP algorithm against RF-interference
- Seven memories with 1x50, 3x20 and 4x50 characters are accessible via menu and available as macros: Z: T: U: V: W: X: Y
- Six memories 1x50, 4x120, 1x200 characters are accessible by buttons (read / write)
- Comfortable memory input with straying and repetition of the last word
- 18 Commands embeddable in memory text
- Two memory recall modes are selectable, stack or quick change
- IAMBIC-modes, no memory, dot-memory, dot- and dash-memory
- Dash / Dot ratio (weight) dynamically adjustable and
- Quick change between thumbprint-weight or standard-weight
- Interactive effect when programming the keyer is achieved by two different pitches
- Quick Hand-button emulation with function-key
- 5-digit counter for contest number assignment
- 3 contest output formats selectable 109, 1T9, 1TN
- Adjustable burst with switchover to continuous tone for TX-tuning as function-key
- Setup and status of FROG-3 available as CW plain text
- Battery voltage monitoring, warning if < 2.75 V (reference 2 x 1.5 V cells).
- 30 uA current consumption in sleep mode will protect long operating
- PCB design available

Shift recorder with 50 characters "CW on the fly" or "what I gave"

- Detection and storage of the partner calls while typing and available as a macro: K
- Detection and storage of the partner name during input and available as a macro: L
- DEL clears the Shift recorder
- MON outputs the shift recorder content on the speaker
- FM6 transfers the contents of the shift- recorder to memory 6
- FCN output the currently stored partner-call and the partner-name to the speaker

Semi-automatic, programmed, fast memory configuration

- Memory 1-4 Standard QSO operation using macros T, U, V, P
- Memory 1-4 Standard QSO operation supplementary using the Fly-macros K, L
- Memory 1-2 DX-operation usage of macro :T
- Memory 1-3 Contest operation usage of macros T: X, Y

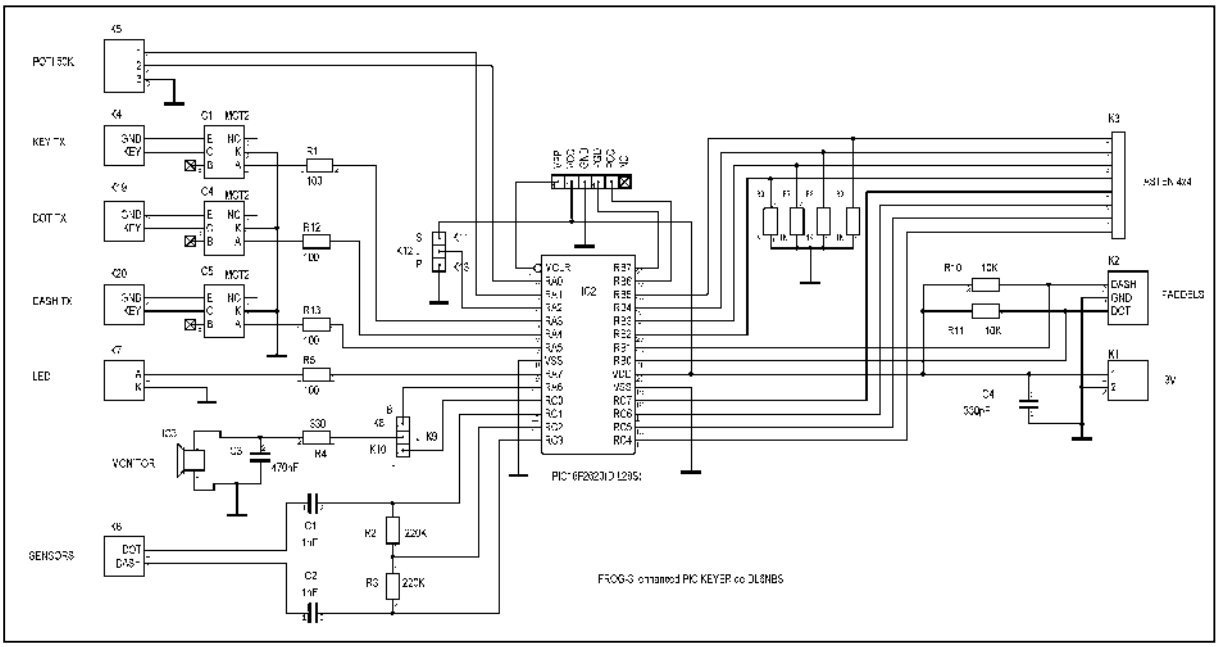
Integrated CW trainer with 9 different exercise programs

- 1 = 5-letter groups random Training
- 2 = 5-numbers groups random Training
- 3 = 5-signs groups random Training
- 4 = letters + numbers 5-series groups random training
- 5 = letters + numbers + sign 5-series groups random training
- 6 = learn letters
- 7 = learn numbers
- 8 = learn Standard signs
- 9 = learn special signs
- 0 = memory-6 random training from your own text)

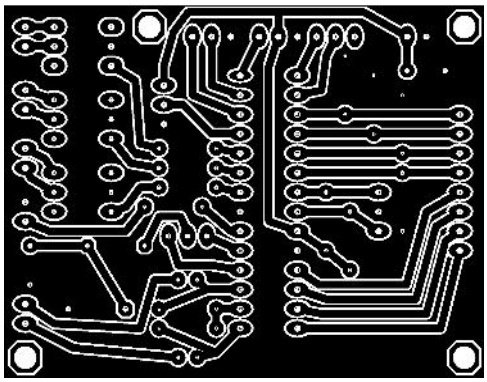
2. Design and connections of the FROG-3

This chapter will help you to define your FROG-3 and to build.

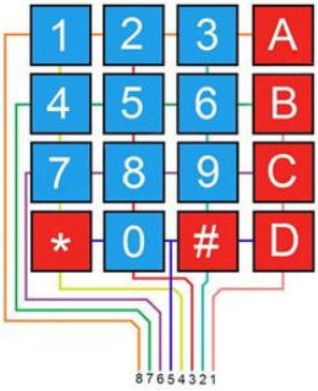
Whether paddle or sensors are used, whether three signal outputs or just a keyer output is required -> you decide. Whether your FROG-3 is used for the modernization of an existing device or a new device is also left to you. Whether the connection to the TRX via the provided optocoupler or whose base is only as support for a small transistor board -> your decision. The choice of 4x4 matrix keyboard, whether cheap membrane keyboard or premium keys, you decide. In principle, a breadboard construction without PCB is conceivable. The PIC does not matter where he performs his work and many components there are really not. Here the schematic:



If you want to etch PCB, here's the layout and placement plan

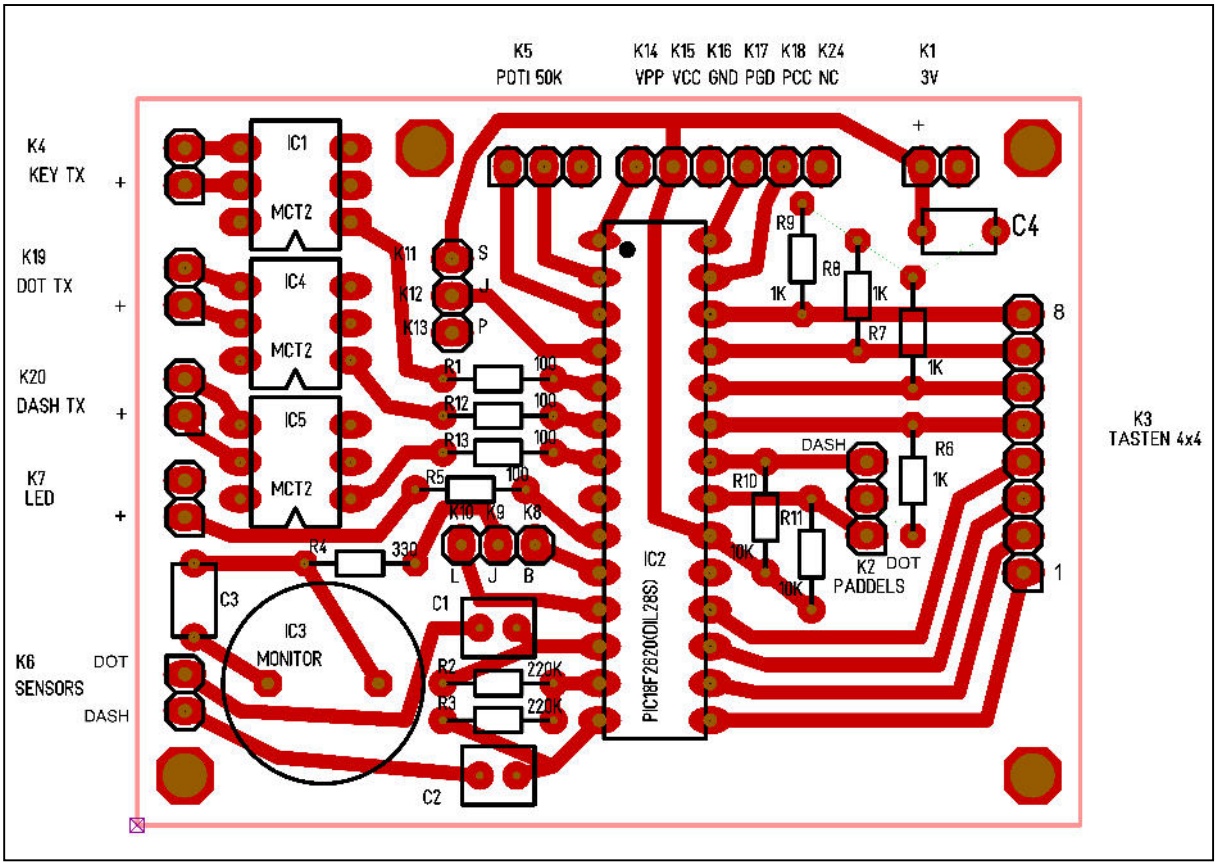


PCB (Components view)



Keyboard-connection

Overlay membrane-pad



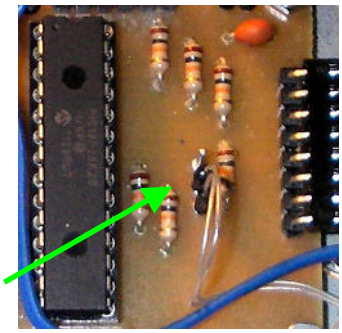
Placement and connections plan (Components view)

BOM

Pos	Anz.	Bezeichnung	Bauteil	Wert / Typ
1	4	Widerstand	R1,R5,R12,R13	100 Ohm 1/4W
2	1	Widerstand	R4	330 Ohm 1/4W
3	2	Widerstand	R2,R3	220 k 1/4W
4	6	Widerstand	R6-R9	1k 1/4W
5	6	Widerstand	R10,R11	10 k 1/4W
6	2	Kondensator	C1,C2	1 nF keramisch
7	1	Kondensator	C3	470 nF Folie
8	1	Kondensator	C4	330 pF keramisch
9	1 bis 3	Optokoppler	IC1,IC4,IC5	MCT-2 (o. ä.)
10	1	Summer	IC3	EPM 121 (Reichelt o. ä.)
11	1	Mikrocontroller	IC2	PIC-18F26K20 (Firmware von DL6NBS)
12	1	Stiftleiste	K1-K20	36 pol. 2,54mm, gerade (Reichelt MPE 087-1-036)
13	1	Stiftleiste	K3 + Programm	36 pol. 2,54mm, 90 Grad (Reichelt SL 1X36W 2,54)
14	1	Potentiometer	extern	50 k / linear
15	1	LED	extern	3 mm / rot (oder ähnlich)
16	2	Jumper	select	Lautsprecher-Beeper / Sensor-Paddel
17	1	Platine	FROG-3	oder Lochrasterplatine 2,54 mm Raster
18	1	Key-Pad	extern	Martix 4x4 Tasten (EBAY China ca. 2 €)

Now I present my sensor prototype. I found a half-shell steel housing 135 x 57 x 20 mm in the junk box. There was enough place for all components and a solid and compact FROG-3 grew (see Figures 1 and 2). As sensors I use the already proven technology of the FROG-2 (please read the FROG-2 documentation if necessary).

At the left you can see the sensor-carrier with the DASH-sensor which was made of a solderable steel plate. The identical DOT-sensor is located on the opposite side. The red LED has been integrated into the carrier. In the front side of the carrier you can see the glued wake up button. This switch is connected to the paddle-Dot-pin and used to wake up the FROG-3 from sleep mode. In the paddle version of the FROG-3 this button is not necessary. The wiring of the four carrier components (sensors, LED and button) was performed with a thin wrap wire.



The TRX jack is electrically isolated to reduce the RF-susceptibility. The sensors work well if there is a sufficient "mass". The FROG-3 connection with the TRX is already sufficient. At the right you can see the power switch.

3. Setup the FROG-3

Before you get started with the CW mode, you can find out everything for parameter setting of the FROG-3.

The first time you power-on the FROG-3 responds with "bip", the LED will flash on and after about 3 seconds first initialisation he responds with "FROG3 x DE DL6NBS".
A letter after FROG3 identifies the firmware version. If the FROG-3 later is switched off and on again, he responds with "R". A new first-time initialization is achieved if the wake up button respectively the dot paddle is operated at a FROG-3 paddle version during power up.

If the SET button is pressed briefly, "S" for setup sounds and the LED will flash in 3-second intervals. The FROG-3 is in the setup-mode and ready to accept commands. If there is no input for one minute, it will automatically switch back to CW mode. Except the "loud functions" (see description).

If SET is pressed for three seconds, a "siren" sounds and the following values are set:

Monitor off, IAMBIC-dash+dot on, Digi-speed normal, dash-stretching standardized, monitor-audio frequency normal, Key inverter off, FLY-mode LED, quick-change memory, memory protection off, Timeout on.

Now the individual commands in the setup mode.

A -> start the CW-Trainer

☞ Input A

☀ FROG-3 answers ?

☞ input a number from 0 to 9 for desired program (CW or PAD)

1 = Random training letters
2 = Random training numbers
3 = Random training signs
4 = Random training letters + numbers
5 = Random training letters + numbers + signs
6 = Learn letters (A-Z)
7 = Learn numbers (0-9)
8 = Learn standard signs ( ) KN AR , - . / = ? @
9 = Learn special signs " SK Ä Ö Ü CH : ; Unterstreichung
0 = Random training from memory 6 content

☀ FROG-3 repeats the selected number

☀ FROG-3 waits 1 second and starts with with groups of 5

☞ DOT

☀ short 'bip"and FROG-3 repeats now the current group of 5

☞ DASH

☀ Short 'bip"and FROG-3 continues with new groups of 5

☞ ESC push longer to abort *("loud" function -> no automatic return to CW-mode)*

☀ FROG-3 answers R and is back in CW-mode

B -> change IAMBIC-mode

☞ input B

☀ FROG-3 answers 0 or 1 or 2

0 = DOT and DASH memory off
1 = DOT memory on
2 = DOT and DASH memory on (default)

☞ If change is desired, enter B to the desired mode again

☞ ESC to abort *(or automatic return to CW-mode after 1 minute)*

☀ FROG-3 answers R and is back in CW-mode

D -> memory mode stack or fast change

☞ input D

☀ FROG-3 answers 0 or 1

0 = Batch Output all memory operated in order
1 = Switch immediately to a newly selected memory without stacking (default)

☀ FROG-3 answers R and is back in CW-mode

☞ If change is desired run the setup again

E -> quit setup

☞ input E *(or ESC-button)*

☀ FROG-3 answers R and is back in CW-mode

F -> take pre-programmed memory contents

Study the section "in memory embeddable commands"

☞ input F

☀ FROG-3 answers ?

☞ input a number from 0 to 4 for desired set (CW or PAD)

1 = Set standard QSO without FLY-macros

Memory 1 = :3 CQ DE :3 :T CQ PSE K :R9
Memory 2 = IN QTH :2 :U = MY NAME IS :3 :V = HW?
Memory 3 = MNI TNX FR INFO = RIG IS :W
Memory 4 = :T

2 = Set Standard QSO with FLY-macros

Memory 1 = :3 CQ DE :3 :T CQ PSE K :R9
Memory 2 = :T = GD DR :L ES MNI TNX FER CALL = UR RST IS :P = MY NAME IS :3 :V = MY QTH IS :2 :U = HW? BK
*Memory 3 = :K DE :T = MNI TNX FER RPRT ES INFO :P = TNX FER NICE QSO ES HPE CUAGN = NW HR QRU = BEST 73 ES GL DR :L = :K DE :T **
Memory 4 = ":K DE :T = MNI TNX AGN DR :L 73/55 DE :T # EE

3 = Set DX

Memory 1 = :3 CQDX DE :3 :T DX K :R7
Memory 2 = :T UR 5NN EE."

4 = Set Contest

Memory 1 = CQ :X DE :T :R3
Memory 2 = TU :I2 5NN :D3 :+
Memory 3 = TU :I2 5NN :D3 :Y

☀ FROG-3 short LED flash, the copy is made, duration about 3 seconds

☀ FROG-3 answers R and is back in CW-mode

G -> Information **see chapter 5, Details**

H -> Speed change monitor

While listening you can change your speed to your partners speed. When the potentiometer is changed, DIT DAH is given to the monitor, and allows the speed-approach. This operation is possible 1 second after the last paddle or sensor contact. If the potentiometer is adjusted during the sleep-mode in off-position, the "A" sounds even when switched on as an speed change information for the OP.

☞ input H

☀ FROG-3 answers 0 or 1

0 = speed chang monitor off
1 = speed chang monitor on

☀ FROG-3 meldet R und befindet sich wieder in CW-Modus

I -> set or delete preferred CW-speed

☞ turn the potentiometer to the desired speed

☞ input I

☀ FROG 3 stores the current speed for retrieval at the mini-position of speed poti

☀ FROG-3 answers R and is back in CW-mode

☞ or turn the potentiometer to the mini-position

☞ input I

☀ Delete preferred CW-speed

☀ FROG-3 answers R and is back in CW-mode

J -> activate / deactivate on the FLY-mode

The entered CW is pushed through a 50 character FIFO when the flight mode is activated. The last 50 characters are stored in the RAM of the PIC. With the MON key the FIFO content is output through the speaker. While the inputs are made, the program looks for the strings DE and DR. If DE is discovered, the program copies the previously given word in the separate HisCall buffer. If DR is detected, the program stores the now following word in the HisName buffer. While HisName is copied, the LED lights up. The two buffers are available as macros :L for HisName and :K for HisCall. This allows a comfortable use in the memories. Prerequisite for good recognition is a precise CW. Right here this "gimmick" can make progress in the cleanliness of giving CW. With the FCN-key HisCall and HisName is output through the speaker. Each new DE or DR-trigger overwrites the buffer. With the DEL-key both buffers and the FIFO can be deleted manually. HisName is thereby initialized with "OP". This ensures that, when you use the macro: K, there is no gap in the QSO and the partner is called OP. If the FIFO content has to be saved or even sent, this is done with the FM6 button. The FIFO contents are copied into the memory 6. The copying process is acknowledged with BEEP. If FLY-mode is deactivated, the aforementioned four keys are inactive. FLY-mode 2 corresponds to 1:1 the mode 1, in addition, there is a brief acoustic trigger message which can be very annoying though.

☞ input J

☀ FROG-3 answers 0 or 1 or 2

0 = FLY-mode off
1 = FLY-mode on with LED feedback (default)
2 = FLY-mode on with LED and speaker feedback

☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm

☞ If change is desired, enter J again to the desired mode

☞ ESC to abort *(or automatic return to CW-mode after 1 minute)*

☀ FROG-3 answers R and is back in CW-mode

L -> enter the CW-speed directly in WPM

☞ input L

☀ FROG-3 answers ?

☞ input number from 15 to 30 WPM (CW or PAD)

☀ FROG-3 repeats the entered number

☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm

☞ ESC to abort *(or automatic return to CW-mode after 1 minute)*

☀ FROG-3 answers R and is back in CW-mode

M -> switch the monitor speaker on or off

☞ input M

☀ FROG-3 answers 0 or 1

0 = speaker off
1 = speaker on

☀ FROG-3 answers R and is back in CW-mode

☞ If change is desired run the setup again

N -> Contest-number set / reset / define format

The number is always entered as a 5-digit number sequence. If a digit is entered incorrectly, it can be deleted by error input and re-entered. The input 0-9 is also possible on the NumPad (TUN = 0, M1 = 1, M2 = 2, M3 = 3, M 4 = 4 = 5 M5, M6 = 6, CNR = 7, DEC = 8 SET = 9).
T can be used instead of 0 and N can be used instead of 9. If all 5 characters entered as pure numbers the later output is classical -> 95 for ninety-five. If you gave N instead of 9 the later output will be N5 for ninety-five. If T was entered instead of 0 the later output will be TN5 for ninety-five because the use of T extends the output to 3 digits if the number is less than three digits. Leading zeros are thereby output as T. The input Z resets the counter to zero. The format set is maintained.
TIP: Format TTN is desired and the counter has to start with zero -> TNZ + ENT + ESC
Format 95 is desired and the counter has to start with zero -> 09Z + ENT + ESC

☞ Input N

☀ FROG-3 outputs 5 characters, depending on the format numbers or T or N
☀ FROG-3 answers ?

☞ ENT if no change is desired

☞ or 5 digits and ENT

☀ FROG-3 outputs 5 characters, depending on the format numbers or T or N
☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm

☞ or Z followed by ENT if only counter-zero is desired

☀ FROG-3 outputs 5 characters, depending on the format numbers or T or N
☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm

☞ ESC to abort *(or automatic return to CW-mode after 1 minute)*

☀ FROG-3 answers R and is back in CW-mode

O -> invert keyer DOT / DASH

☞ input O

☀ FROG-3 answers 0 or 1

0 = DASH right / DOT left (default)
1 = DOT right / DASH left

☀ FROG-3 answers R and is back in CW-mode

☞ If change is desired run the setup again

P -> adjust monitor sound

When programming the keyer an "interactive" effect is achieved by two different pitches. The higher tone is the FROG the lower tone the operator. The sound of the tone pair may be varied within certain limits. The rough sound is the FROG distinctive mark (froggy).

☞ input P
☀ FROG-3 answers with 2 quickly changing sounds
☞ give DOT or DASH for change
☞ push ENT
☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm
☞ push ESC to abort *("loud" function -> no automatic return to CW-mode)*
☀ FROG-3 answers R and is back in CW-mode

Q -> memory protect on / off

If a cheap membrane-pad is used, it is sometime necessary to push longer to get the contact. To avoid accidentally enter the write mode, this causes the storage's cleared, the memory input can be locked.

☞ input Q
☀ FROG-3 answers 0 or 1

0 = Memory 1 to 6 unlocked
1 = Memory 1 to 6 locked

☀ FROG-3 answers R and is back in CW-mode

R -> adjust DOT / DASH weight and define thumbprint-pattern

☞ input R
☀ FROG-3 answers with dit-dah in a loop
☞ holding DASH will stretch the dashes
☞ DOT will compress the dashes until norm (default)
☞ ENT stores weight and deletes "thumbprint-pattern" permanently
☞ or FM6* stores weight permanently and activates "thumbprint-pattern-key"
☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm
☞ push ESC to abort *("loud" function -> no automatic return to CW-mode)*
☀ FROG-3 answers R and is back in CW-mode

** If setting is completed with FM6-key instead of ENT key, the selected value is stored in a fast-change-memory. You can switch between "thumbprint-pattern" and "standard-pattern" with FM6-key and ESC-key.*

S -> adjust CW speed operating-point

With the S parameter, the working point for the speed potentiometer is changed

☞ Input S
☀ FROG-3 answers with dit-dah in a loop
☞ holding DASH will speed down
☞ holding DOT will speed up
☞ ENT stores digital speed (operating-point) permanently
☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm
☞ push ESC to abort *("loud" function -> no automatic return to CW-mode)*
☀ FROG-3 answers R and is back in CW-mode

T -> set the own CALL for use as macro :T / 20 signs

☞ input T
☀ FROG-3 outputs the current contents
☀ FROG-3 answers ?
☞ ENT if no change is desired
☞ or new contents and ENT, mistakes can be corrected by error = more than 7 DOTS
☀ FROG-3 outputs the current contents
☀ FROG-3 signals S, the LED starts in 3 flashing in 3 seconds rhythm
☞ ESC to abort *(or automatic return to CW-mode after 1 minute)*
☀ FROG-3 answers R and is back in CW-mode

The previous explained procedure is identical for:

U -> QTH	for use as macro :U / 20 characters
V -> NAME	for use as macro :V / 20 characters
W -> RIG	for use as macro :W / 50 characters
X -> Text	or contest-Call for use as macro :X / 50 characters
Y -> Text	or contest-exchange for use as macro :Y / 50 characters
Z -> Text	for use as macro :Z / 50 characters

4. Operation with the FROG-3

Here you find out what is important for the operation with the FROG-3 is and what is different from a "normal CW Keyer".

The 16-key-matrix-pad allows direct access to all major functions of the FROG-3. Some buttons perform dual functions, for example to enter numbers. The original keys of the pad (right) is covered with a paper overlay (left).
A transparency adhesive folio protects the surface.

TUNE function for TX tuning
Creates a burst for tuning. The LED flashes. Holding DOT extends the ratio, DASH switches to continuous tone. To switch off push ESC.

ESCAPE function
ESC is used to return to the CW-mode or the abort a function.

ENTER function
ENT is used to finish an entry / setting. If not in SETUP-mode the ENT-key switches to "**straight key**". Then DASH causes continuous tone and DOT a single shot. To stop the straight key, push ESC. Memory inputs and FLY functions are blocked in straight key mode.

SETUP function
Enter the SETUP-mode or set defaults (see chapter 3).

FLY- functions (see chapter 3)
DEL erases all FLY-buffers
MON output FLY-buffer to speaker
FCN output HisCall und HisName to speaker
FM6 copy FLY-buffer to memory 6.

The FM6-key can also be programmed to switch on the "thumbprint-pattern". If previously an individual adjustment of the dot / dash ratio was stored with the FM6-key (see setup R) this value can now be recalled with the FM6-key. The ESC key will return to standard dot / dash ratio.

Verify contest number

Output the last given number (if > 0) to speaker

Decrement contest number
Subtract 1 if > 0 and output number to speaker

Write to memory
Press one of the the buttons M1 to M6 for about 1 second until ? sounds. The memory is open, the LED flashes in 3 seconds rhythm and the input can start. The LED flashes after each accepted sign briefly up, invalid characters are not accepted.
Please let sufficient time between two words until a "bip" sounds.

Spaces between words do not occupy any space. The 6 memories are allocated as follows:
M1 50, M2-M3-M4-M5 each 120 and M6 200 characters.

Allowed characters:
*A - Z and 0 - 9 and signs +AR #SK *KN CH Ä Ö Ü ( ) = ? @ , - . / : ; " _*

After *ur rst is* the FROG-3 responds with "DIT" and the LED lights.
Now you can proceed any length of manual input. Each sensor operation sets the wait timer to zero, the LED lights on.
If no input occours, the output continues after a waiting period. Then = *name is* and 5 points slower *bernd* will be sent.

I in memory embeddable commands

Commands always start with : (---...) "colon"

:+	increment (counter + 1) and output the new value
-	decrement (counter - 1) and output the new value
:=	output the new value
:In	Increase output speed n-time (n = 1 - 9)
:Dn	Reduce output speed n points (n = 1 - 9)
:n	Repeat n-time the following word (n = 1 - 9)
:P	Pause for manual input with automatic continuation
:Rn	Memory loop after n-seconds (n = 1 - 9) or 3 minutes beacon for n = 0
:R	like :Rn but without Pause
: K	inserts HisCall (from FLY-recorder)
:L	inserts HisName (from FLY-recorder)
:T	inserts MyCall (see Setup T)
:U	inserts QTH (see Setup U)
:V	inserts own name (see Setup V)
:W	inserts RIG (see Setup W)
:X	inserts contest-call (see Setup X)
:Y	inserts contest-exchange (see Setup Y)
:Z	inserts anything (see Setup Z)

Example 1 with FLY-Macros :K and :L

:K DE **:T** = MNI TNX FER RPRT ES INFO **:P** = TNX FER NICE QSO ES HPE CUAGN = NW HR QRU = BEST 73 ES GL DR **:L** = **:K** DE **:T** *

CALL *de* ***MYCALL*** *= mni tnx fer rprt es info* ***PAUSE*** *= tnx der nice qso es hpe Cuagn = nw hr qru = best 73 es gl dr* ***NAME*** *=* ***CALL*** *de* ***MYCALL*** *kn*

Example 2 without FLY-Makro

:**3 CQ** DE **:2 DL6NBS** CQ PSE K **:R9**

CQ CQ CQ *de* ***DL6NBS DL6NBS*** *cq pse k* -> ***Wiederholung nach 9 Sekunden***.

Example 3 with speed change and number

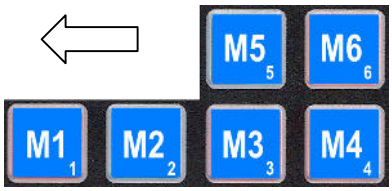
TU UR **:I3 5nn :D4 :+**

tu ur ***(fast) 5nn (slow) LFD NUMMER***

Example 4 with pause

UR RST IS **:P** = NAME IS **:D5** BERND

After *ur rst is* the FROG-3 responds with "DIT" and the LED lights.
Now you can proceed any length of manual input. Each sensor operation sets the wait timer to zero, the LED lights on.
If no input occours, the output continues after a waiting period. Then = *name is* and 5 points slower *bernd* will be sent.



Recall memory

Briefly pressing a button M1 to M6 triggers the memory output. Depending of the setting parameter D the FROG-3 behaves as follows:

0 = Batch output all memory operated in order
1 = Switch immediately to the new selected memory without stacking (default)

The output can be cancelled by a DASH or a DOT.

5. Details

Operation of the FG-3 with paddles or sensors
The program can work with both, paddle and sensors. Paddles and sensors have different input pins. K11 - K12 is jumpered for sensor operation, K12 - K13 is jumpered for paddle operation. In principle, both paddle and sensors can be connected simultaneously and selected by switching between K11 - K12 - K13 in real time.

Operation of the FROG-3 as pure sensor keyer (without memory-electronics)
The DOT signal can be tapped at K19, the DASH signal at K20. These outputs are extremely fast and can be fed to the keying-input of the TX. Each optocoupler includes an LED which consumes power. IC4 and IC5 should only be equipped if the option described here is used.

Speaker or beeper
The piezo speaker of the FROG-3 is used for setup and control. The slightly rough "Operator-sound" is the typical FROG marks. The "interactive" effect is only given in the speaker variant. The jumper is to set between K9 - K10.
Alternatively, a piezoelectric beeper may be used. Then the jumper must be set between K9 - K8 set and the capacitor C3 is omitted. The beeper only receives logic level and no sound. Beepers have high sound levels by adjusting the resistor R4, the volume can be adjusted slightly.

Operating voltage and energy-saving
The message = BAT LOW = occours if the battery voltage drops below 2,75V and when you turn on or wake up the FROG-3.
If during 30 minutes no sensor or paddles is touched and no key is pressed, the FROG-3 sounds "DIT" and goes to the sleep-mode. Pushing the wake up button in the sensor-variant or DASH or DOT in the paddle-variant awakens the FROG-3 with R .
Measured power consumption at Ub = 3V (2 x AA-size alkaline AA):

Keyed with one optical coupler:	*10mA*	*(theor. Running time approx 10 days)*
Unkeyed active:	*4mA*	*(theor. Running time approx 25 days)*
Inactive (dormant):	*30uA*	*(theor. Running time approx 8 years)*

In normal operation the running time will be between months to years.

Connection
For connecting cable I use about 40 cm old USB cable with ferrite choke.

Board (holes)
Components = 0.8 mm, beeper and soldering nails = 1 mm, mounting holes 3.5 mm.

Menu item G -> Information

The point is dealt separately here, as it has nothing to do with CW operation. During programming I developed utility routines and make them available for the technically interested OP. If **SET** is pressed and **G** is entered, we are in the programs info-level. Possible entries are then:

A => Toggle Powersaveer -> 0 = saver on / 1 = Keyer always switched on
Useful in Contest mode with PC-aid, keyer is always activ.

B => battery short test, siren and LOW BAT if voltage < 2.75 volts.

S => Go to sleep mode

T => seconds clock, stop with DOT

V => battery voltage, CW output x, y volts, 5 measurements, abort with ESC.

I => Detailed information about all active settings, abort with ESC.

= TEST NUMBER	*actual contest number if > 0*
= TEST FORMAT T89	*if number > 0 and T instead of 0*
= TEST FORMAT T8N	*if number > 0 und N instead of 9*
= SPEAKER ON	*if selected*
= SPEAKER OFF	*if selected*
= SENSOR	*if sensor-Jumper*
= PADDEL	*if paddle-Jumper*
= IAMBIC OFF	*if selected*
= IAMBIC DOT	*if selected*
= IAMBIC DASH	*if selected*
= DASH STRETCH	*if selected*
= FM6 THUMB	*if selected*
= KEY INVERS	*if selected*
= ID SPEED SET	*if selected*
= FLY OFF	*if selected*
= FLY LED	*if LED-mode on*
= FLY SIG	*if LED-mode and Sound-signal on*
= MEMO STACK	*if selected*
= MEMO CHANGE	*if selected*
= MEMO PROTECT	*if selected*
= ALWAYS ON	*if power save disabled*
= CALL	*own call in Soft-T*
= QTH	*own qth in Soft-U*
= NAME	*own name in Soft-V*
= RIG	*own rig in Soft-W*
= SOFT X	*content output*
= SOFT Y	*see above*
= SOFT Z	*see above*
= MEMO 1	*content output with all embedded commands*
= MEMO 2	*see above*
= MEMO 3	*see above*
= MEMO 4	*see above*
= MEMO 5	*see above*
= MEMO 6	*see above*
= IDENT FROG3 x DE DL6NBS	*x = Version*

Setup Chart

1. Setup

CW Betrieb | Taste SETUP | Ausgabe S und blinkende LED

A	?	0-9 oder Pad	0-9	~1 sec	Ausgabe *PUNKT	Schleife	*ESC *STRICH	S	R	**A -> CW-Trainer aktivieren (B=Buchstaben, N=Zahlen, Z=Zeichen, S=Sonderzeichen, L=Lernen, Z=Zufall)** 1 = B-Z, 2 = N-Z, 3 = Z-Z, 4 = B+N-Z, 5 = B+N+Z-Z, 6 = B-L, 7 = N-L, 8 = Z-L, 9=S-L, 0 = Speicher6-Z PUNKT -> Schleife ein (blinkt), die letzten 5 Zeichen werden ständig wiederholt, STRICH -> Schleife aus
B	0-2	S	*ESC	R						**B -> Umschaltung IAMBIC-Modus** 0 = kein IAMBIC Speicher, 1 = mit Punktspeicher, 2 = mit Punkt + Strichspeicher
D	0-1	R								**D -> Umschaltung Speichertasten Stapel / Wechsel** 0 = Tasten-Betätigungen werden gestapelt, 1 = Tastenbetätigung beendet Ausagabe und startet neu
E	od. *ESC	R								**E -> Setup verlassen**
F	?	1-4 oder Pad	~3 sec	R						**F -> Vorprogrammierte Speicherinhalte übernehmen** 1 = Standard QSO, 2 = Standard QSO mit FLY, 3 = DX-Verbindung, 4 = Contest-Verbindung
G	?	*ESC	R							**G -> Einstellungen und Informationen**
		B	(LOW BAT)	R						B = Batteriekontrolle Schnelltest
		I	Information	R						C = Info Ausgabe Einstellungen und Version
		S	BIP ->	Schlafzustand						S = Schlafzustand auslösen
		T	Endlosschleife	*PUNKt	R					T = Sekundentakgeber
		V	x,y Volt (5er Schleife)	*ESC	R					V = Voltmeter / Batteriespannung in CW
H	0-1	R								**H-> Speed Poti Monitor** 0 = aus, 1 = ein
I	R									**I -> Vorzugsgeschwindigkeit setzen**
J	0-2	S	*ESC	R						**J -> On the fly Modus aktivieren / deaktivieren** 0 = aus, 1 = ein mit LED-Signal, 2 = ein mit LED- undTonsignal
L	?	15-30 oder Pad	15-30	S	*ESC	R				**L -> Direkteingabe CW=Geschwindigkeit als WPM in CW oder über Zifferntasten** Eingabe der Ziffernfolgen 15 bis 30 werden übernommen (Beispiel 20WPM = 20 x 5 = Tempo 100)
M	0-1	R								**M -> Lautsprecher ein- oder ausschalten** 0 = aus, 1 = ein
N	5 Ziffern	?	ENT	5 Ziffern	S	*ESC	R			**N -> Laufende Kontest-Nummer setzen / beibehalten, Format bestimmen**
			5 Ziffern neu oder TTTTN Z für 0 oder Pad Irrung	ENT	5 Ziffern oder mit Format	S	*ESC	R		ENT = übernimmt bisherigen Wert, 5 Ziffern + ENT übernimmt neuen Wert T stellt Schema TT9 ein, N stellt Schema T8N ein Z stellt zähler auf 0, Beispiel TNZ + ENT stellt Format ein und nullt den Zähler Zahleneingabe auch über Tastatur möglich Wurde eine Ziffer falsch eingegeben kann dies duch Irrung-Eingabe korrigiert werden
			*ESC	R						Keine Änderung und Setup verlassen
O	0-1	R								**O -> Umschaltung Strich / Punkt Seite** 0 = Punkte links / Striche rechts, 1 = umgekehrt
P	2-TON	PUNKT	ENT	S	*ESC	R				**P -> Mithör-Ton einstellen**
		STRICH								Punkt -> Ton tiefer / Strich -> Ton höher
		*ESC	R							Keine Änderung und Setup verlassen
Q	0-1	R								**Q -> Speicherschutz ein / aus** 0 = aus, 1 = ein
R	DIT-DAH	PUNKT	ENT	S	*ESC	R				**R -> Punkt / Strich Verhältnis einstellen**
		STRICH	FM6							Strich -> Striche dehnen, Punkt -> Striche stauchen bis zur Norm / FM6 satt ENT -> aktiviert Handschriftmodus
		*ESC	R							Keine Änderung und Setup verlassen
S	DIT-DAH	PUNKT	ENT	S	*ESC	R				**S -> CW=Geschwindigkeit Arbeitspunkt einstellen**
		STRICH								Punkt -> Gechwindigkeit steigern / Strich -> Geschwindigkeit reduzieren
		*ESC	R							Keine Änderung uns Setup verlassen
T	alter Inhalt	?	ENT	alter Inhalt	S	*ESC	R			**T -> Call setzen für spätere Nutzung als Makro :T .**
			neuer Inhalt	ENT	neuer Inh.	S	*ESC	R		
			Irrung							Ein falsch eingegebenes Wort kann mit Irrung korrigiert werden
			*ESC	R						Keine Änderung und Setup verlassen
U	analog, wie unter T beschrieben									**U -> QTH setzen für spätere Nutzung als Makro :U wie Unterkunft (wie unter T beschrieben)**
V										**V -> Name setzen für spätere Nutzung als Makro :V wie Vorname (wie unter T beschrieben)**
W										**W -> RIG setzen für spätere Nutzung als Makro :W wie Werkzeug (wie unter T beschrieben)**
X										**X -> X-Text setzen für spätere Nutzung als Makro :X (wie unter T beschrieben)**
Y										**Y -> Y-Text setzen für spätere Nutzung als Makro :Y (wie unter T beschrieben)**
Z										**Z -> Z-Text setzen für spätere Nutzung als Makro :Z (wie unter T beschrieben)**

Legende:

*Abbruchfunktion z.B. *ESC oder *PUNKT
CW-Modus
Operator-Eingabe
FROG-Ausgabe mit timeout
FROG-Ausgabe ohne timeout

6. Chronologie

Jan. 2015	planning FROG3, Migration Firmware-FROG2, first tests on breadbord.
März 2015	PCB 4x4 ready, test in the shack and debugging.
April 2015	running Version "a".
Nov. 2015	speedmonitor (H) added, running Version "b".