Helge Karlsen Elektronikk
Hersethøgda 149, N-2355 Gaupen, Norway
Tlf.: +47 623 54282 WEB: www.hke.no

Date: 25.08.2015

OPERATING INSTRUCTIONS

HamControllerC

PCB Version: C

GUI 7.4.5

Firmware 7.2.6

CONTENTS:

1. OVERVIEW 2
2. GUI 2
3. FIRMWARE UPGRADE 3
4. REPEATER ACCESS 3
5. INSTALLATION 3
6. CONNECTIONS. 3
7. PARAMETERS 4
8. LINK, COMMAND RX 12
9. LEDs 12
10. SQUELCH 13
11. ALARMS 13
12. CROSS-BAND REPEATER MODE 13
13. REPEATER KEEPER'S CODE 13
14. VOICE MESSAGES. 16
15. REPEATER COVERAGE 16
16. DTMF TO CCIR CALL 16

1. OVERVIEW

The HamControllerC repeater controller is developed to be used on amateur radio repeaters, and will take care of all necessary features to operate the repeater.
The controller is having 3 radio ports. One for the repeater TX/RX connection, one for a link radio TX/RX connection (can also be configured as a second repeater port if you have 2 different repeaters at the same QTH) and one for a command RX. The controller can also be set in cross-band repeater mode, operating a repeater using two different radios on different bands.
A GUI application is developed to be used to configure controller parameters, uploading of firmware updates and speech synthesizer voice files.
The size of the Main PCB is 100x112 mm.

Specifications:

Power supply:	13.6VDC nominal, 7 – 15 VDC
Power consumption:	Less than 50mA
Input AF level:	50-700 mV peak-to-peak, max 1V
Output AF level:	Adjustable up to 1 V peak-to-peak
Relay outputs:	Open drain, maximum 300 mA
Digital inputs:	Maximum 14V DC
RSSI:	Maximum 7V DC (/2 power divider fitted)
BCD outputs:	3.3V TTL

2. GUI

Please download the Graphical User Interface (GUI) application (SetupHamControllerC.exe) from my web (http://hke.no/hamcontroller-gui.html) , which runs under Windows on a PC. Double click the downloaded file, and the GUI application will be installed on your computer. The Manual will also be installed in the same directory (HamControllerC in the Program files directory), and can be read from the Help menu. To read the Manual, Adobe Reader has to be installed on your PC.
The GUI will take care of all repeater settings needed to operate the HamControllerC properly, and a file with your settings can be stored on your hard drive.

Connecting the controller:

Use a Mini-USB cable, and connect to a USB port of your PC and the controller, then power-up the controller.
When connecting the controller to your PC for the first time, Windows is looking for a driver, and if found, it will be automatically installed. Just follow the on screen information. If the driver is not found automatically, it can be located in the GUI installation folder (HamController in the Program files directory).
When the driver is installed, then launch the GUI by clicking on the HamControllerC icon on your desk top.
When the GUI is launched, click the **"Connect Controller"** button, and when the GUI finds the controller, parameters will be read to the GUI.
The "RX" LED will be on and the "Status" LED will flash fast while the GUI is doing any operation on the USB port.
Then you can do your changes, and click menu item **"Link>Write Parameters"**, and all parameters will be uploaded to the controller, and the controller will start working with the new settings immediately.

3. *FIRMWARE UPGRADE*

When upgrading, only the correct HEX file will be accepted by the GUI. The firmware can be download from my Web (http://hke.no/hamcontroller-firmware.html). Choose HamControllerC V7.2.6 or higher. Unzipp the file to a folder on your PC. Click menu item **Link>Firmware update"**. In the file load dialog box, locate the HEX file in the folder you saved it, and double click it. The upgrade then starts,
and do nothing until the upgrade is finished. Progress is shown in the red text box. When finished, the new firmware starts automatically, no restart needed.

4. *REPEATER ACCESS*

Select the combination you want to use. If "1750/DTMF" is selected, repeater is searching for a 1750 Hz tone or the DTMF access code. If one of the 2 ways of accessing the repeater is detected, the repeater will key up transmitting the call sign. If "1750 only" is selected, the repeater is only searching for the 1750 Hz access tone. Select in the **"Repeater access"** box the way you want the users to open the repeater.

5. *INSTALLATION*

The controller can be delivered as a PCB with all components soldered, or in an enclosure.
The PCB is provided with RJ45 connectors for all connections.
Shielded wire should be used for repeater and link radio connections.
Please note that output OUT2 have two different functions, either ordinary open drain output or fan control. When used as fan control (GUI selection), the output will be active when repeater is open or if temperature exceeds 30°C.
The OUT1 and 2 outputs can sink 300mA only; so don't connect high current equipment (fan) directly.
The 2 digital inputs (IN1 and IN2) can be used for alarms. Maximum voltage is 15VDC.

6. *CONNECTIONS*

All AF signals have to be routed via the controller. Don`t connect any AF signals directly from RX to TX. If CTCSS is used, this feature must be switched off in the repeater if available, and the audio from the repeater RX must not be filtered (flat audio).

RJ45 connectors, REPEATER

RJ45:	Signal:	Cat. 5E colours:
1	**RSSI,** RSSI signal input from repeater RX for signal strength measurements.	White/Orange
2	**BCD1,** 3,3V BCD output	Orange
3	**12V,** +8 - 15VDC input.	White/Green
4	**GND,** Ground	Blue
5	**AFRX,** Audio signal input from RX.	White/Blue
6	**AFTX**, Audio signal output to TX modulator.	Green
7	**PTT,** Open drain output for TX key-up	White/Brown
8	**SQU**, RX squelch signal.	Brown

RJ45 connectors, LINK1

RJ45:	Signal:	Cat. 5E colours:
1	N/C	White/Orange
2	**BCD2,** 3,3V BCD output	Orange
3	**12V,** +8 - 15VDC input.	White/Green
4	**GND,** Ground	Blue
5	**AFRX,** Audio signal input from RX.	White/Blue
6	**AFTX**, Audio signal output to TX modulator.	Green
7	**PTT,** Open drain output for TX key-up	White/Brown
8	**SQU**, RX squelch signal.	Brown

RJ45 connectors, LINK2

RJ45:	Signal:	Cat. 5E colours:
1	N/C	White/Orange
2	N/C	Orange
3	N/C	White/Green
4	**GND,** Ground	Blue
5	**AFRX,** Audio signal input from RX.	White/Blue
6	**AFTX**, Audio signal output to TX modulator.	Green
7	**PTT,** Open drain output for TX key-up	White/Brown
8	**SQU**, RX squelch signal.	Brown

RJ45 connector, I/O

RJ45:	Signal:	Cat. 5E colours:
1	**IN1,** Digital alarm input. Select in the GUI if the input is to be used for alarm. Maximum input voltage is +15VDC.	White/Orange
2	**IN2,** Digital alarm input. Select in the GUI if the input is to be used for alarm. Maximum input voltage is +15VDC.	Orange
3	**OUT1,** Open drain output. To be used for a on/off output using DTMF.	White/Green
4	**OUT2,** Open drain output. Can be used for either a on/off output using DTMF or fan control.	Blue
5	N/C	White/Blue
6	N/C	Green

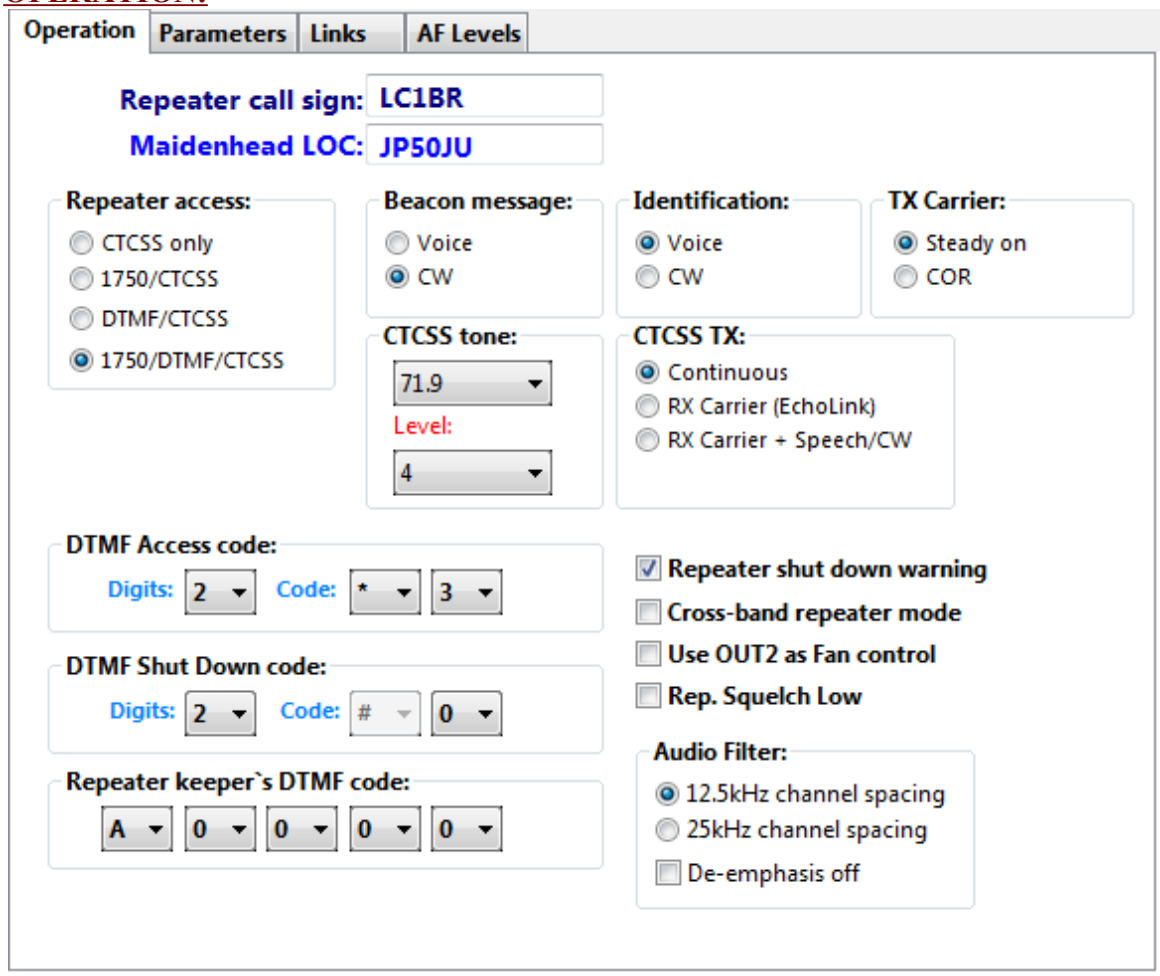
7	**GND**, Ground	White/Brown
8	**GND**, Ground	Brown

7. *PARAMETERS*

You can change all repeater parameters using the GUI, and also some parameters can be changed remotely using the Repeater keeper`s DTMF code (read chapter "Repeater Keeper`s code" for more information).

GUI PARAMETERS:

OPERATION:



Repeater call sign:

This is the repeater call sign transmitted in CW. If you want to use a voice message instead of CW when repeater is opened using 1750 Hz tone or DTMF, the call sign voice message has to be uploaded from GUI (read chapter " Voice messages" for more information).

Maidenhead LOC:

This is the Maidenhead Locator transmitted in the CW beacon message.

Repeater access:

Select the combinations the repeater users can use.
If no CTCSS tone is required, select CTCSS tone = NOTONE, and select if you want to use 1750Hz tone or DTMF code.
If 1750/DTMF is checked, the repeater will open when receiving a 1750Hz tone, or when the selected DTMF code is decoded.

CTCSS:
The repeater can transmit and decode CTCSS (PL) tones. If "NOTONE" is selected, the CTCSS function is off. Select when you want the CTCSS tone to be transmitted in the **"CTCSS TX"** box. When **"CTCSS only"** is selected, only users having the correct tone programmed in their radios will get through the repeater. For the other options, also radios not using a CTCSS tone will get through the repeater.
When the tone is detected, the repeater will go on the air at once.

DTMF:
Dial the 1 or 2 digit DTMF code set in the GUI. Use radio DTMF pad to dial the access code. The repeater will open when correct code is detected.

1750 Hz tone:
The repeater will key up when a 1750 Hz tone is detected for the time set in GUI.

Beacon message:
Select if you want the beacon to be transmitted as a CW or voice message. If CW is selected, the repeater call sign and Maidenhead LOC will be transmitted. If voice is selected the message recorded will be played.
Beacon message is only transmitted if set to on by Repeater keeper's DTMF code task 2, and the message interval is the time in minutes selected in edit field **"Beacon interval (Min.):"** under Parameters tab.
Beacon is only transmitted if the repeater is not used, and the timer is reset every time the repeater is opened.

Identification:
When repeater is opened, the repeater is keying up transmitting call sign in CW or Voice. If CW is selected, the call sign in the **"Repeater call sign"** edit box is transmitted, and when selecting **"Voice"**, the repeater voice call sign message stored is transmitted (read chapter "Voice messages" for more information). If "CTCSS only" is selected, only the CW call is transmitted when the operator's PTT is released.

TX carrier:
If "Steady on" is selected, the repeater TX is on the air even if there is no carrier detected at repeater RX when open, but if "COR" (Carrier Operated) is selected, the repeater TX is keyed up only when a RX carrier is present. The TX will remain on-air for the time "COR TX tail" set in the "Parameters" tab.

CTCSS tone and level:
Select the CTCSS tone to be used by the repeater. If level is set to 0, the controller will not transmit the tone. Level 1 to 5 will set the deviation of the CTCSS tone with 5 as the highest level.
If NOTONE is selected, no tone will be received or transmitted.

CTCSS TX:
Continuous: The tone will always be transmitted.
RX Carrier: The tone will only be transmitted when a RX signal is detected. Preferred if repeater is connected to EchoLink.
RX Carrier + Speech/CW: The tone will be transmitted when a RX signal is detected, and when the controller is transmitting a Speech or CW message.

Repeater shut down warning:
When checked, the repeater will transmit three warnings consisting of a CW "E" at an interval of about 1 second when the shut down timer has expired. If a carrier is detected before shut down, the timer will be reset.

Cross-band repeater mode:
When checked, the controller can be used with a cross-band repeater. Please read chapter «Cross-band repeater mode» for more information.

Use OUT2 as Fan control:

When checked, the output will be active when repeater is open or if temperature exceeds 30°C. Do not connect the fan directly to the RLY2 output. The output can control a relay switching the fan on/off.

Rep. Squelch level:

The squelch output signal from repeater RX can be either high or low. If the signal is having a high-level (+voltage) when RX is receiving a signal (squelch active), the box must be checked.

DTMF access code:

Select number of digits in the access code (1 or 2), and the code to be dialled from the operator's DTMF pad from the drop down boxes.

DTMF shut down code:

If the repeater is not operating properly, and you need to shut it down while open, this can be done by dialling the selected code. After dialling the code, the speech message "repeater is off" is played, and then repeater is reset.

Repeater keeper`s DTMF code:

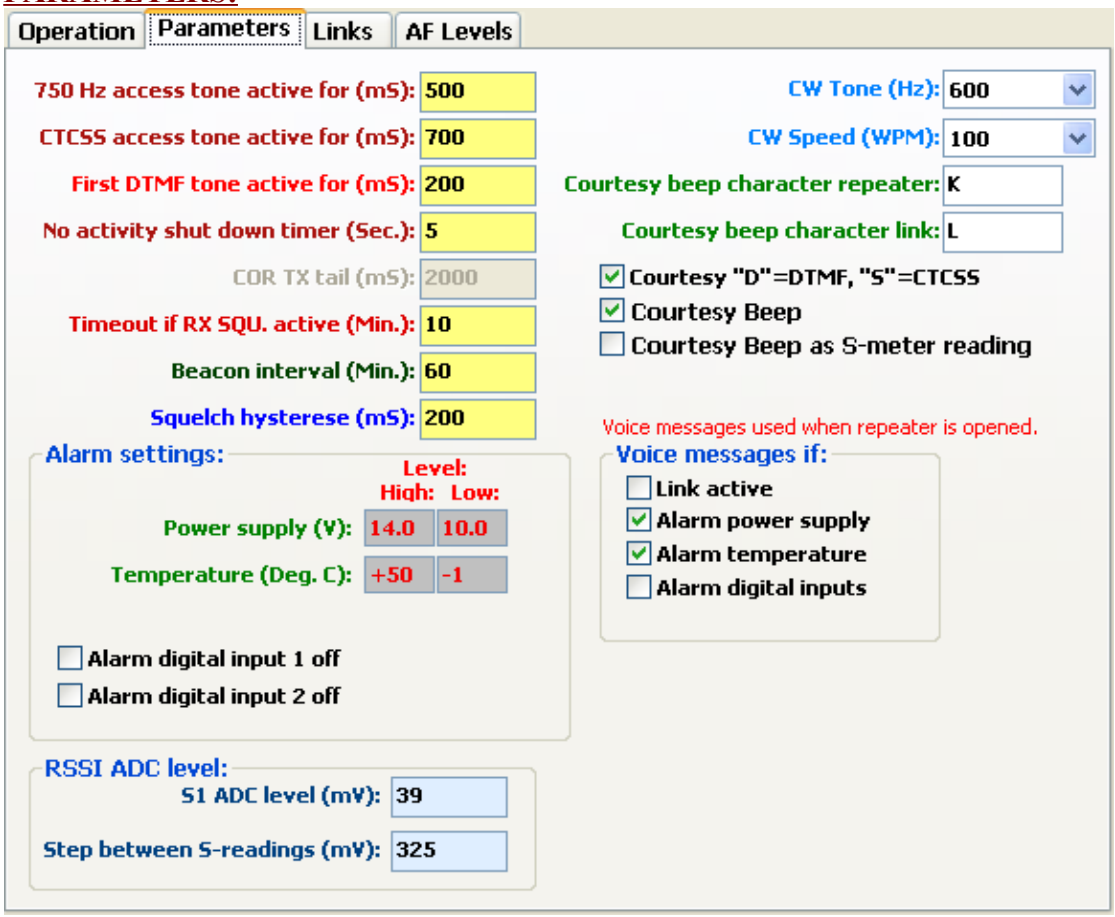
This is the code used by the repeater keeper to access the various repeater settings and readout of repeater operational timers and counters. Please read chapter «Repeater keeper`s DTMF code» for more information.

Audio filter:

Select either 12.5 or 25 kHz filter setting for the channel bandwidth. The VHF band plan is having a channel spacing of 12.5 kHz, so please use 12.5 kHz filter setting for VHF repeaters, selecting a 2.5 kHz AF low pass filter. If 25 kHz is selected, the 3 kHz AF low pass filter is selected.

There is also an option selecting the De-emphasis to be set on or off. Set to on if RX audio is output from the RX discriminator without any RX filtering.

PARAMETERS:



1750 Hz access tone active for:

When the 1750Hz tone is detected, the tone must be present for the time set. If the tone is pressed for a time lower than the one set, the repeater will not open.

CTCSS Hz access tone active for:

When the CTCSS tone is detected, the tone must be present for the time set. If the tone is pressed for a time lower than the one set, the repeater will not open.

First DTMF tone active for:

Select the time in mS the first DTMF tone must be present to be acknowledged. For all DTMF tasks, the first tone in the code must be present for at least the set time. All following tones have no time limit.

No activity shut down timer:

When the repeater is accessed by a selected tone, the repeater remains open (the user don`t need to send a new access tone) for the time in seconds before shutting down, if there is no traffic. This timer is reset each thime the squelch closes.

COR TX tail (mS):

When “COR" is selected in the “TX Carrier” group box, the TX will stay on-air for the time set before TX is switched off. When used along with a cross band repeater, set this timer as low as possible (100).

Timeout if RX SQU. is active:

Select the time in minutes the repeater remains on-air if there is a continuous carrier at the repeater RX. This timer will be reset each time the RX carrier is lost.

Beacon interval:

Select the time in minutes between each time the repeater will transmitt the beacon

message. This feature must be switched on by using the Repeaters keepers code, task 2. Beacon is only transmitted when repeater is inactive.

Squelch hysterese:

This is the time the AF will be modulated on TX after the RX carrier is lost. When timer elapsed and no new squelch detected, the TX AF is muted and courtesy beep transmitted.

CW tone (Hz):

Select the CW audio tone from the drop down box. Only the pre-programmed tones can be selected.

CW speed (WPM):

Select the CW speed in Words Per Minute from the drop down box. Only the pre-programmed tones can be selected.

Courtesy beep character repeater:

Select the character to be transmitted in CW when the repeater is ready for the next operator to transmit. The selected character is transmitted when the repeater squelch has been active. "Courtesy beep" have to be checked, otherwise no character will be transmitted.

Courtesy beep character link:

Select the character to be transmitted in CW when the repeater is ready for the next operator to transmit. The selected character is transmitted when the link squelch has been active. "Courtesy beep" have to be checked, otherwise no character will be transmitted.

Courtesy «D»=DTMF, S=»CTCSS»:

When checked, the repeater will transmit a «D» if the repeater is opened using DTMF, and «S» if opened used CTCSS instead of the selected courtesy beep character which will be transmitted when accessed by 1750 Hz tone. If not checked, the repeater will always use the selected character.

Courtesy Beep:

When checked, the repeater will transmit a selected CW letter when the repeater is ready for the next operator to transmit.

Courtesy Beep as S-meter reading:

When checked, the repeater will transmit the RSSI signal level as a voice message, e.g «Strength five». The repeater RSSI output must be connected to the controller RSSI input. Calibrate the reading using the «RSSI ADC level» box int the Paramters tab. Please read chapter «Repeater coverage» for more information on how to do the calibration.

Voice messages if:

When the repeater opens, several alarm messages can be set to be transmitted if the corresponding alarm is on.

Messages transmitted if the box is checked:

Link active: When opened by 1750 or DTMF, the link on message will be played if LINK1 and/or 2 is active.

Alarm power supply: When a low or high trigger is detected the power supply alarm message is played.

Alarm battery: When a low is detected the battery alarm message is played.

Alarm temperature: When a low or high trigger is detected the temperature alarm message is played.

Alarm digital inputs: When a trigger from high to low level is detected the external alarm message is played.

Power supply (V):

Select the high and low trigger voltage for the power supply. The voltage at the «PWR» terminal is measured.

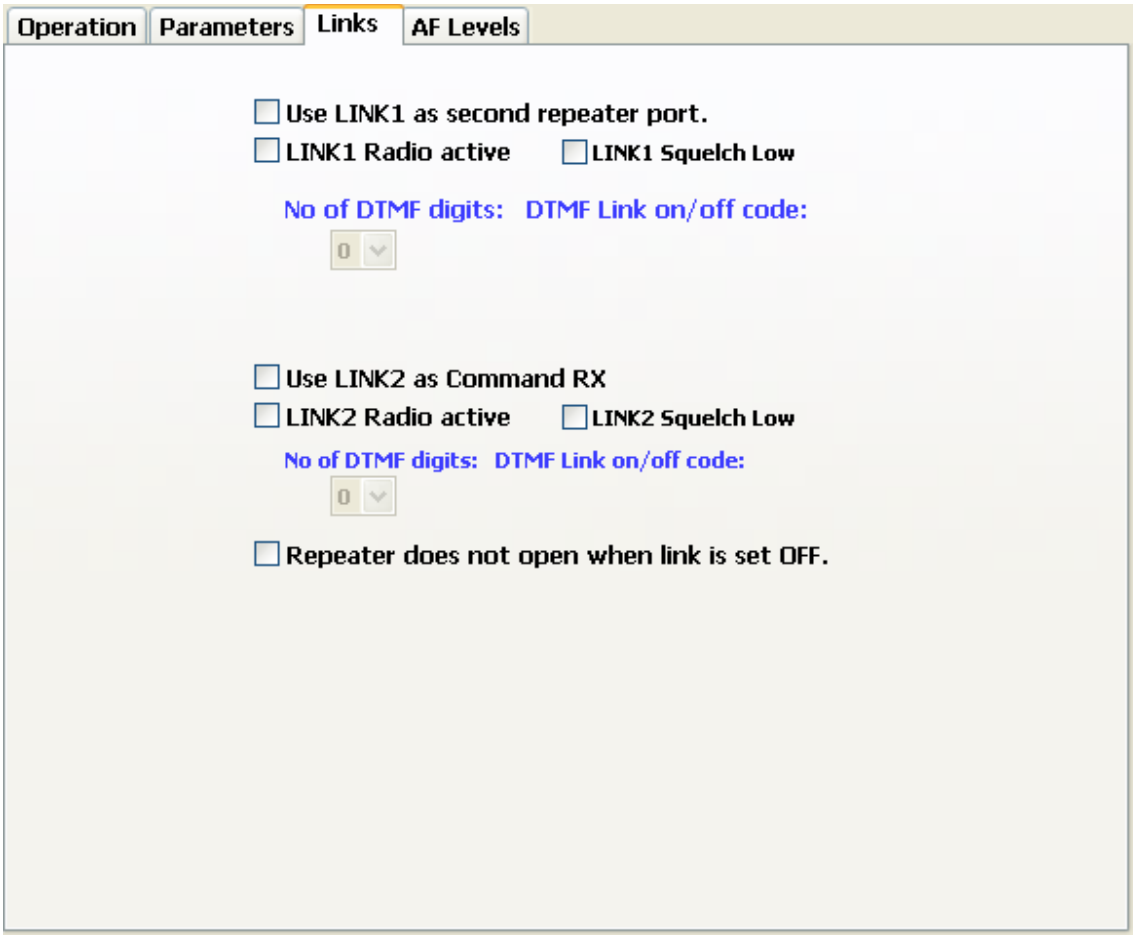
Temperature (Deg. C):
Select the high and low trigger point for the temperature sensor located on the PCB.

Alarm IN1 on (high level):
When this box is checked, an external alarm sensor must be connected to «IN1» pin at the I/O port. The alarm is active when the terminal voltage is higher than 3VDC.

Alarm IN2 on (high level):
When this box is checked, an external alarm sensor must be connected to «IN2» pin at the I/O port. The alarm is active when the terminal voltage is higher than 3VDC.

RSSI ADC level:
Please read chapter «Repeater coverage» for more information.

LINKS:



Use LINK1 as second repeater port:
When this box is checked, the LINK1 port is used as a second repeater port. That is, you can connect one repeater to the REP. port and a second repeater to the LINK1 port. Can be used if you have two different repeaters operating on different bands at the same QTH, and repeaters is having the same callsign.

LINK1 Radio active:
If a link to another repeater is used, this box must be checked.

LINK1 Squelch level:
The squelch output signal from link radio RX can be either high or low. If the signal is having a high-level (+voltage) when RX is receiving a signal (squelch active), the box must be checked.

LINK1 DTMF:

A DTMF code can be selected used to switch to Link on/off. If «0» is selected in the «No of DTMF digits» box, the Link is always on. Select number of digits in the DTMF code and the user code from the drop down boxes. When this code is used, the Link will be turned on if off and the other way around.

Use LINK2 as Command RX:

A RX can be connected to LINK2 port to be used by the Repeater keeper to execute any DTMF task. Only a RX is needed, as the repeater responds by transmitting on the repeater frequency. When this box is checked, the LINK2 port is configured to be used with a command RX, otherwise it is used as a secondary Link port.

When opened by the command RX, the AF through the repeater is blocked, and will be on again after a repeater shut down.

LINK2 Radio active:

If a link to another repeater is used, this box must be checked, and not the «Use LINK2 as command RX» box.

LINK2 Squelch level:

The squelch output signal from link or command radio RX can be either high or low. If the signal is having a high-level (+voltage) when RX is receiving a signal (squelch active), the box must be checked.

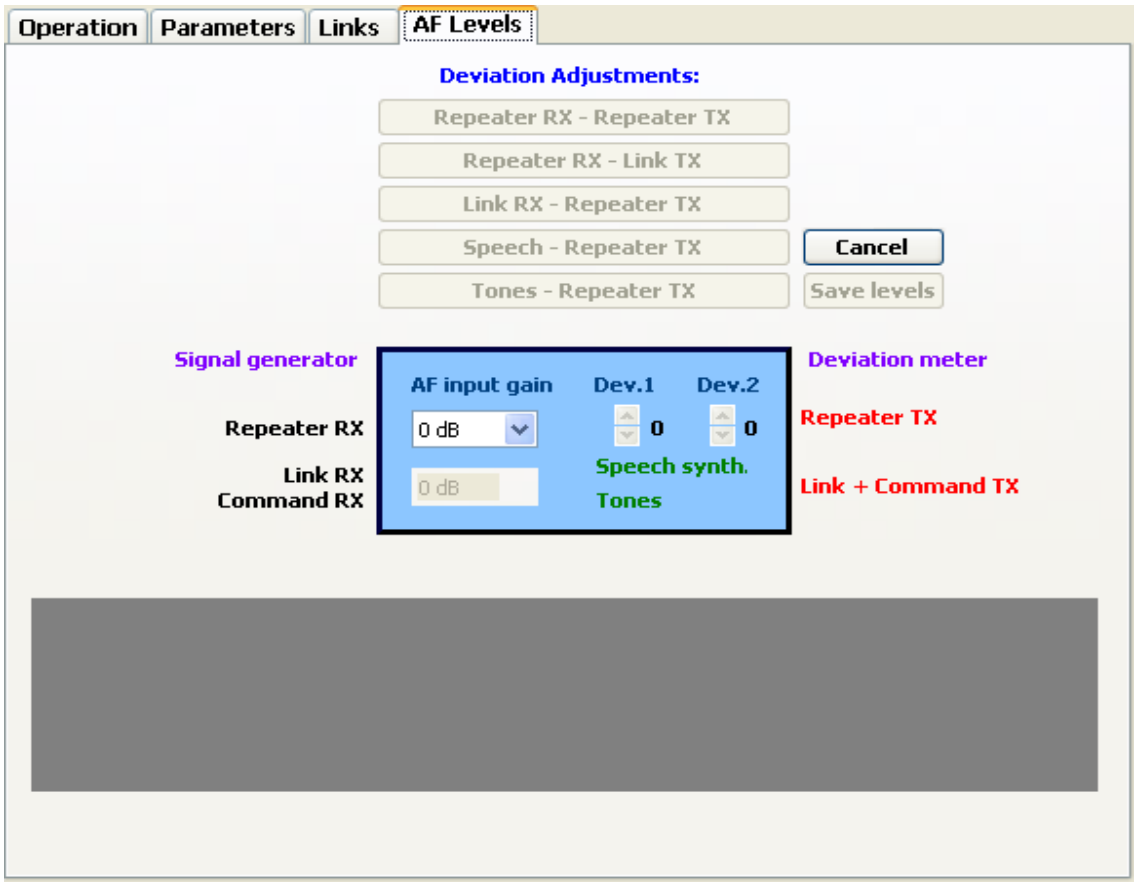
LINK2 DTMF:

A DTMF code can be selected used to switch to Link on/off. If «0» is selected in the «No of DTMF digits» box, the Link is always on. Select number of digits in the DTMF code and the user code from the drop down boxes. When this code is used, the Link will be turned on if off and the other way around.

Repeater does not open when Link is set off:

In older versions the repeater would always open on a squelch signal on the Link ports if the LINK1 or 2 was set active and the link was on. By checking this box, the repeater will not open when the link is set to off

AF Levels:



The AF signal path through the controller is linear, no de/pre-emphasis.
Test equipment needed:

- Oscilloscope
- Signal generator operating on your repeater frequency
- Deviation meter

All AF signal level adjustments are made from the GUI, setting the correct deviation on repeater and link radio TX.

Click the button for the adjustment you want to perform. There is a on-screen instruction on how to connect the test equipment.
Different repeaters will have a different AF level output. If the level is too high, there might be some distortion. Adjust the "**AF input gain**" setting for best distortion, then adjust the **"Dev.1"** and **"Dev.2"** buttons up or down until you have a proper deviation setting. The button settings will overlap each other, so select a combination giving the best setting.
Use a oscilloscope to check the AF fed to the TX. The signal should be a clean sinus with no distortion. Compare with the signal from the RX.
Set the signal generator deviation to 3 kHz, using a 1 kHz tone.

Repeater RX – Repeater TX

Allignment of repeater deviation.
If CTCSS tone is selected, set this to NOTONE before doing this adjustment.
Deviation on the TX should be exactly the same set on the signal generator connected to repeater RX.
If CTCSS tone is to be used, set the tone and level in the «Operation» tab. The deviation of th CTCSS tone should be 400-500Hz.

Repeater RX – Link TX

Allignment of link radio deviation. Deviation on the link radio should be exactly the same set on the signal generator connected to repeater RX.

Link RX – Repeater TX

Allignment of repeater deviation. Deviation on the TX should be exactly the same set on the signal generator connected to the link radio.

Speech – Repeater TX

Allignment of speech synthesizer. Adjust to about 2-3 kHz deviation.

Tones – Repeater TX

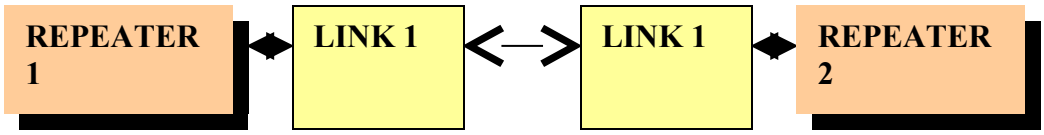
Allignment of tones sent. Adjust to about 2 kHz deviation. The tone level should be a bit lower than speech levels.

8. *LINK, COMMAND RX*

A link radio can be connected to LINK1 and/or LINK2 connector. LINK2 connector can be configured to be used either as a link radio port or for connection of a command RX. When a link radio is connected, the repeater can be linked to a repeater at another QTH. The link should not use the same band as the repeater as this might cause interference. Under the tab **"Links"** you can activate the links, and select if LINK2 is to be connected by a link radio or a command RX.

When the Link is activated, you can select if you want to have the possibility of switching the link on or off by using a DTMF code. If no code is selected, the link will always be on.

When the link is on, the link radio will be on the air when the repeater squelch is open, transmitting to the next repeater. When the link radio is receiving a signal, the repeater TX will be on the air transmitting the link signal.



The command RX (only a RX is needed, no TX) is used by the Repeater keeper to change parameters using DTMF codes, or shutting the repeater down if the repeater RX frequency is busy by noise or other unwanted signals. The repeater keeper is transmitting on the command RX frequency, and listening on the repeater TX frequency. The AF through the repeater is blocked, and will be on again after a repeater shut down.

9. *LEDs*

There are four LEDs on the PCB. When the controller is powered-up, the STATUS LED will flash fast, and the OPEN and TX LED is on. After a couple of seconds the OPEN LED will go off, and then the TX LED. The controller is ready for use when the STATUS LED goes from fast flash to flashing once a second. If the STATUS LED is still flashing fast, there is something wrong.

The LEDs are also used when the GUI is communicating with the controller.

Normal LED behaviour:

REP OPEN:

Steady on state when the repeater is opened for use.

TX:

Steady on state when repeater TX is on air.

STATUS:

Slow flashing LED (1 flash/sec.) indicates normal operation.

Fast flash indicates an error or GUI communication, and the controller is not ready for normal operation.

RX:

Steady on state when repeater or link radio squelch is active.

10. SQUELCH

The squelch LED will be at a steady on state when repeater RX or any link radio is detecting a carrier.

From your repeater RX and link radios, the level of your squelch signal might be a low- or high-level. The level is set in the GUI. If the repeater RX squelch level is at a high state when the receiver squelch is on, you have to check the **"Rep. Squelch low"** check box in "Operation" tab, and it will change to "Rep. Squelch high"

If a link radio or command RX is used, check the corresponding check boxes in the "Links" tab.

11. ALARMS

In the GUI you can configure several alarms to be enabled or not. These alarms are power supply voltage high or low, temperature high or low and digital inputs.

The alarm condition can be read by using the Repeater keeper's code and task 4.

Alarms has to be checked in the "Voice messages if:" box in the GUI for readout every 5 courtesy beeps during a QSO.

If any set alarm is active, it is also indicated by a voice message when the repeater is opened using 1750 Hz tone or DTMF.

Digital inputs:

There are 2 digital alarm inputs, IN1 and IN2 located at the RS232, I/O connector. Set in the GUI if these alarms to be active or not. If set on, the alarm is triggered when the IN1 or IN2 pins is changing state from high to low level.

12. CROSS-BAND REPEATER MODE

When the check box "Cross-band repeater" is checked in the GUI, the controller will operate in cross-band repeater mode. The controller will then operate two separate radios operating on two different bands.

Connect the radio for band one (e.g. two meters) to REPEATER terminal and the other (e.g. a 70 cm radio) to LINK1 terminal.

The repeater will operate as an ordinary repeater except two different radios are used operating on two different bands.

In order to access the repeater, juste push your radio PTT button. If CTCSS is required, tone has to be defined in the used radios connected to the controller. When squelch is detected, the repeater will go on the air transmitting the call sign on both frequencies. Then the repeater keys down, and the operator can start transmitting on one band, and this signal will be transmitted on the other band. The other operator then has to answer using the other band than operator one.

13. REPEATER KEEPER'S CODE

Select the 5 digits DTMF Repeater keeper's code (only known by the repeater keeper) in the GUI. All changes and status reports will be responded with a speech message. The repeater will also respond to the code when received from a command RX. When code is dialled on the operator's radio DTMF pad when the repeater is open, the repeater will respond with "verify". Then dial the task code from the list below. When a operation is finished, the repeater will be ready for next task indicated with a short "Beep". If no task

is received within 5 seconds, the repeater will return to normal operation, and Courtesy beep is transmitted, if activated.

Tasks:

1 **Repeater on/off.** Repeater may be switched off for no operation. Turn on again by dialling the Repeater keeper's code, wait for "verify", and task1. If repeater is off, the repeater will not respond to any access codes. Speech: "Repeater is off", "Repeater is on".

2 **Beacon on/off.** If beacon message is set to on, beacon message will be changed to off, and the other way around. If beacon set to on, the beacon message will be transmitted when no repeater activity at time intervals set in the GUI "Beacon interval" edit field. Speech: "Beacon is on", "Beacon is off".

4 **Alarms condition.** Power supply, temperature and input alarms state. Message: power supply, temperature and digital inputs on or off.

5 **Repeater operation.** Several parameters can be changed over-air, instead of using the GUI. When DTMF 5 is dialled, release radio PTT and the repeater responds with "verify" once again. Then dial the change parameters task from the list below. Release radio PTT, and the repeater responds using a voice message telling the new parameter state.

1 **Repeater carrier operated on/off.** If carrier operated mode is set to off, the repeater TX will be keyed up as long as the repeater is open, and if set to on, the TX will key up only if a RX carrier is present. If function was set to on, carrier off function will be selected and the other way around. This task is not functional in cross-band repeater mode.

2 **Repeater identification CW/Voice.** If identification is set to CW, repeater identification will be changed to voice, and the other way around. If voice is selected, the call sign message recorded (task 3+C) will be played when the repeater opens.

31 **Courtesy beep on/off.** If Courtesy beep is set to on, it will be changed to off, and the other way around. If state is on, a CW letter will be transmitted 30 mS after the repeater RX carrier is lost, depending on which way the repeater was accessed - CW "K" = 1750 Hz, CW "S" = CTCSS, CW "D" = DTMF.

32 **S-meter Courtesy beep on/off.** If S-meter Courtesy beep is set to on, it will be changed to off, and the other way around. If state is on, a S-meter reading will be transmitted 30 mS after the repeater RX carrier is lost.

4 **Repeater shut down warning on/off.** If warning beep is set to on, it will be changed to off, and the other way around. If state is on, the repeater will transmit 3 "E"s in CW with a interval of 1 second, then sending the CW shut down signal.

5 **Beacon message CW/Voice.** If beacon message is set to CW, beacon message will be changed to voice, and the other way around. If voice is selected, the message no 2 recorded (task 3+2) will be played at the interval set when no repeater activity. When CW is selected, the CW message will be call sign + Maidenhead locator.

6 **Link message on/off when repeater opens.** If link message is set to on, it will be changed to off and the other way around. If state is on, the repeater will respond with "Link" after the call sign when the repeater opens, to indicate that a link to another repeater is active.

7 **Alarm power supply message on/off when repeater opens.** If PS message is set to on, it will be changed to off and the other way around. If state is on, the

repeater will respond with “Alarm supply” after the call sign if alarm active when the repeater opens, to indicate the alarm condition.

9 **Alarm temperature message on/off when repeater opens.** If temperature message is set to on, it will be changed to off and the other way around. If state is on, the repeater will respond with “Alarm temperature” after the call sign if alarm active when the repeater opens, to indicate the alarm condition.

0 **Alarm digital inputs message on/off when repeater opens.** If digital message is set to on, it will be changed to off and the other way around. If state is on, the repeater will respond with “Alarm digital input 1/2” after the call sign if alarm active when the repeater opens, to indicate the alarm condition.

A2 **Repeater access:** 1750 Hz tone, DTMF access code

A3 **Repeater access:** 1750 Hz tone, CTCSS tone

A4 **Repeater access:** 1750 Hz tone only

A5 **Repeater access:** CTCSS tone only

A6 **Repeater access:** DTMF access code, CTCSS tone

B **CTCSS TX Continuous/RX Carrier:** If CTCSS TX is set to continuous it will be changed to RX Carrier, and the other way around. When continuous is selected, the CTCSS tone will be transmitted all the time, and when RX Carrier is selected, the tone will only be transmitted when a RX carrier is present.

6 **Repeater carrier operated (VOX) mode.** The repeater shut down timer is disabled, and TX will be keyed up if a carrier is detected at RX. When RX carrier is lost, the repeater will transmit a short tone (beep) after a delay of 100 mS, and repeater will key down. The repeater will remain in this mode until released by dialling DTMF code **66.** If in cross-band repeater mode, System operator’s code has to be dialled followed by task 6 in order to release the mode.

7 **STATUS:** Power supply and battery voltages, and temperature played as a voice messages.

8 **STATUS:** The time the repeater has been on air along with the repeater access counter played as a voice message. The time will be played as hh(hours) comma mm(minutes) the repeater has been on air.

9 **Reset task 8 counters.** All counters and timers set to zero. When this task is dialled, the repeater responds with “verify” once again, then dial DTMF * to reset the counters, and counter setting is played as a voice message, all zero.

0 **Firmware version.** Speech: “Firmware + version”

B **Output**1 on/off. Output ”OUT1” on or off. If output state is on, it will be set to off. Speech: “Relay one is on/off”.

C **Output2 on/off.** Output ”OUT2” on or off. If output state is on, it will be set to off. Speech: “Relay two is on/off”. Not active if “Use RLY2 as Fan control” checked in GUI.

***** **Change BCD outputs.** Change of BCD1 and BCD2 state. Outputs will change to the digit followed by DTMF * task. When DTMF task * is dialled, the repeater responds with “verify” once again, and then dial the DTMF code corresponding the BCD setting. The settings are 0, 1, 2 and 3 (2 bit). The repeater responds with “New output active”.

**RSSI.** Repeater coverage. (Read chapter “Repeater coverage” for more information)
This task is not functional in cross-band repeater mode.

14. VOICE MESSAGES

The Speech synthesizer can store a voice message and the repeater call sign. Message bank can store a message up to 40 seconds long, and the call sign message bank is 8 seconds long.

To play the message, dial **#1** on your radio DTMF pad, and if the flash memory storage location is not empty, the corresponding message will be played. If Beacon Message Voice is activated and the Beacon set on, the message will be played at the set Beacon intervals.

The WAV-file must be recorded using 8bit mono sampled at 8 kHz, and the WAV-file must be uploaded from GUI.

15. REPEATER COVERAGE

Dial the DTMF Repeater keeper's code followed by the RSSI (#) task. The repeater responds with "Repeater signal strength mode is on", and then repeater is keyed down. When the repeater is receiving DTMF #, the repeater will key up and the signal strength 1 – 9 will be transmitted by voice (e.g. "signal strength 5") followed by the corresponding DTMF tone for 1 second.

To terminate this mode, dial DTMF *, and repeater returns to normal operation.

If you have equipment in your car recording the DTMF tone along with GPS position, you can store this information for future use.

Different repeaters may have different RSSI voltage levels, and measurements have to be set for your repeater by using the settings in the **"RSSI ADC level"** group box. Use the signal generator, and select the S1 and S9 levels and measure the voltages for both on the RSSI terminal. The voltage step between each S-meter reading can then be calculated using the equation:

Step=(S9-S1)/9

The S1 reading and the Step value have to be updated in the GUI parameters.

To prevent any damage if the RSSI voltage is higher than 3.3V, there is a voltage divider (R14, R15) on the PCB dividing the voltage by 2. If the RSSI voltage does not exceed 3.3V at maximum reading, remove R15 and replace R14 by a link or low value resistor.

16. DTMF TO CCIR CALL

If you are using a radio with DTMF pad and no CCIR function, and you want to alert an operator or other equipment whose radio is only activated by a CCIR code, the controller can take care of this.

When repeater is ready for use, dial DTMF 60* followed by the CCIR radio code in one sequence. If the CCIR code is 77853, then dial **60*77853** (the 3 first digits are always 60*, and is not a part of the code), and when PTT is released; the repeater will transmit the 77853 codes as CCIR tones. The first digit tone length is 700mS, and the following 4 tones having duration of 100mS.