Major 4a

Major 5a

ENTWICKLUNG PRODUKTION SOFTWARE HARDWARE ELEKTRONIK BERATUNG

FunkTronic

Kompetent für Elektroniksysteme

SW Version 3.20 and newer

Order Information

Ord.-Nr.	Description
681000	Major 4a Major 4a with FMS option Major 4a with BOS option
714000	Major 5a Major 5a with option FMS Major 5a with option BOS
900012	Power supply unit (230/12 Volt), suitable for Major 4a and Major 5a

Attention: Power supply units for Major 4a/5a are not included!

General Features

The Major 4a/5a is the newer design of the well-known Major 4/5 An alphanumeric LC Display with background lighting has replaced the LED Display. A gooseneck microphone with a high dynamic range is part of the standard equipment of Major 5a as well as Major 4a. By using a plain text based menu structure the programmable features have been extended significantly and at the same time programming has become more straightforward. All buttons are freely programmable. Hence, each of the buttons can be assigned two different functions.

A radio set can be connected directly (multiwire) or via 2- or 4-wire line. All viable tone sequences can be transmitted and interpreted.

With the optional TIM (telephone interface module) a dial-up connection to the telephone network can be established. It can be used to forward a radio to the telephone network and also for remote control of radio sets via analogous land-line. To gain access to the radio a dial-up connection is established. Major 4a/5a (if a TIM is included) can be ordered with a software option that enables the substitution of a permanent line by using a dial-up connection.

There are two sockets for headsets. One can be used for a remote PTT foot switch. The 7 digital outputs can be used for remote channel select or for other functions. For operation an external 12-volt power supply is necessary.

The Major 4a/5a can be programmed via the serial interface or keypad. It is also possible to connect a printer or a terminal to the serial interface. For printers with a parallel interface an additional interface is available.

Control Elements Major 4a

Control Elements Major 5a

Display Elements Major 4a / 5a

LC Display

All alphanumeric readouts are presented by a LC display with background lighting.

Status LEDs

Carrier Display (Squelch) ▼

The carrier display LED ▼ can be controlled by voice (2-wire connection) or via squelch input (using the radio set). If the light is on, the radio circuit is occupied, that is, a carrier signal (carrier is keyed) is present.

PTT Display (Push-to-Talk) ▲

The PTT display LED ▲ is on, if the transmitter is keyed. Keying of the transmitter is achieved by pressing the PTT button during telephony or by sending a call.

Loudspeaker Display (Incoming Call)

The loudspeaker display LED is on, if the loudspeaker or the earphone capsule in the handpiece are switched on.

Keypad Layout Major 4a / 5a in Radio Mode

Button	Major 4a	Major 5a
0 to 9	input of number to call	input of number to call
S1 to S4	no function	not available
*	no function	input of A
#	short: scroll ID-code memory long: delete ID-code memory	short: scroll ID-code memory long: delete ID-code memory
F4	switch on/off telephone mode	not available
PTT	push-to-talk	push-to-talk
call button	transmit call	transmit call
short call button	transmit short call 0-9	transmit short call 0-9
loudspeaker button	short: loudspeaker on/off long: adjust volume	loudspeaker on/off
volume button	not available	adjust volume

General Handling

Talking to the Radio

There are two different ways to talk to the radio.

By pushing the red PTT button the transmitter is switched on and the transmission LED ▲ is lit. This can also be achieved by an external PTT (see Connections). Now, talking to the radio is possible via the gooseneck microphone. After releasing the PTT button, the person on the radio can be heard in the loudspeaker. The loudspeaker LED ◀ is lit. If the conversation is finished, the loudspeaker can be switched off using the loudspeaker button

The transmitter (and the transmission LED) can also be switched on by pushing the PTT button at the inside of the handpiece. Accordingly, the microphone and the loudspeaker of the handset are used for conversation in this case. The conversation is terminated by simply hanging up the handpiece.

Switching of the Loudspeaker (on/off)

The loudspeaker is switched on after sending a call by pushing the red or the external PTT button or upon reception of a call. However, it can also be activated manually via the loudspeaker button.

The loudspeaker is switched off manually (loudspeaker button) or automatically after a certain time is elapsed. This loudspeaker timer is started when the loudspeaker is turned on and is reset as long as a carrier is present or PTT is keyed.
If desired, this timer can also be disabled. Furthermore, the loudspeaker can be configured for open-mode („always-on“, see Table of Registers, Register 050).

Volume Settings

In order to set the desired volume the volume button is pushed (Major 5a) or the loudspeaker button is pressed long (Major 4a). The display now shows „volume:“ and the present value (0-9). Now the new volume can be set via the keypad. The chosen value is saved permanently (also after power-off).

Short Call

The Major can remember up to 10 short calls. These are transmitted by pushing the short call button z followed by the respective number (0-9).
These short calls are programmed in the registers 000 to 009 (see Table of Registers, Registers 000-009)

Call Options

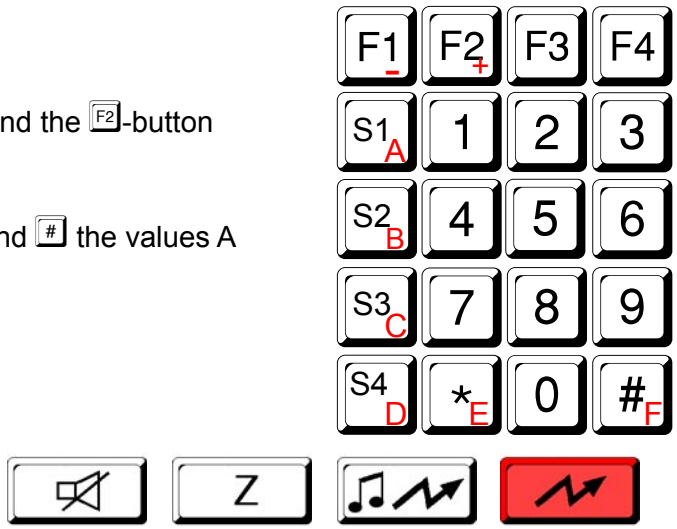
With the standard settings, „select number:“ followed by the previously transmitted call is displayed in the LCD. Of course, after power-on no number is displayed.
In order to send a call the variable digits of the tone sequence (see Table of Registers, register 010) first have to be entered. The tones entered via the keyboard are displayed right-justified in the LCD. The transmission of the call is achieved by pushing the call button . Alternatively, calls can be sent automatically after the last free number is entered (see Table of Registers, register 082).

Programming Mode

Keypad Layout of Major 4a in Programming Mode

The F1-button reduces by 1 und the F2-button increases by 1.

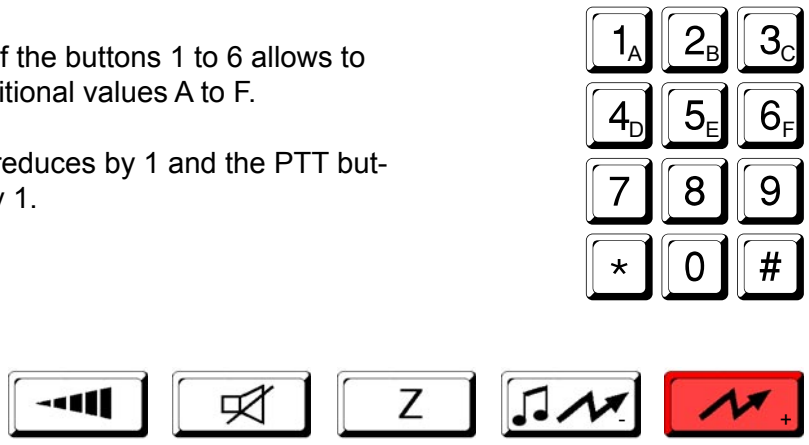
To the buttons S1 to S4, * and # the values A bis F are assigned.



Keypad Layout of Major 5a in Programming Mode

Long pressing of the buttons 1 to 6 allows to achieve the additional values A to F.

The call button reduces by 1 and the PTT button increases by 1.



Differences between Major 4a and Major 5a

Major 4a and Major 5a show the following differences:

1. different keyboards
2. Major 4a includes a handset, Major 5a does not
3. minor differences in the software, resulting from 1. and 2.
4. optional telephone interface only for Major 4a (permanent line also Major 5a)

Menu Structure

Simultaneuos pressing of the buttons * and # opens the menu.

Due to the different keypad designs, for the same operations different keys are used in Major 4a and Major 5a. In the following, the handling of Major 4a is described. For the respective keys that have to be used in Major 5a please consider the table below.

Function	Major 4a	Major 5a
next menu	F3	*
select menu item	F4	#
escape discarding changes	F3	*
save changes and escape	F4	#
increase value by 1	F2	
reduce value by 1	F1	

```
select number:
```

* and #

```
EEPROM programming  : F4
Next menu           : F3
```

F3 ➡

```
Software Version    : F4
Next menu           : F3
```

F3 ➡

```
Level settings      : F4
Next menu           : F3
```

F4 | F4 | F4

```
Register:
```

- enter the register number to be programmed

- with 222 the factory default values are programmed

```
Register:   000
Code      12345
```

- overwrite the code with the desired values

F3 = escape menu discarding changes

F4 = save changes, escape menu

```
Software: Major 4a V1.24
Date    :       23.09.04
```

- displayed 3 seconds

*

GN = gooseneck
HP = handpiece
HS = headset

```
Poti-Nr. (1-6):
```

1 = input level
nominal value: 300mV
indicated on the display
2 = output level
as required
3 = GN microphone level *
4 = HA microphone level *
5 = HS microphone level *
6 = DTMF output level

- the potis can be adjusted from 0 to 255
- input directly via keypad or

F2 = increase value by 1

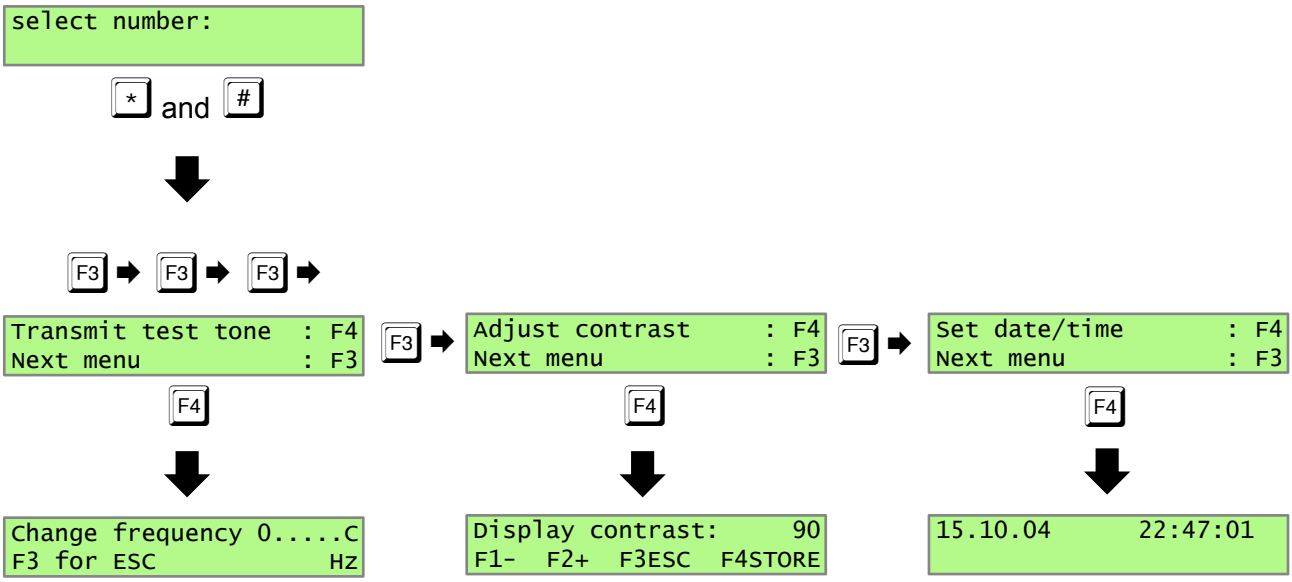
F1 = reduce value by 1

F3 = escape menu discarding changes

F4 = save changes, escape menu

Menu Structure

continued



0 = 200 Hz
1 = 300 Hz
2 = 400 Hz
3 = 600 Hz
4 = 800 Hz
5 = 1000 Hz
6 = 1600 Hz
7 = 2400 Hz
8 = 3400 Hz
9 = 4000 Hz
S1 = 2900 Hz
S2 = 3000 Hz
S3 = 3100 Hz
S4 = 3300 Hz
* = 1200 Hz
# = 1800 Hz

F3 = escape menu

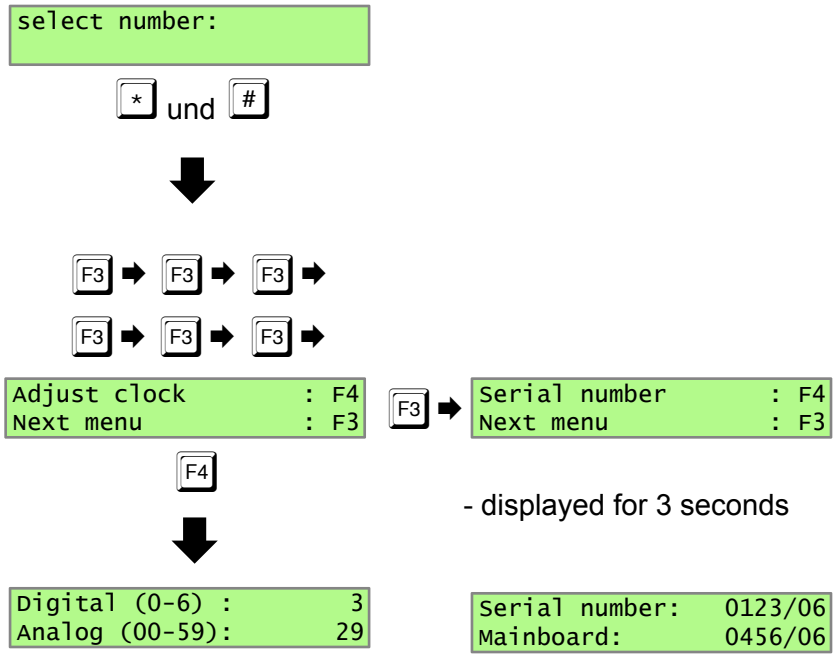
F1 = reduce contrast by 1
F2 = increase contrast by 1
F3 = escape menu discarding changes
F4 = save changes, escape menu

F1 = one digit to the left
F2 = one digit to the right
F3 = escape menu discarding changes
F4 = save changes, escape menu

The values can be changed directly using the buttons 0 to 9.

Menu Structure

continued



F1 = one digit to the left

F2 = one digit to the right

The onboard clock is factory calibrated. Before changing the values please note down the current values. Higher values accelerate the clock, while lower values slows it down. Changes made in digital have more effect than changes made in analog. Fine adjustment must be done in analog, step by step.

F3 = escape menu
discarding changes

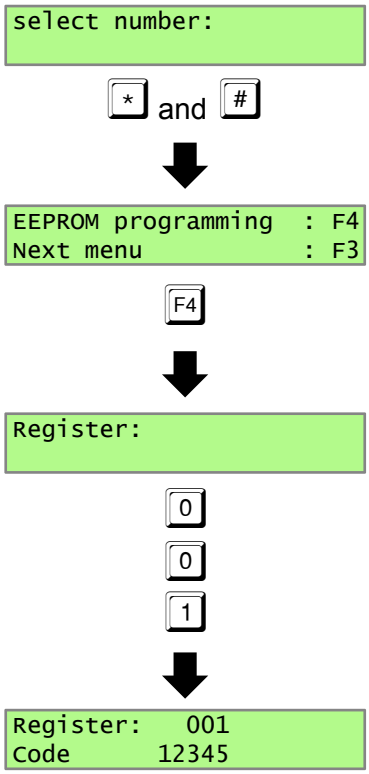
F4 = save changes,
escape menu

Programming Short Call

In the following a programming example of the Major‘s registers is shown. The procedure is always the same. Depending on the desired effects, however, the programming of several registers can be necessary.

This example illustrates the programming of short call 1 in register 001 with the tone sequence 12345.

Please press the following buttons:



Switch to programming mode with * and #

confirm EEPROM programming with F4.

Register: 001 (keypad input)

and

input tone sequence: 12345

The line „Code“ shows the present programming of the register. The displayed value can be overwritten with the new value.

With button **F3** the menu can be quit any time discarding the changes.

With button **F4** the displayed value is programmed.

As every button of the Major 4a/5a is freely programmable, the registers 174 and 175 for the Z-button have to be programmed with the right values. As this already is the case in the factroy defaults, this step is not necessary.

Hence, register 174 (function Z-button, short press) usually is programmed with 22F01 and register 175 (function Z-button, long press) with 00000. The first 0 in register 175 defines that no additional function of the button is exercised upon long pressing.

Transmitting 5-Tone Sequences

For the transmission of 5-tone sequences it can be configured which tones are set by manual input and which ones are preset (see Table of Registers, register 010).

Example: 5-tone sequence
5-tone sequence with the following properties are to be sent:

- 1st digit: tone 9
- 2nd digit: tone 8
- 3rd digit: manual input via keypad
- 4th digit: tone 7
- 5th digit: manual input via keypad

Register 010: 98F7F000 contains the tone sequence (digits 1-5).
F allows for a manual input at the respective digit.
Digits 6 and 7 are not in use and, hence, are set to zero. Digit 8 defines the type of the tone sequence, the ID-code. Here, zero stands for a 5-tone sequence.

If all digits are coded with FFFFFFFF, the complete tone sequence has to be entered manually.
If all digits are coded with EEEEEEEE, the manual input of numbers to call is turned off.

Register 082: 07707000 is the factory default of the register.
Digits 1 and 2 define the length of the first tone to 70ms.
Digit 3 defines the length of all other tones to 70ms.
Digits 4 and 5 define the length of a break to 70ms (no effect in this case).
Digit 6 disables the automatic transmission of the call upon entering all required digits.

Transmit 3-7-Tone Sequence

The Major can transmit tone sequences of variable length. Therefor, different procedures exist to build the tone sequence.

3-7-tone sequences are defined completely in register 010.
Dazu wird die 8. Stelle des Registers auf 9 gesetzt.
Free digits (manual input) are coded with F, digits that are not in use are coded with 0.
The number of tones in the sequence is defined in register 081 (digit 6).

Example: 7-tone sequence 123xx89
7-tone sequence with two free digits (4 and 5).

Register 010: 123FF899 defines the tone sequence.
Digits 1-7 represent the tone sequence. The digits coded with F are entered via the keypad before transmission.
Digit 8 defines the type of the tone sequence (ID-code), here: 3-7-tone sequence.

Register 081: 01810700 digit 6 defines the length of the 3-7-tone sequence (here: 7 digits).

Register 082: 07707000 is again set to the factory default (see section Transmitting 5-tone sequences).

Transmission of Double Sequences

Double sequences can be transmitted as 3-7-tone double sequences (see 3-7-tone sequence).
The number of tones is set in register 081 (digit 6).
The break or an alternative coupling tone between the two tone sequences is programmed with the call button (register 172).
The call is programmed in register 010, the own ID-code in register 015.
The order of the sequences, call -> ID-code or ID-code -> call (ID mode), is defined in register 010 (digit 8). 1: call first, then ID-code 2: ID-code first, then call

Example: 5-tone double sequence with call and ID-code
A call is to be sent as a 5-tone double sequence, consisting of call and the own ID-code. The 5-tone sequence begins with 123, the last two digits can be entered via the keypad. The own ID-code is 12311 (see Table of Registers, register 015).

Register 010: 123FF001 contains the tone sequence (digits 1-5).
F (digits 4 und 5) stands for manually programmable digits.
Digits 6 and 7 are not in use and, hence, set to 0.
Digit 8 defines the type of the tone sequence. 1 stands for a double sequence with call first and then ID-code. The number of tones in every sequence is defined in register 081 (digit 6). The break between both tone sequences is programmed with the call button (see Table of Registers, register 172).

Register 015: 12311000 The first 3 digits are usually coded as in register 010. However, if desired they can also be coded completely arbitrarily.
The 1 in digit 4 and 5 corresponds to the own ID.

Register 081: xxxxx5xx specifies 5-tone sequence.

Register 082: 07707000 is again set to factory defaults (see section Transmitting 5-tone sequences). This time the time of the break will have an effect.

Register 172: 2000F000 The programming of the call button decides whether both sequences are separated by a break or a coupling tone. Coding F into digit 5 activates the break.

Transmission of 6-, 7-, 8-Tone Sequences

This is another possibility to transmit tone sequences of varying length (see Table of Registers, register 010). The 6-,7-,8-tone sequences (register 010: digit 8 is coded with 3,4 or 5) are composed by a 5-tone sequence from register 010 and the additionally necessary digits from register 015. These additional digits correspond to the own ID-code. Hence, the tone sequence consists of the call plus the own ID-code (from register 015).
The ID is always programmed in the digits 3, 4 and 5 of register 015.
For a 6-tone call it is digit 5,
for a 7-tone call digits 4 and 5
and for an 8-tone call digits 3 to 5 are used.

Example: 7-tone sequence 123xx89
In this example a 5-one sequence with a two-digit ID-code (two free digits at positions 4 and 5) plus an own two-digit ID-code.

Register 010 123FF004 contains three invariable digits of the tone sequence(digits 1 -3).
Digits 4 and 5 can be freely set by manual input..
Digits 6 and 7 are not in use and, hence coded as zero.
Digit 8 is programmed with 4 and specifies a 7-tone sequence.

Register 015 12389000 contains the own ID-code in digits 4 and 5.
The first 3 digits are usually programmed according to the invariable digits of the tone sequence, however, they do not have any effect in this case.

Register 082 07707000 is again set to the factory default (see section Transmitting 5-tone sequences).

Decoder

Major 4a/5a contains 10 decoders that are freely programmable by 3 registers for each of the decoders (see Table of Registers, registers 020-049). If the Major is set to factory defaults, an alarm tone signalizes a decoded call. Furthermore, the loudspeaker is activate, its LED flashes, the alarm output (switching output 7) is switched and the standard acknowledgement is sent (only decoder 0, all the others are not active).

The corresponding registers:

Register 020 - 029: tone sequences and activation/deactivation of the respective decoder

Register 030 - 039: actions upon decing a call, alarm tone, volume

Register 040 - 049: ID mode (type of tone sequence, call->ID-code / ID-code->call,...)
switching outputs, loudspeaker, display, emergency call flag

Every single decoder can be configured independently. Starting with decoder 1, the received tone sequence is compared to the stored tone sequence. If the sequence is recognized positively by the decoder, no further decoding of the other decoders is performed. If the tone sequence is not recognized by decoder 1 it is compared to the sequence stored in decoder 2. This routine is repeated for all decoders until decoding is successful or until comparison to the last decoder is performed.

The alarm tone can be programmed separately for each decoder (see Table of Registers, registers 030-039). The alarm tone is an alternating sequence of two tones with different frequencies. Upon calling the alarm tone can be set to a defined volume for a certain time. This can be an explicit value between 0 and 9 or a volume increase of 0 to 5 steps (programmed as A to F). The duration of the volume increase can be set from 0 to 3 s in 200 ms steps.

Register 030 - 039

1st digit: alarm tone

1 = 600/675Hz	6 = 1100/1375Hz
2 = 800/900Hz	7 = 500/750Hz
3 = 1000/1125Hz	8 = 1000/1500Hz
4 = 700/875Hz	9 = 700/1283Hz
5 = 900/1125Hz	0 = no alarm tone

B = 600/675Hz, 10 repetitions
C = 800/900Hz, 10 repetitions
D = 1000/1125Hz, 10 repetitions
E = 700/875Hz, 10 repetitions
F = 900/1125Hz, 10 repetitions

2nd digit: duration — 0 to F: n* 200ms, corresponding to 0 to 3s

3rd digit: call volume — 0 to 9: constant volume, A to F: volume increased by 0 to 5 steps

Example 1: decode 5-tone sequence 9867x
The first decoder is to decode the tone sequence 9867x, i.e., for the 5th digit arbitrary tones should be accepted. The first decoder is programmed in registers 020, 030 and 040.

Register 020 9867FFF1
1st - 4th digit are the 4 invariable digits of the tone sequence (9867)
5th digit is arbitrary and hence coded with an F.
6th and 7th digit are not in use. thus, they are both coded with F.
8th digit is set to 1 and activates the decoder.

Register 030
1st digit: alarm tone type, e.g. 1
2nd digit: alarm tone duration in steps of n*200ms between 0 and 3s, e.g. A = 10 => 2s
3rd digit: alarm tone volume (constant volume: 0 - 9, A - F: increased by 0 to 5 steps,
e.g. C => 2 steps louder
4th digit: duration of call volume
5th digit: call volume

Register 040
1st digit is 0 (ID-Mode) for a 5-tone sequence with ID decoding, else 7
2nd digit: defines the correspondng switching contact, e.g. 7 => output 7 (0: no output)
3rd digit: switching time (n * 1s)
4th digit: acknowledgement, e.g. 4 as an acknowledgement for a received ID-code
5th digit: switch loudspeaker/LED, e.g. 1 for loudspeaker on, LED does not flash
6th digit: without effect for 5-tone sequences

Register 016 9867FFFF
1st - 4th digit: invariable digits of the tone sequence
5th digit takes an arbitrary value (coded with F) and hence causes the 1-digit ID-code
to be displayed
6th - 8th digit are not in use (coded with F)

Example 2: decode 3-7-tone sequence with ID-code
Decoder 2 (registers 21, 31, 41) is to decode the 7-tone sequence 1234589 (ID mode 9). The tone sequence is specified completely in register 021.

Register 081 contains 7 for 7-tone sequence at digit 6.

Register 021 coded with 12345891, 7-digit tone sequence, 8th digit: 1 (decoder activation)

Register 031 defines the reactions to an incoming call (see example 1)

Register 041 contains the ID mode in digit 1 (here: 9), for further digits see example 1

Register 016 e.g. 123458FF
1st - 6th digit: invariable digits of the tone sequence
7th digit: arbitrary (F), hence 1-digit ID-code is displayed
8th digit not in use (F)

Example 3: decode double sequence
In this example a 5-tone double sequence is to be decoded that consists of call and a following ID code. Decoding is performed in decoder 3 (registers 022, 032, 042).
The invariable digits of the 5-tone sequence for the ID code usually is identical to the own ID code (as in register 015). The length of the tone sequence is stored in register 081, digit 6.

Register 081 xxxxx5xx

Register 022 contains the (own) call that is to be decoded, e.g. 12311FF1.

Register 032 defines the reactions to an incoming call (see example 1).

Register 042 contains the ID mode in digit 1 (here coded as 1), for further digits see example 1

Register 016 e.g. 123FFFFF invariable digits: 123, followed by two-digit ID display FF, last three digits are not in use: FFF

Example 4: decode 6-, 7-, 8-tone sequence
The example shows a 7-tone sequence that is to be decoded by decoder 4 (registers 023, 033, 043). The first 5 tones of the sequence to decode are defined in register 023. Depending on the chosen tone sequence (6-,7-, or 8-tone) the remaining tones are decoded as the ID code of the caller. The length of the tone sequence is defined in register 043 (ID mode).

Register 023, **e.g. 12311FF1** 5-digit tone sequence, 8th digit activates the decoder

Register 033 defines the reactions to an incoming call (see example 1).

Register 043 contains the ID mode in digit 1 (here coded as 4 => 7-tone sequence)
For further digits see example 1.

ID code memory

The key tones for ID decoding and ID code memory are programmed in register 016 for all decoders.
The first 7 digits of register 016 contains the tone sequence that has to be decoded for the ID code memory. Arbitrary digits are coded with F, as well as the digits that are not in use.

In register 086 the ID code memory is configured.
The first digit activates/deactivates the update function. If update is activated and an ID code from the memory is decoded the old ID is deleted and the new one is stored in the respective position.
The second digit activates/deactivates the FIFO mode (first in - first out). In FIFO mode the ID code that arrived first (i.e. the oldest one) is displayed.
In the third digit it can be defined if an arriving ID code is displayed immediately or if it is to appear only after skimming to its position.

Storing of ID codes from double sequences is done according to the decoder programming. The ID mode defines in which of 2 tone sequences the ID code is transmitted. It is then passed to the ID code memory.

Example: 6-tone sequence 123x5x with 2-digit ID code in digits 4 and 6:
Register 016 123F5FFF
1st - 3rd and 5th digit are invariable digits of the tone sequence
4th and 6th digit can have arbitrary values and are coded with F
7th and 8th digit are not in use and thus also coded with F

Register 086 10100000
1st digit activates update mode
2nd digit deactivates FIFO mode
3rd digit = 1 defines that new ID codes are displayed immediatelay

Muting 5-Tone Sequence

Muting (register 018) is triggered by the first two tones and lasts until the end of the tone sequence. The first tone must be a valid tone in terms of duration. As soon as the second tone is recognized, handpiece and loudspeaker are muted. For digits that are programmed with ‘F‘, all tones are valid. To disable muting ‚EE‘ is programmed.

FFSK mode

Major 4a can be used in mixed networks, where FFSK and common tone sequence signalling (see Transmitting 5-Tone Sequences) are to be used simultaneously. Therefor, a FFSK-decoder/ encoder is active in addition to the tone-decoder/encoder.

Composition of a Telegram
The call telegram starts with an unmodulated carrier that has to be present at the receiver for at least 25 ms. This is followed by a 16-bit digital sequence and the block synchronization. For block synchronization a 15-bit barker word with a preceding 1 is used. The following selective call consists of 8 digits:

1st digit: code of the mode of operation (CMO) (invariable)
2nd digit: status (invariable)
3rd digit: hash key identification (invariable)
4th+5th digit: producer identification (variable)
6th-8th digit: call (variable)

Code of the Mode of Operation (CMO)
The CMO distiguishes the different types of telegrams. The following types are supported by the Major:

Nr.		Meaning	Major
0		available (free)	(x)
1	Q	call to car	x
2	Q	call to control center	x
3		ID code	x
4		acknowledgement	x
5		additional telegram	
6	Q	cutting call	
7		reserve	
8	Q	priority call	
9	Q	status request	
A		reserve	
B		reserve	
C		reserve	
D		available (free)	
E		available (free)	
F		emergency call	x

CMOs marked with a Q require an acknowledgement. The CMO is programmed together with the PTT button at digit 5 (usually with ‘1’ => call to car, standard: call button, short press; see Table of Registers, register 172).

The CMO for call decoding is programmed in register 091 (2nd digit, usually programmed with ‘2’ => call to control center).

Status
The status of the call is programmed in register 054 (digit 3). For decoding the status is not important. All values are accepted.

Producer Identification and Call
Digits 4 and 5 (producer identification) and 6-8 (call) are combined by the Major and treated like a 5-tone sequence. Hence, call encoder and decoder are programmed in the same way as for the 5-tone sequence.

Hash Key Identification for Calls
The 1-digit hash key identification is programmed in register 090 (digit 5). For decoding all values are accepted.

Threshold Number
While 5-tone-decoder and FFSK-decoder are active simultaneously, it has to be decided before a call if a 5-tone-telegram or an FFSK telegram is to be sent. The decision depends on the value of the call (three last numbers of the FFSK telegram). Below a certain threshold number one telegram type is used, aboce this number the other is used.
The threshold number is set in register 090 (digits 1-3). The 4th digit defines if a FFSK or tone sequence is used below the threshold number. If it is coded with 0, FFSK is used below the threshold number and starting with the threshold number tone sequences are used. The reverse case is achieved by programming ‘1’.

Example 1:
Below the threshold number 51 tone sequences are to be sent, while FFSK signals should be sent above it.

Register 090 0511xxxx contains the threshold number 051 and a ‘1’ at digit 4 to enable FFSK starting at the threshold number.

Example 2:
If only FFSK signals are to be sent, the threshold value is set to ‘000’ and digit 4 is set to ‘1’.

Register 090 0001xxxx

Example 3:
Only tone sequences are sent. Threshold number is again set to ‘000’, but this time digit 4 is set to ‘0’.

Register 090 0000xxxx (factory default)

FFSK Encoder

The 5 digits of the producer identification and the call (4th - 8th digit in the 8-digit FFSK telegram) are treated in the same way as for 5-tone telegrams. The digits that should not be entered via the keypad are invariably coded. Invariable digits can be located anywhere throughout these 5 digits. Hence, it is also possible to invariably set digits 4, 6 and 8 of the FFSK telegram. In this case, digits 5 and 7 areentered via the keypad. Usually, the first 2 digits (producer indentification) or the first 3 digits (producer identification and first digit of the call) are preset. The digits that are to be entered by the keypad are always displayed right-justified. The encoder is programmed in register 010 (see section Transmitting of 5-Tone Sequences).

FFSK Decoder

For all telegrams the CMO is checked. If the CMO is consistent with register 091 (digit 2), the encoder is activated. The encoders are coded in registers 020-029, 030-039 and 040-049 (see Table of Registers). The recognized telegram is compared to the decoder values, accepting all values at digits that are programmed with an ‘F’. After a positively recognized telegram, the loudspeaker and the earphone are switched on, the loudspeaker display flashes, depending on the settings the FFSK acknowledgement is sent and the alarm tone is activated. An additional comparison to other decoders is not performed.

Individual Programming of the Buttons

All buttons of the Major 4a/5a are freely programmable. The numeric keys, the * and # keys as well as the function buttons for volume (only Major 5a), loudspeaker, short call, call and PTT are programmed ex factory for the respective tasks.
Every button can be assigned two different functions. One is achieved by pressing the button shortly and the other by pressing it for a longer time.
If the button is pressed for less than second, the function programmed for „short press“ is executed. For longer pressing the function programmed for „long press“ is executed. If no function is programmed for long press, the „short press“ function is executed immediately.

Programming of the button‘s functions is done in registers 130-179. For every button 2 registers are reserv ed, the first onie for short press, the second one for long press (see Table of Registers, registers 130-179).
The function of the LEDs in buttons F1 to F4 is defined in registers 180-183.

Every register contains 8 digits. the first digit chooses the desired, the second digit chooses a subfunction (if necessary). The following digits specify the settings necessary for the respective function.

The following functions are available:

0: no function

1: transmit single tone

2: transmit call
- 0: transmit entered call
- 1: transmit callback
- 2: transmit short call
- 3: transmit Intercom
- 4: transmit external short call
- 5: transmit channel remot call

3: PTT

4: volume
- 0: loudspeaker on/off
- 1: volume
- 2: loudspeaker on/off in telephone mode

5: channel selection / switching outputs
- 2/3: channel 00 -99
- 2: E => configure switching outputs

6: ID-code memory / call number memory
in normal mode: edit ID-code memory / decoder
in telephone mode: edit call number memory

7: call number / tone input
in normal mode: input of tones
in telephone mode: input of call numbers

8: status input
in normal mode: status input
in telephone mode: input of telephone status

9: ext. inputs
0: squelch input
1: external muting

B: mode functions
0: activate normal mode
1: activate telephone mode
F: standby

Example 1: Programming „short press“ of Buttons F1 F2 F3

As an example, the functions for „short press“ of the buttons F1, F2 and F3 are programmed. In this case the buttons are programmed for channel selection.

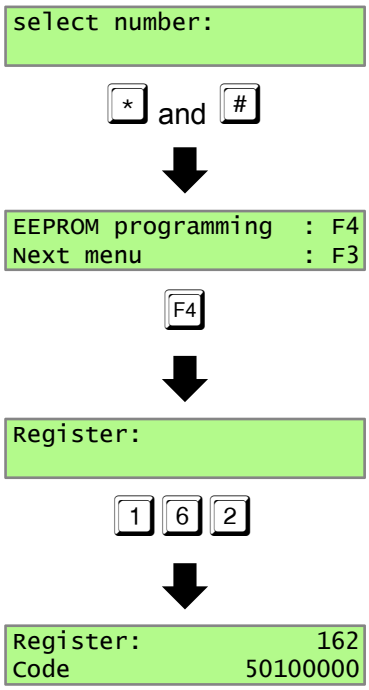
F1 chooses channel 01
F2 chooses channel 02
F3 channel number must be entered via the keypad

Programming of button F1 short	register 162
funktion channel selection:	1st digit: 5
channel number 1:	2nd digit: 0
channel number 2:	3rd digit: 1

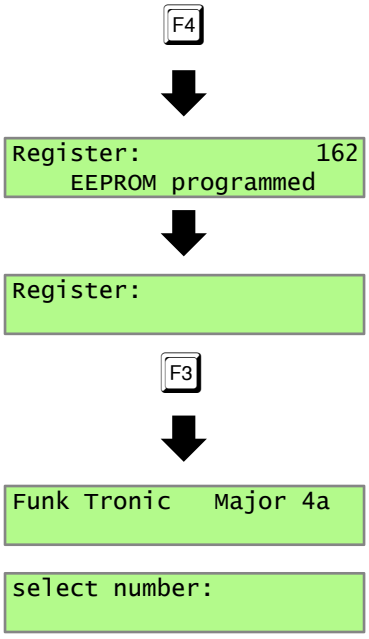
Digits 4-8 are not in use in this case.

Stepwise programming of F1:

Start Register Programming



Finish Programming / Save



Buttons F2 and F3 are programmed analogously:

Programming of button F2 short	register 164
function channel selection:	1st digit: 5
channel number 1:	2nd digit: 0
channel number 2:	3rd digit: 2
Digits 4-8 are not in use.	

Programming of button F3 short	register 166
function channel selection:	1st digit: 5
channel number 1:	2nd digit: F (entered via keyboard)
channel number 2:	3rd digit: F (entered via keyboard)
Digits 4-8 are not in use.	

Example 2: Programming the LEDs of buttons F1 and F2
If the respective channel is activated by one of the buttons, the LED is to be lit.

Programming of the LED in button F1	register 180
channel display:	1st digit: 2
channel number 1:	2nd digit: 0
channel number 2:	3rd digit: 1

Programming of the LED in button F2	register 181
channel display:	1st digit: 2
channel number 1:	2nd digit: 0
channel number 2:	3rd digit: 1

Stepwise programming of the LED in button F1:

Start Register Programming

```
select number:
```

* and #

```
EEPROM programming  : F4
Next menu           : F3
```

F4

```
Register:
```

1 8 0

```
Register:           180
Code           20100000
```

Finish Programming / Save

F4

```
Register:           180
   EEPROM programmed
```

```
Register:
```

F3

```
Funk Tronic   Major 4a
```

```
select number:
```

Inputs / Outputs

The in/outputs are configured in registers 096 and 097.
Ex factory both registers are set as follows:

register 096	11111000	programs the I/Os 1-5 as output, not inverted
register 097	11100000	programs the I/Os 6-8 as output, not inverted

The outputs are open collector circuits. They can be configured as follows:
- 1 not inverted, passive state: switch is open, active: switches to GND
- 8 outside switching, is input and not inverted output, simultaneously the state of the input can be read out, so that a switching state imposed on the I/O from an external source can be interpreted.
- 9 inverted, passive state: switches to GND, active: switch is open

If a connection is to be configured as input, the respective digit has to be coded with
- 2: input is low-active, i.e. is switched to GND
- 3: input is high-active, i.e. is switched to +batt

Inputs can be assiged different functions. Therefor, it has to be decided, if the input is switched on or off.

Example: Reciprocal muting of the loudspeakers
If two Major 4a/5a control sets are situated next to each other it might be desired to mute the loudspeaker of the respective inactive Major. Hence, if one Major is used for conversation, the other one is muted.

Therefor, I/O pin 2 is to be used. As the inputs are to be switched as well as read out, it is necessary to configure the I/O for outside switching:

Register 095 18111000 2nd digit: 8, I/O 2 is configured for outside switching.

For the muting the function radio-mute (see Table of Registers, register 083)is used.

Register 083 22000000 Digit 1defines I/O pin 2 as muting output, the 2nd digit configures the output to low-active and activates it only during transmission (TX or PTT is pressed).

Now, the function for external muting still has to be programmed for I/O pin 2 (see Table of Registers, function 9). For I/O pin 2 this is done in register 112/113.

Register 112 91110000 function 9 (digit 1) with subfunction 1 (digit 2) stands for external muting. The ‘1‘ at digit 3 activates muting if input 2 is activated. The ‘1‘ in digit 4 causes flashing of the PTT button if the input is activated from outside.

Register 113 91000000 function 9 (digit 1) with subfunction 1 (digit 2: external muting) disables the muting and flashing again if input 2 is back to the inactive status (‘0‘ in digit 3)

Both I/Os have to be connected to each other. The easiest way to do this is the use of an ordinary patch cable (if no other I/O-Pins are in use) to connect the I/O sockets of both Majors.

Alarm Signals FT634aC => Major 4a/5a

Up to 3 alarms can be transmitted from an FT634aC to a Major 4a/5a. The FT634aC transmits transmits any change of the alarm switching contacts to the major immediately. If no acknowledgement is received, 3 repetitions are transmitted. If again no acknowledgement was received, transmission is retried after a minute.
The Major displays each new alarm immediately. The operator has to acknowledge the alarms with the #-button. All received alarms are displayed until they are acknowledged, even if they are not active any more. In this case the present alarm status is displayed after the operator‘s acknowledgement and also has to be acknowledged.

FT634aC:

Register 095: configuration for I/O 0-7 (0=output, 1=input)
Register 096: configuration for I/O 8-15 (0=output, 1=input)
Register 104: digits 1-4: alarm switching tone sequence (ABC0)
digit 5: send alarm tone sequence without active alarms if already begun y/n (1/0)
Register 108: function I/O 0 passive=>active (high=>low)
Register 109: function I/O 0 active=>passive (low=>high)
...
Register 124: function I/O 8 passive=>active (high=>low)
Register 125: function I/O 8 active=>passive (low=>high)
...
Register 138: function I/O 15 passive=>active (high=>low)
Register 139: function I/O 15 active=>passive (low=>high)

Function alarm input (has to be programmed into the respective register 108-139)
1st digit: 2: function alarm input
2nd digit: 0: emergency power input, 1:housebreaking input, 2:alarm input
3rd digit: 0: alarm off, 1: alarm active

Standard programming for alarm transmission:
Register 096: 111xxxxx (I/O 8,9,10 are inputs)
Register 104: ABC01xxx (transmits alarm notification ABC0x when set active)
Register 124: 201xxxxx I/O 8: emergency power input low: active
Register 125: 200xxxxx I/O 8: emergency power input high: off
Register 126: 211xxxxx I/O 9: housebreaking input low: active
Register 127: 210xxxxx I/O 9: housebreaking input high: off
Register 128: 221xxxxx I/O 10: alarm input low: active
Register 129: 220xxxxx I/O 10: alarm input high: off

Major 4a/5a:

Register 075: digit 1-4: tone sequence for alarm notification (ABC0)
digit 5: PTT for acknowledgement/request
5 = with pilot-tone
6 = without pilot-tone
7 = without pilot-tone, without TX

Register 076: configuration for alarm decoder
digit 1: type of alarm tone
digit 2: duration of alarm tone: n*200ms
digit 3: alarm tone volume

Register 077: configuration 2 for alarm decoder
digit 1: request at power-on y/n (1/0)
digit 2: number of switching output: 0 (none), 1-7
digit 3: switching output: 0(off),F(on), time is variable: 1...E(14) seconds
digit 4: acknowledgement: yes/no (1/0)
digit 5: display time 1-F = 1-15s, 0 = ends with acknowledgement (#-button)

It is also possible to program a button, so that an alarm query is sent to the FT634aC Line Interface.

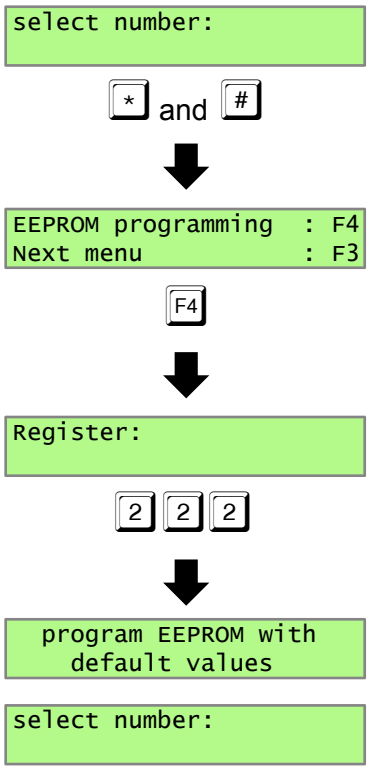
Function 2 (transmit call):

2nd digit: 6: transmit alarm query

Reset to Factory Defaults

Using the following steps, Major 4a can be reset to factory defaults.

Attention! All parameters are reset to the default values without further confirmation.



When entering register 223 the potentiometers are also reset to factory defaults.

Channel Scanning Function

The channel scanning function is activated if the waiting time in register 067/5 is programmed NOT to be zero. Zero deactivates this function. The scanner will wait for at least the programmed waiting time per channel. Just before the end of the waiting time, the channel is checked for a carrier. If no carrier is detected the next channel will be scanned. Scanning will stop when a carrier is detected if "scanner stops on carrier" (register 068/1) is programmed. If not the scanner will be stopped for at least 100 ms. During this time the scanner will scan for a tone. If a tone is detected, the scanner will wait for the scanner waiting time (068/2+3). If a call is decoded during that time the scanner stops. Otherwise the next channel is scanned.
The channel range programmed in register 067/1-4 will be scanned. If register 067/1+2 is programmed with 'EE' the specified channels programmed in register 070-074 (EEPROM table) will be scanned. Scanning the table can be aborted by 'FF'.
In order to scan channels 1, 5 and 6, register 070 is programmed with 0105xxxx and register 071 with 06FFxxxx.
After decoding a call the scanner stops for the programmed loudspkeaker time (050/1-3) which is retriggered by a carrier and/or PTT. Furthermore, the scanner can be switched off by activating the loudspeaker (LS button) manually.
Scanning can be initiated by hanging up the handpiece (050/5). The scanner can also be activated using the "loudspeaker off" function (function 4; second digit: 0).

Option FMS

The FMS option allows for the status input and the reception of orders according to the German Funkmeldesystem (FMS).
As for this option buttons 0-9 are used as status buttons, manual selection of a 5-tone sequence is not possible.

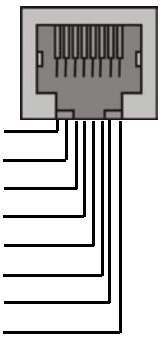
PWR **ST4** **ST3** **ST2** **ST2A** **ST1**

PWR operating voltage 12V, max. 1,5 A
inside: positive terminal, outside: GND

Sockets Pinout Major 4a/5a

All of the schemes show the sockets as viewed from the rear of the Major.

Pinout S/E
Radio Circuit (ST1)

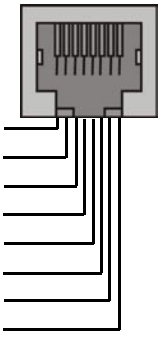


AF input B	1
AF input A	2
Squelch input	3
GND	4
output +12 V, max. 200 mA	5
PTT active, low	6
AF output A	7
AF output B	8

All AF in/outputs are equipped with transformers and, hence, potential-free. PIN 5 is for supply (+12V) of external devices (LIM-AC, FT634C).

Attention: Do not use PIN 5 to supply a radio set. 200 mA output current is not sufficient.

Pinout I/O
Digital In/Outputs (ST3)

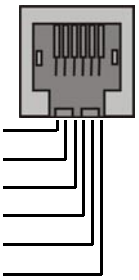


IN/OUT 0	1
IN/OUT 1	2
IN/OUT 2	3
IN/OUT 3	4
IN/OUT 4	5
IN/OUT 5	6
IN/OUT 6	7
GND	8

The digital connections can be configured as inputs or outputs, respectively. Usually, these are used as outputs for remote channel select.

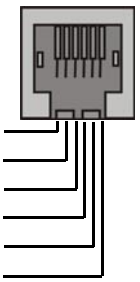
There are two sockets for connecting a headset. One is for connecting the headset, the other for the use of an external PTT button (e.g. foot switch)

Pinout HS
Headset (ST2A)



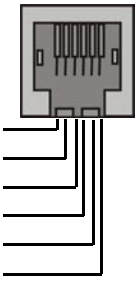
GND	1
AF input (mic. +)	2
AF earphone	3
GND earphone	4
GND AF input (mic. -)	5
PTT, active GND	6

Pinout PTT
Headset (ST2)



GND	1
GND AF input (mic. -)	2
NF earphone	3
GND earphone	4
AF input (mic. +)	5
PTT, active GND	6

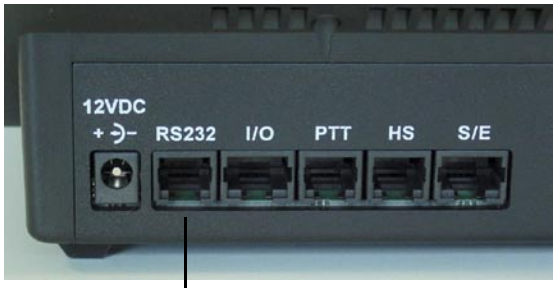
Pinout RS232
(ST4)



NC	1
NC	2
TxD	3
RxD	4
GND	5
NC	6

To socket RS232 a printer can be connected.

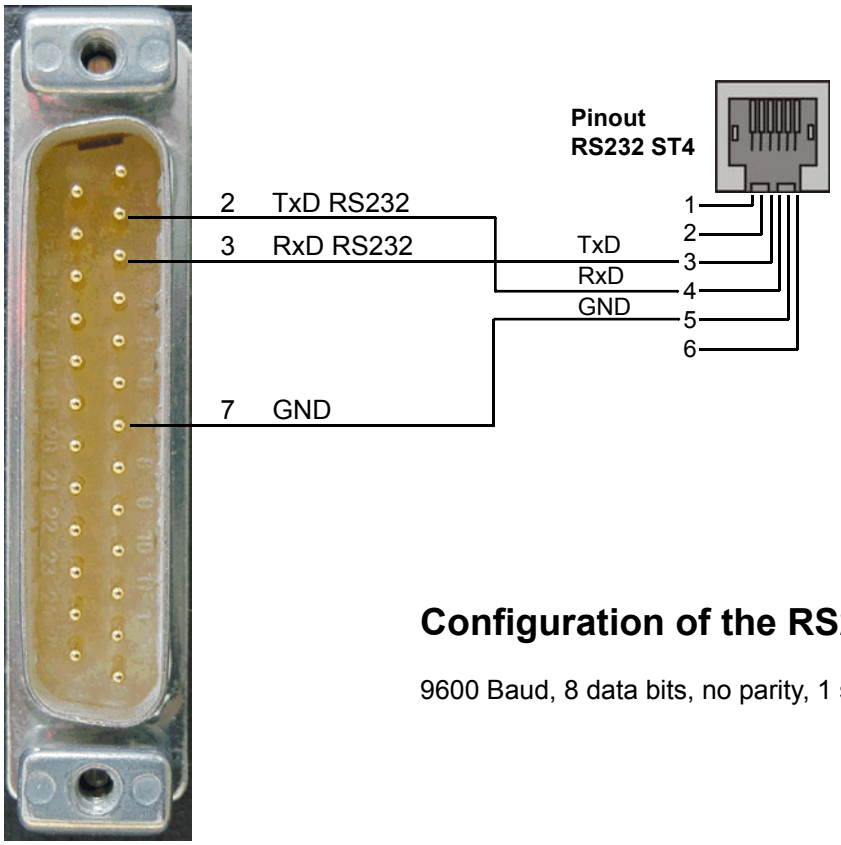
RS232 Interface



ST4 RS232 Interface

RS232 Cable for Flashing/Printing/Monitoring

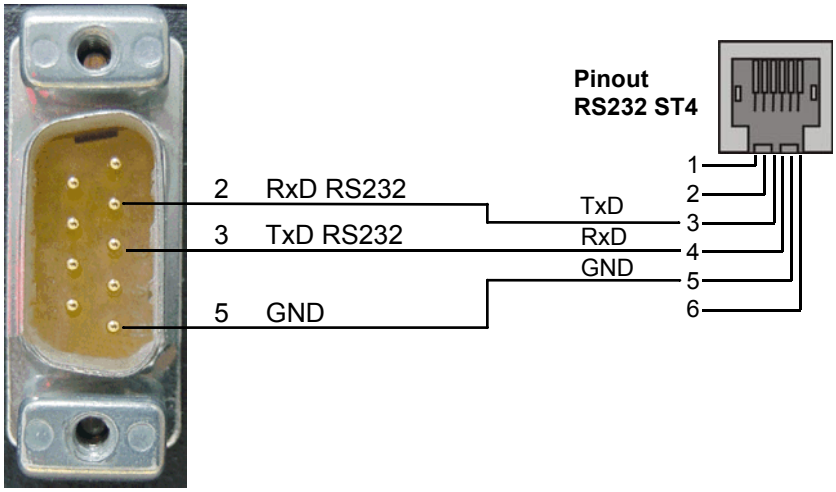
RS232 25pin connector on computer **RS232 socket on Major**



Configuration of the RS232 Interface

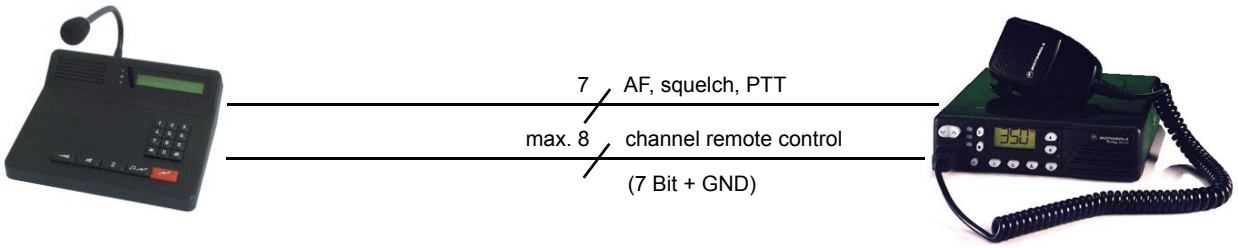
9600 Baud, 8 data bits, no parity, 1 stop bit, no protocol

RS232 9pin connector on computer **RS232 socket on Major**



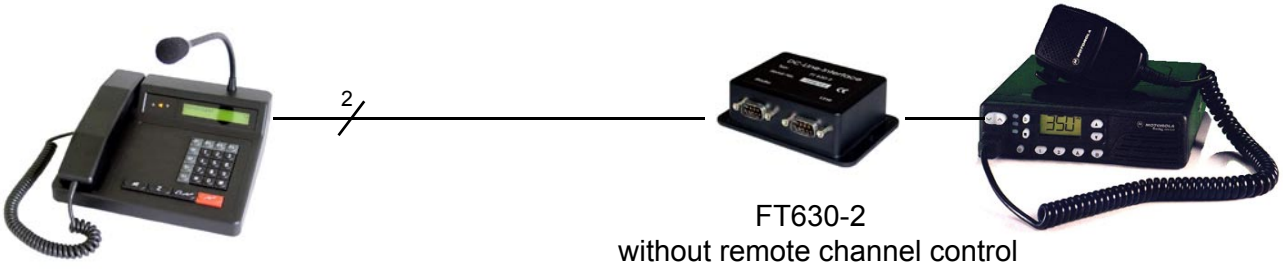
Sample Configurations Major 4a/5a

The following situation shows the easiest way for remote radio control using a Major 4a/5a. If a remote control is not required, a 7-wire line is sufficient for AF, squelch and PTT.

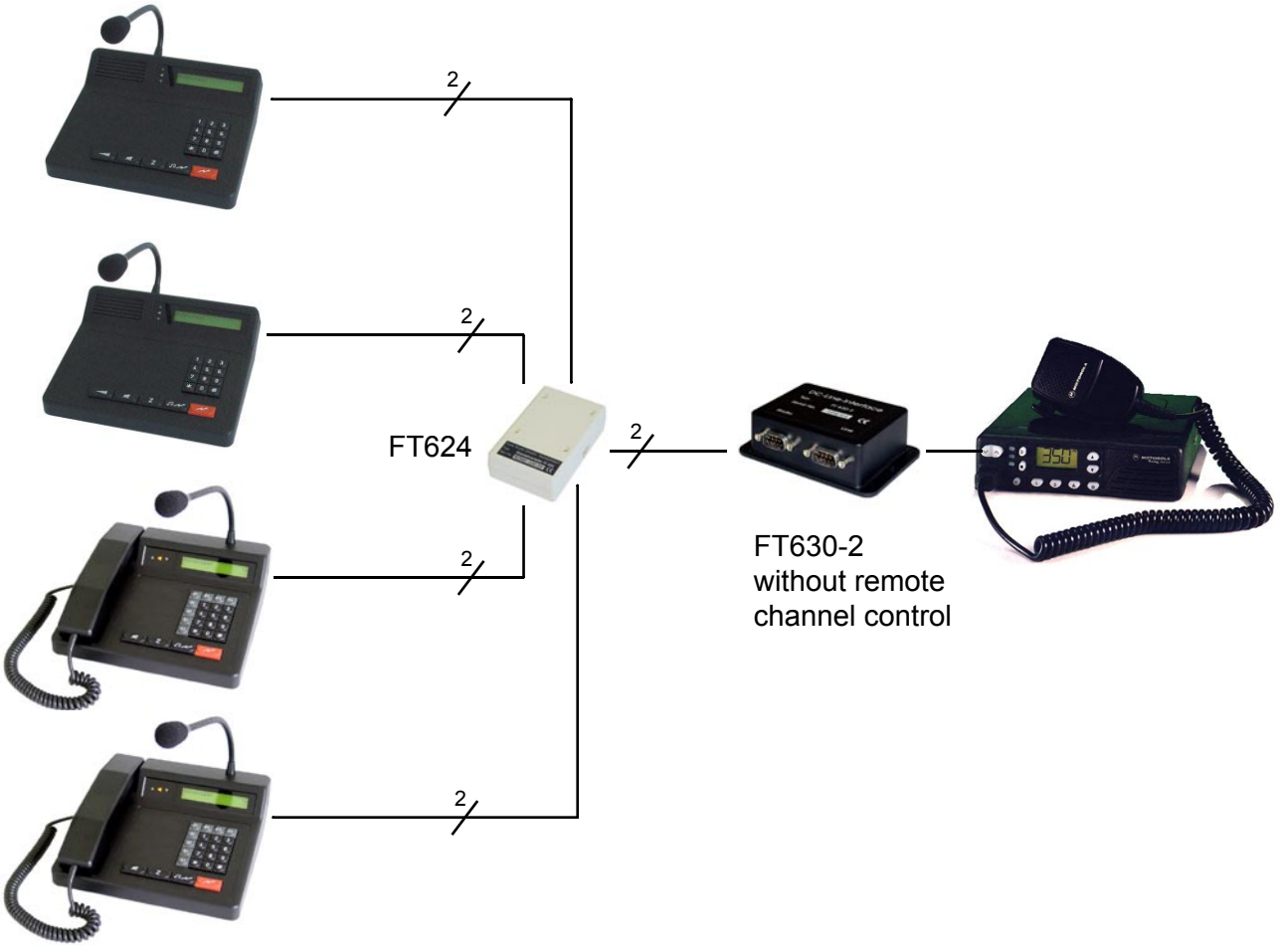


Sample Configurations Major 4a/5a, DC controlled

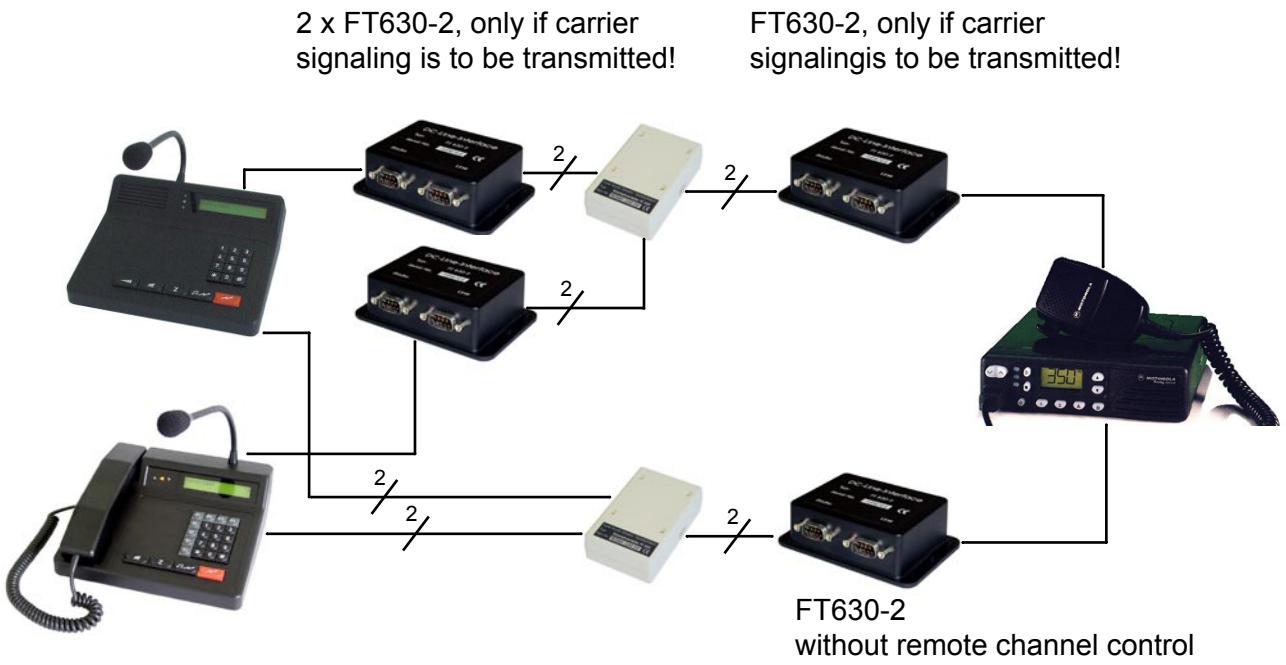
If only a local 2-wire line is available the following set-up using a DC line interface FT630-2 is recommended. In this configuration remote channel select and duplex mode are not possible.



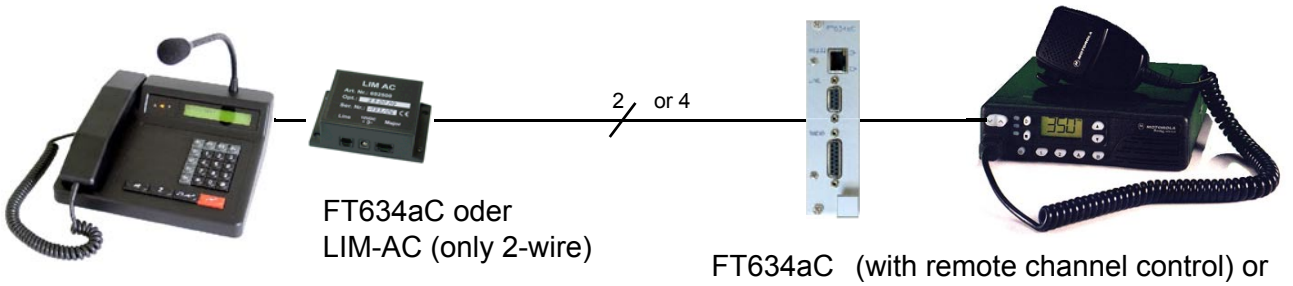
Several control panels in parallel circuit



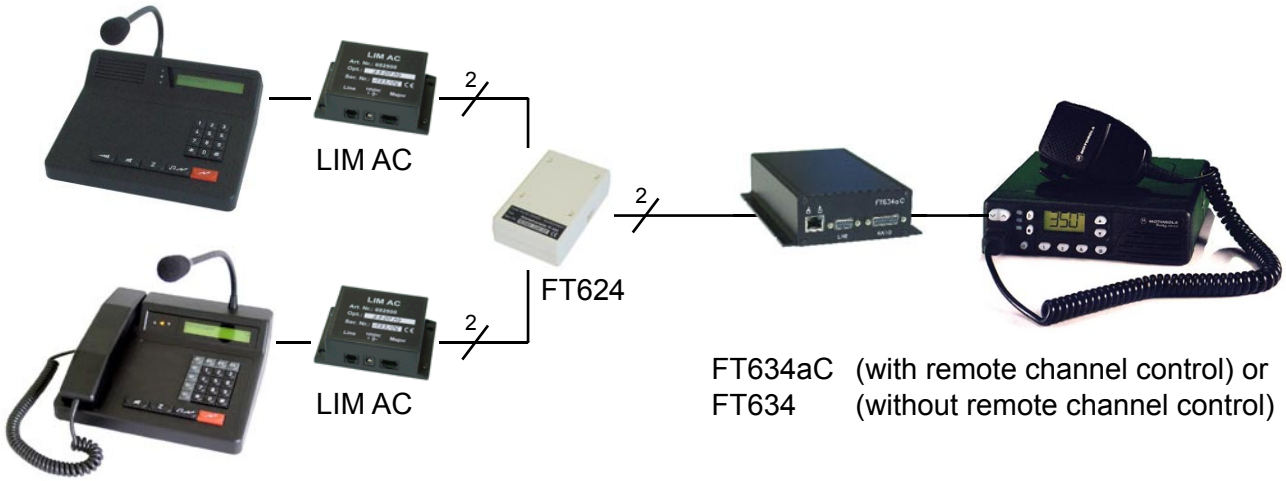
Example for duplex mode with 4-wire transmission



Sample Configurations Major 4a/5a, AC controlled



Several control panels in parallel circuit --> LIM AC has to be equipped with a notchfilter to suppress the PTT keying tone. LIM AC is employed for rather long or rented lines.

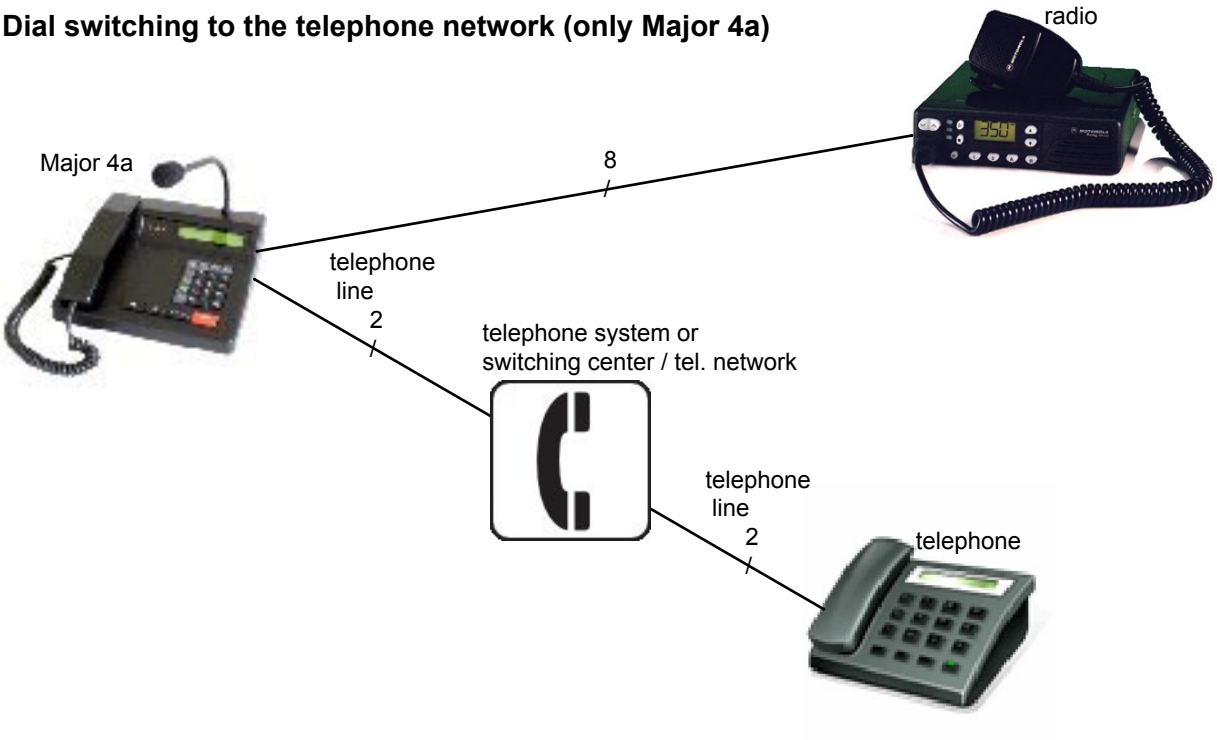


Sample Configurations with Telephone Interface

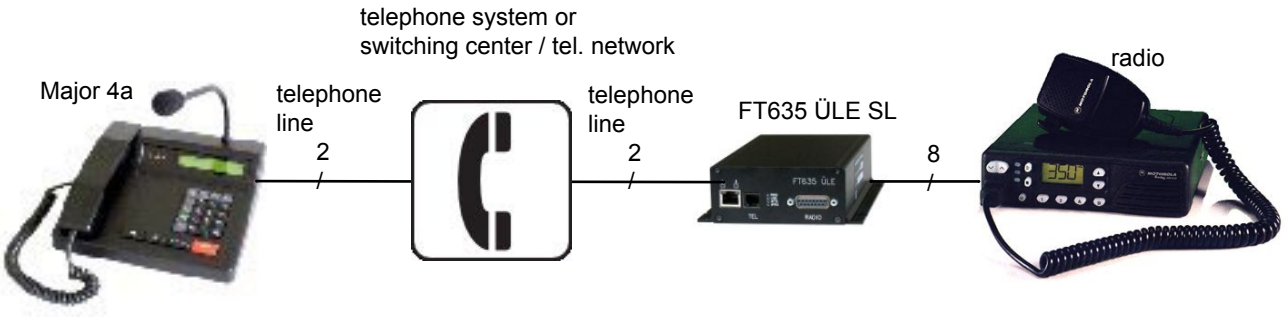
Major 4a can be equipped with an optional telephone interface. Now the major can be connected to to the telephone network or an interphone system via an ordinary (analogous) telephone connection. This is achieved with a common RJ11 telephone socket at the rear of Major 4a. Now, the following additional features are available:

- dial switching of telephone connections to radio (manually or automatically)
- dial switching of a radio connection to a telephone subscriber (manually or automatically)
- connection of distant radio sets via analogous land-line. (with FT635 ÜLE, substitution of a permanent line)

Dial switching to the telephone network (only Major 4a)



Remote control of a distant radio (pseudo-permanent line, Major 4a and Major 5a)

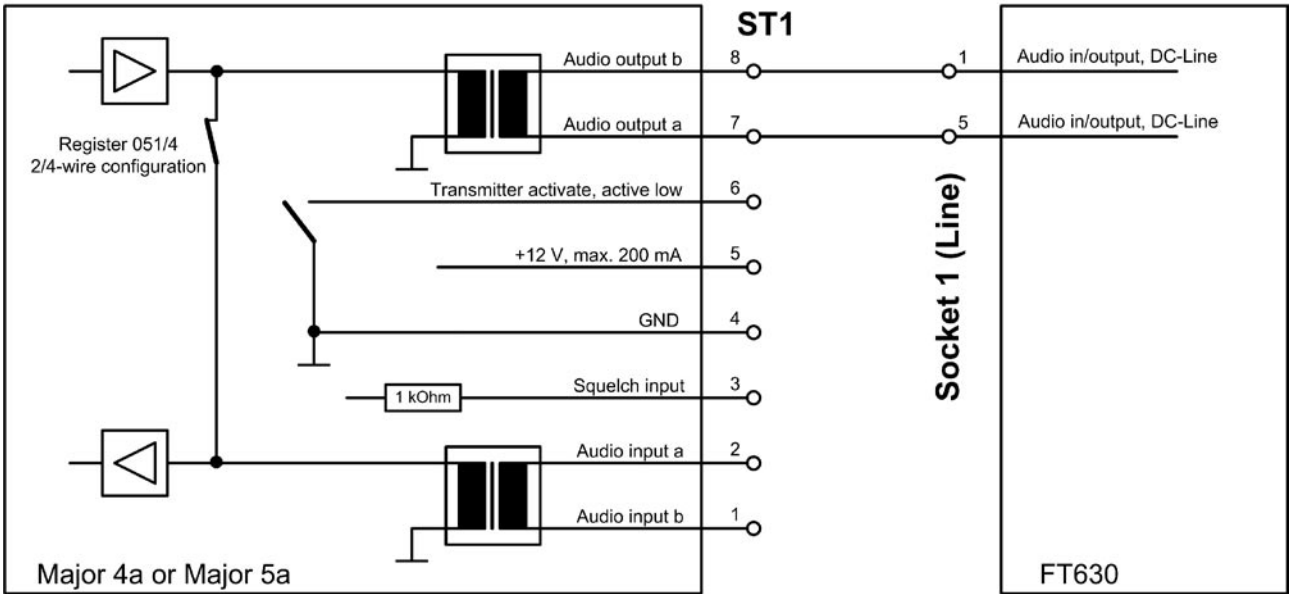


Remote control of a distant radio is achieved using an FT635 ULE SL. For this configuration a telephone connection, of course, must also be present at the location of the radio.
Basically, the ÜLE SL establishes a telephone connection, that is maintained for the desired time. Both devices monitor the status of the connection and rebuild the connection, if it was disconnected.

Two/Four-Wire Configuration

The Major 4a/5a can be configured for 2-wire and 4-wire connection. Starting with software version 2.0 switching from 2-wire to 4-wire is done by programming register 051/4.

Two-Wire Connection using FT630



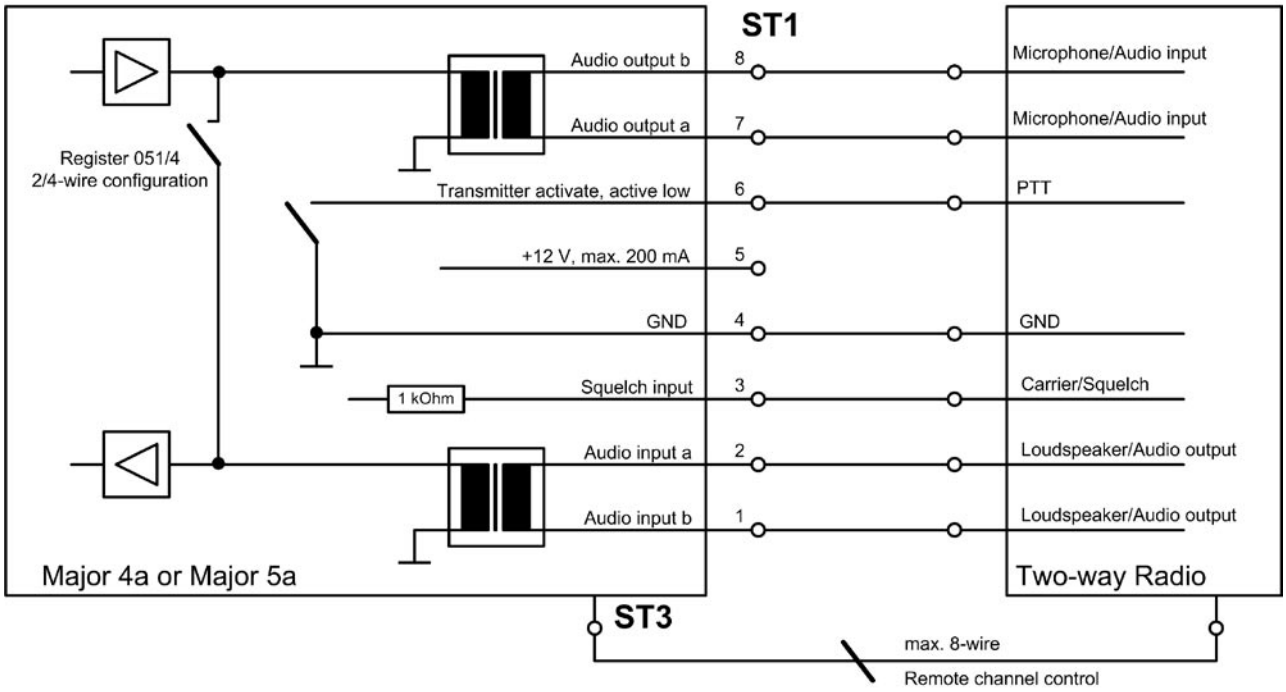
Over longer distances the radio set can be controlled via a 2-wire line. If PTT is keyed at the Major, a DC voltage is applied to the line in addition to the audio signal. This voltage is analyzed in the FT630-2 and the PTT relay turns on the transmitter. In the reverse situation the FT630-2 is able to apply a DC voltage to the line if an incoming signal (squelch) is present.

If the DC voltage is used for transmitter keying as well as for detection of an incoming signal, no transmission is possible while a squelch signal is detected.

Instead of the FT630-2 (DC) the line interfaces FT634aC or FT634 can also be used. For these no DC coupling is necessary and additional features are available, e.g. the transmission via digital in-/outputs (alarm in case of dysfunction, housebreaking, fire...) and remote channel control.

Register 069/1 defines if PTT keying is conducted by the PTT keying tone or by a DC voltage.

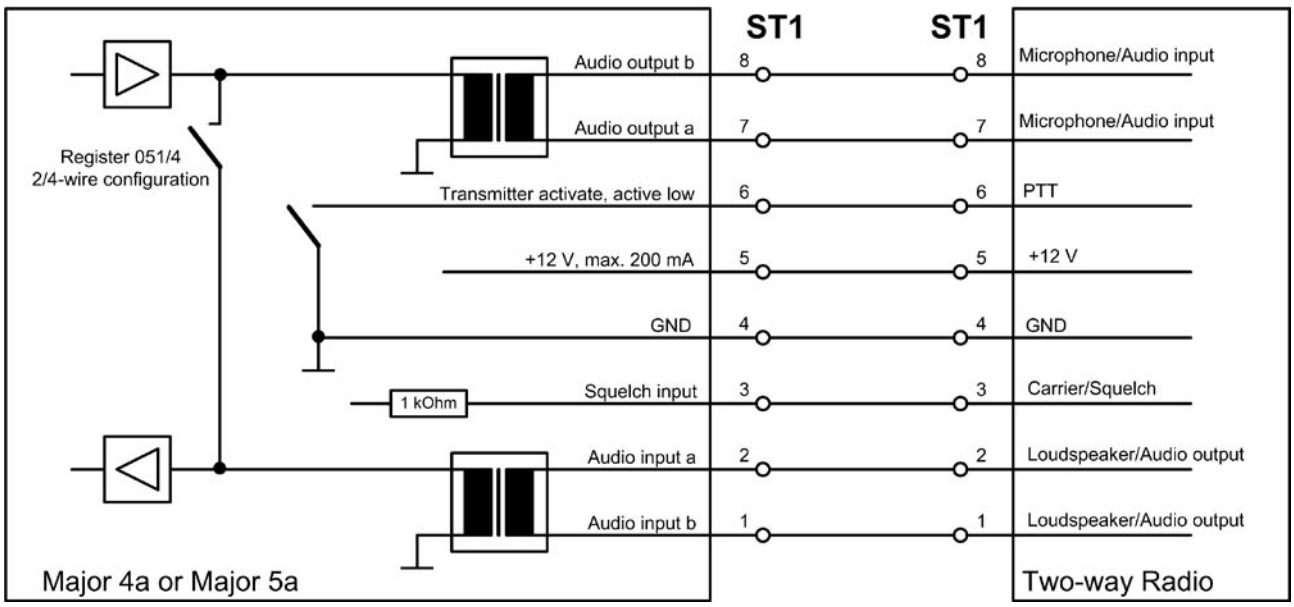
Connecting Major 4a/5a --> Two-Way-Radio via Multiwire



All audio in/outputs of the Major 4a/5a are equipped with transformers and hence are potential-free. If no potential-free in/outputs are available at the radio, in both cases one of the audio connections has to be grounded, preferably by connecting pins 1 and 8 to GND pin 4. Switching from 2- to 4-wire is carried out by programming register 051/4.

PIN 5 is for supply (+12V) of external devices (LIM-AC, FT634aC).
Attention: Do not use PIN 5 to supply a radio set. 200 mA output current is not sufficient.

Connecting Major 4a/5a --> LIM-AC



The LIM-AC can be connected to Major 4a/5a with a 8-terminal line. Commercially available computer cables may be used. For this, Major 4a/5a must be set to 4wire mode (factory default in reg. 051/4)

Telephone Interface

A Major 4a/5a with telephone interface is able to perform the following operations:

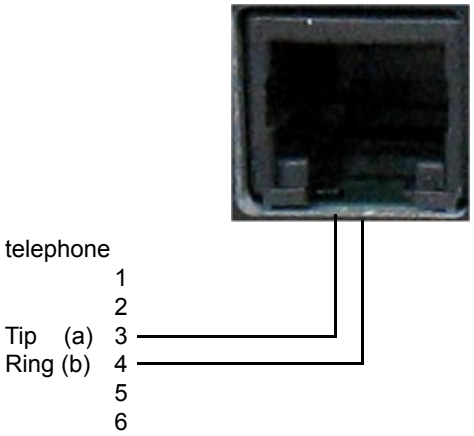
- control a distant radio set via a FT635ÜLE SL module (pseudo-permanent line)

only Major 4a

- dial switching of telephone connections to radio (manually oder automatically)
- dial switching of a radio connection to a telephone subscriber (manually or automatically)
- calls to the conventional telephone network

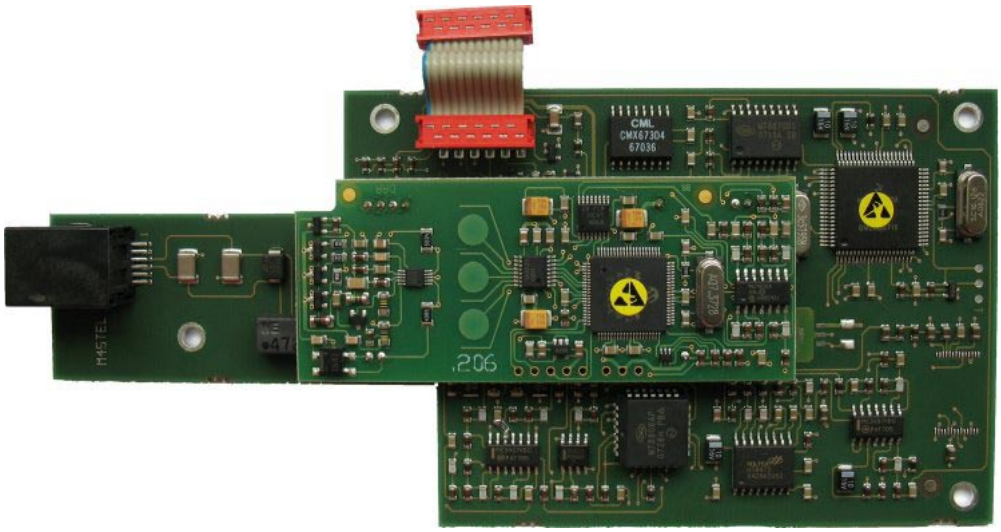
Connection to the telephone network:
With the telephone interface the an additional RJ11 socket is present at the Major. This socket is used for connection to the telephone network with a common telephone cable.

Socket Pinout RJ11 (telephone)



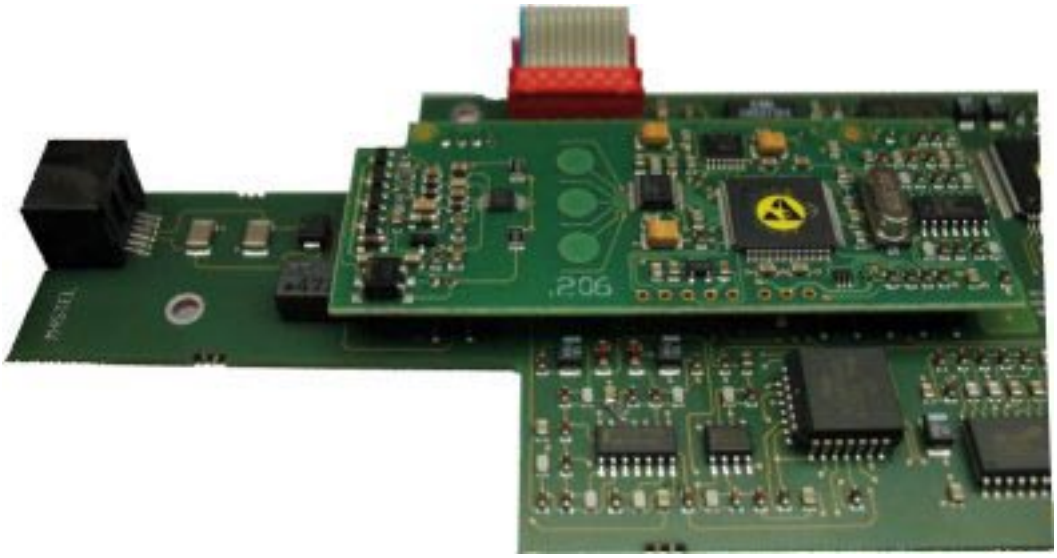
Handling of the Component Group

The telephone interface consists of the carrier board and the attached TIM module.
Please pay attention to the orientation while mounting the TIM, so that the connectors are not confused.

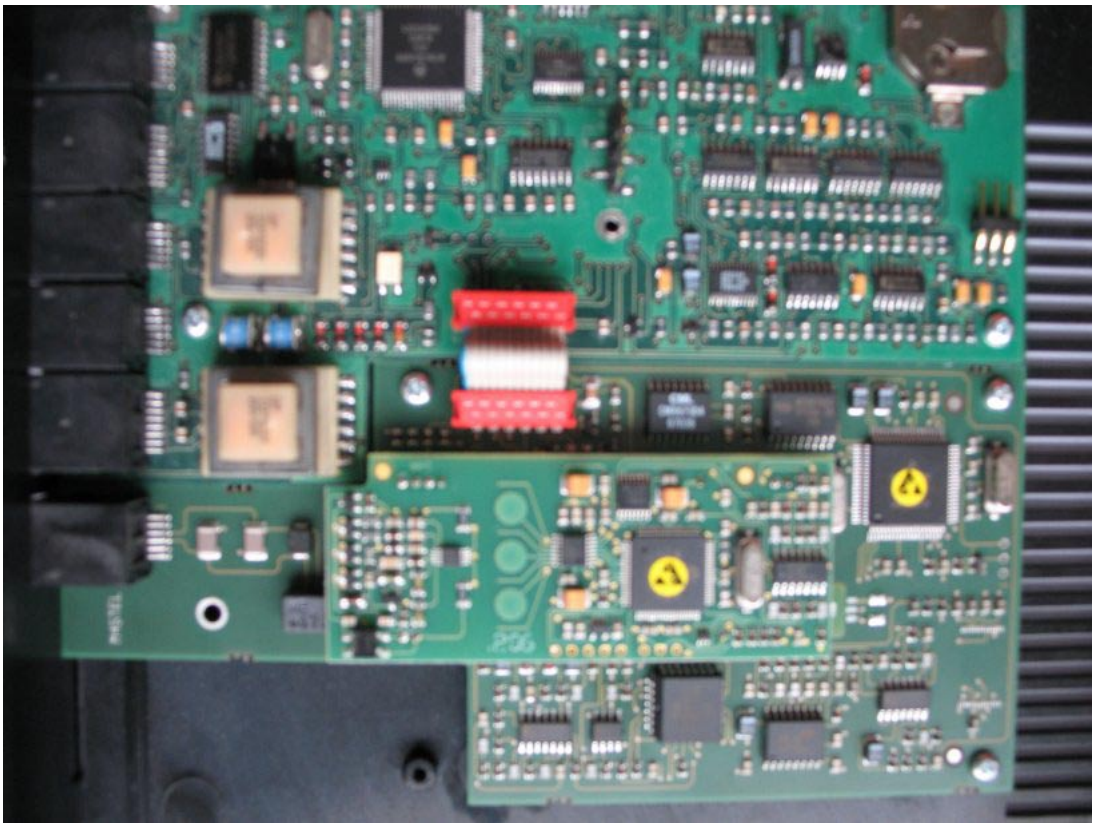


The gap at the upper left corner of the TIM has to be directly above that of the carrier board. The edge-on view shows the positions of the connectors.

An additional oblique view further illustrates the setting.



The telephone interface, built into the Major:



Telephone Mode (optional)

Major 4a can be used for manual and automatic switching between radio and telephone network. Therefor, it has to be furnished with the option telephone interface.

Connection and Dial-Mode
The connection to the telephone network is, as usually, established with a telephone cable with RJ11 plugs. The dial-mode is programmed in register 366:

Reg.	**Function**
366	4th digit 0 = pulse dial 1 = DTMF

Switching from Radio Mode to Telephone Mode
Button F4 activates the telephone mode (do not delete last number, forwarding options unchanged).

Keypad Layout in Telephone Mode

F1	short:	forward <==> toggle telephone (on/off)
F4	short:	start radio mode - does not delete last number - telephone on hold
0 - 9	short:	Input telephone number 0 - 9
0 - 9	long:	Input space ,* ,# ,A ,B ,C ,D ,/ ,- ,_
S1 - S4	short:	read out call number memory registers 001 - 004
*	short:	previously dialed number
#	short:	delete last digit of input
#	long:	delete input completely
PTT		talking with the gooseneck microphone
Call	short:	button for dialing, call reception and hanging up - does not change loudspeaker
Z	short:	read out entered (0 - 999) or next call number from register
Z	long:	program entered call number to memory (press twice)
LS	short:	toggle loudspeaker - does not hang up telephone
LS	long:	volume

Connection Types
Establishing a connection from the telephone to the radio can be achieved in 3 different ways:

- Either the telephone call arrives at the control set and can be forwarded manually to the radio or
- the incoming call is forwarded automatically to a preset radio participant or
- the incoming call is forwarded automatically via DTMF to the desired radio participant.

Telephone Mode (optional)

The operator of the Major 4a can initiate and receive phone calls at any time (given that no automatically established connection exists already).

Initiate Call button F4

display

```
_
Telefonnummer eingeben
```

compose number

```
012345
Telefonnummer eingeben
```

call button 

the display shows:

```
012345
Telefongespräch aktiv
```

Receive Call

Incoming Calls are signalized by a dial tone and by flashing of button F4.

the display shows:

```
Telefonanruf
```

activate telephone mode F4

accept with call button 

the display shows:

```
Telefongespräch aktiv
```

Button F4 lights permanently.

The phone call is terminated by hanging up or forwarded to the radio (see **Manual Forwarding**).
If no actions are performed in the telephone mode, the Major returns to radio mode automatically.

Manual Forwarding

Radio =>Telephone

If a radio participant calls the control set he can be forwarded to the telephone network.
The operator calls the telephone subscriber and subsequently presses F1.

the display shows:

```
Funküberleitung aktiv
```

The handpiece can be hung up now. in order to listen, the loudspeaker can be activated. If the operator wants to take part in the conversation (conference) this can be achieved by simply taking the earphone and pushing the PTT button.

Dial-Up - Telephone => Radio

Reg.	Function
360	4th. digit: T11-55 on connection establishment fromtelephone to radio y/n (1/0)
367	5th. digit: number of ringing signals until line is occupied

Automatic Connection - Telephone => Radio

An incoming phone call automatically occupies the line after N ringing signals. Two signal tones are sent to the telephone (interval of 1 s). Subsequently, the phone call is forwarded to the radio. If the function T11-55 is activated, the second signal tone is delayed until the channel is free. If the channel is occupied for more than 45 seconds, the connection establishment is canceled. Please consult also section T11-55. The conversation is terminated automatically by modulation monitoring or time monitoring, or manually by a terminating call.

Reg.	Function
363	1st digit: F = immediate, automatic connection

Direct Dialing with DTMF - Telephone => Radio

An incoming telephone call results in the automatic occupation of the line after N ringing signals and a signal tone is sent to the telephone. In EEPROM register 361, 0-7 digits are preset. The missing digits (coded with ‘F‘) are now added as DTMF-tones. The input of the call numbers is continued until all 7 digits are (pre)set or entered. E.g. if a 5-tone sequence is to be sent, digits 6 and 7 may not be programmed with ‘F‘. Else, additional (unused) DTMF digits have to be entered. After complete input of the call number, the call is initiated automatically or by the end button of the telephone (usually the ‘#‘-button). If not all digits have been entered, the telephone participant receives an error message (two short signal tones). If the function T11-55 is activated, the second signal tone is delayed until the channel is free. If the channel is occupied for more than 45 seconds, the connection establishment is canceled. Please consult also section T11-55. After transmission of the call a second signal tone is sent to the telephone and the connection is established. In case of wrong input, the delete button of the telephone (usually button ‘*‘) is able to delete the complete number and a new input can be made.
Within 15s after the transmission of the call the last call can be sent again. It is also possible to call several radio participants. Therefor, you can delete the last input with the delete button and start to enter the next number.

5s after the input of the last DTMF digit the input mode is terminated automatically. If no call was sent to a radio yet, the connection is terminated..
The conversation is terminated automatically by modulation monitoring or time monitoring, or manually by a terminating call.

Reg.	Function	
361	1st-7th	digit: preset digits for the tone sequence (direct dial tel=>radio)
361	8th	digit: initiation of call with end button y/n (1/0)
363	1st	digit: ID mode of the tone sequence (direct dial tel=>radio)
363	2nd	digit: coupling tone at a double tone sequence

Automatic Forwarding with DTMF - Telephone => Radio

The automatic forwarding is a special case of Direct Dialing with DTMF. here, all digits of the tone sequence are preset. an incoming phone call results in the automatic occupation of the line after N ringing signals. A signal tone is sent to the telephone and the programmed call is sent to the radio.
If the function T11-55 is activated, the second signal tone is delayed until the channel is free. If the channel is occupied for more than 45 seconds, the connection establishment is canceled. Please consult also section T11-55. After transmission of the call a second signal tone is sent to the telephone and the connection is established.
The conversation is terminated automatically by modulation monitoring or time monitoring, or manually by a terminating call.

Night Mode - Telephone => Radio

The night mode is an alternative possibility for connection establishment from telephone to the radio. Like in normal mode all 3 methods of connection establishment are possible (automatic connection, direct dialing with DTMF and automatic forwarding with DTMF). The only difference of the night mode is the used registers. Switching from normal to night mode is achieved by a tone sequence from the radio.

Reg.	**Function**
362	1st-7th digit: night mode: preset digits for tone sequence (direct dialing tel=>radio)
362	8th digit: night mode active y/n (1/0)
363	3rd digit: night mode: ID mode of the tone sequence (direct dialing tel=>radio)
363	4th digit: night mode: coupling tone at a double tone sequence

Radio => Telephone

Reg.	**Function**
320-339	tone sequence decoder and its configuration
360	1st digit: Initiating call and dial-up with DTMF radio to telephone y/n (1/0)
360	2nd digit: short dialing radio to telephone y/n (1/0)
360	3rd digit: on direct dial with tone sequence: radio to telephone y/n (1/0)
360	4th digit: on direct dial with DTMF: radio to telephone y/n (1/0)

Direct Dialing with DTMF - Radio => Telephone

For direct dialing with DTMF every desired telephone number can be chosen. The radio participant can initiate the direct dialing procedure (radio => telephone) by two types of initiating calls: Either by transmitting a tone sequence or by a sequence of DTMF-tones. The break in between 2 of the DTMF tones may not be more than 5s.
Both types of initiating calls can be used alternatively or together. If programmed as such, the ULE acknowledges the initiating call with a signal tone. After the initiating call the DTMF tones follow. They contain the telephone number.
The first DTMF tone has to be received after 15s the other tones after additional 5s each. All DTMF tones received from the radio are saved. Hence, fast incoming DTMF tones can also be processed. After complete input of the call number, the call is initiated automatically or by the end button of the telephone (usually the '#'-button). If the function T11-55 is activated, the second signal tone is delayed until the channel is free. If the channel is occupied for more than 45 seconds, the connection establishment is canceled. Please consult also section T11-55. Before starting to dial a signal tone (acknowledgement tone) is sent to the radio participant (see section signaling tone delay). The line is occupied and depending on the configuration the presence of the dial tone is verified (see section dialing tone recognition).

In the following the entered number is dialed automatically using the chosen dial-mode. After a wrong input the complete number is deleted with the delete button (usually the *-button) and a new input can be given. The conversation is terminated automatically by modulation monitoring or time monitoring, or manually by a terminating call.

Hint: The signal tone after recognition of the initiating call may not be activated, if the dialing is performed en-bloc. For en-bloc dialing the initiating call and the DTMF tones of the phone number are sent by the radio without a significant break.

Reg.	**Function**
357	4th digit: send acknowledgement tone after DTMF initiating call y/n (1/0)
358	1st digit: number of digits in the DTMF initiating call (0-7)
358	2nd-7th digit: code for initiating call by DTMF

Direct Dialing with Tone Sequence - Radio => Telephone

For direct dialing with tone sequence, telephone numbers with a specified length can be called. However, the number of digits is limited by the maximum length of a tone sequence (15 digits, minus preset digits, plus pre-selection digits). For the first digit a range of allowed numbers can be defined. The incoming tone sequence must exhibit the length that is programmed in the configuration register and must equal the tones in the decoder register. In addition, the first digit must be an element of the programmed range.
If the function T11-55 is activated, the second signal tone is delayed until the channel is free. If the channel is occupied for more than 45 seconds, the connection establishment is canceled. Please consult also section T11-55.

Before dialing starts, a signaling tone (acknowledgement tone) is sent to the radio participant (see section signaling tone delay). The line is occupied and if programmed the presence of the dialing tone is checked. Then the entered number is dialed automatically using the desired dial mode. The number to call consists of the prgrammed pre-selection digits followed by all numbers of the tone sequence. The conversation is terminated automatically by modulation monitoring or time monitoring, or manually by a terminating call.

Short Dialing - Radio => Telephone

The Major 4a TIM exhibits a short dial memory of 1000 storage locations (000-999) à 16 digits. For short dialing the tone sequence must be a 3-digit short dial number, so that the digits of the respective storage location is chosen. The short dial number can either be completely defined by the tone sequence or it can be composed from cariable digits in the tone sequence and invariable digits in the register. After recognition of the tone sequence the line is occupied and (if programmed) the presence of the dialing tone is checked (see section dialing tone recognition). Subsequently, a signaling tone is sent to the radio participant (see section signaling tone delay) and the respective number from the short dial memory is called automatically using the selected dial mode.
The conversation is terminated automatically by modulation monitoring or time monitoring, or manually by a terminating call.

Short Dial Memory

The short dial memory contains 1000 storage locations with a maximum of 16 digits each. It can be read and programmed using the keypad or via the RS232 interface.

Programming with the Keypad
For programming the short dial memory the Major must be in telephone mode, which is activated using button F4. Possibly, an appearing telephone number has to be deleted by long pressing of button #.

Display Location of the Short Dial Memory
The memory location is entered with 1-3 digits (e.g. 023) followed by a short press of button Z. The content of the memory location is displayed in the following way: e.g. 023:08154711.

Browse Locations of the Short Dial Memory
Firstly, again a memory location is chosen to be displayed (see above). Now, short pressing of the Z-button displays the next memory location and so on.

Program a Location of the Short Dial Memory
In telephone mode the phone number is entered directly followed by a long press of the Z-button. The display now shows the current memory location and, separated by a colon, then phone number, e.g. 023:08154711. Now the current memory location can be overwritten, e.g. from 023 to 123. By a long press of the Z-button the number is saved at the chosen memory location.

Programming via RS232 Interface
Reading out memory locations can be performed one-by-one or block-wise. Additionally, the output can be configured to be plain text or a list for editing and loading back to the Major. Using a terminal program the output of the TIM can be saved as a text file and edited later on. When sending back the short dial list, after each line the terminal program has to wait for 10 ms before sending the next one. The short dial memory can contain all characters for formatting the number. However, only the numbers 0-9 and P for a break of 1s (plus DTMF-tones A-F if DTMF is chosen) are used. The rest is ignored.

Short dial memory functions:

WRxxx-yyy	display short dial memory xxx (-yyy) (as plain text)
WLxxx-yyy	display short dial memory xxx (-yyy) anzeigen (as a list for editing and sending back)
WPxxx:yy...y	program memory location xxx with yy...y (16 digits max.)
WCxxx-yyy	delete short dial memory xxx-yyy

Conversation Monitoring

Maximum Duration of a Conversation
All connections are terminated after a duration of N seconds at the latest, if they have not been terminated earlier. When only 30 seconds of conversation time are left, a warning tone is sent to the telephone participant. The maximum time of a conversation can be adjusted from 1 to 9999 seconds or deactivated when a ‘0‘ is programmed. Ex factory it is set to 5 minutes (300 s).

Reg.	**Function**
365	1st - 4th digit: maximum conversation time: nnnn * 1s

Maximum Transmission Time (Simplex)
If the maximum transmission time is reached, e.g. due to heavy noise in the telephone line, the phone call is terminated automatically. The maximum transmission time can be adjusted from 1 to 990s or deactivated with ‘0‘. Ex factory it is set to 45s.

Reg.	Function
366	1st - 3rd digit: maximum transmission time (Simplex) nnn * 1s

Maximum Receiving Time (Simplex)
If the maximum receiving time is reached, e.g. due to a permanently detected carrier, the phone call is terminated automatically.
The maximum receiving time can be adjusted from 1 to 990s or deactivated with ‘0‘. Ex factory it is set to 45s.

Reg.	Function
367	1st - 3rd digit: maximum receiving time (Simplex) nnn * 1s

Modulation Monitoring
The connection is terminated after N seconds without modulation (talking) and the line is set free again. The maximum conversation time without modulation can be adjusted from 1 to 99s or deactivated with ‘0‘. Ex factory it is set to 10 s.

Reg.	Function
365	5th - 6th digit: maximum conversation time without modulation: nn * 1s

Canceling of the Connection by a Terminating Call
The radio participant can terminate an existing telephone connection by two different types of terminating calls:
Either by sending a tone sequence that is configured as terminating call in one of the telephone decoders T1-T10, or by sending a sequence of a maximum of 7 DTMF-tones, that are programmed as terminating call. Here, the break between 2 DTMF-tones may not be longer than 5 seconds
Both types of terminating calls can also be used together if desired.

Reg.	Function
320-339	tone sequence decoder and corresponding configuration
359	1st digit: number of digits of the terminating call(0-7)
359	2nd - 7th digit: code for DTMF terminating call

Signaling Tone Delay
In either way to establish a connection (radio => telephone) a signaling tone (acknowledgement tone) is sent to the radio. If the radio participant is not ready to receive directly after the transmission of the tone sequence (or DTMF) that initiated the connection, the signaling tone might not be received. Thus, a signaling tone delay (n*100ms) can be programmed.

Reg.	Function
369	2nd digit: signaling tone delay to the radio: n * 100ms

Mode of Operation

Major 4a with TIM supports 3 different modes of operation for transmitter control: **simplex (vox)**, **simplex (carrier)** and **duplex**.
In **simplex (vox)** mode the voice from the telephone and the radio is analyzed. If transmission is active in one way, it remains activated as long as a voice is present. Only after a certain time without voice, transmission in the other way can be activated. Levels and delay times for vox are preset, but they can also be adjusted in the TIM.
In **simplex (carrier)** mode the carrier input of the radio is analyzed, not the voice. For telephone still the voice is analyzed. The rest of the procedure remains unchanged compared to simlpex (vox). In simplex mode a maximum time for non-stop transmission or reception can be defined. Exceeding the time leads to the breakup of the conversation.
In **duplex** mode the transmitter is keyed permanently until the end of the connection. In both simplex modes the transmitter is keyed via voice control from the telephone. For detecting the voice and keying the transmitter a certain time is necessary. As a consequence, part of the first word is lost. In order to prevent this, the ULE can delay the voice transmission from the telephone to the radio. If a longer delay time is needed, the voice can also be compressed during the delay. There are two different ways of compression: A-Law cuts in half the resolution from 16 to 8 bit. Furthermore the baud rate can also be cut in half from 28.8 to 14.4 kHz. For particularly long delays, it is also possible to combine both types of compression. Ex factory, the mode of operation is “simplex (vox)“ without a delay time.

Reg.		Function
366	1st - 3rd digit:	max. transmission time in simplex mode: nnn * 1s
366	5th digit:	mode of operation 0=simplex (vox), 1=duplex, 2=simplex (carrier)
367	1st - 3rd digit:	max. reception time in simplex mode nnn * 1s
417	1st - 3rd digit:	voice delay telephone => radio nnn * 1ms
417	4th digit:	compression: 0 = none (delay time: max. 55ms) 1 = A-law (delay time: max. 110ms) 2 = half the baud rate (delay time: max. 110ms) 3 = A-law and half the baud rate (delay time: max. 220ms)

Voice Message

If the TIM is additionally equipped with the option VMM, the voice messages necessary for connections to the public telephone network can be transmitted to the telephone participant.

Recording Voice Messages
Recording is controlled via the RS232 interface and can be done from the radio or the telephone. In the terminal the monitor command including the number of the text and the recording source is entered. If recording of the voice message is performed from the telephone, the telephone connection must be established beforehand. The recording is then started and stopped at the terminal using the space bar.
In theory, a maximum of 240 voice messages can be stored. The total storage capacity is limited to 4 minutes (240s). However, the ULE uses only messages 1 and 2. Ex factory, the following texts are recorded:

Text 1 (establishing connection: telephone => radio):
„Bitte warten - der gewünschte Teilnehmer wurde über das öffentliche Funknetz gerufen !“

Text 2 (establishing connection: radio => telephone):
„Sie sind jetzt über das öffentliche Funknetz mit dem Teilnehmer verbunden !“

Both texts can be given to the telephone participant as voice messages during the connection establishment.

Reg.	Function
369	3rd digit: voice message (text 1) at dial-up telephone => radio
369	4th digit: voice message (text 2) at dial-up radio => telephone

for both digits:
0 = no voice message,
1 = no AF from radio can be heard during the voice message
2 = AF from radio can be heard during the voice message

Configuration Examples

I. 5-Tone Sequences with Car Numbers and Telephone Numbers (from Short Dial Memory)

- calling a car: 12100-12149, 2-digit input
- dialing a phone number: 12150-12199, short dial register: 050-099
- register 320 = 121FFFFF: decodes all tone sequences beginning with 121
- register 330 = 52045000: 1st digit: decoding 5-tone sequence
  - 2nd digit: short dial
  - 3rd digit: the hundreds of the short dial number are invariable (coded in digit 6)
  - 4th digit: the tens of the short dial number are found in digit 4 of the tone sequence
  - 5th digit: the units of the short dial number are found in digit 5 of the tone sequence
  - 6th digit: fixed value of the hundres in the short dial number = 0
  - 7th+8th digit: not in use, two digits of the short dial emanate from the tone sequence
- short dial memory 000-049: must be empty (numbers for the cars)
- short dial memory 050-099: contains the phone numbers

2. 8-Tone Sequences for Telephone Numbers and 3-Digit Selection from Short Dial Memory

- phone numbers: 12345000-12345999, short dial registers: 000-999
- register 320 = 12345FFF: decodes all tone sequences, starting with 12345
- register 330 = 82678000: 1st digit: decoding 8-tone sequence
  - 2nd digit: short dial
  - 3rd digit: the hundreds of the short dial number are found in digit 6 of the tone sequence
  - 4th digit: the tens of the short dial number are found in digit 7 of the tone sequence
  - 5th digit: the units of the short dial number are found in digit 5 of the tone sequence
  - 6th-8th digit: digit: not in use, all digits of the short dial emanate from the tone sequence
- short dial memory 000-999: contains the phone numbers

3. 5-Tone Sequences with Car Numbers and Telephone Numbers (Direct Dial with Tone Sequences abd DTMF)

- calling a car: 12100-12109 and 12130-12198, 2-digit input
- phone numbers: 12110-12129, extension line: 510-529
- dialing any phone number with 12199 followed by DTMF call
- register 320 = 12199FFF: decodes all tone sequences starting with 12199
- register 330 = 51010000: 1st digit: decoding 5-tone sequence
  - 2nd digit: initiating call
  - 3rd digit: no terminating call with 12199
  - 4th digit: send acknowledgement tone to the radio
- register 321 = 121FFFFF: decodes all tone sequences beginning with 121
- register 331 = 53412150: 1st digit: decoding 5-tone sequence
  - 2nd digit: direct dial
  - 3rd digit: 4th digit of the tone sequence is the 1st variable digit
  - 4th digit: the 1st variable digit must be 1 or higher
  - 5th digit: the 1st variable digit must be 2 or lower
  - 6th digit: one pre-selection digit
  - 7th digit: pre-selection digit = 5
  - 8th digit: not in use (only one pre-selection digit is used)

Remark: As decoding stops after a decoder was able to decode the tone sequence, the initiating call has to be programmed before the direct dial. If the direct dial was programmed first, the initiating call would be decoded as a direct dial. It would however be rejected in the second step because the constraint for the 1st variable digit is not fulfilled. Still, due to the successful decoding in the first place, a comparison to the inferior decoders 2-10 would not be performed any more.

Dial Tone Recognition

The recognition of dial tones is of special importance for automatically establishing connections. In the following, the different dial tones that are recognized by the ULE and their purposes are described.

Dial Tone Recognition before Dialing

"Dial Tone Recognition before Dialing“ causes the dialing to start only after the recognition of the dial tone. Here, after a waiting time of 18 seconds the dial-up is aborted. For operation at extension lines this function has to be disabled. In this case, depending on the dialing mode (DTMF or pulse dialing) dialing starts automatically 3-4 seconds after occupying the telephone line. Ex factory, dial tone recognition is not activated. „Dial Tone Recognition before Dialing“ is only active, if no prefix number is programmed (in order to get an outside line).

Dial Tone Recognition after Prefix (for outside line access)

If a prefix for outside line access is necessary for an automatic dial-up, the prefix number (0-9) has to be composed before the telephone number in all cases (for direct dial as well as for short dial). If “Dial Tone Recognition after Prefix“ is active, the prefix number is composed and dialing of the desired number begins only after the dial tone is recognized.
Ex factory, dial tone recognition is not activated.

Reg.	Function
367	4th digit: dial tone recognition on/off (1/0)
369	1st digit: prefix number for outside line access (0-9, F = no prefix)

Busy Signal Recognition
If a busy signal is detected, an existing radio => telephone connection is always terminated. Hence, the conversation is aborted when the telephone participant hangs up. Otherwise, in simplex mode the busy signal would result in PTT keying until time-out occurs. In the section „Dial Tone Configuration“ several busy signals are noted that are already programmed ex factory. The programming of custom busy signal types is possible.

Recognition of the Call Connected Signal
After a phone number is called automatically and if the respective line to the telephone participant is not occupied, the call connected signal is transmitted to the radio. If the telephone participant does not accept the call, the transmitter is keyed almost all the time by the call connected signal, making the transmission of a terminating call almost impossible. Hence, a certain time can be defined, in which the telephone participant has to accept the call. After this time the connection is aborted. It can be set from 1 to 999 seconds or deactivated (‘0‘). Ex factory, it is set to 45s.

Reg.	**Function**
368	1st - 3rd digit: maximum duration of the call connected signal nnn * 1s

Dial Tone Configuration
The EEPROM contains a configuration table for the dial tone recognition. This table defines, which combinations of tone and break lengths are recognized as call connected signals or as busy signals.
This table is programmed with two possible call connected signals and four busy signals. In rare cases, these settings are not sufficient and some signals have to be reprogrammed in or added to the dial tone configuration table. The table can contain a maximum of 19 entries (registers), each one defining a repetitive sequence of tones and breaks. By combining several registers more complex dial tones can be decoded that consist of a combination of tones and breaks exhibiting different lengths. This way, it can also be programmed to recognize dial tones after they were decoded several times consecutively.
If new dial tones are to be programmed, the exact durations of the new dial tones have to be known. In order to simplify measuring the durations, the Major can plot the current durations via the RS232 interface.

Ex factory, the following dial tones are programmed:

call connected signal:	- 1s tone / 4s break
	- 1s tone / 5s break
busy sign:	- 400ms tone / 400ms break / 400ms tone / 400ms break
	- 500ms tone / 500ms break / 500ms tone / 500ms break
	- 240ms tone / 240ms break / 240ms tone / 240ms break
	- 160ms tone / 480ms break / 160ms tone / 480ms break

Reg.	**Function**	
380	1st digit:	tolerance for dial tone decoding: n * 3,125%
380	2nd - 4th digit:	tone duration for decoding of a permanent tone: nnn * 10ms
380	5th - 7th digit:	break duration necessary for decoding: nnn * 10ms
380	8th digit:	display decoded tone durations y/n (2/0)
381 - 399:	1st digit:	type of dial tone: 0 = continuation of previous register (decoding of a combination) 1 = call connected signal 2 = busy signal, F = free
	2nd - 4th digit:	tone duration: nnn * 10ms
	5th - 7th digit:	break duration:nnn * 10ms

As a coding example the dial tones, which are set ex factory are described:

register	content	type	tone length	break length
381	11004000	call connected	1s	4s
382	11005000	call connected	1s	5s
383	20400400	busy	400ms	400ms
384	00400400	continuation	400ms	400ms
385	20500500	busy	500ms	500ms
386	00500500	continuation	500ms	500ms
387	20240240	busy	240ms	240ms
388	00240240	continuation	240ms	240ms
389	20160480	busy	160ms	480ms
390	00160480	continuation	160ms	480ms
391-399	FFFFFFFF	empty registers		

T11-55

By using T11-55, the establishing of new conversations on an already occupied radio channel is prevented. Therefor, an additional receiver is necessary in duplex or semi-duplex mode that monitors the transmission channel. The carrier recognition on the respective channel must be read-out by an input. In simplex mode, the common squelch input can be used. In duplex mode however, a different input has to be used, if the common squelch input is already in use (see section Sockets Pinout). If T11-55 is activated, the ULE delays the start of the conversation as long as the channel is occupied. After a maximum delay of 45s the conversation is terminated. This function can be activated separately for all types auf connection establishment.

Reg.	Function
360	1st digit: T11-55 for radio => tel: initiating call + dialing with DTMF y/n (1/0)
360	2nd digit: T11-55 for radio => tel: short dial y/n (1/0)
360	3rd digit: T11-55 for radio => tel: direct dial with tone sequence y/n (1/0)
360	4th digit: T11-55 for tel => radio: direct dial with DTMF y/n (1/0)

Table of Registers Major 4a/5a

Reg. Function

000 short call 0
001 short call 1
002 short call 2
003 short call 3
004 short call 4
005 short call 5
006 short call 6
007 short call 7
008 short call 8
009 short call 9
000 - 009:
1st-7thdigit: short call x
8thdigit: type of call (see register 010),
F= type, that is programmed with the button

010 encoder
1st-7thdigit: invariable encoder digits
code digits not in use as '0'
F = variable digit (keypad input)
e.g.: 5-tone sequence with 2 variable digits (10100-10199): 101FF00
8thdigit: type, F= type, that is programmed with the button
tone call mode:
0: 5-tone sequence
1: double sequence: call => ID-code (3-7 tone sequence)
2: double sequence ID-code => call (3-7 tone sequence)
3: 6-tone sequence
4: 7-tone sequence
5: 8-tone sequence
6: free
7: free
8: 4-tone sequence
9: 3-7 tone sequence
FFSK mode:
0: only call
1: double sequence: call => ID-code
The number of tones of the 3-7 tone sequences are programmed in register 081, digit 6.

011 general configuration
1st digit: language
0 = German
1 = English
2 = French
3 = Dutch
4 = Italian
5 = Czech
4th digit: RS232 monitor is on/off (1/0) at power-on
5th digit: pressing *+# (or F1+F4) is necessary for n*1s to enter programming mode
0 = immediately
F = disabled

014 Intercom tone sequence
015 own ID-code for ID transmission
016 key tones for ID decoding
017 standard acknowledgement
018 muting register
1st+2nddigit:(nn) muting of a tone sequence
nnxxx; EE = disabled

019 key tones for printer output

020 decoder 1
021 decoder 2
022 decoder 3
023 decoder 4
024 decoder 5
025 decoder 6
026 decoder 7
027 decoder 8
028 decoder 9
029 decoder 10
020-029:
1st-7thdigit: decoder, program unused digits with an F
8thdigit: 0 = decoder off
1 = decoder on

030 configuration 1 for decoder 1
031 configuration 1 für decoder 2
032 configuration 1 für decoder 3
033 configuration 1 für decoder 4
034 configuration 1 für decoder 5
035 configuration 1 für decoder 6
036 configuration 1 für decoder 7
037 configuration 1 für decoder 8
038 configuration 1 für decoder 9
039 configuration 1 für decoder 10
030-039:
1stdigit: alarm tone type
2nddigit: alarm tone duration n*200ms
3rddigit: alarm tone volume (0-9, A..F=Offset +0...5)
4thdigit: call volume duration n*200ms
5thdigit: call volume

040 configuration 2 für decoder 1
041 configuration 2 für decoder 2
042 configuration 2 für decoder 3

Reg. Function

043 configuration 2 für decoder 4
044 configuration 2 für decoder 5
045 configuration 2 für decoder 6
046 configuration 2 für decoder 7
047 configuration 2 für decoder 8
048 configuration 2 für decoder 9
049 configuration 2 für decoder 10
040-049:
1st digit: type of call
0 = 5-tone sequence
1 = call => ID-code (2* x-tone sequence) (3-7 tones))
2 = ID-code => call (2* x-tone sequence (3-7 tones))
3 = 6-tone sequences
4 = 7-tone sequences
5 = 8-tone sequences
6 = x-tone sequence without ID-code (3-7 tones)
7 = 5-tone sequence without ID-code
8 = 4-tone sequence
9 = x-tone sequence (3-7 tones)
A = emergency call: 5-tone sequences
B = emergency call: 5-tone seq. ZVEI
C = emergency call: 6-tone seq. NL
D = emergency call: 2x5-tone seq.
The number of tones of the 3-7 tone sequences is programmed in register 081, digit 6.

2nd digit: switching output:
number: 0 (none), 1-7
3rd digit: switching output:
0(off) F(on)
for a variable time: 1-D (0-13)s
4th digit: acknowledgement:
0 = no acknowledgement
1 = acknowledgement
2 = single tone
3 = own ID-code
4 = received ID-code
5 = additional 5-tone sequence on de-coding FSK
5th digit: Lautsprecher/LED:
0=nichts
1=LS an
2=LED blinkt
3=LS an + LED blinkt
6th digit: emergency flag for x-tone calls (ID: 1,2,9)
0 = ordinary call - no emergency call
1-7 = emergency call: display last 1-7 digits

Reg. Function

050 loudspeaker (LS) configuration
1st-3rd digit: LS timer: nnn * 1s
(000=no timer, FFF=open mode)
4th digit: M4a: LS status on taking earphone
0 = off
1 = on
2 = unchanged
5th digit: M4a: LS status on hanging up:
0 = off
1 = on
2 = unchanged
3 = off + scanner: on
5th digit: M5a: LS status at power-on:
0 = off
1 = on

051 general configuration
1st-3rd digit: transmission time limit
nnn * 1s.
4th digit: 0 = 4-wire simplex
1 = 4-wire duplex
2 = 2-wire simplex
3 = 2-wire duplex
5th digit:
0 = LS is off after call tone sequence is not heard
1 = LS is on after call tone sequence is not heard
2 = LS is off after call tone sequence is heard
3 = LS is on after call tone sequence is heard

052 display lighting
1st-3rd digit: lighting is active for nnn *1s
000 = lighting disabled
001 = lighting is always on

053 PTT buttons are blocked, if:
1st digit:
0 = never
1 = carrier is present
2 = muted externally
3 = muted externally or carrier is present
054 status configuration (only FMS/FFSK)
1st digit: status
0 = none
1 = 1-digit
2 = 2-digit
2nd+3rd digit: status at power-on
4th digit: FMS: display time for virtual status 5 (n*1s)
5th digit: FMS: display time for virtual status 9 (n*1s)

Reg.	Function
055	general configuration 1st+2nddigit: TX pre-running time nn * 10ms 3rddigit: key beep 0 = off 1 = on 4thdigit: FFSK ID-code at the start of PTT y/n (1/0) 5thdigit: FFSK ID-code at the end of PTT y/n (1/0)
056	general configuration 1st digit: squelch mode 0= active low 1= active high 2= NF squelch 3= active high and low 4-7= audio squelch + configuration for SQL-input (reg.126/127) 2nddigit: number of plain text digits for call input (0=none) 3rd+4thdigit: NF squelch follow-up time nn * 10ms 5thdigit: NF squelch detection: 0 = only if own TX is off (simplex mode) 1 = always on
057	printer parameters 1 1st digit: print header y/n (1/0) 2nd+3rddigit: number of lines (nn) per page (without header)
058	printer parameters 2 1st digit: print transmitted call y/n (1/0) 2nddigit: print received call y/n (1/0) 3rddigit: print received emergency call y/n (1/0)
059	RS232 parameters 1st digit: BIT0-3: plot LINE, CH, TX, SQL y = 1, n = 0 2nddigit: BIT0-3: plot Key, HOOK, FSK/FMS y = 1, n = 0 3rddigit: BIT0-3: plot tone sequence, emer gency call, inband tone, special tone, y = 1, n = 0
063	channel remote control 1st-3rddigit: fixed digits of the remote control tone sequence (BCD)
064	channel register 1st digit: save channel, y = 1, n = 0 2nd+3rddigit: current channel (00-99)
065	channel range from which to choose 1st+2nddigit: lowest channel number nn 3rd+4thdigit: highest channel number nn
066	configuration for channel control 1st digit: 0 = no channel selection 1 =1-digit channel selection 2 = 2-digit channel selection 5 = 1-digit channel selection, permanently displayed 6 = 2-digit channel selection, permanently displayed 2nddigit: 0 = channel output TRC 1 = channel output decimal 2 = channel output binary-1 3 = channel output binary 4 = channel output 2xBCD 5 = CHr emote control with pilot-tone 6 = CH remote control without pilot-tone 7 = CH remote control without pilot-tone, without TX 3rddigit: 0 = common channel output 1 = inverted channel output 4thdigit: number of channel bits (1-7) 5thdigit: 0 = expects common channel acknowledgement (BCDxy) 1 = expects channel acknowledgement of Major6 (CBDxy)
067	scanner configuration 1st+2nddigit: start scan at channel nn (EE = as in registers 070-074) 3rd+4thdigit: stop scan at channel nn 5thdigit: dwell time (n*20ms per channel (0 = scanner disabled)
068	scanner configuration 2 1st digit: stop scanner at carrier y = 1, n = 0 2nd+3rddigit: nn * 100ms scanner waiting time (at carrier) for decoding

Reg. Function

069 pilot-tone
1st digit:
0= programmed pilot-tone frequency
1= TRC
with programmed pilot-tone frequency
2= DC without pilot-tone
2nd-5thdigit: pilot-tone frequency (nnnn Hz)
6.Stelle: DC: time decoders are blocked after encoding was active (n*20ms)

pilot-tone 0000 = off
TRC 0000 = 2100Hz

070 EESCAN channels 1+2
071 EESCAN channels 3+4
072 EESCAN channels 5+6
073 EESCAN channels 7+8
074 EESCAN channels 9+10
070-074:
1st+2nddigit: channel 1/3/5/7/9
3rd+4thdigit: channel 2/4/6/8/10
The first unused channel has to be programmed with 'FF'.

075 FT634aC alarm decoder configuration
1st+4thdigit: alarm tone sequence digits 1-4
5thdigit: PTT at acknowledgement/request:
5 = with pilot-tone
6 = without pilot-tone
7 = without pilot-tone, without TX

076 FT634aC alarm decoder configuration 1
1stdigit: alarm tone type
2nddigit: duration of alarm tone (n*200ms)
3rddigit: alarm tone volume

077 FT634aC alarm decoder configuration 2
1stdigit: request at power-on
j = 1, n = 0
2nddigit: number of switching output:
0 (none), 1-7
3rddigit: switching output:
0 = off F = on
time 1-D(13) seconds
4thdigit: acknowledgement
0=no acknowledgement
1=acknowledgement
5thdigit: display time
1-F = 1-15s
0 = with acknowledgement (#-button)

Reg. Function

078 configuration emergency call ZVEI
1stdigit: number of tone bursts to decode
2nd+3rd: minimum burst length (nn*5ms)
4th+5th: maximum burst length (nn*5ms)
079 configuration 6th tone emergency call NL
1st-3rddigit: maximum tone length of the 6th tone emergency call NL (nnn*5ms)
4th+5th: minimum tone length of the 6th tone emergency call NL (nn*5ms)

080 reference values for tone sequences
1st-3rddigit: maximum tone length
1st tone (nnn*5ms)
4th+5th: minimum tone length of all tones (nn*5ms)

081 reference values for tone sequences 2
1st-3rddigit: maximum tone length of other tones (nnn*5ms)
4thdigit: time decoders are blocked after transmission of tone sequence (n*100ms)
5thdigit: tone table for encoder/decoder
0=ZVEI
1=CCIR
2=ZVEI2
3=EEA
4=ZVEI3
6thdigit = number of tones for ID-mode
1,2,9 (RK,KR,R, register 010, 3-7-tone sequence)

082 encoder configuration
1st+2nddigit: tone length 1st tone (nn*10ms)
3rddigit: tone length of other tones(n*10ms)
4th+5th: break time between call and ID-code (nn*10ms)
6thdigit: transmit call automatically (y/n,1/0)

083 configuration of radio mute
1stdigit: radio mute-output
0=off
1-7, 8=TX
2nddigit: logic of radio mute
1=RX
2=TX
3=RX+TX
1-3=active low at mute
5=RX
6=TX
7=RX+TX
5-7=active low if no mute
3rddigit: follow-up time (n*1s)
4thdigit: output for HOOK-contact
(0=none, 1-7)

Reg. Function

084 configuration 1 for group call decoder
1st digit: group call tone
F = disables group call decoder
2nd digit: switching output
0 = none 1-7
Bit3=1 (8-F): special call tones instead of group call tone (call 1/2)
3rd digit: switching output:
0 = off
F = on,
activate for 1-D(13) seconds
4th digit: acknowledgement
0=none
1=acknowledgement
2=single tone
3=own ID-code
4=received ID-code
5th digit: loudspeaker/LED:
0=no action
1=activate loudspeaker
2=LED flashes
3=activate LS + LED flashes

085 configuration 1 for group call decoder
1st digit: alarm tone type
2nd digit: alarm tone duration n*200ms
3rd digit: alarm tone volume
4th digit: call volume duration
5th digit: call volume

086 configuration of ID-code memory
1st digit: update, y/n (1/0)
2nd digit: FIFO, y/n (1/0)
3rd digit: display immediately, y/n (1/0)
4th digit: display single FFSK-IDs, y/n (1/0)
5th digit: display timestamp in empty ID-code line, y/n (1/0)

087 configuration 'roger'-beep
1st-4th digit: nnnn*1Hz 'roger'-beep frequency
5th-6th digit: nn*10ms 'roger'-beep duration
7th digit: 'roger'-beep at PTT start, y/n (1/0)
8th digit: 'roger'-beep at PTT end, y/n (1/0)

090 configuration FFSK (ZVEI)
1st-3rd digit: threshold number FFSK - tone sequence
4th digit: if call < threshold number FFSK = 1 tone sequence = 0
5th digit: hash key identification (all values are valid)

Reg. Function

091 configuration 2 FFSK (ZVEI)
1st digit: FFSK - emergency call activated
0= no
1= with CMO ('F')
2= mit CMO ('F') and reg. 094
2nd digit: CMO RX
5th digit: FFSK-suppression, y/n (1/0)

092 configuration 1 for FFSK emergency call (as in reg. 03x)
093 configuration 2 for FFSK emergency call (as in reg. 04x)
094 decoder for FFSK emergency call
1st-5th digit: decoder for producer number and car number, (F=variable, => display)

095 configuration I/O 1-5 (digits 1-5)
096 configuration I/O 6-7,TX (digits 1-3)
095-096:
0: none
1: output
2: input, active low
4: input, active high
8: output, outside switching
9: output, inverted

097 service password (master password)
099 customer password

100 volume
1st digit: save last volume y/n (1/0)
2nd digit: volume at power-on

101 listening to sent tone sequences
1st-3rd digit: input level for the listening to sent tone sequences

102 configuration for external calls (started by I/O-pin)
1st-4th digit: repete external calls after nnnn*1s
103 short call A
104 short call B
105 short call C
106 short call D
107 short call E

Reg.	Function

In registers 108 to 129 the functions of the inputs are programmed. Every input has two functions: one upon activation (passive => active) and one upon deactivation (active => passive).

108	function PTT2 passive > active
109	function PTT2 active > passive
110	function IN1 passive > active
111	function IN1 active > passive
112	function IN2 passive > active
113	function IN2 active > passive
114	function IN3 passive > active
115	function IN3 active > passive
116	function IN4 passive > active
117	function IN4 active > passive
118	function IN5 passive > active
119	function IN5 active > passive
120	function IN6 passive > active
121	function IN6 active > passive
122	function IN7 passive > active
123	function IN7 active > passive
124	function TX passive > active
125	function TX active > passive
126	function RX (SQL) passive > active
127	function RX (SQL) active > passive
128	function DC passive > active
129	function DC active > passive

In registers 130 to 179 the functions of the buttons are programmed. Every button has two functions, too: one for short pressing of the button and one for long pressing.

130	function 0 -button short
131	function 0 -button long
132	function 1 -button short
133	function 1 -button long
134	function 2 -button short
135	function 2 -button long
136	function 3 -button short
137	function 3 -button long
138	function 4 -button short
139	function 4 -button long
140	function 5 -button short
141	function 5 -button long
142	function 6 -button short
143	function 6 -button long
144	function 7 -button short
145	function 7 -button long
146	function 8 -button short
147	function 8 -button long
148	function 9 -button short
149	function 9 -button long

Reg.	Function

150	function S1-button short
151	function S1-button long
152	function S2-button short
153	function S2-button long
154	function S3-button short
155	function S3-button long
156	function S4-button short
157	function S4-button long
158	function * -button short
159	function * -button long
160	function # -button short
161	function # -button long
162	function F1-button short
163	function F1-button long
164	function F2-button short
165	function F2-button long
166	function F3-button short
167	function F3-button long
168	function F4-button short
169	function F4-button long
170	function PTT-button short
171	function PTT-button long
172	function RUF-button short
173	function RUF-button long
174	function Z-button short
175	function Z-button long
176	function LS-button short
177	function LS-button long
178	function VOL-button short(only Major 5a)
179	function VOL-button long(only Major 5a)

In registers 180 to 184 the meaning of the LEDs in the F-buttons is programmed.

Programmable Functions

180 function LED in F1
181 function LED in F2
182 function LED in F3
183 function LED in F4
180-183:
1st digit: function
0: no function
1: display switching output status
2: display channel
3: display telephone mode
4: display decoder status

if 1st digit = 1: display status of switching output
2nd digit: 1-7: number of the switching output (1-7)
3rd digit:
0: display, if active low (normal)
1: display, if active high (inverted)

if 1st digit = 2: display channel
2nd+3rd digit: 00-99 (channel 00-99)

if 1st digit = 3: display telephone mode
LED is on, if telephone mode is active
LED flashes slowly upon call

if 1st digit = 4: display decoder status
2nd digit: 1-A: decoder 1-10 (register 020-029)
3rd digit:
0: LED is on, if decoder is off
1: LED is on, if decoder is active

189 headset configuration
1st-3rd digit: threshold voltage (analog-digital converter for headset detection
nnn (000-999) * 5mV,
headset is present if voltage is lower

190 telephone configuration
1st digit: ringtone at phone call (0=none, B=standard)

191 automatic termination of the telephone mode
1st-6th digit: function when timer is elapsed
7th+8th digit: nn*1s timer for telephone mode without manipulation

Programmable functions for buttons and inputs: The first digit of the respective register contains one of the following functions. The additional digits define the function in detail.

1st digit: function
0: no function
1: transmit single tone
2: transmit call
3: PTT
4: volume
5: channel selection / switching output
6: ID-code memory
7: calling tone input
8: status input
9: ext. inputs
B: mode functions

Function 1 (transmit single tone):

1st digit: 1: transmit single tone
2nd digit: 0: transmit as long as button is pushed
1-F: tone length n * 100ms
3rd digit: 0-F: tone frequency (n*500Hz)
4th digit: 0-F: tone frequency (n*50Hz)
5th digit: 0-F: tone frequency (n*5Hz)

Function 2 (transmit call):

1st digit: 2: transmit call
2nd digit: 0: transmit incoming call
1: transmit callback
2: transmit short call
3: transmit intercom
4: transmit external short call
5: transmit channel remote call
6: transmit alarm request

1st digit: 2: transmit call
2nd digit: 2: transmit short call
3rd digit: 0-9: transmit short call n
F: manual input of short call number

1st digit: 2: transmit call
2nd digit: 3: transmit intercom
3rd digit: 0: intercom off
1: intercom on
E: toggle intercom (on/off)
F: input of intercom status
4th digit: transmit intercom call y/n (1/0)

1st digit: 2: transmit call
2nd digit: 4: transmit external short call
3rd digit: 0-E: transmit short call n

1st digit: 2: transmit call
2nd digit: 5: transmit channel remote call
3rd digit: 0: transmit channel remote call
1: transmit channel request

4th digit: (not valid for intercom, channel remote and alarm request)
tone call mode:
0: 5-tone sequence
1: double sequence call => ID-code (3-7 tone sequence)
2: double sequence ID-code => call (3-7 tone sequence)
3: 6-tone sequence
4: 7-tone sequence
5: 8-tone sequence
6: pager call (OPTION)
7: free
8: 4-tone sequence
9: X-tone sequence (3-7)
FFSK mode:
0: only call
1: double sequence call => ID-code
The number of tones in the 3-7 tone sequences is programmed in register 081, register 6.
The 4th digit can be overwritten by the ID-mode in the short call or encoder registers.

5th digit: tone call mode (not valid for intercom, channel remote and alarm request)

0-E: coupling tone for 2x5-tone sequence
F : break for 2x5-tone sequence
FFSK mode: 0-F: CMO

Function 3 (PTT):

1st digit: 3: PTT
2nd digit: 0-3: button starts PTT (ends when button is released)
4-7: input starts PTT (ends with function PTT off)
0,4: gooseneck mic.
1,5: headset mic.
2,6: handset mic.
3,7: gooseneck- or headset mic.
8: switching of GN / HS mic.
F: PTT off (if started with input)

1st digit: 3: PTT
2nd digit: 0-7: starts PTT
3rd digit: 0: no ID-code at PTT start
4: transmit short call (5th digit)
4th digit: 0: no ID code at PTT end
4: transmit short call (5th digit)
5th digit: 0-E: short call number

1st digit: 3: PTT
2nd digit: 8: switching of GN / HS mic.
3rd digit: 0: GN microphone is on
1: HS microphone is on
2: automatic HS detection (Standard after power-on)
E: toggle GN/HS
F: input
4th digit: 0: no text display
1: n*100ms text display

Function 4 (volume):

1st digit: 4: volume
2nd digit: 0: toggle loudspeaker (on/off)
1: volume
2: toggle loudspeaker (on/off) in telephone mode

1st digit: 4: volume
2nd digit: 0: toggle loudspeaker (on/off)
3rd digit: 0: scanner remains deactivated
1: scanner on, if LS is off

1st digit: 4: volume
2nd digit: 1: volume
3rd digit: 0-9: volume
A: increase by 1 step
B: decrease by 1 step
F: input
4th digit: 0-9: minimum volume 0-9
5th digit: 0-9: maximum volume 0-9

1st digit: 4: volume
2nd digit: 2: toggle loudspeaker (on/off) in telephone mode
3rd digit: 0: do not hang up at LS on=>off
1: hang up at LS on=>off and hung up earphone

Function 5 (channel selection / switching outputs):

1st digit: 5: channel selection
2nd+3rd digit: 00-99: channel nn
FE: working channel
FF: input

1st digit: 5: switching outputs
2nd digit: E: set status of switching output
3rd digit: 1-7:number of the switching output (1-7)
F: manual input of the number
4th digit: 0: switching output off (passive, high)
1: switching output on (active, low)
E: toggle switching output (on/off)
F: manual input of the status

Function 6 (ID-code memory/decoder/short dial memory):

in normal mode:
1st digit: 6: ID-code memory/decoder
2nd digit: 0: delete ID-code
1: display next ID-code
2: display current ID-code
3: switch decoder on/off

1st digit: 6: decoder
2nd digit: 3: switch decoder on/off
3rd digit: 1-A: decoder 1-10 (register 020-029)
4th digit: 0: turn off decoder
1: turn on decoder
E: toggle decoder status (on/off)

in telephone mode:
1st digit: 6: short dial memory
2nd digit: 0: read short dial memory
1: display memory location
2: store displayed number

1st digit: 6: short dial memory
2nd digit: 0: read short dial memory
3rd-5th digit: memory location nnn (000-999)

1st digit: 6: short dial memory
2nd digit: 1: display memory location
3rd digit: 0: display typed-in / previous short dial memory location
1: display typed-in / next short dial memory location

Function 7 (input calling tone):

in normal mode:
1st digit: 7: input of calling tone
2nd digit: 0: delete input
1: new input
2: input of complete call

1st digit: 7: input of calling tone
2nd digit: 0: delete input
3rd digit: 0: delete call completely
1: delete last input
2: call +1 (see 4th digit)
3: call -1 (see 4th digit)
4th digit: 0: scroll by +/- 1
1: scroll by +/- 1 at least to the next occupied memory location

1st digit: 7: input of calling tone
2nd digit: 1: new input
3rd digit: 0-E: calling tone 0-E
F: break

1st digit: 7: input of calling tone
2nd digit: 2: input of complete call
3rd digit: 1-5: number of digits
4th-8th digit: 1-5 digits

in telephone mode:
1st digit: 7: input of dial number
2nd digit: 0: delete input
1: new input of digit
2: new input of formatting signs
3: call repetition
use previous call

1st digit: 7: input of dial number
2nd digit: 0: delete input
3rd digit: 0: delete dial number completely
1: delete last input

1st digit: 7: input of dial number
2nd digit: 1: new input of a digit
3rd digit: 0-F: input 0-9,*,#,A-D

1st digit: 7: input of dial number
2nd digit: 2: new input of formatting signs
3rd digit: 0-5: input sign
0: space 1: / 2: - 3: _ 4: , 5: .

Function 8 (status input):

in normal mode:
1st digit: 8: status input
2nd digit: 0: delete status
1: set status

1st digit: 8: status input
2nd digit: 1: set status
3rd+4th digit: 00-99: set status
FF: manual input

in telephone mode:
1st digit: 8: input of telephone status
2nd digit: 0: automatically
(establishing call / receiving call / hanging up)
1: establishing call / receiving call
2: hanging up
3rd digit: only at establishing call / receiving call
0: LS off
1: LS on
2: LS status remains unchanged
3: LS depending on handset

Function 9 (ext. inputs):

1st digit: 9: external inputs
2nd digit: 0: squelch input
1: external muting

1st digit: 9: external inputs
2nd digit: 0: squelch input
3rd digit: 0: squelch off
1: squelch on
4th digit: 0: LS muting off
1: LS-Muting on
2: LS-Muting unchanged
4: NF-Muting off
5: NF-Muting on

1st digit: 9: external inputs
2nd digit: 1: external muting
3rd digit: 0: muting off
1: muting on
4th digit: 0: TX-LED is off during silence
1: TX-LED flashes during silence

Function B (MODE Functionen):

1st digit: B: mode switching
2nd digit: 0: normal mode
1: telephone mode
F: standby

1st digit: B: mode switching
2nd digit: 0: activate normal mode
3rd digit: 0: do not delete last call
1: delete last call
4th digit: 0: telephone off
1: hold telephone

1st digit: B: mode switching
2nd digit: 1: activate telephone
3rd digit: 0: do not delete last phone number
1: delete last phone number
4th digit: 0: forwarding telephone<=>radio off
1: forwarding telephone<=>radio on
2: forwarding telephone<=>radio unchanged
E: toggle forwarding

1st digit: B: mode swtching
2nd digit: F: standby
3rd digit: 0: standby is off (reset)
1: standby is on
E: toggle standby
4th digit: 0: illumination off
1: illumination on
5th digit: 0: reset by standby off
1: reset by every button

Reset to Factory Defaults

Reg. Function

222 restore factory defaults

223 restore factory defaults including potentiometer settings

Attention!!
factory defaults are restored without further confirmation

Table of Registers Telephone Interface V1.10

Reg.	Function

310 transmission time limit
1st-3rddigit: transmission time limit of nnn*1s during a telephone conversation

320 decoder 1
321 decoder 2
322 decoder 3
323 decoder 4
324 decoder 5
325 decoder 6
326 decoder 7
327 decoder 8
328 decoder 9
329 decoder 10
reg. 320 - 329: All digits are in use all the time. Hence. all digits that are not in use have to be coded with F (all tones are valid)

330 configuration 1 für decoder 1
331 configuration 1 für decoder 2
332 configuration 1 für decoder 3
333 configuration 1 für decoder 4
334 configuration 1 für decoder 5
335 configuration 1 für decoder 6
336 configuration 1 für decoder 7
337 configuration 1 für decoder 8
338 configuration 1 für decoder 9
339 configuration 1 für decoder 10
reg. 330 - 339:
1stdigit: number of tones in the sequence (3 - 15 (F))
2nddigit decoder type:
0: not in use
1: initiating call
2: short dial
3: direct dial
4: night mode
9: terminating call

initiating call (2nddigit = 1)
3rddigit:
0: only initiating call, no decoding at present call
1: initiating call, if no call is present, else terminating call
4thdigit: transmit confirmation tone at initiating call y/n (1/0), must not be activated for en-bloc dialing

short dial (SD) (2nddigit = 2)
3rddigit
hundreds of the SD number are stored in digit (0 = default)
4thdigit
tens of the SD number are stored in digit (0 = default)
5thdigit
units of the SD number are stored in digit (0 = default)
6thdigit 100s of SD number (default)
7thdigit 10s of SD number (default)
8thdigit 1s of SD number (default)
example 1:
tone sequence 34567 => SD 067
52045000 (enables SD 000-099)
example 2:
tone sequence 34567 => SD 167
52045100 (enables KW 100-199)

direct dial (DD) (2nddigit = 3)
3rddigit: 1st number of direct dial is stored in digit n of the tone sequence
4thdigit: minimum value for 1st number of direct dial
5thdigit: maximum value for 1st number of direct dial
6thdigit: number of pre-selection digits to the telephone (1 - 2)
7th+8thdigit pre-selection digits 1 + 2
example:
tone sequence 34567 => DD 67
53409000 (enables 00-99)
example:
tone sequence 34567 => DD 367
53466130 (enables 300-399)

at night mode: telephone => radio
(2nddigit = 4)
3rddigit:
0: night mode off
1: night mode on
2: change night mode status as defined in 4th-7thdigit
3: toggle night mode (on / off)
4thdigit:
digit of the tone sequence that defines the night mode status
5thdigit:
value that turns on the night mode
6thdigit:
value that turns off the night mode
7thdigit:
value that toggles night mode

357 DTMF configuration
1stdigit: delete-button of the radio (0-F,A-D,*,#)
2nddigit: end-button of the radio (0-F,A-D,*,#)
3rddigit: delete-button of the tel (0-F,A-D,*,#)
4thdigit: end-button of the tel (0-F,A-D,*,#)
5thdigit: send confirmation tone at DTMF-initiating call, y/n (1/0)

358 initiating call by DTMF
359 terminating call by DTMF
reg. 358 und 359:
1stdigit:
number of DTMF tones to decode (1-7, 0=off)
2nd-7thdigit:
DTMF-tones to decode

360 configuration for T11-55 (telephone)
y/n (1/0)
1stdigit:
radio => telephone: initiating call + dialing with DTMF
2nddigit:
radio => telephone: short dial
3rddigit:
radio => telephone: direct dial with tone sequence
4thdigit:
telephone => radio: direct cial with DTMF

361 direct dial with DTMF (telephone => radio)
1st-7thdigit: tone sequence, digits with an F are entered at the telephone
8thdigit:
start call with end-button # y/n (1/0)

362 night mode (tel => radio)
1st-7thdigit: tone sequence
digits with an F are entered at the telephone
8thdigit: night mode (tel => radio)
turn on/off night mode tel => radio with a fixed tone sequence on/off = 1/0

363 dialing configuration tel => radio
1stdigit: ID-mode
0 = 5-tone sequence
1 = call - ID-code
2 - ID-code - call
3 = 6-tone sequence
4 = 7-tone sequence
2nddigit: coupling tone at double sequence
3rd-4thdigit: valid in night mode
3rddigit: ID-mode
0 = 5-tone sequence
1 = call - ID-code
2 - ID-code - call
3 = 6-tone sequence
4 = 7-tone sequence
4thdigit: coupling tone at double sequence

365 configuration telephone mode
1stdigit-4thdigit:
nnnn * 1s max. conversation time
5th-7thdigit:
nn * 1s max. conversation time without modulation

Reg. Funktion

366 configuration telephone mode
1st-3rddigit:
nnn * 1s max. transmission time in simplex mode
4thdigit: dialing mode
0 = pulse, 1 = DTMF
5thdigit: mode of operation
0 = simplex, 1 = duplex
6thdigit: NF-delay telephone => radio on/off (0/1)

367 configuration telephone mode
1st-3rddigit:
nnn * 1s max. receiving time in simplex mode
4thdigit: dial tone recognition on/off (0/1)
5thdigit:
number of ringing signals until line is occupied

368 configuration telephone mode
1st-3rddigit:
nnn * 1s max. waiting time at call connected sign

369 configuration telephone mode
1stdigit:
prefix for outside line access
2nddigit:
signaling tone delay (lead time at BEEP to the radio), n * 100ms
3rddigit:
voice message text1 at connection establishment tel => radio on/off (1/0) OPTION!
4thdigit:
voice message text1 at connection establishment radio => tel on/off (1/0) OPTION!
5thdigit:
turn on/off (toggle) night mode tel => radio with a fixed tone sequence on/off (1/0)

370 NF-level to the telephone
1st-3rddigit: 0 - 255
371 NF-level to the telephone
1st-3rddigit: 0 - 255

Reg. Funktion

380 register for dial tone decoder
1stdigit: tolerance for dial tone decoder
n * 3.125%
2nd-4thdigit: tone duration for decoding of a permanent tone: nnn * 10ms
5th-7thdigit: break duration necessary to decode a break/“no tone“: nnn * 10ms
8thdigit:display decoded tone durations via RS232: y/n (2/0)

381 - 399 dial tone decoder table
1stdigit:
dial tone type
0 = continuation line
1 = call connected signal
2 = busy signal
F = free
2nd-4thdigit: tone duration
nnn * 10ms
5th-7thdigit: break duration
nnn * 10ms

standard values:
381 11004000 call connected signal,
1s tone, 4s break
382 11005000 call connected signal,
1s tone, 5s break
383 20400400 busy signal,
400ms tone, 400ms break +
384 00400400 continuation line (of reg. 383)
400ms tone, 400ms break
385 20500500 busy signal,
500ms tone, 500ms break +
386 00500500 continuation line (of reg. 385)
500ms tone, 500ms break
387 20240240 busy signal,
240ms tone, 240ms break +
388 02400240 continuation line (of reg. 387)
240ms tone, 240ms break
389 20160480 busy signal,
160ms tone, 480ms break +
390 00160480 continuation line (of reg. 389)
160ms tone, 480ms break

430 - 477 button functions in telephone mode
(as registers 130 - 177 in radio mode)

Register in the TIM (Telephone Interface Module)

Reg. Function

DTMF encoder/decoder

600 durations for DTMF encoder
- 1st-4thdigit: DTMF tone duration: nnnn*5ms
- 5th-8thdigit: DTMF break duration: nnnn*5ms

601 durations for DTMF encoder
- 1st-4thdigit: DTMF lead time: nnnn*5ms
- 5th-8thdigit: DTMF follow-up time: nnnn * 5ms

602 4th-8thdigit: output level DTMF high: tone to the radio (0-32768)

603 4th-8thdigit: output level DTMF low: tone to the radio (0-32768)

604 4th-8thdigit: output level DTMF high: tone to the telephone (0-32768)

605 4th-8thdigit: output level DTMF low: tone to the telephone (0-32768)

606 configuration DTMF decoder (radio)
- 1stdigit: max. allowed level difference between DTMF low and high
  - 0 = not regarded
  - 1-F = 1-15dB
- 2nddigit: DTMF recognition decode for n*10ms until: on
- 3rddigit: DTMF recognition nothing decoded for n*10ms until: off
- 4th-8thdigit: DTMF recognition min. level (0-32767)
  - 128 = standard level -12dB
  - *2 = -3dB sensitivity
  - /2 = +3dB sensitivity

607 configuration DTMF decoder (telephone)
- 1stdigit: max. allowed level difference between DTMF low and high
  - 0 = not regarded
  - 1-F = 1-15dB
- 2nddigit: DTMF recognition decode for n*10ms until: on
- 3rddigit: DTMF recognition nothing decoded for n*10ms until: off
- 4th-8thdigit: DTMF recognition min. level (0-32767)
  - 00128=standard level -12dB
  - *2 = -3dB sensitivity
  - /2 = +3dB sensitivity

Pulse Encoder

610 durations for pulse dialing
- 1st+2nddigit: pulse duration nn*5ms (on hook time)
- 3rd+4thdigit: pulse break nn*5ms (off hook time)
- 5th-8thdigit: break between 2 dial numbers nnnn*5ms

Reg. Function

611 durations for pulse dialing
- 1st-4thdigit: pulse dialing lead time: nnnn*5ms
- 5th-8thdigit: pulse dialing follow-up time: nnnn*5ms

Dial-Tone Decoder

614 configuration
- 2nddigit: dial-tone recognition decode for n*10ms until: on
- 3rddigit: dial-tone recognition not decoded for n*10ms until: off
- 4th-8thdigit: dial-tone recognition min. level (0-32767)
  - 00128 = standard level -12dB
  - *2=-3dB sensitivity
  - /2=+3dB sensitivity

Ringing Decoder

615 durations for ringing decoder
- 1st-4thdigit: min. ringing duration to be counted as a valid ringing: nnnn*5ms
- 5th-8thdigit: max. break between 2 ringings: nnnn*5ms

Telephone Configuration

616 configuration data for IA3222B
- 1stdigit: transmit voltage headroom and DC voltage drop
  - 0 = high
  - 1 = normal
  - 2 = low
  - 3 = lowest
- 2nddigit: termination
  - 0 = 600R oder 600R+2,16µF
  - 1 = 600R+1µF
  - 2 = 900R
  - 3 = 900R+1µF
  - 4 = ES203021 Zr:Australien, China
  - 5 = Zr:Neuseeland
  - 6 = TBR21
  - 7 = reserved
- 3rddigit: transmit gain
  - 0 = normal
  - 1 = +6dB
  - 2 = +6dB bei DTMF
  - 3 = +6dB bei DTMF Amtsholung Wx
- 4thdigit: current sensor
  - 0 = enabled
  - 1 = disabled

Reg.	Function
	5th digit: ringing threshold 0 = 10/20V 1 = 12.5/25V 2 = 15/30V 3 = 20/40V) 6th digit: line-in-use threshold 0 = 22.5+/-7.5 1 = 30+/-10, 2=15+/-5 3 = 2.5 (line disconnect)
	NF-Delay
617	configuration NF delay telephone => radio 1st-3rd digit: nnn * 1ms NF delay telephone => radio 4th digit: compression 0 = none (max. 55ms) 1 = A-law (max. 110ms) 2 = half the baud rate (max. 110ms) 3 = A-law and half the baud rate (max. 220ms)
	VOX
618	configuration VOX radio
619	configuration VOX telephone
	registers 618+619: 1st+2nd digit: minimum level threshold no NF => NF is present (00-99) 3rd+4th digit: level has to be > threshold for (00-99, nn*5ms) => NF is present 5th+6th digit: minimum level threshold NF is present => no NF (00-99) 7th+8th digit: level has to be < threshold for (00-99, nn*10ms) => no NF
	NF level
620	4th-8th digit: output level telephone => radio (0-65536)
621	4th-8th digit: output level radio => telephone (0-65536)
622	4th-8th digit: output level tone => radio (0-32768)
623	4th-8th digit: output level tone => telephone (0-32768)
624	4th-8th digit: output level pilot-tone => radio (0-32768)
625	4th-8th digit: output level pilot-tone => telephone (0-32768)

Reg.	Function
652	pilot-tone decoder (from the telephone) 1st digit: frequency of pilot-tone filter 0 = no filter 1 = 3300Hz 2 = 3000Hz 3 = 2800Hz 4 = 3320Hz 2nd digit: pilot-tone recognition decode for n*5ms until: on 3rd digit: pilot-tone recognition not decoded for n*5ms until: off 4th-8th digit: pilot-tone recognition, min. level (0-32767) 00128 = 75mV *2=-3dB sensitivity /2=+3dB sensitivity
669	pilot-tone encoder (to the telephone) 2nd-5th digit: pilot-tone frequency 1000er,100er,10er,1er Hz 6th digit: frequency of pilot-tone filter 0 = no filter 1 = 3300Hz 2 = 3000Hz 3 = 2800Hz 4 = 3320Hz 7th digit: line-filter 0 = off 1 = on (band-pass: 300-3400Hz)

in normal mode

F4 start telefone mode - do not delete last call - forwarding unchanged

in telephone mode

F1	short:	toggle forwarding <==> telephone (on/off)
F4	short:	start radio mode - do not delete last call - telephone on hold
0 - 9	short:	dial number 0 - 9
0 - 9	long:	input „space“, *, # , A, B, C, D, /, -, _
S1 - S4	short:	read-out short dial register 001 - 004
*	short:	previously dialed number
#	short:	delete last number
#	long:	delete complete input
PTT		talk with the gooseneck microphone
RUF	short:	button for call, call reception and hanging up - do not change loudspeaker status
Z	short.	read-out entered (0 - 999) or next short dial number
Z	long:	program entered phone number in short dial memory (press twice)
LS	short:	toggle loudspeaker - do not hang up phone
LS	long:	volume

Technical Data

operation voltage	12 V
current uptake	max. 800 mA
weight	1.5 kg
dimensions W x D x H (without GN microphone)	245 x 220 x 95 mm
input impedance 2-wire/4-wire	600 ohm
input level 4-wire	50 mV (-24 dBm) to 775 mV (0 dBm)
input level 2-wire	70 mV (-21 dBm) to 1050 mV (+2,5 dBm)
output impedance 2-wire/4-wire	600 ohm
output level at 600 ohm	
NF without additional pilot-tone	30 mV (-28 dBm) to 550 mV (-3 dBm)
NF with additional pilot-tone	30 mV (-28 dBm) to 450 mV (-5 dBm)
ex factory set to	450 mV

Tone Table

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

General Safety Information

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.

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.

2 February, 2006

Subject to change, Errors excepted

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