Major BOS 4a

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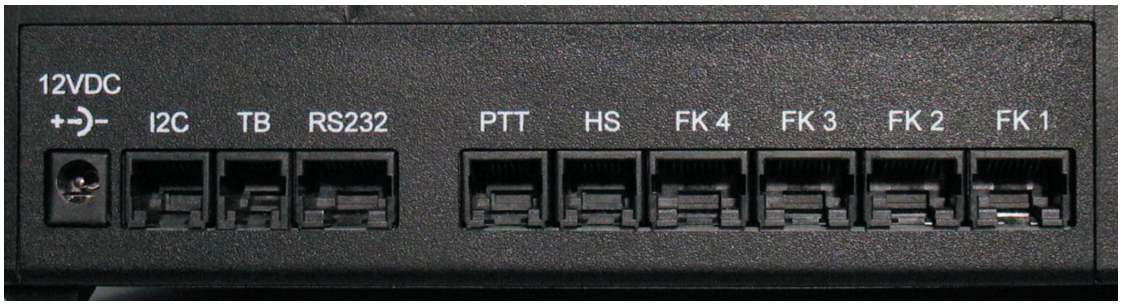
Major BOS 4a

Major BOS 4a is a µC-controlled desktop controller unit for 2-way radio systems controlling up to four radios. Different operating parameters can either be factory preset or programmed during installation.

System / Connectivity

The Major BOS 4a is powered by an external **+12V-DC power supply**.
Up to four channels (radio sets, PA systems -/intercom etc.) can be connected, also an external handset/headset, up to two external monitoring-interfaces (**TBBox4**), an external signal source, a tape recorder and a AF-RX-amplifier for each channel. Furthermore there is a RS232-connection, to which a terminal can be connected, or a PC for external control.
There is a squelch input for each radio and also a PTT output, a busy-line, an AF-input and AF-output. As the TX-AF-outputs are only active while transmitting, several ***Major BOS 4a´s*** can be connected in parallel without any problems.

For detailed pinout see section **Sockets Pin Layout Connection**.



12VDC	power supply connector (12VDC, external, max. 1,5A)
I2CI	I²C-Bus
TB	Tape recorder
RS232	RS 232 connection
PTT	PTT (e.g. foot switch)
HS	Headset
FK1 – 4	Transmit / Receive (channel 1 – 4, radio, PA system-/ . Intercom, etc.)

Also see section **Sockets Pin Layout Connection.**

Control and Display Elements

Keyboard

The keyboard holds the following functions for each of the four channels:

Funkkreis x	Selection button
+	Volume higher
-	Volume lower
L	Loudspeaker mute button
S	Special function button
I	Caller button for encoder 1
II	Caller button for encoder 2
	PTT button

All buttons can be locked separately

Busy LED ▼

For each of the four radios there is a separate busy LED. To control the busy LED the carrier input can be switched to ground or to +12V (or an external reference voltage U_{ref}). The logic of the busy input can be configured separately for each radio with the jumpers J10 to J13. To change the reference voltage (+12V or U_{ref}) use jumper J5. For jumper settings see **Chart: Jumper and Potentiometer**

TX-LED ▲

For each of the four channels there also is a separate TX LED, which lights up when the corresponding transmitter is activated. The transmitter is activated by pushing the PTT button while talking or by transmitting a call. Flashing of the TX LED means that another Major BOS 4a is using this channel. Also see section **Major BOS 4a´s in parallel circuit**.

Channel Selection LED ●

The channel selection LED (separate for each channel) lights up permanently when the corresponding channel is selected and activated. Flashing of the channel selection LED means that this channel has already been selected by another Major BOS 4a. Also see section **Major BOS 4a´s in parallel circuit**.

Loudspeaker / Volume LED Display

The loudspeaker / volume display (separate for each channel) is a row of LEDs and indicates the volume setting. If the loudspeaker-AF for the corresponding channel is turned off the display turns dark.

Display and Control Elements

1 - Transmiting- ▲, Squelch-▼, Selection Status LED ●
2 - Channel Selection Buttons
3 - Volume Display (row of LEDs)
4 - Volume Control Buttons (+/–)
5 - Loudspeaker Buttons (mute)
6 - Special Function Buttons
7 - Encoder Buttons (I/II)
8 - PTT (for gooseneck or headset microphone)
9 - Loudspeaker
10 - PTT Button (for handset)
11 - Handset
12 - Gooseneck Microphone

Calling a single Radio Subscriber

Channel Selection

To activate one of the four channels push the corresponding selection button. To deactivate a channel again push the corresponding selection button once more.
Depending on the configuration of the **EEPROM-Register 030 in Bit 1** you can either select several channels simultaneously or only one channel at a time.

Register 030 **Number of selectable channels**

Bit 1: 0 = several channels simultaneously (cumulative)
1 = only one channel at a time selected

When channels are activated the channel selection LED lights up. If the channel has already been selected by a different Major BOS 4a the device can be programmed so that the corresponding channel selection LED flashes.
Also see section **Parallel circuit of several Major BOS 4a´s.**
!!) In the **EEPROM-Register 024** you can preselect which of the channels 1..4 **(Bit 0..3)** is automatically selected after turning on the radio installation.

Register 024 **selected channels after turning on**

Bit 0: **Channel 1** No / Yes (0/1)

Bit 1: **Channel 2** No / Yes (o/1)

Bit 2: **Channel 3** No / Yes (0/1)

Bit 3: **Channel 4** No / Yes /0/1)

It is possible to configure the **EEPROM-Register 027** so that the selected channels are automatically saved in the EEPROM-Register 024 when the radio installation is turned off.

Register 027 **Save the selected channels** No / Yes (00/01)

Communicating with the Radio Subscriber ▲

There are three different ways of communication with a calling radio subscriber:

a) By pushing one of the red PTT buttons the transmitter of the corresponding channel is activated on (the corresponding sending status LED lights up) and you can talk to the caller through the gooseneck microphone. (It is also possible to connect an external switch contact instead of a PTT button. See section **Opto-Coupler input.)** If another controlling device is already transmitting on a channel the Major BOS 4a can be programmed so that the corresponding sending status LED flashes and optionally the PTT button is blocked. Also see section **Parallel circuit of several Major BOS 4a´s.** After depressing the PTT button the caller can be heard on the loudspeaker. The receiver volume of the corresponding channel is adjustable, see section **Loudspeaker (Volume setting).**

b) By picking up the handset and pushing the PTT button on the inside of the handset. By doing so the transmitter of the selected channel is activated (TX LED lights up) and you can talk with the caller through the microphone of the handset.
If another controlling device is already transmitting on a channel the Major BOS 4a can be programmed so that the corresponding TX LED flashes and optionally the PTT button is blocked. Also see section **Parellel circuit of several Major BOS 4a´s.**

Depending on the configuration you can hear the caller constantly on the handset or only after deactivating the PTT button, see section **Loudspeaker.**
The call is ended by replacing the handset.

The volume of the earpiece and the microphone are each adjustable by a potentiometer. The potentionmeter is situated near the earpiece of the handset and is easily accessible from the outside, using a screw-driver through a small opening on the inside of the handset.

c) By connecting a compatible handset/headset and pressing the corresponding PTT button PTT2 (e.g. a foot switch). By doing this the transmitter of the selected radio channel is also turned on (TX LED lights up) and you can talk with the caller through the microphone of the handset/headset. (It is also possible to connect another external switch contact. See section **Opto-Coupler input.)**
If another controlling device is already transmitting on a radio channel the Major BOS 4a can be programmed so that the corresponding TX LED blinks and optionally the PTT button is blocked. Also see section **Parallel circuit of several Major BOS 4a´s.**
Depending on the configuration you can hear the caller constantly on the handset or only after depressing the PTT button, see section **Loudspeaker.**
After deactivating the PTT button you can also hear the caller on the loudspeaker. The volume of the corresponding channel is adjustable, see section **Loudspeaker (volume setting).**

The microphone level of the handset/headset can be adjusted with the potentiometer **P10** and the level of its loudspeaker with the potentiometer **P12**.

!!) After ending the call the activated radio channel can be deactivated by pressing the corresponding selection button again.

Loudspeaker Switching Status

The *built in* loudspeaker is automatically turned off during transmission.

It is also possible to configurate the **EEPROM-Register 02A in Bit 1** so that the loudspeaker is also turned off automatically when the handset is lifted.

Register 02A **Loudspeaker switching status when handset is lifted**

Bit 1: 0 = Loudspeaker ON
1 = Loudspeaker OFF

The receiver-AF (on the loudspeaker) of individual radio channels can either be muted manually by pressing the loudspeaker buttons or automatically when the correspending busy line is activated (see section **Parallel circuit of several Major BOS 4a´s**).

If the loudspeaker-AF of a certain radio channel is turned off, the corresponding volume LED display (row of LEDs) turns dark.

!!) In the **EEPROM-Register 025** the loudspeaker switching statuses of the radio channels 1..4 (**Bit 0..3**) can be preselected after turning on the radio installation.

Register 025 **Loudspeaker switching status after turning on**

Bit 0: **Channel 1** OFF/ON (0/1)
Bit 1: **Channel 2** OFF/ON (0/1)
Bit 2: **Channel 3** OFF/ON (0/1)
Bit 3: **Channel 4** OFF/ON (0/1)

In addition it is possible to make a configuration in the **EEPROM-Register 028** so that loudspeaker switching statuses are automatically saved in the EEPROM-Register 025 when the radio installation is turned off.

Register 028 **Saving the loudspeaker switching statuses**
No/Yes (00/01)

The **EEPROM-Register 02A in Bit 0** can be configurated so that the receiver-AF of all radio channels (without muting) is switched to the loudspeaker or that the corresponding radio channels also have to be activated additionally.

Register 02A **Receiver-AF on loudspeaker**

Bit 0: 0 = all radio channels without muting
1 = only activated radio channels without muting

Loudspeaker (Volume Control)

The volume of the loudspeaker which is turned on can be set separately with the volume buttons (+ = higher, - = lower) for each radio channel. The volume level is displayed on the LED chain.

!!) In the **EEPROM-Registers 018...01B** the volume settings **(´01..´08)** for each radio channel can be preselected separately after turning on the radio installation.

Volume after switching on for

Register 018 **Channel 1**
Register 019 **Channel 2**
Register 01A **Channel 3**
Register 01B **Channel 4**

In the **EEPROM-Register 029** you can also make a configuration so that the selected volume settings are automatically saved in the EEPROM-Registers 018...01B when the radio installation is turned off.

Register 029 **Save Volume setting** No / Yes (00/01)

Earphones

The receiver-AF of the selected radio channel can always be heard on the earphones of the handset and the headset.
The earphone-AF of individual radio channels can be muted either manually by pressing the selection buttons or automatically by transmitting on the active or on one of the other radio channels (earphone muting).

a) In the **EEPROM-Register 022** a configuration for the radio channels 1..4 (**Bit 0..3)** can be made so that the earphone-AF for the active radio channel is muted while transmitting.

Register 022 **Earphone-AF** (while transmitting on the **active** channel) for

Bit 0: **Channel 1** OFF / ON (0/1)
Bit 1: **Channel 2** OFF / ON (0/1)
Bit 2: **Channel 3** OFF / ON (0/1)
Bit 3: **Channel 4** OFF / ON (0/1)

b) In the **EEPROM-Register 023** a configuration for the radio channels 1..4 (**Bit 0..3)** can be made so that the earphone-AF is muted while transmitting on a different radio channel.

Register 023 **Earphone-AF** (while transmitting on a **different** radio channel) **for**

Bit 0: **Channel 1** OFF / ON (0/1)
Bit 1: **Channel 2** OFF / ON (0/1)
Bit 3: **Channel 3** OFF / ON (0/1)
Bit 4: **Channel 4** OFF / ON (0/1)

RX-AF-Ausgänge

The volume controlled receiver-AF can be tapped individually for each radio channel on the **Major BOS 4a.** The outputs can be used e.g. for connecting external AF-amplifier (per radio channel).

The receiver-AF (for the AF-RX-outputs) of individual radio channels can be muted either

- manually by pressing the loudspeaker buttons or
- automatically by activating the corresponding busy lines (see section **Parallel circuit of several Major BOS 4a´s**) or
- automatically by transmitting on the active or a different radio channel

There is one **Muting-Output** per radio channel with which the connected AF-RX amplifier can be muted when there is no receiver signal (busy??/squelch) (output switches to GND). See section **Sockets Pinout.**

a) In the **EEPROM-Register 020** a configuration for the radio channels 1..4 (**Bit 0..3)** can be made so that the AF-RX-Output is muted while transmitting on the own radio channel.

Register 020	**AF-RX-Output** (while transmitting on the **active** radio channel) **for**
Bit 0:	**Channel 1** OFF / ON (0/1)
Bit 1:	**Channel 2** OFF / ON (0/1)
Bit 2:	**Channel 3** OFF / ON (0/1)
Bit 3:	**Channel 4** OFF / ON (0/1)

b) In the **EEPROM-Register 021** a configuration for the radio channels 1..4 (**Bit 0..3)** can be made so the AF-RX-Output is muted while transmitting on a different radio channel.

Register 021	**AF-RX-Output** (while transmitting on a **different** radio channel)**for**
Bit 0:	**Channel 1** OFF / ON (0/1)
Bit 1:	**Channel 2** OFF / ON (0/1)
Bit 2:	**Channel 3** OFF / ON (0/1)
Bit 3:	**Channel 4** OFF / ON (0/1)

Encoder

The Major BOS 4a has an integrated encoder for **ID 1** and **ID 2.** The calls for each channel are transmitted directly with the corresponding buttons on the keyboard (**I** or **II**). The ID is transmitted as long as the corresponding button is being pressed.
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Externel Signaling Device

An external signaling device can be connected to the **Major BOS 4a**. The sensitivity of the potential-free inputs can be adjusted with the potentiometer **P11.**
By activating the corresponding PTT button input (**PTT3**)the external signal is transmitted via the selected radio channel.(An additional external switch contact can be connected as PTT button. See section **Opto-coupler input**.**)**

Transmitter Control

The transmitters of the selected radio channels are activated with one of the PTT buttons (e.g. handset or headset) and stay activated as long as the PTT button is being pressed. During transmitting the corresponding transmitters are automatically activated.
It is always possible to transmit on non-activated radio channels by using the red PTT buttons on the control panel.

If another controlling device is already transmitting on a channel the Major BOS 4a can be programmed so that the corresponding sending status LED flashes and optionally the PTT button is blocked. Also see section **Parallel circuit of several Major BOS 4a´s**.

The transmitter control can be switched to ground or to +12V (or an external reference voltage U_{ref}). The logic of the PTT button outputs can be configured separately for each radio with the jumpers **J6** to **J9**. To change the reference voltage (+12V or U_{ref}) use jumper **J5**.
By using the **Open-collector** outputs it is easily possible to connect several Major BOS 4a´s in parallel circuit.

For jumper settings see Chart: Jumper and Potentiometer.

AF-Connection

The audio-frequency-connection is not integrated in the **Major BOS 4a** anymore. But by connecting the external headset-adapter the headset can be used as a combined communicating device for telephone and radio.
The headset is switched to the telephone by an opto-coupler input, which has to be programmed accordingly (**see section Opto-Coupler input**).

Microphone Selection

For each of the 3 PTT inputs it is possible to program the corresponding microphone individually in register 052. Additionally there are two automatic possibilities to detect the headset. Either the PTT2 input can be programmed as headset detection (programming register 04C) or the Major BOS 4a can detect if a headset is connected by measuring the headset supply voltage (programming register 051/052). The threshold level in register 051 has to be set so that the measured supply voltage (at ST10 between Pin 2 and 5) without headset is higher and with headset is lower than the threshold level. If the PTT2 input is used as headset detection the Major BOS 4a detects the headset when the input is activated (bridge to ground (GND)). If the Major BOS 4a has detected a headset then all buttons programmed as SH/HS/PTT use the headset microphone. Otherwise they use the gooseneck microphone.

Channnel Selection (additionally)

In register 04E you can program whether the loudspeaker is turned on simultaneously when activating the radio circuit. In register 04F you can program whether the loudspeaker is turned off simultaneously when deactivating the radio circuit.

Opto-Coupler Input

The **Major BOS 4a** has an **opto-coupler input** at connector **ST10**. This **opto-coupler input** can be programmed for different functions.

a) If this register is encoded to value ´**00**´**,** the opto-coupler input switches the handset/ headset to the audio-frequency-connection when activated (standard function, see section **Audio-Frequency-Connection**).

b) The opto-coupler input can also be used to emulate certain key functions of the switch panel or to make switching functions for special applications possible.

To do this the assignment to the radio channels is coded at the **1st digit** (High-Nibble) in the **EEPROM-register 047**. At the 2nd digit (Low Nibble) the key function resp. the special function which is to be emulated, is encoded:

Register 047 **Opto-coupler input**

Special function
00 = control the telephone relais
10 = microphone switching for PTT2
PTT2 transmits by gooseneck microphone, when opto-coupler is turned on
20 = microphone switching for PTT2
PTT2 transmits by gosseneck microphone when opto-coupler is turned off

1st digit **Assignment to**

0 **=** all activated radio channels
1..4 **=** radio channel 1..4

2nd digit **emulated key / special function**

0 = (-no function -)
1 = radio channel (selction)
2 = volume higher
3 = volume lower
4 = loudspeaker ON / OFF
5 = call 2
6 = call 1
7 = transmit (gooseneck microphone)
8 = transmit (microphone of handset/headset)
9 = transmit (external encoder)
A = special functions button
B = transmit (SH or HS-micro), PTT2 selects micro
C = transmit (SH or HS-micro), switching by automatic headset detection

To activate the opto-coupler input direct current (3V < U < 15V) is necessary. For higher switching voltages an additional external dropping resistor is necessary (internal dropping resistor = 1kOhm).

Major BOS 4a's in Parallel Circuit

Several **Major BOS 4a´s** can be interconnected without any problems as the AF-outputs are only activated during transmitting and the AF-outputs can be switched to high-impedance by replugging of jumper **J1** to **J2.**
For this purpose all connections with the individual radio channels (TX-AF, RX-AF, squelch and transmitter PTT) only have to be connected in **parallel circuit** (bus- or hub wiring).

Here the busy lines of the radio channels, which can only be connected with the Major BOS 4a´s , have a special function.

Activating the Busy Lines

Each Major BOS 4a, which is connected to the corresponding busy line, can signalize to other Major BOS 4a´s in paralle circuit, if a radio channel has already been selected and/or if a radio channel is already used for transmitting.

a) In the **EEPROM-register 02B** it is possible to make a configuration for the radio channels 1..4 (**Bit 0..3**) so that the corresponding busy line is activated if selected.

Register 02B **Activating busy line when channel is selected**

Bit 0:	**Radio channel 1**	NO / YES (0/1)
Bit 1:	**Radio channel 2**	NO / YES (0/1)
Bit 2:	**Radio channel 3**	NO / YES (0/1)
Bit 3:	**Radio channel 4**	NO / YES (0/1)

b) In the **EEPROM-register 02C** it is possible to make a configuration for the radio channels 1..4 (**Bit 0..3)** so that the corresponding busy line is activated when transmitting (on this channel).

Register 02C **Activating busy line when transmitting on**

Bit 0:	**Radio channel 1**	NO / YES (0/1)
Bit 1:	**Radio channel 2**	NO / YES (0/1)
Bit 2:	**Radio channel 3**	NO / YES (0/1)
Bit 3:	**Radio channel 4**	NO / YES (0/1)

Scanning of the Busy Lines

Each Major BOS 4a, which is connected to the corresponding busy line, detects an activated busy line and reports this optically to the user as a blinking channel selection LED ● or as a blinking TX LED ▲ .

This optical display can be configurated in the **EEPROM-register 02D** for the radio channels 1..4 (**Bit 0..3**).

Register 02D **Optical busy-LED for**

Bit 0: **Radio channel 1** as blinking channel selection LED / TX LED (0/1)
Bit 1: **Radio channel 2** as blinking channel selection LED / TX LED (0/1)
Bit 2: **Radio channel 3** as blinking channel selection LED / TX LED (0/1)
Bit 3: **Radio channel 4** as blinking channel selection LED / TX LED (0/1)

You can also configure how the **Major BOS 4a** treats busy radio channels: e.g. the *transmitter PTT* can be *disabled* and/or the receiver-AF for the *loudspeaker* (and the *RX-AF output)* can be muted:

a) In the **EEPROM-register 02E** it is possible to make a configuration for the radio channels 1..4 (**Bit 0..3)**so that the *PTT* is *disabled* when the radio channel is busy.

Register 02E **PTT is disabled when the channel is busy**

Bit 0: **Radio channel 1** NO / YES (0/1)
Bit 1: **Radio channel 2** NO / YES (0/1)
Bit 2: **Radio channel 3** NO / YES (0/1)
Bit 3: **Radio channel 4** NO / YES (0/1)

b) In the **EEPROM-register 02F** it is possible to make a configuration for the radio channels 1..4 (**Bit 0..3**) so that the *loudspeaker-AF* is *muted* when the radio channel is busy.

Register 02F **Loudspeaker-AF is muted when the channel is busy**

Bit 0: **Radio channel 1** NO / YES (0/1)
Bit 1: **Radio channel 2** NO / YES (0/1)
Bit 2: **Radio channel 3** NO / YES (0/1)
Bit 3: **Radio channel 4** NO / YES (0/1)

Monitoring-Interface TBBox4 (Accessories)

The optional monitoring-interface **TBBox4** can be looped in to max. 4 radio channels in order to connect a multi-track **voice recorder** and/or to interpret or transmit signaling on the radio channels with the help of a PC if the TBBox4 is equipped with the corresponding **UGA-modules** (option)(**using a modem**).
For this purpose the external PC is connected by the integrated RS232-interface of the **TBBox4**.

Together with the **Major BOS 4a** certain calls like tone sequences or single tones (e.g. call 1, call 2), which are preprogrammed in the **TBBox4,** can be evaluated. The evaluation status is transmitted to the **Major BOS 4a** by the I²C-Bus (connector **ST14**).

If the **Major BOS 4a** is used in bigger systems together with **Major BOS 8** units up to eight radio channels and therefore up to two **TBBox4** units can be attached.
In this case, if the 4 radio channels of the **Major BOS 4a** are to be connected on two separate **TBBox4** units, their control inputs have to be connected to the I²C-Bus-concentrator **I2C-Con**. In this case the I²C-Bus-adresses of the **TBBox4** units have to be coded differently (please ask for advice!). Also see manual **Major BOS 8**.

For programming the TBBox4 see manuals Monitoring-Interface TBBox4 and Universal-encoder/decoder-module UGA00.

Assigning Channels to the UGA-Modules

Each **TBBox4** can be equipped with max. 4 **UGA-modules,** so that up to 8 UGA-modules are available for decoder functions when 2 TBBox4 units are connected..
The individual radio channel numbers (´**01**´...´**04**´) in the **EEPROM-registers 031...038** can be assigned freely to these 8 UGA-modules. If no radio channel is to be assigned to a certain UGA-module set the radio channel number to value '**00'**.

Assigned radio channel number for

register 031	**UGA(1)/TBBox4(1)**
register 032	**UGA(2)/TBBox4(1)**
register 033	**UGA(3)/TBBox4(1)**
register 034	**UGA(4)/TBBox4(1)**
register 035	**UGA(1)/TBBox4(2)**
register 036	**UGA(2)/TBBox4(2)**
register 037	**UGA(3)/TBBox4(2)**
register 038	**UGA(4)/TBBox4(2)**

Ex factory the EEPROM-registers 031...034 are programmed in sequence with the radio channel numbers 01...04 and the EEPROM-registers 035...038 with the value '00' (no radio channel assigned).

Decoder Functions

Each TBBox4 can be equipped with max 4 ***UGA-modules***, so that up to 8 UGA-modules are available for decoder functions when 2 TBBox4 are connected.

Each UGA-module can be programmed so that when certain signalings (single tones, tone sequences) are decoded either one of the two switching outputs ***DEC1*** or ***DEC2*** briefly (e.g. 1 sec)switches to ground (GND). See manuals **Monitoring-Interface TBBox4** and **Universal-encoder/decoder-module UGA00.**

The status of the switching outputs ***DEC1*** and ***DEC2*** of all UGA-modules is transmitted to the ***Major BOS 4a*** and causes the loudspeaker-AF of the corresponding radio channels to be turned on(if it was turned off before):

a) If the switching output ***DEC2*** is turned on because of the UGA-decoding, then the loudspeaker-AF of the corresponding radio channel is turned on *permanently.*

b) If the switching output ***DEC1*** is turned on because of the UGA-decoding, then the loudspeaker-AF of the correspong radio channel is turned on *for the duration **T.*** The duration **T** can be programmed separately for the radio channels 1..4 in the **EEPROM-registers 03D...040** in steps of seconds (Value coded as **HEX-Number** in seconds).

Register 03D **Radio channel 1**
Register 03E **Radio channel 2**
Register 03F **Radio channel 3**
Register 040 **Radio channel 4**

Ex factory the EEPROM-registers 03D...040 are programmed with the Hex-value '**0A'** (10*1sec=10sec).

Tape Control (switching contact)

The switching contact for controling the tape (Start/Stop) can be configured separately for each of the two ***TBBox4*** units.

In the **EEPROM-registers 039 respectively 03A** you can code which radio channels 1..4 (**Bit 0..3**) control the audio tape switching contact of the ***TBBox4(1) resp. TBBox4(2).***

Register 039 **Audio tape switching contact *TBBox4(1)* controlled by**

Bit 0: **Channel 1** NO/YES (0/1)
Bit 1: **Channel 2** NO/YES (0/1)
Bit 2: **Channel 3** NO/YES (0/1)
Bit 3: **Channel 4** NO/YES (0/1)

Register 03A **Audio tape switching contact TBBox4(2) controlled by**

Bit 0: **Channel 1** NO/YES (0/1)
Bit 1: **Channel 2** NO/YES (0/1)
Bit 2: **Channel 3** NO/YES (0/1)
Bit 3: **Channel 4** NO/YES (0/1)

Tape Control **(Switching Contact)** (continued)

The tape control switching contacts are activated with each PTT or squelch/carrier detection of the corresponding radio channels. After discontinuation of these conditions they are deactivated automatically after the **delay time T.**
The delay time **T** can be programmed separately for the tape control switching contacts of the **TBBox4(1) resp. TBBox4(2)** in the **EEPROM-registers 03B resp. 03C** in steps of 100ms.

Delay time **T = N*100ms (enter as Hex-value!!!)**

Register 03B **Delay time for tape control switching contact TBBox4(1)**
Register 03C **Delay time for tape control switching contact TBBox4(2)**

Ex factory the EEPROM-registers 03B and 03C are programmed with the Hex-value „**32”** (50*100ms = 5sec).

The own tape control switching contact (ST5 / Pin2) is activated as long as one of the two TBBox4 switching contacts is activated.

Service Program

The ***Major BOS 4a*** has a **RS-232-interface w**ith the following specifications:

19200 Baud, 1 startbit, 8 databits, no parity, 1 stopbit

The connectors for the RS-232-interface (RXD, TXD, GND) are located on the 8-pole RJ45-plug **ST15** inside. See section **Sockets pin layout.**

To use the service program, a simple terminal or a PC with terminal program has to be connected to this RS-232-interface.
For this purpose the data format resp. the interface has to be set to the above mentioned specifications.
If ***Windows*** is installed on your PC, you can configure the standard Windows terminal program (e.g. Hyperterminal) accordingly, choosing the option **protocol = X on / X off.** (Therfore you only have to connect the three pins **RXD, TXD** and **GND**.

If the terminal (or the PC) is connected correctly, you will have access to the service program and to a range of service commands for:

- programming mode EEPROM

- software reset

To start the service program just enter <return> or <**$A2**>, <return>. The following text will appear on the screen:

```
Online – Monitor PIC 16F877A Software ,MBOS4a`V 2.0
vom (Datum)  ( C ) FunkTronic , 01-07

Rxxx          Read EEPROM Register xxx
Pxxx_yy       Program yy in EEPROM Register xxx

X          Reset

#
```

Please note: the character _ means <space> resp. <blank>.

Monitor Status

The service program may be locked after the device has been turned on (monitor status = ´**00**`). In this case the service program has to be started by entering <**$A2><CR>**(=Enter). Then the **monitor menu (** see above) appears on the screen.

If the ***Major BOS 4a*** is to be programmed or controlled automatically by a PC or a control center computer it may be useful for the monitor function to be immediately available when turned on (monitor status = ´**01**`or ´**02**`).

The *monitor status* can be programmed in the **EEPROM-register 026** as follows:

Register 026 **Monitor status after turning on**

00 = monitor function is turned off
01 = special control function (WED) is turned on
02 = monitor function is turned on

The monitor status (´**00**`,´**01**`or ´**02**`) can also be switched over while operating by entering <**$A0><CR>, <$A1><CR>** or **<$A2><CR>.**

Programming Mode EEPROM

To program an EEPROM-register address <xxx> with the content <yy> proceed as follows:

1) Start the service program (see section **service program**)

2) Enter <**R**xxx>,<Return> on the terminal.
=> <>xxx: ww> appears on the screen.

3) Now change the desired value (Hex value!!!), so that the new register is set to <yy> (Hex value!!!).

4) Program the new register content <yy> (Hex value!!!) in the register address <xxx> by entering the following on the terminal:
<Pxxx_yy>,<Return>(_=<**Space**>).

5) Check the new register content by means of the on-screen message:
<>xxx: ww **==>** yy >.

If instead of a valid address <xxx> the address <**999**> is entered, all registers are programmed with the ex factory preset values. A list of all the EEPROM- addresses can be found in the following section.

Please note (1): Do not change any registers, which are not described in this manual or whose functions are unclear or unknwon to you.

Please note (2): Almost all adjustable values (e.g. times etc.) of the ***Major BOS 4a*** have to be programmed as HEX numbers. See section **EEPROM-addresses**! A conversion chart for HEX numbers can be found in the **attachment!**

EEPROM Address Layout

Register **Coding for**

018 – 01B Volume level after turning on for

018 radio channel 1
019 radio channel 2
01A radio channel 3
01B radio channel 4

020 **RX-AF-output** (when transmitting on the **own** channel) **for**
Bit 0(..3): radio channel 1(..4) OFF/ON (0/1)

021 **RX-AF-output** (when transmitting on **another** channel) **for**
Bit 0(..3): radio channel 1(..4) OFF/ON (0/1)

022 **Headset-AF** (when transmitting on the **own** channel) **for**
Bit 0(..3): radio channel 1(..4) OFF/ON (0/1)

023 **Headset-AF** (when transmitting on **another** channel) **for**
Bit 0(..3): radio channel 1(..4) OFF/ON (0/1)

024 **Activated channels after turning on**
Bit 0(..3): radio channel 1(..4) NO/YES (0/1)

025 **Loudspeaker switching status after turning on**
Bit 0(..3): radio channel 1(..4) OFF/ON (0/1)

026 **Monitor status after turning on**
00 = monitor function is turned off
01 = special control function (WED) is turned on
02 = monitor function is turned on

027 **Saving selected channels**
NO / YES (00/01)

028 **Saving loudspeaker switching statuses**
NO / YES (00/01)

029 **Saving volume levels**
NO / YES (00/01)

EEPROM-Adressen (continued)

Register **Coding for**

02A 1st digit

Bit 0: **Receiver-AF on earphone**

0 = earphone-AF ON, when radio and LS are turned on
1 = earphone-AF ON, when radio is turned on

2nd digit

Bit 0: **Receiver-AF on loudspeaker**

0 = all radio channels without muting
1 = only activated radio channels without muting

Bit 1: **Loudspeaker switching status at earphone lift**

0 = loudspeaker ON
1 = loudspeaker OFF

02B **Activating busy-lines at selected**

Bit 0(..3) radio channel 1(..4) NO / YES (0/1)

02C **Activating busy-lines when transmitting on**

Bit 0(..3) radio channel 1(..4) NO / YES (0/1)

02D **Optical busy signal for**

Bit 0(..3) radio channel 1(..4) as blinking selection display / transmitting display (0/1)

02E **PTT disabled at busy**

Bit 0(..3) radio channel 1(..4) NO / YES (0/1)

02F **Loudspeaker-AF muted at busy**

Bit 0(..3) radio channel 1(..4) NO / YES (0/1)
transmitting display (0/1)

02E **PTT disabled at busy**

Bit 0(..3) radio channel 1(..4) NO / YES (0/1)

02F **Loudspeaker-AF muted at busy**

EEPROM-Adressen (Continued)

Register **Coding for**

030 **Number of selectable radio channels**

Bit 0: (-- no function --)
Bit 1: 0 = several radio channels at the same time (cumulative)
1 = only one radio channel (triggering)

031 – 038 **Corresponding radio channel no. for**

031 UGA (1)/TBBox4 (1)
032 UGA (2)/TBBox4 (1)
033 UGA (3)/TBBox4 (1)
034 UGA (4)/TBBox4 (1)
035 UGA (1)/TBBox4 (2)
036 UGA (2)/TBBox4 (2)
037 UGA (3)/TBBox4 (2)
038 UGA (4)/TBBox4 (2)

039 **Audio-tape switching contact *TBBox4(1)* controlled by**

Bit 0(..3): radio channel 1(..4) NO / YES (0/1)

03A **Audio-tape switching contact *TBBox4(2)* controlled by**

Bit 0(..3): radio channel 1(..4) NO / YES (0/1)

03B **Delay time for audio-tape switching contact *TBBox4(1)***
*N*100ms* **(enter as HEX-value!!!)**

03C **Delay time for audio-tape switching contact *TBBox4(2)***
*N*100ms* **(enter as HEX-value!!!)**

03D – 040 **Loudspeaker activation time at DEC1 for**
*N*1sec* **(enter as HEX-value!!!)**

03D radio channel 1
03E radio channel 2
03F radio channel 3
040 radio channel 4

EEPROM-Adressen (continued)

Register **Coding for**

047 **Opto-coupler input**

Special function
00 = activate telephone relais
10 = switching microphone for PTT2
PTT2 transmits via gooseneck microphone
when opto-coupler is turned on
20 = switching microphone for PTT2
PTT2 transmits via gooseneck microphone
when opto-coupler is turned off

1st digit **Assignment** to
0 = all activated radio channels
1..4 = radio channel 1..4

2nd digit **Emulated key / special function**
0 = (- no function -)
1 = radion channel (selection)
2 = volume higher
3 = volume lower
4 = loudspeaker ON / OFF
5 = call 2
6 = call 1
7 = transmit (gooseneck microphone)
8 = transmit (microphone of the handset/headset)
9 = transmit (ext. signal source)
A = special function key
B = transmit (SH or HS-micro), PTT2 switches micro
C = transmit (SH or HS-micro), switch over by
automatic headset detection

04C **Headset detection**
PTT2 active ==> headset microphone is used
PTT2 inactive ==> gooseneck microphone is used

00 = normal PTT-function, PTT2 is headset-PTT
>00 = PTT2 is headset detection,
SH-micro is open, HS-micro is active

>00 = INP 1-3 and opto-coupler is SH/HS-PTT
(if programmed)
01 = PTT3 is SH/HS-PTT
02 = keyboard-PTT is SH/HS-PTT
03 = PTT3 and keyboard-PTT is SH/HS-PTT
04 = only opto-coupler is SH/HS_PTT
(if programmed)

EEPROM-Adressen (continued)

Register	Coding for
04D	**PTT turns on LS** NO / YES (0/1)
1st digit	
Bit 0:	LS on at call 1
Bit 1:	LS on at call 2
2nd digit	
Bit 0:	LS on when PTT with HA-microphone
Bit 1:	LS on when PTT with HS-microphone
Bit 2:	LS on when PTT with SH-microphone
Bit 3:	LS on when ext. PTT
04E	**Automatic activating of loudspeaker when radio channel is activated**
Bit 0(..3)	radio channel 1(..4) NO / YES (0/1)
04F	**Automatic deactivating of loudspeaker when radio channel is deactivated**
Bit 0(..3):	radio channel 1(..4) NO / YES (0/1)
051	**Threshold value for automatic headset detection**
	threshold value = nn*19,5mV
052	**Flags for PTT / automatic headset detection**
	00 = **HS-mic**, 01 = **SH-mic**, 10 = **ext. AF**,
	11 = **SH / HS**
Bit 0+1:	HS – PTT
Bit 2+3:	Ext.- PTT
Bit 4+5:	SH – PTT
090 – 096	**Activating of buttons**
Bit 0(..3):	radio channel 1(..4) NO / YES (0/1)
090	for button Radio channel
091	for button VOL+
092	for button VOL-
093	for button LS
094	for button Call 2
095	for button Call 1
096	for button Transmit (PTT)

Chart: Jumper and Potentiometer

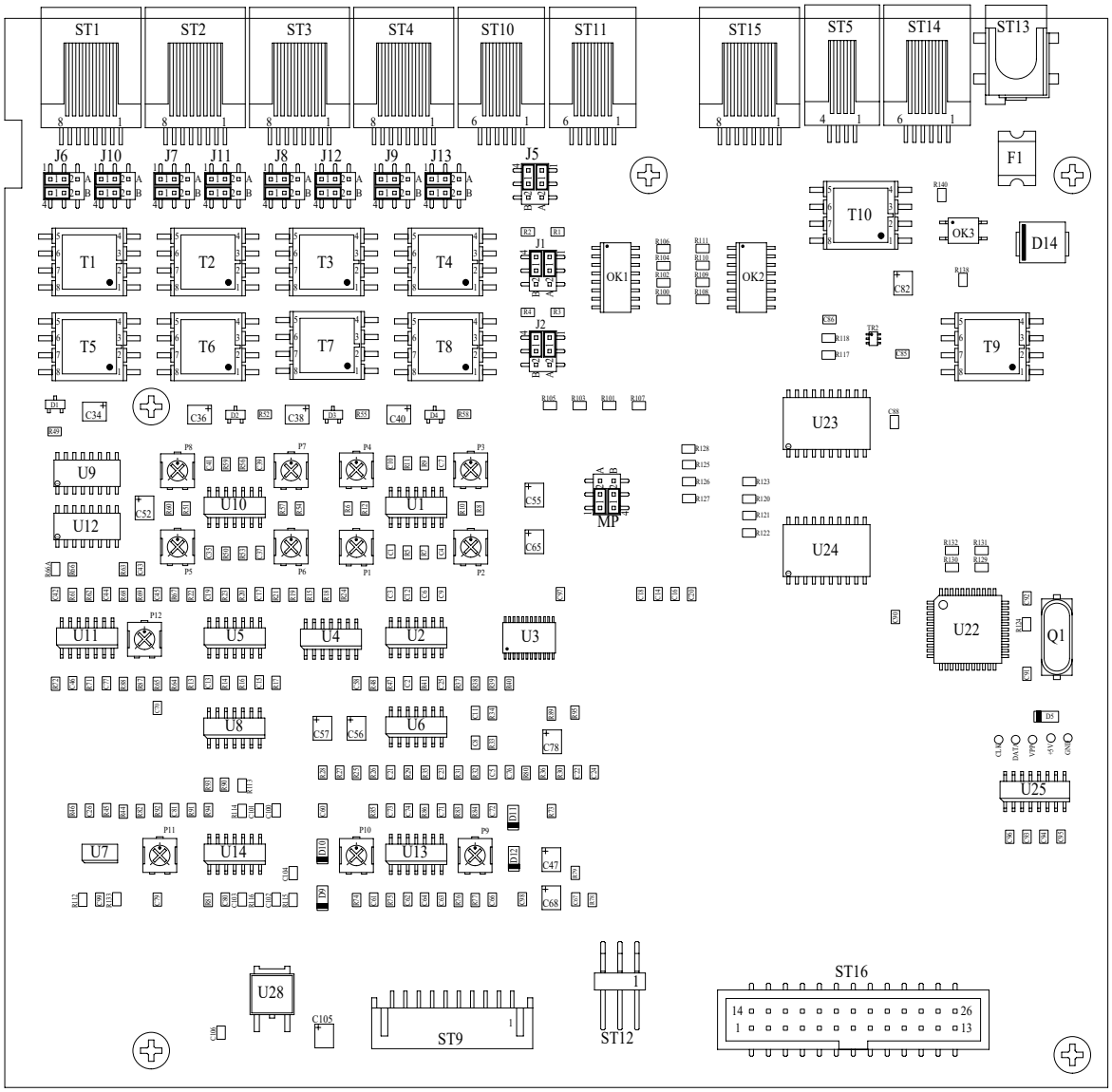
If necessary different configurations and adjustments can be made by using miscellaneous jumpers. See **Layout.**

The jumper functions can be seen in the following chart:

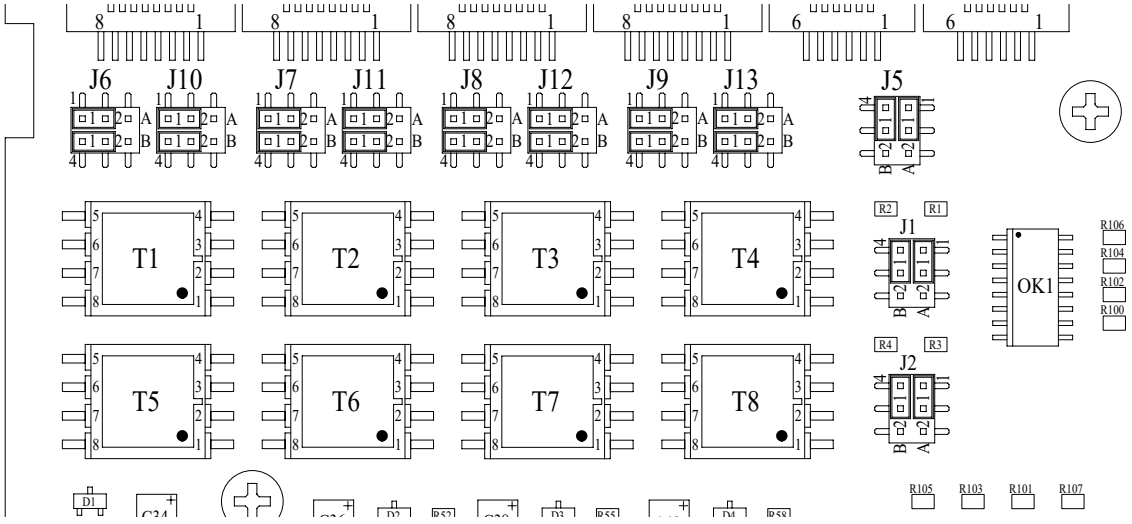
Jumper	Funktion	Position
J1 A	RX-AF-input radio channel 1 is **600 Ohm/3kOhm**	
J1 B	RX-AF-input radio channel 2 is **600 Ohm/3kOhm**	
J2 A	RX-AF-input radio channel 3 is **600 Ohm/3kOhm**	
J2 B	RX-AF-input radio channel 4 is **600 Ohm/3kOhm**	
J6	PTT-output radio channel 1 connects to **+Uptt/GND**	(A+B 1 / A+B 2)
J7	PTT-output radio channel 2 connects to **+Uptt/GND**	(A+B 1 / A+B 2)
J8	PTT-output radio channel 3 connects to **+Uptt/GND**	(A+B 1 / A+B 2)
J9	PTT-output radio channel 4 connects to **+Uptt/GND**	(A+B 1 / A+B 2)
J10	squelch input radio channel 1 active on **+12V/GND**	(A+B 1 / A+B 2)
J11	squelch input radio channel 2 active on **+12V/GND**	(A+B 1 / A+B 2)
J12	squelch input radio channel 3 active on **+12V/GND**	(A+B 1 / A+B 2)
J13	squelch input radio channel 4 active on **+12V/GND**	(A+B 1 / A+B 2)
J5 A	$+U_{PTT}$ ist **+12V/ U_{ref}**	(1 / 2)

Poti	Funktion/Pegel
P1	RX-AF for radio channel 1
P2	RX-AF for radio channel 2
P3	RX-AF for radio channel 3
P4	RX-AF for radio channel 4
P5	TX-AF for radio channel 1
P6	TX-AF for radio channel 2
P7	TX-AF for radio channel 3
P8	TX-AF for radio channel 4
P9	Input sensitivity for gooseneck microphone
P10	Input sensitivity for handset/headset microphone
P11	Input sensitivity for external signal source
P12	Earphone-AF for handset /headset

Layout



Jumper Positions (Layout excerpt)



Adjustment Instructions

The AF-levels have already been correctly preadjusted ex factory. If necessary please follow these instructions.

1) **Adjustment RX-inputs (radio channels 1..4)** (receiving radio)

a) At the *RX-input radio channel 1 (2,3,4)* feed in the AF-level provided by the radio device at **1000 Hz**.

b) Select *radio channel 1 (2,3,4)*

c) Connect the level meter to the RX-AF-output **H_Sum** (ST15/Pin6) **(GND** is **MP0).**

d) Adjust the level with potentiometer **P1 (P2, P3, P4)**. The level should be **500mVeff (=-3,8 dBm)**.

e) After finishing the adjustment: repeat steps a) to d) correspondingly for the *radio channels 2 to 4.*

2) **Adjustment TX-outputs (radio channels 1..4)** (transmitting radio)

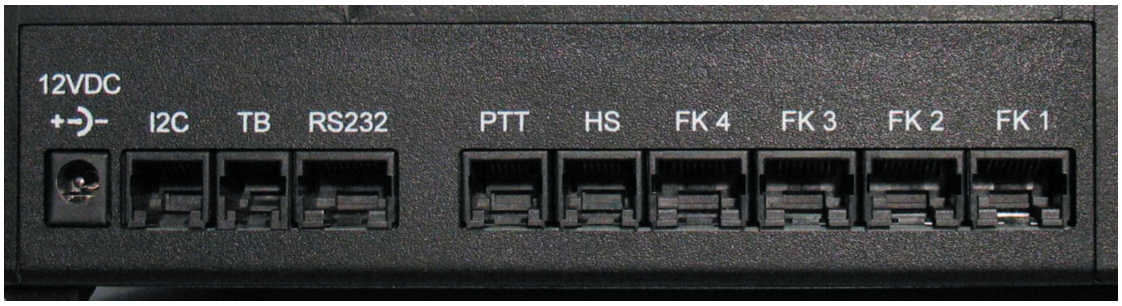
a) Connect the level meter and the radio device at the *TX-output radio channel 1(2,3,4).*

b) Transmit **encoder 1 (1750Hz)** on *radio channel 1(2,3,4).*

c) Adjust the level with the potentiometer **P5 (P6, P7, P8)**.

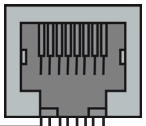
d) After finishing the adjustment: repeat steps a) to d) correspondingly for the *radio channels 2 to 4.*

Steckerbelegung



All sockets of the Major shown from rear view.

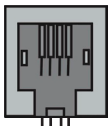
Layout FK 1- 4 (radio channels) ST1 - 4



RX-AF-Input (Earphone +)	1
RX-AF-Input (Earphone –)	2
Squelch-Input (Carrier)	3
GND (Ground)	4
Busy Lines (**Do not connect to FuG!**)	5
PTT-Output (PTT-Out, Open-Colector **max. 100mA**)	6
TX-AF-Output (Mod +)	7
TX-AF-Output (Mod –)	8

The AF- in/ouputs are equipped with transformers and therefore are potential-free.

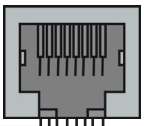
Layout TB Audio Tape ST5



GND (Ground)	1
Audio Tape Switching Contact	2
AF-Output A (Mod. +)	3
AF-Output B (Mod. –)	4

The AF-output A-B is equipped with a transformer and therefore is potential-free.

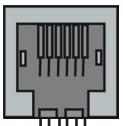
Layout RS 232 ST15



TXD (RS232)	1
RXD (RS232)	2
GND	3
PTT-Input ext. Signal Source (PTT3, to GND)	4
RX-AF-Output LS-Sum (Loudspeaker AF, activated radio channels)	5
RX-AF-Output H-Sum (Earphone AF, selected radio channels)	6
AF-Input, ext. Source. **Ext_AF** (Mod +)	7
AF-Eing. ext. Source. **Ext_NF** (Mod –)	8

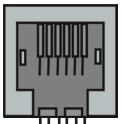
Two connectors for headsets are available. A headset can be connected to ST13. An external PTT button (e.g. foot switch) can be connected to ST12.

Layout Headset ST10



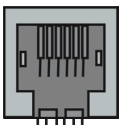
PTT input HS (PTT2, to GND)	1
AF-input HS (micro +)	2
AF-output HS (headset +)	3
AF-output HS-GND (headset -)	4
AF-input HS-GND (micro -)	5
GND (PTT2-Ground)	6

Layout PTT (Headset Switching) ST11



PTT input, HS (PTT2, to GND)	1
+Batt. Output., Supply Voltage for Headset-Headset Switching PCB	2
Control Pin for Headset-Headset Switching PCB	3
Opto-Coupler Input(Anode +)	4
Opto-Coupler Input(Cathode –)	5
GND (PTT2-Masse)	6

Layout I2C ST14



Power Supply. (+12VDC)	1
Power Sypply. (+12VDC)	2
SDA (I^2C-Bus-Data)	3
SCL (I^2C-Bus-Clock	4
GND (Ground)	5
GND (Ground)	6

Layout Power PWR

12 VDC, max 1,5 A,
center positive polel, ring GND

Sockets Pin Layout (continued)

Connector ST16 for external RX-AF-amplifier
(internal 26-pole latch-connector)

Pin 1	RX-AF-output radio channel 1 **LS1** (loudspeaker AF)
Pin 2	RX-AF-output radio channel 2 **LS2** (loudspeaker AF)
Pin 3	RX-AF-output radio channel 3 **LS3** (loudspeaker AF)
Pin 4	RX-AF-output radio channel 4 **LS4** (loudspeaker AF)
Pin 9 – 12	mute switching contact for **LS1** to **LS4**
Pin 13 – 21	GND (ground for RX-AF-outputs)
Pin 25	reference voltage for PTT / SQL

The use of these mute switching contacts via button press is programmable via the software. The firmware V3.4 is needed for support, which was supplied ex factory for SN #3062 and newer.

Technical Data

Power supply

Voltage	+12V DC-15%+25%
Consumption of current	min. 100mA, max. 600 mA

Input level (RX-IN), (from radio channel 1..4)

Ex factory set to	500mV (=-3,8 dBm)
Adjustment range (with potentiometer **P1..P4**)	-8dBM to +3dBm
Input impedance (**J1..J4** plugged)	600 Ohm
Input impedance (**J1..J4** unplugged)	ca. 20 kOhm

Output level (TX-Out), (to radio channel 1..4)

Ex factory set to	500mV (=-3,8 dBm)
Adjustment range (with potentiometer **P5..P8**)	-11 dBm to -1 dBm
Output impedance (when **transmitting**)	ca. 600 Ohm
Output impedance (when **receiving**)	high-ohm (open)

Earphone output level (RX-Out, routed to handset/headset)

Ex factory set to	-10 dBm (at 200 Ohm)
Adjustment range (with potentiometer **P12**)	-18 dBm to -8 dBm (at 200 Ohm)
Output impedance	ca. 150 Ohm

Microphone input MIC2 (TX-In, Electret, routed from handset/headset)

Ex factory set sensitivity	4 mV(=-46dBm)
Adjustment range (with potentiometer **P10**)	-52 dBm to -41dBm
Input impedance	ca. 700 Ohm

AF-input Ext_AF (TX-In, routed from e.g. external signal source)

Ex factory set sensitivity	500 mV (=-3,8 dBm)
Adjustment range (with potentiometer **P11**)	-7 dBm to -1 dBm
Input impedance	ca. 20 kOhm

Technical Data (continued)

AF-output LS_Sum
(RX-Out, routed to e.g. external loudspeaker amplifier)

at max. volume	-14 dBm (at 600 Ohm)
Output impedance	ca. 1 kOhm

AF-output H_Sum
(RX-Out, routed to e.g. external headset)

at selected radio channel	-13 dBm (at 600 Ohm)
Output impedance	ca. 1 kOhm

AF-outputs LS-i
(RX-Out, routed to e.g. external loudspeaker amplifier)

at max. volume	ca. 400 mV (at 10 kOhm)
Output impedance	ca. 1 kOhm

Weight	ca. 1500 g

Dimensions
(without gooseneck microphone)

Width x depth x height	245 x 220 x 90 mm

Order Information

Order No.	Description
620010	Major BOS 4a
900011	Power supply unit, suitable for Major BOS 1a, 2b, 4a, 8a
635090	RS232 programming cable

General Safety Instructions

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.

Factory returning of old equipment

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

Please send old equipment for disposal to:

FunkTronic GmbH
Breitwiesenstraße 4
36381 Schlüchtern

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

February 2nd , 2006

Subject to change, Errors excepted

Release Notes

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

November 7, 2007 (WP)	– compiled (V1.0)
December 21, 2007 (WP)	– Pinout of connectors revised (Page 4 / Page 30)
February 25, 2014	– Pinout of connector ST10 revised
March 13, 2014	– Order Information (RS232 cable) added
Sptember 05, 2018	– Use of "mute switching contacts" added (see Sockets Pinout ST15)
March 29, 2019	– high resistor values for AF input revised