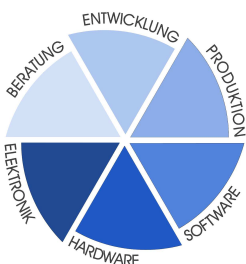


# Relay control

FT635 REL AC



**FunkTronic**  
Kompetent für Elektroniksysteme

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## **Technical Data**

Voltage of operation	+12V DC +/- 30%
Current demand	ca. 100 mA
Fuse	1 A, self-resetting
Weight	ca. 525 g
Dimensions W x H x D	104 x 44 x 175 mm
Frequency of pilot tone	ex factory 3300 Hz
Pilot tone decoder	+/- 0,8 % (+/- 26 Hz)
Response time	< 20 ms
Release time	< 40 ms
min. pilot tone level at measuring point	75 mV
Notch filter pilot tone suppression	> 50 dB

### **2- resp. 4-wire**

Input level 2-wire	-10 dBm nominally, 250 mV
Adjustment range 2-wire	-41 dBm to -1 dBm, 7 mV to 700 mV
Input level 4-wire	-9 dBm nominally, 275 mV
Adjustment range 4-wire	-40 dBm to +1 dBm, 8 mV to 850 mV
Input impedance	2-wire Zr or 600 Ohm, 4-wire 600 Ohm
Output level 2-wire	-10 dBm, 250 mV (alternatively: -19 dBm, 190 mV)
Pilot tone 2-wire	-12 dBm, 200 mV
Output level 4-wire	-14 dBm, 150 mV (alternatively: -5 dBm, 450 mV)
Pilot tone 4-wire	-16 dBm, 125 mV
Output impedance 2-wire	Zr or 600 Ohm
Output impedance 4-wire	600 Ohm

### **Interface radio device resp. desk top control**

Input level	ex factory setting + 3 dBm, 1100 mV
Adjustment range	- 24 to + 6 dBm, 50 mV to 1550 mV
Input impedance	600 Ohm
Output level	ex factory setting - 17 dBm, 100 mV
Adjustment range	- 30 to + 8 dBm, 25 mV to 2000mV
Output impedance	600 Ohm

# **General features**

The FT635 REL AC relay control is used to operate a relay. A connection with a two or four wire cable is also possible. With that very long distances can be bridged, depending on the cable attenuation.

## **All versions of the FT635 REL AC**

- Relay function radio in to radio out
- 2 or 4-wire connection (selectable by jumper)
- Impedance 600 Ohm or Zr (selectable by jumper) (Zr only for 2-wire)
- Connector radio device --> AF-in/output and PTT
- Pilot tone decoder 3300 Hz or DC-decoder
- Serial interface RS232 to adjust and program
- All levels adjustable with RS232
- All AF-in/outputs galvanically separated (transformer)
- Remote channel switching by 5-tone sequences
- Programmable pilot tone encoder
- DC-encoder
- 8 digital inputs
- 8 digital outputs

## **Option line monitoring**

The connection of the 2-/4-wire is constantly monitored by the option line monitoring.

The FT635 REL AC relay control is available in a black flange aluminum housing.



- black flange aluminum housing

## Channel switching

Remote switching of channels is achieved by transmitting certain 5-tone sequences. The interface to the two-way radio device is parallel. The channel output can be "binary", "binary-1", "decimal" and "2xBCD". The channel output can be inverted if necessary. Remote channel switching is done via the line-in.

## Option line monitoring

In order to configure the operating mode line monitoring a device with this option is needed at both ends of the line. Line monitoring is only active during idle times.

For this one of the devices has to be configured as master, the other device as slave. The master device then scans the slave device in certain intervals. If there is no reply or the slave-device doesn't receive a scan by the master-device within a certain interval, one of the switching outputs can be programmed as error indicator.

## Transmitter control

The transmitter control is activated as soon the AC-line has received and decoded the pilot tone. Then the PTT-output is switched by a potential-free relay. The PTT output can also be controlled by DC- or AF-decoding (register 053/1). The line-input is switched through to the radio even if the relay is active. In that case line has priority over radio.

## Functions of the LEDs

The **green LED** is always on when the relay is active or the pilot tone has been decoded by the AC-line or when a DC potential is applied or AF has been decoded, depending on the configuration. The green LED blinks when there is a decoding, but the switching of the transmitter relay is suppressed.

The **yellow LED** is on when the pilot tone has been activated or DC has been applied to the line or the AF has been connected to the line. The yellow LED blinks when the activation of one of the aforementioned functions has been suppressed.

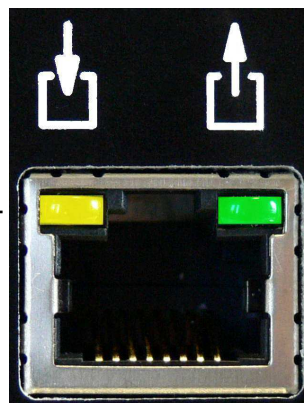
## Examples

Depending on the setup of the radio installation the FT635 REL AC is used together with different other FunkTronic modules. The following questions should be answered when planning:

- Connection of the FT635 REL AC to an operation terminal and a two-way radio
- Remote channel switching necessary
- Line monitoring necessary
- 2- or 4-wire connection, simplex or duplex
- Connected to FT634aC or operating terminal

**LED yellow**

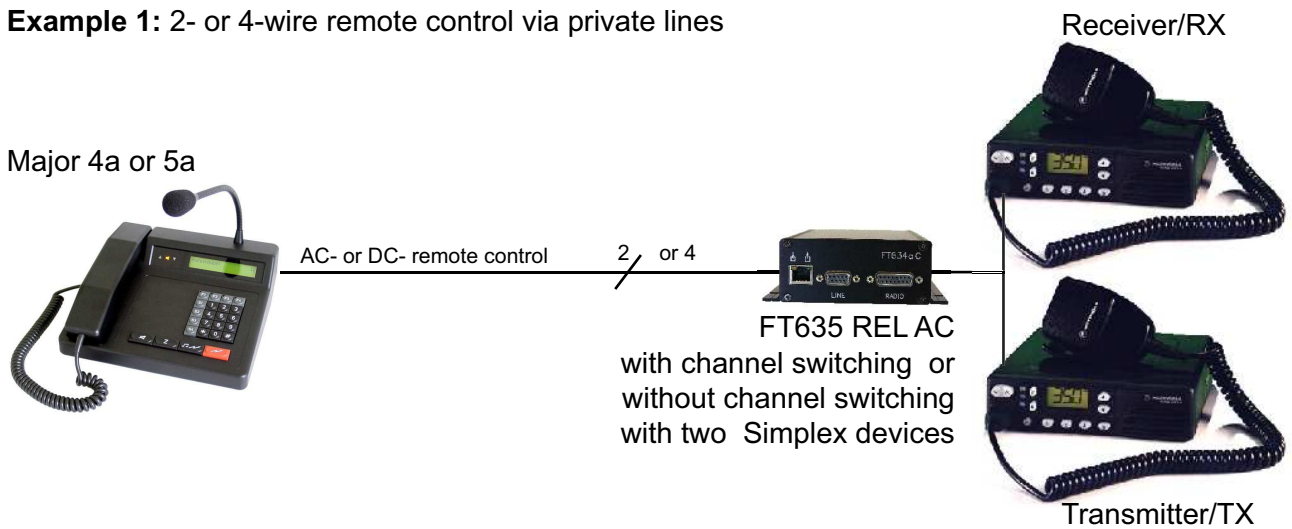
- Pilot tone turned on or
- DC applied and
- AF connected to the line  
(blinking see description)



**LED green**, transmitter relay on because

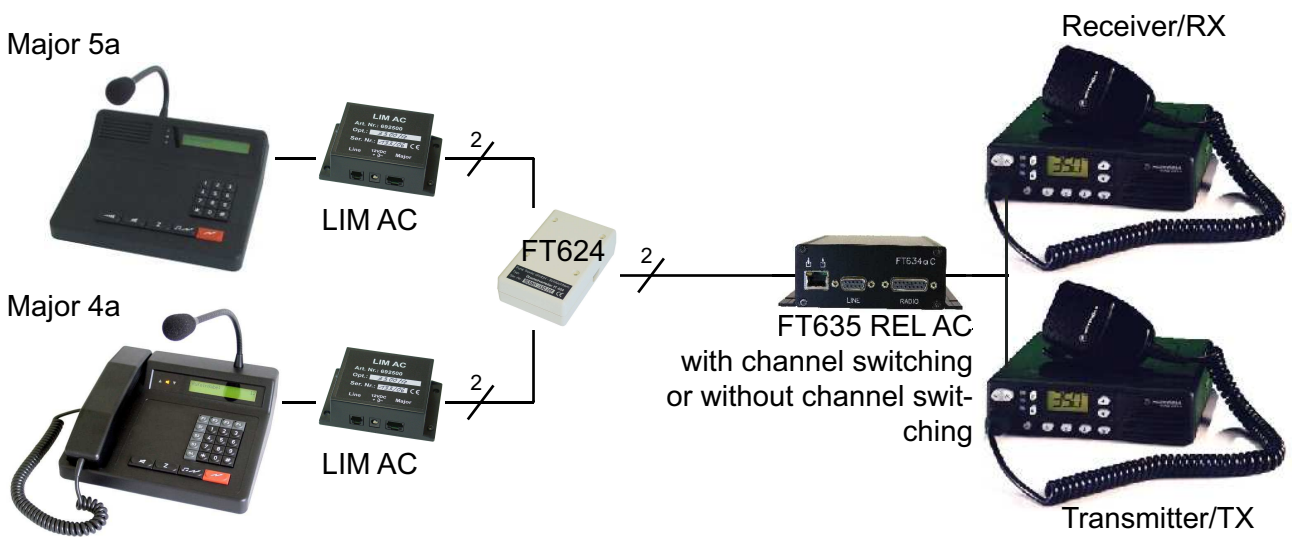
- relay is active
- pilot tone has been decoded or
- DC has been decoded or
- AF has been decoded  
(if blinking see description)

**Example 1:** 2- or 4-wire remote control via private lines



**Example 2:** Parallel circuit of several operation terminals --> LIM AC has to be equipped with notch for pilot tone.

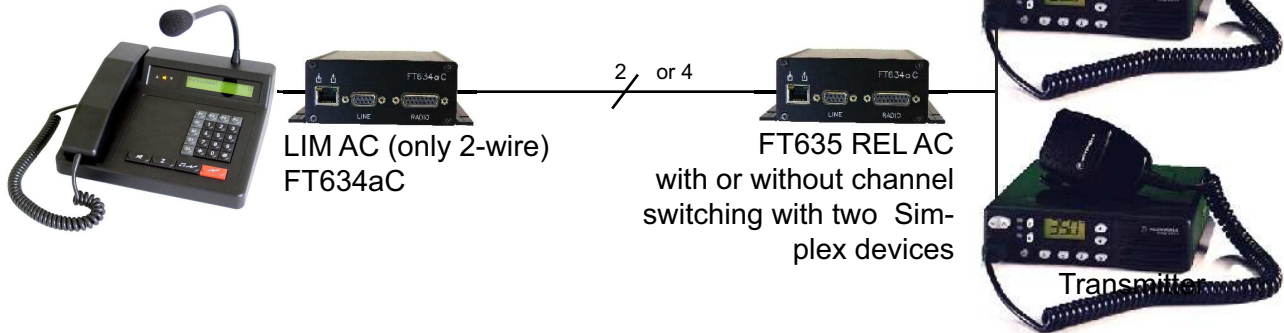
On private lines the remote control can be carried out by DC.  
In this case the two LIM AC and the notch filters for the pilot tone are needed.



---

**Example 3: 2- or 4-wire remote control via leased lines**

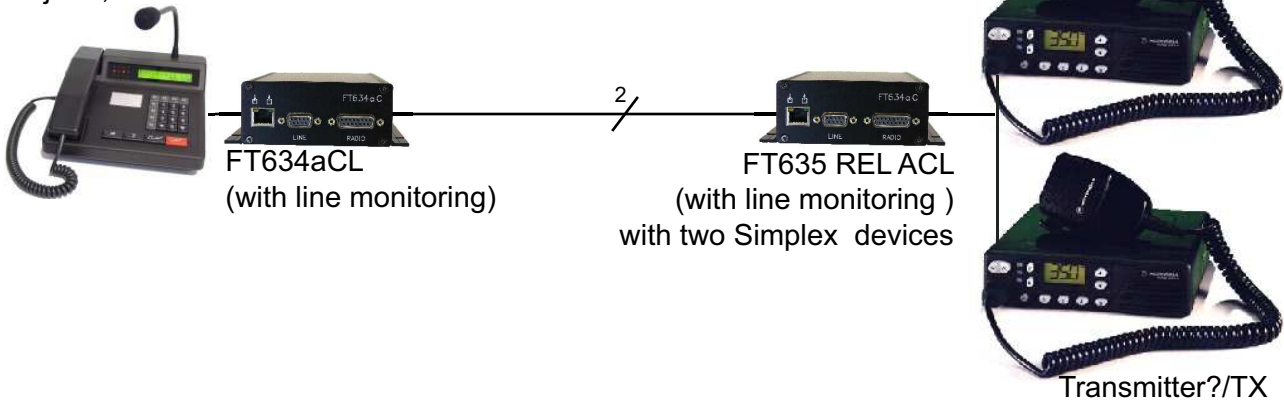
Major 4a, 5a or 6



---

**Example 4: Operation terminal Major 6 via 2-wire to the multi-channel radio set (with the option of line monitoring)**

Major 6, 4a or 5a



---

**Relay operation according to T11-55**

When operating the relay according to „T11-55“ the carrier of the transmitting channel is monitored by an input (I/O0-I/O15) and the starting of the relay is impossible if the channel is active. For this an I/O has to be programmed as T11-55 squelch input.

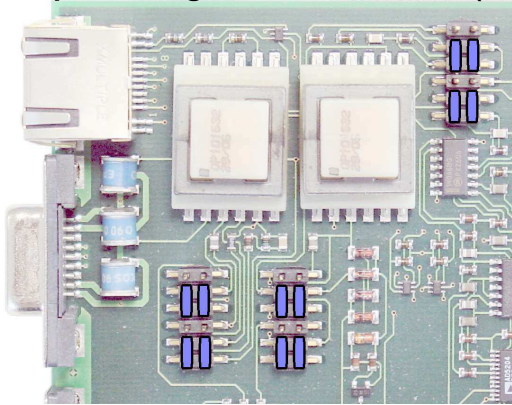
**Listening in with 4-wire connection**


The FT635 REL AC also supports listening in on the transmitted AF on a 4-wire connection.

# Jumper

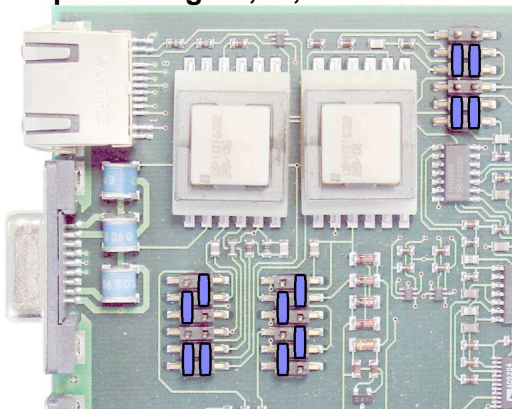
Different configurations can be adjusted with the internal jumpers. For example you can choose between 2- or 4-wire connections. The functions of the different jumpers are printed directly onto the circuit board.

## Jumper setting normal, 2D, Zr, AC (ex factory)

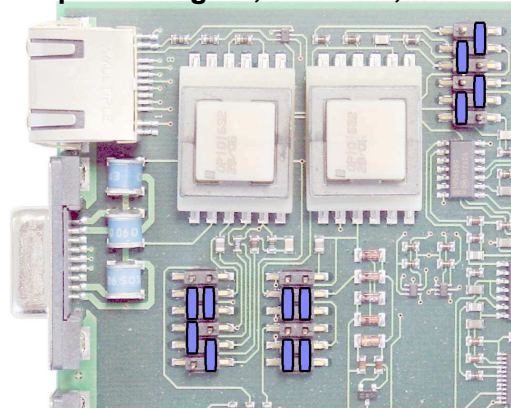


- 2D = 2-wire
- 4D = 4-wire
- Zr = complex impedance
- 600 = real impedance 600 Ohm
- AC = remote control by AC voltage
- DC = remote control by DC voltage
-  = jumper

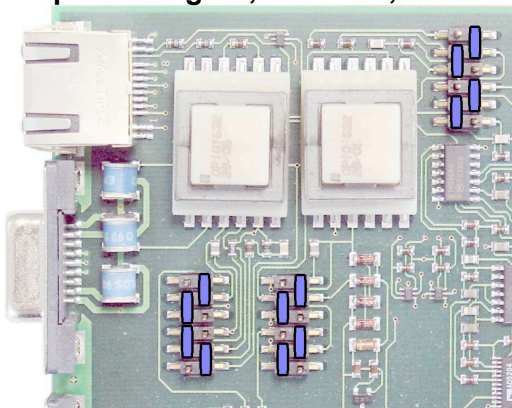
## Jumper setting 2D, Zr, DC



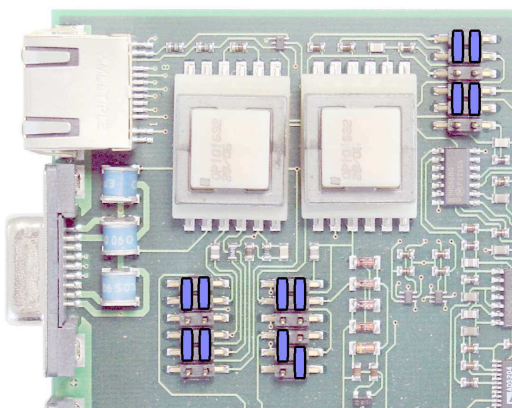
## Jumper setting 2D, 600 Ohm, AC



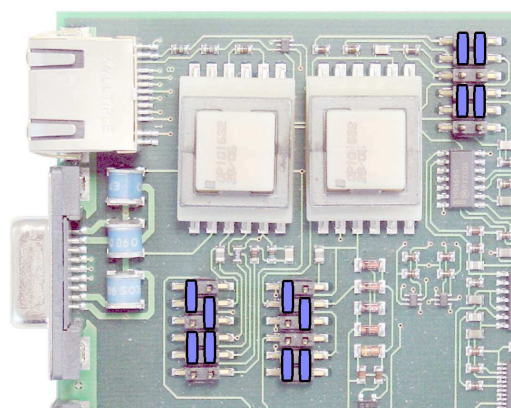
## Jumper setting 2D, 600 Ohm, DC



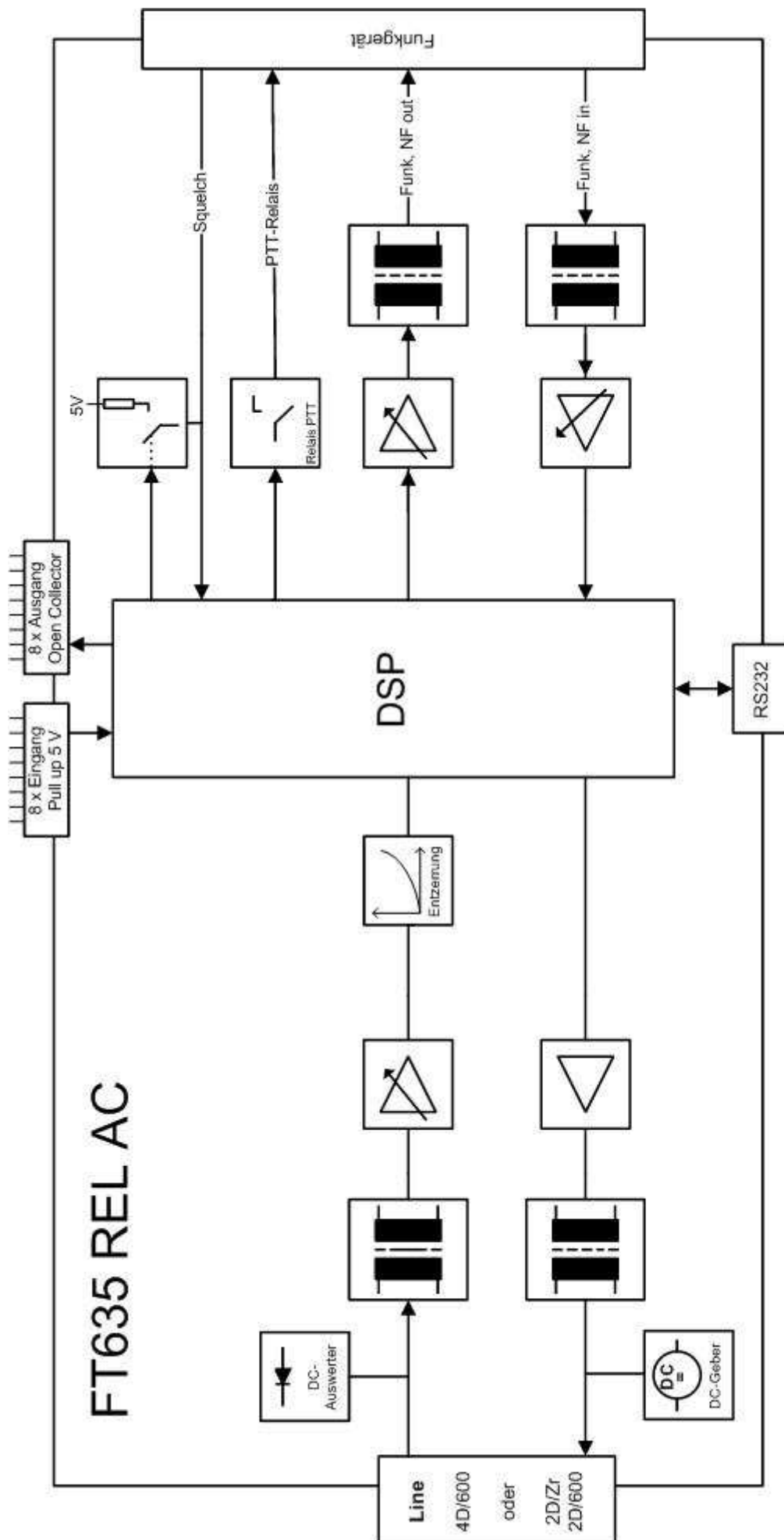
## Jumper setting 4D, 600 Ohm, DC



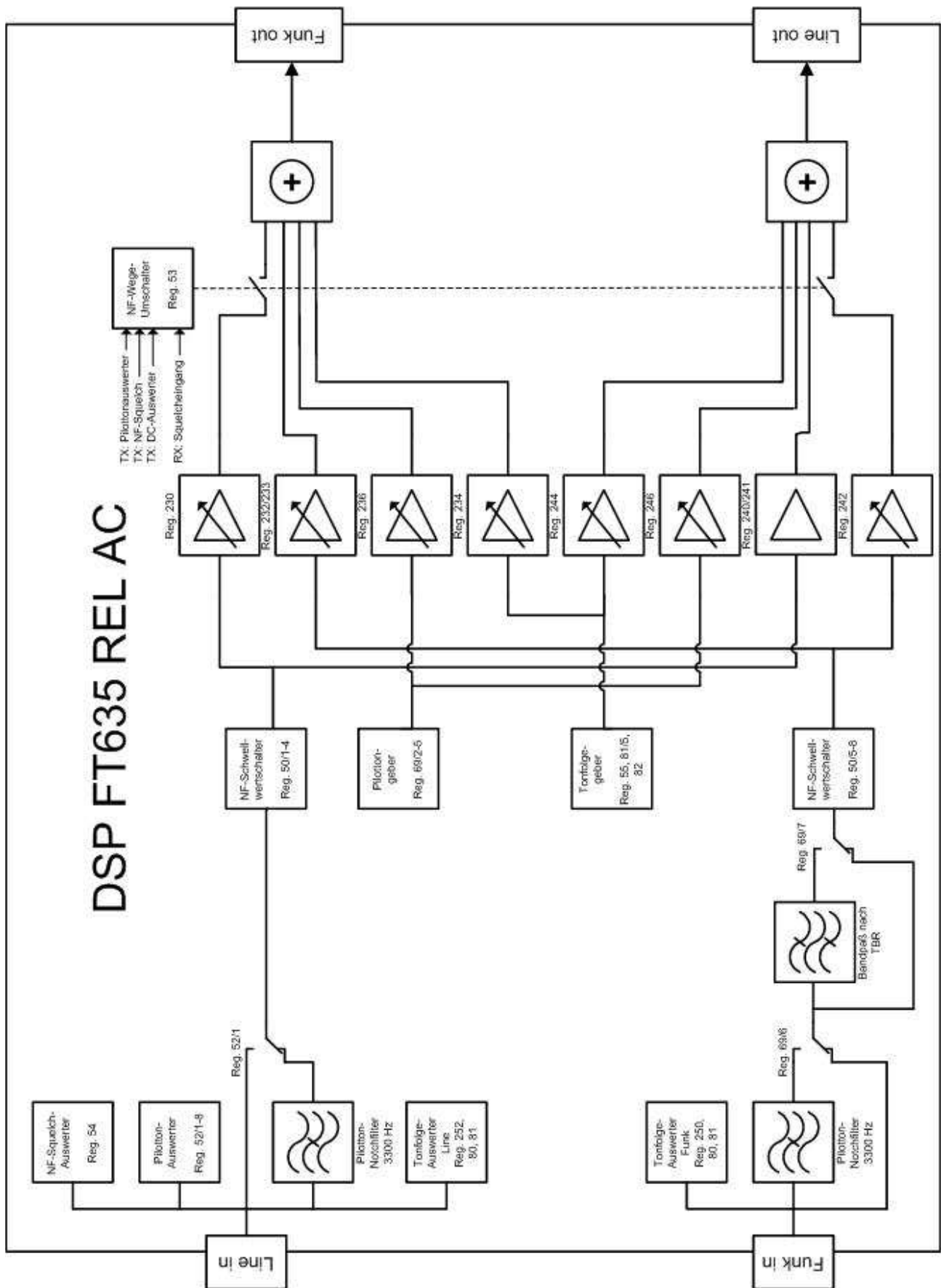
## Jumper setting 4D, 600 Ohm, AC



# Block diagram FT635 REL AC

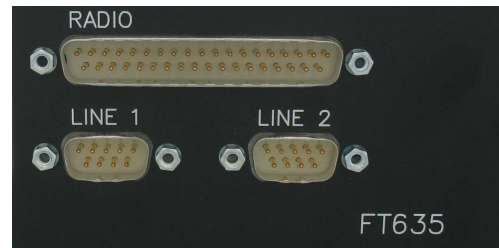
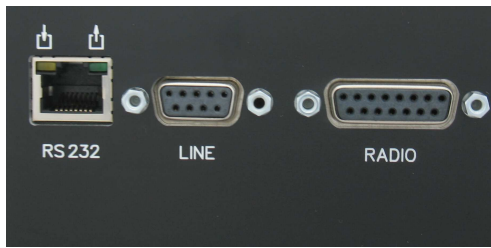


# Block diagram DSP



# Pinout

Pinout of the FT635 REL AC



## 8-pole Western jack "RS232"

**LED yellow**

- pilot tone on or
- DC on and
- AF connected to line  
(if blinking see description)

**LED green**, transmitter relay on because

- relay active
- pilot tone decoded or
- DC decoded or
- AF decoded  
(if blinking see description)

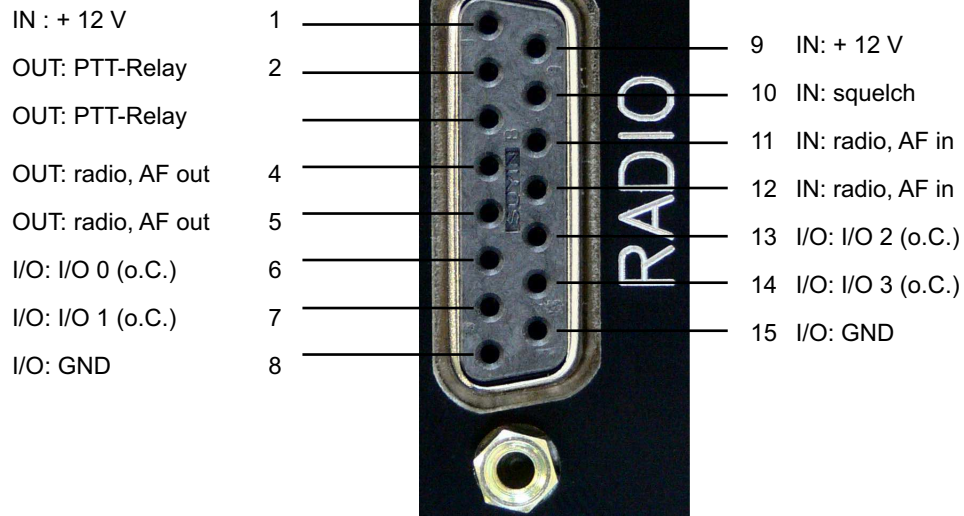
  

I/O 12 (in/output)	8	
I/O 11 (In/output)	7	
I/O 10 (in/output)	6	
I/O 09 (in/output)	5	
I/O 08 (in/output)	4	
GND (in/output)	3	
RS232 RxD (input)	2	
RS232 TxD (output)	1	

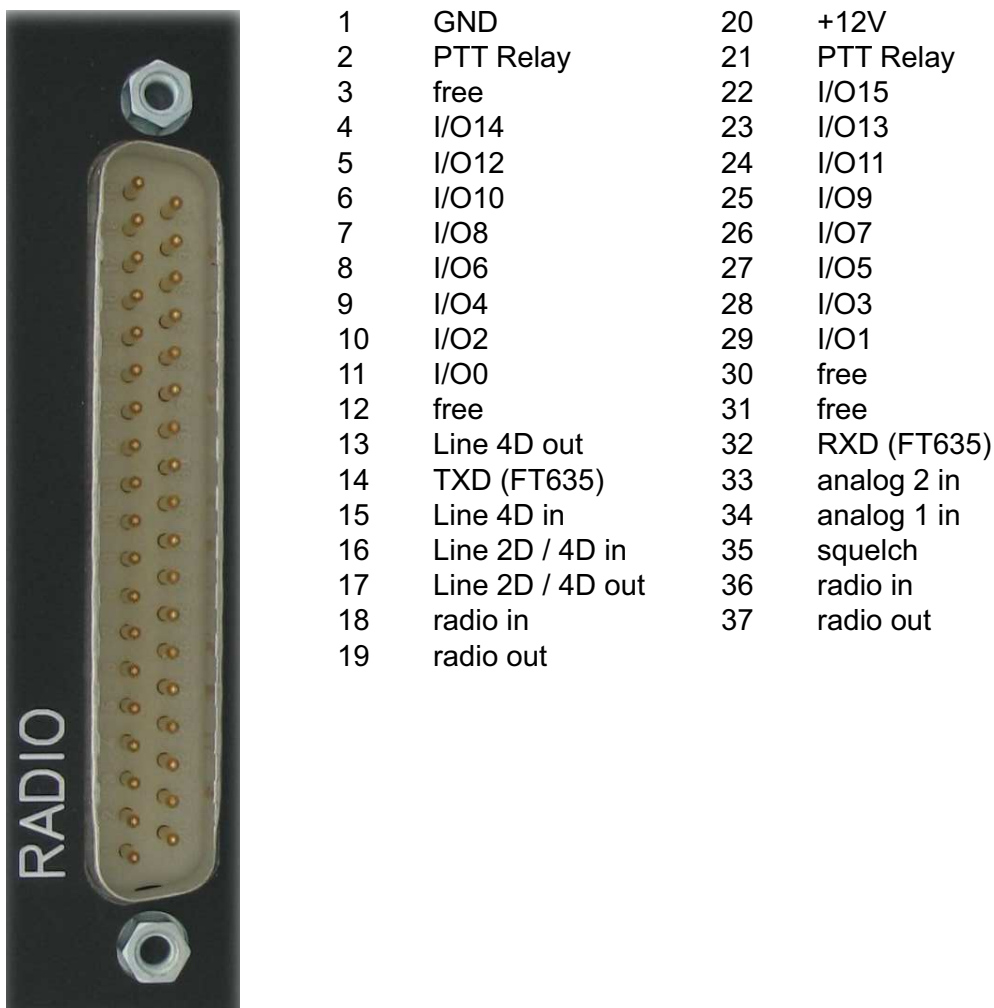
## 9-pole Sub-D jack "LINE" and "LINE 1"

I/O: line, 2D, 4D out	1			
free	2			6
I/O: GND	3			7
free 4	4			8
I/O: line, 2D, 4D in	5			9
				OUT: line, 4D out
				I/O: I/O 13 (Pull-up 5V)
				I/O: I/O 4 (o.C.)
				IN: line, 4D in

## 15-pole Sub-D jack "RADIO"



## 37-pole Sub-D plug male connector (except for PTT like FT633):

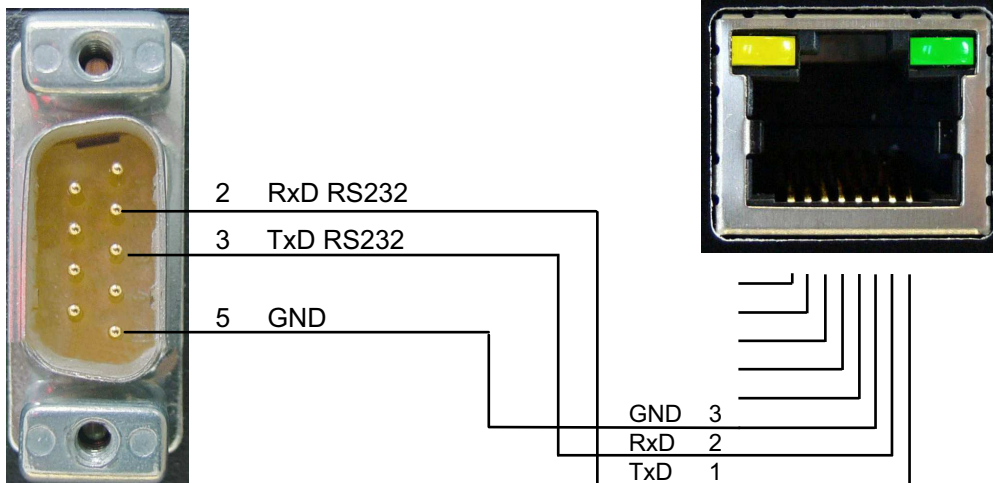


The radio device can be connected either by the 15pole SubD connector (radio) in the front or by the 37pole SubD connector (radio) in the back. The line can be connected either by the 9pole SubD connector (line) on the front or by the 9pole SubD connector (line 1) in the back. The pinout on both connectors is the same.

# RS232-connecting cable

Computer equipped with RS232 9-pole jack

RS232 jack on FT635 REL AC



## Service program/Adjustment

The *FT 635 REL AC* has a *RS-232 interface* with the following specifications:

**9600 Baud, 1 Startbit, 8 Data bits, No Parity, 1 Stop bit,  
np protocol or Xon/Xoff**

For communication with Windows e.g. the terminal program "HyperTerminal" can be used. For Linux we recommend the program minicom.

After hitting the key ENTER the terminal program prompts you for input. You have the following choices:

```
Online - Monitor FT635 REL AC
-----

Software: FT635REL
Version : V1.00
SW-Datum: 17.10.06

Rxxx.....read register xxx
Pxxx yyyyyyy.....program register xxx with yyyyyyy
A.....adjust potentiometer
Tx.....TX-relay on/off (1/0)
Kxx.....switch channel xx (00-99,?)
Ixxxx.....tone generator on with xxxxHz
$xxxxx .....transmit tone sequence xxxxx
Q.....reset software
X.....end monitor
```

After hitting the key A the monitor prompts you for adjustment with the following screen:

```
Which potentiometer is to be adjusted?
1: input of line - amplification
2: input of line - equalization
3: output to two-way radio
4: input of two-way radio
x: end
```

### The screen for potentiometer 1:

(The actual reading of the internal reference value is shown after changing or blank key)

```
Adjustment potentiometer 1:
Feed with required level into line-input at 1000Hz.
Adjust ,Line` to 300mV at internal reference value.
Initial value: adjustment potentiometer 1:
Feed with required level into line-input at 1000Hz.
Adjust ,Line` to 300mV at internal reference value.
Initial value: 014 (min:000 max:255) level: 000 mV reference value:
300 mV
Keys:  <+> : +1
        <*> : +10
        <-> : -1
        <_> : -10
        < > : measuring only
        <a> : self-adjustment
        <p> : programming
        <x> : cancel
```

### The screen for potentiometer 2:

```
Adjustment potentiometer 2:
Feed with required level at line-input at 3400Hz.
Adjust ,Line` to 300mV at internal reference value.
Initial value: 057 (min:000 max:255) level: 000 mV required value:
300 mV
Keys:  <+> : +1
        <*> : +10
        <-> : -1
        <_> : -10
        < > : measuring only
        <a> : self-adjustment
        <p> : programming
        <x> : cancel
```

### The screen for potentiometer 3:

```
Adjustment potentiometer 3:
Feed with required level at line-input at 1000Hz.
Adjustment potentiometer 1 and 2 (reference value ,Line` = 300mV).
Adjustment radio-output at required level (required modulation
depth).
Initial value: 015 (min:000 max:255)
Keys:  <+> : +1
        <*> : +10
        <-> : -1
        <_> : -10
        <t> : transmitter on/of
        <p> : programming
        <x> : cancel
```

### The screen for potentiometer 4:

```
Adjustment potentiometer 4
Feed at radio-input with required level at 1000Hz.
Adjust at internal reference value ,Radio` to 300mV.
Initial value: 160 (min:000 max:255) level: 000 mV required value:
300 mV
Keys:  <+> : +1
        <*> : +10
        <-> : -1
        <_> : -10
        < > : measuring only
        <a> : self-adjustment
        <p> : programming
        <x> : cancel
```

- 050** 03100320 AF-mute level  
1.+2. digit: ca. nn\*0,9mV threshold AF-mute line>radio activate  
3.+4. digit: ca. nn\*0,9mV threshold AF-mute line>radio deactivate  
5.+6. digit: ca. nn\*0,9mV threshold AF-mute radio>line activate  
7.+8. digit: ca. nn\*0,9mV threshold AF-mute radio>line deactivate
- 052** 12500128 Pilot tone  
1. digit: pilot tone filter frequency  
0=no filter  
1=3300Hz  
2=3000Hz  
3=2800Hz  
4=3320Hz  
5=2982Hz  
6=3850Hz  
2. digit: pilot tone detection, n\*5ms decoding until on  
3. digit: pilot tone detection, n\*5ms no decoding until off  
4.-8. digit: pilot tone detection, min.level (0-32767) 00128=75mV,  
\*2=-3dB;/2=+3dB sensitivity
- 053** 12211220 TX-configuration  
1. digit: TX-decoder 0=off, 1=PIL, 2=DC, 3=PIL+DC, 4=AF-Squelch  
2. digit: operating mode:  
0=4-wire, low amplification of line (-25...0dBm)  
1=4-wire, high amplification of line (-40...-15dBm)  
2=2-wire, low amplification of line (-25...0dBm)  
3=2-wire, high amplification of line (-40...-15dBm)  
3. digit: priority  
0=none  
1=RX before TX, radio has priority over line  
2=TX before RX, line has priority over radio  
3=first come, first served...  
4. digit: AF-directions without RX, without TX  
5. digit: AF-directions with RX, without TX  
6. digit: AF-directions without RX, with TX  
7. digit: AF-directions with RX, with TX  
4. to 7. digit: 0=RADIO>LINE off, LINE>RADIO off  
1=RADIO>LINE on , LINE>RADIO off  
2=RADIO>LINE off, LINE>RADIO on  
3=RADIO>LINE on , LINE>RADIO on  
8. digit: line amplification  
0= auto, amplification low at 4-D, high at 2-D  
1=amplification low  
2=amplification high  
RX meaning SQL-input (056/1), TX means TX-decoder (053/1)
- 054** 02604010 AF-squelch configuration  
1.-2. digit: n\*5ms above threshold, until SQL on  
3.-4. digit: ca. nn\*1,8mV threshold AF on  
5.-6. digit: n\*5ms below threshold, until SQL off  
7.-8. digit: ca. nn\*1,8mV threshold AF off
- 055** 10100000 Advance time register  
1.+2. digit: nn\*10ms advance time  
3.+4. digit: nn\*10ms delay time

**056** 00051205 Squelch configuration  
 1. digit: squelch input  
           0: active low, pullup on  
           1: active high, pullup off  
           4: active low, pullup off  
           5: active high, pullup on  
 3.+4. digit: nn\*10ms TX-blocking period after own AF on line, only 2-D  
 5.+6. digit: nn\*10ms TX-blocking period after own DC on line, only 2-D  
 7.+8. digit: nn\*10ms TX-blocking-period after own pilot tone on line, only

2-D

**063** BCD00000 Channel remote switching register  
 1.-3. digit: digit 1-3 of the channel remote switching tone sequence

**064** 00100000 Channel register  
 1. digit: save channel y=1, n=0  
 2.+3. digit: channel 00-99

**065** 30100000 Blocking-periods for RX and TX  
 1.+2. digit: nn \* 10 ms before channel switching  
 3.+4. digit: nn \* 10 ms after channel switching

**066** 01080000 Channel configuration  
 2. digit: channel output  
           0=none  
           1=decimal  
           2=binary-1  
           3=binary  
           4=2xBCD  
 3. digit: channel output  
           0=channel output normal  
           1=channel output inverted  
 4. digit: number of channel bits (0-8)  
 5. digit: channel acknowledgement  
           0=channel acknowledgement normal (BCDxy)  
           1=channel acknowledgement Major6 (CBDxy)  
           2=channel acknowledgement normal with line activation  
               (like 069/1)  
           3=channel acknowledgement Major6 with line activation  
               (like 069/1)  
 7. digit: substitution channel bit for I/O4, if I/O4 is used for line  
 activation  
           (register 069/1=1)

**069** 00000100 RX-configuration  
 1. digit: RX-signaling to line  
           0=programmed pilot tone  
           2=DC  
           3=I/O4  
           4=PTT at 9pole DSub line connector ST2, Pin8  
 2.-5. digit: pilot tone  
               frequency in Hz  
 6. digit: pilot tone filter frequency  
           0=no filter  
           1=3300Hz  
           2=3000Hz  
           3=2800Hz  
           4=3320Hz  
           5=2982Hz

6=3850Hz

7. digit: line filter, 0=off, 1=on (bandpass 300-3400Hz)

- 070** 30005010 Relay radio>radio configuration 1  
1.-3.digit: max. relay call duration (nnn \* 1s)  
4.-6.digit: relay follow-up time (nnn \* 100ms)  
7.digit: relay can be activated y/n (1/0) - 0 blocks all relay functions
- 071** 04500000 Relay radio>radio configuration 2 (T11-55)  
1.digit: relay operation according to „T11-55“ y/n (1/0)  
2.+3.digit: max. waiting period for free channel (nn \* 1s)
- 072** EEEEE000 Tone sequence for relay start  
1.-5.digit: 5-tone sequence for relay start
- 073** F0000000 Relay radio>radio configuration 3  
1.digit: relay start induced by single-tone of the tone sequence (0-E, F=off)  
2.digit: relay start induced by carrier y/n (1/0)  
3.digit: relay start induced by special tone of : of/call1/call2/call1+2 (0/1/2/3)
- 080** 01810000 Decoder reference 1  
1.-3. digit: nnn\*5ms max. tone duration 1. tone  
4.+5. digit: nn\*5ms min. tone duration all tones
- 081** 01800000 Decoder reference 2  
1.-3. digit: nnn\*5ms max. tone duration from 2. tone on  
5. digit: tone call system 0:ZVEI, 1:CCIR, 2:ZVEI2, 3:EEA
- 082** 07707000 Encoder reference  
1.+2. digit: nn \* 10ms tone duration 1. tone  
3. digit: n \* 10ms tone duration all other tones
- 083** 10001000 Tone duration single-tone and special tone decoder  
1.+2.digit: minimal tone duration single-tone decoding \*100ms (für Reg.073/1)  
3.+4.digit: maximal tone duration single-tone decoding \*100ms  
00 = decoding as soon as minimal duration is reached  
>00= decoding, if tone duration is between min and max  
5.+6.digit: minimal tone duration special tone decoding \*100ms (for reg.073/3)  
7.+8.digit: maximal tone duration special tone decoding \*100ms  
00 = decoding as soon as minimal duration is reached  
>00= decoding, if tone duration is between min and max
- 103** DCBCDCBC Configuration switching inputs FT634C  
1.-4. digit: tone sequence digit 1-4  
5.-8. digit: expected acknowledgement
- 108** 00000000 Function input 0 (I/O00) passive>active  
**109** 00000000 Function input 0 (I/O00) active>passive  
.  
.  
.
- 138** 00000000 Function input 15 (I/O15) passive>active  
**139** 00000000 SFunction input 15 (I/O15) active>passive

Function T11-55 carrier SQL in:

1.digit: 3

2.digit: active/passive (1/0)

example: I/O8 is to be T11-55 carrier SQL in

<b>124</b>	31000000		
<b>125</b>	30000000		
<b>230</b>	00025560	4.-8. digit:	Multiplier for output level line>radio (0-32768)
<b>232</b>	00025560	4.-8.digit:	Multiplier for output level radio>radio, if relay is on and the AF line>radio is off (0-32768)
<b>233</b>	00000000	4.-8.digit:	Multiplier for output level radio>radio, if relay is on and the AF line>radio is on (0-32768)
<b>234</b>	00008300	4.-8. digit:	Multiplier for output level tone>radio (0-32768)
<b>236</b>	00000000	4.-8. digit:	Multiplier for output level pilot>radio (0-32768)
<b>240</b>	00000000	4.-8.digit:	Multiplier for output level line>line without AF radio>line (0-32768)
<b>241</b>	00000000	4.-8.digit:	Multiplier for output level line>line with AF radio>line (0-32768)
<b>242</b>	00025560	4.-8. digit:	Multiplier for output level radio>line (0-32768)
<b>244</b>	00008300	4.-8. digit:	Multiplier for output level tone>line (0-32768)
<b>246</b>	00006400	4.-8. digit:	Multiplier for output level pilot>line (0-32768)
<b>250</b>	00000128	4.-8. digit:	min. level for tone decoding of radio (0-32768)
<b>251</b>	00000128	4.-8. digit:	min. level for tone decoding of the line (0-32768)

## **Decoder function**

The FT635 REL AC has 30 decoder registers and each has a corresponding configuration register. At present there is only the decoder function ,switching output `.

The following registers are used for the decoder functions:

000 decoder 1  
001 decoder 2  
002 decoder 3  
003 decoder 4  
004 decoder 5  
005 decoder 6  
006 decoder 7  
007 decoder 8  
008 decoder 9  
009 decoder 10  
020 decoder 11  
021 decoder 12  
022 decoder 13  
023 decoder 14  
024 decoder 15  
025 decoder 16  
026 decoder 17  
027 decoder 18

028 decoder 19  
029 decoder 20  
200 decoder 21  
201 decoder 22  
202 decoder 23  
203 decoder 24  
204 decoder 25  
205 decoder 26  
206 decoder 27  
207 decoder 28  
208 decoder 29  
209 decoder 30

000-009, 020-029, 200-209:

1.-8.St.: 0-E = tone (of the tone sequence), which is to be decoded  
F = each tone is accepted at this position

All unused tones have to be programmed with ,F'!!!

010 configuration for decoder 1  
011 configuration for decoder 2  
012 configuration for decoder 3  
013 configuration for decoder 4  
014 configuration for decoder 5  
015 configuration for decoder 6  
016 configuration for decoder 7  
017 configuration for decoder 8  
018 configuration for decoder 9  
019 configuration for decoder 10  
030 configuration for decoder 11  
031 configuration for decoder 12  
032 configuration for decoder 13  
033 configuration for decoder 14  
034 configuration for decoder 15  
035 configuration for decoder 16  
036 configuration for decoder 17  
037 configuration for decoder 18  
038 configuration for decoder 19  
039 configuration for decoder 20  
210 configuration for decoder 21  
211 configuration for decoder 22  
212 configuration for decoder 23  
213 configuration for decoder 24  
214 configuration for decoder 25  
215 configuration for decoder 26  
216 configuration for decoder 27  
217 configuration for decoder 28  
218 configuration for decoder 29  
219 configuration for decoder 30

010-019, 030-039, 210-219:

1.digit: 0 = no decoding

1 = decoding of the line

2 = decoding of the radio

3 = decoding of the line or of the radio

2.digit: 5-F = number of tones in the tone sequence (5-15 tone sequence)

(the correct number of tones and the first 8 tones are always compared to  
the decoding register)

3.digit: 0 = function 0: switching output

when function switching output:

4.digit: 0-F = number of the switching output I/O 0 - I/O 15

5.digit: 0 = switching output for the set time off  
1 = switching output for the set time on  
E = toggle switching output (on-off-on....)  
6.-8.digit: nnn \* 100ms switching time, 000 = without time limit

095 configuration I/O 0-7

096 configuration I/O 8-15

095-096:

1.digit: 0 = I/O 0 (8) is output

1 = I/O 0 (8) is input

...

8.digit: 0 = I/O 7 (15) is output

1 = I/O 7 (15) is input

Example: 5-tone sequence 12345 from radio shall activate I/O 15 for 3 seconds:

020: 12345FFF

030: 250F1030

096: xxxxxxx0

## Option line monitoring (FT 635 REL ACL)

The line monitoring operates like the one in the FT634CL. The operating mode line monitoring can be configured for the FT635 REL ACL. To do this devices with this option are needed at both ends of the line. (e.g. FT634aCL and FT635 REL ACL).

Line monitoring is only active during idle times of the wire, that means only when there is neither a transmitting nor a squelch situation. For this, one of the devices has to be configured as master, the other as slave. The master device then scans the slave device in certain intervals (master cycle time). The slave device then answers. If there is no reply or if the slave device doesn't receive a scan by the master device within a certain interval (slave cycle time) one of the switching outputs (0...15) can be programmed as error display or alarm indicator.

The tone sequence for line monitoring (digits 1..4) can be configured in the EEPROM register 090. Ex factory this identification is set at 'BCBC'. At the 2. digit of the EEPROM register 091 you can program if the line monitoring telegrams shall be transmitted with pilot tone. All parameters for the line monitoring are configured in the EEPROM registers 090-092 according to the following list:

register 090 tone sequence for line monitoring (1...4 digit)

register 091

1. digit line monitoring

0 = OFF

1 = as master device

2 = as slave device

2. digit line monitoring telegrams with pilot tone YES/NO (1/0)

3.-5. digit cycle time nnn\*6s

register 092

1.-8. digit error or alarm indicator on switching output 0-7

register 093

1.-8. digit error or alarm indicator on switching output 8-15

(As standard the switching outputs 8-15 are deactivated - they are configured as inputs.)

programming of the digits in register 092/093:

0=nothing, 1=output low active, 2=output high active

Example for programming:

register 090: BCBC0000

register 091: 10050000 (master, 5min cycle time) or.:

register 091: 20100000 (slave, 10min cycle time)  
 register 092: 10000000 (output I/O 0 is error output)

## Tontabelle

Tonetable					
Tone	ZVEI 1	CCIR	ZVEI 2	EEA	ZVEI 3
0	2400 Hz	1981 Hz	2400 Hz	1981 Hz	2200 Hz
1	1060 Hz	1124 Hz	1060 Hz	1124 Hz	970 Hz
2	1160 Hz	1197 Hz	1160 Hz	1197 Hz	1060 Hz
3	1270 Hz	1275 Hz	1270 Hz	1275 Hz	1160 Hz
4	1400 Hz	1358 Hz	1400 Hz	1358 Hz	1270 Hz
5	1530 Hz	1446 Hz	1530 Hz	1446 Hz	1400 Hz
6	1670 Hz	1540 Hz	1670 Hz	1540 Hz	1530 Hz
7	1830 Hz	1640 Hz	1830 Hz	1640 Hz	1670 Hz
8	2000 Hz	1747 Hz	2000 Hz	1747 Hz	1830 Hz
9	2200 Hz	1860 Hz	2200 Hz	1860 Hz	2000 Hz
A	2800 Hz	2400 Hz	886 Hz	1055 Hz	886 Hz
B	810 Hz	930 Hz	810 Hz	930 Hz	810 Hz
C	970 Hz	2247 Hz	740 Hz	2247 Hz	740 Hz
D	886 Hz	991 Hz	680 Hz	991 Hz	680 Hz
E	2600 Hz	2110 Hz	970 Hz	2110 Hz	2400 Hz
Duration	ZVEI 1	CCIR	ZVEI 2	EEA	
min.	52.5 ms	75 ms	52.5 ms	30 ms	52.5 ms
typ.	70 ms	100 ms	70 ms	40 ms	90 ms
max.	87.5 ms	125 ms	87.5 ms	50 ms	87.5 ms

# General Safety Instructions

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Please read the operating instructions carefully before installation and setup.

The relevant regulations must be complied to when working with 230V line voltage, two-wire-lines, four-wire-lines and ISDN-lines. It is also very important to comply to the regulations and safety instructions of working with radio installations.

## **Please comply to the following safety rules:**

- All components may only be mounted and maintained when power is off.
- The modules may only be activated if they are built in a housing and are scoop-proof.
- Devices which are operated with external voltage - especially mains voltage - may only be opened when they have been disconnected from the voltage source or mains.
- All connecting cables of the electronic devices must be checked for damage regularly and must be exchanged if damaged.
- Absolutely comply to the regular inspections required by law according to VDE 0701 and 0702 for line-operated devices.
- Tools must not be used near or directly at concealed or visible power lines and conductor paths and also not at and in devices using external voltage – especially mains voltage - as long as the power supply voltage has not been turned off and all capacitors have been discharged. Electrolytic capacitors can be still charged for a long time after turning off.
- When using components, modules, devices or circuits and equipment the threshold values of voltage, current and power consumption specified in the technical data must absolutely be complied to. Exceeding these threshold values (even if only briefly) can lead to significant damage.
- The devices, components or circuits described in this manual are only adapted for the specified usage. If you are not sure about the purpose of the product, please ask your specialized dealer.
- The installation and setup have to be carried out by professional personnel.

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## **Factory returning of old equipment**

According to German law concerning electronic devices old devices cannot be disposed off as regular waste. Our devices are classified for commercial use only. According to § 11 of our general terms of payment and delivery, as of November 2005, the purchasers or users are obliged to return old equipment produced by us free of cost. FunkTronic GmbH will dispose of this old equipment at its own expense according to regulations.

Please send old equipment for disposal to:

**FunkTronic GmbH  
Breitwiesenstraße 4  
36381 Schlüchtern**

**>>> Important hint:** freight forward deliveries cannot be accepted by us.

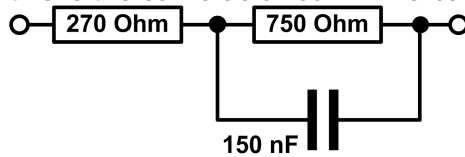
February 2<sup>nd</sup> , 2006

**Subject to change, Errors excepted**

# Terms and abbreviations

Line            2-wire cable  
Radio           2-way-radio

$Z_R$             Reference impedance,  
this is the same as a real 2-wire-cable according to German TBR 15



2D            2 wire  
4D            4 wire  
Zr            Complex impedance according to German TBR  
600           Real impedance 600 Ohm according to German TBR  
AC            Remote control via AC voltage  
DC            Remote control via DC voltage  
IN            Input  
OUT           Output  
I/O           In- and output  
SDA           I2C-Bus Data  
SCL           I2C-Bus Clock  
TXD           RS232 Transmitter  
RXD           RS232 Receiver  
PTT           Push To Talk  
DSP           Digital Signal Processor  
FT            FunkTronic

# Revision remarks

Modifications made are only mentioned in note form in this section. For detailed information please read the corresponding chapters.

30.06.2010 - Translation