Major BOS 1a

DEVELOPMENT PRODUCTION SOFTWARE HARDWARE ELECTRONICS CONSULTING

FunkTronic

Competence in electronics

valid for serial number 3000/16 and newer

Inhalt

Abbreviations

HS **H**ead**S**et

BOS Authorities and organizations concerned with public safety
(German: **B**ehörden und **O**rganisationen mit **S**icherheitsaufgaben)

TB Tape (German: **T**on**B**and)

S/E Radio (German: **S**ende**/E**mpfangs-Einheit)

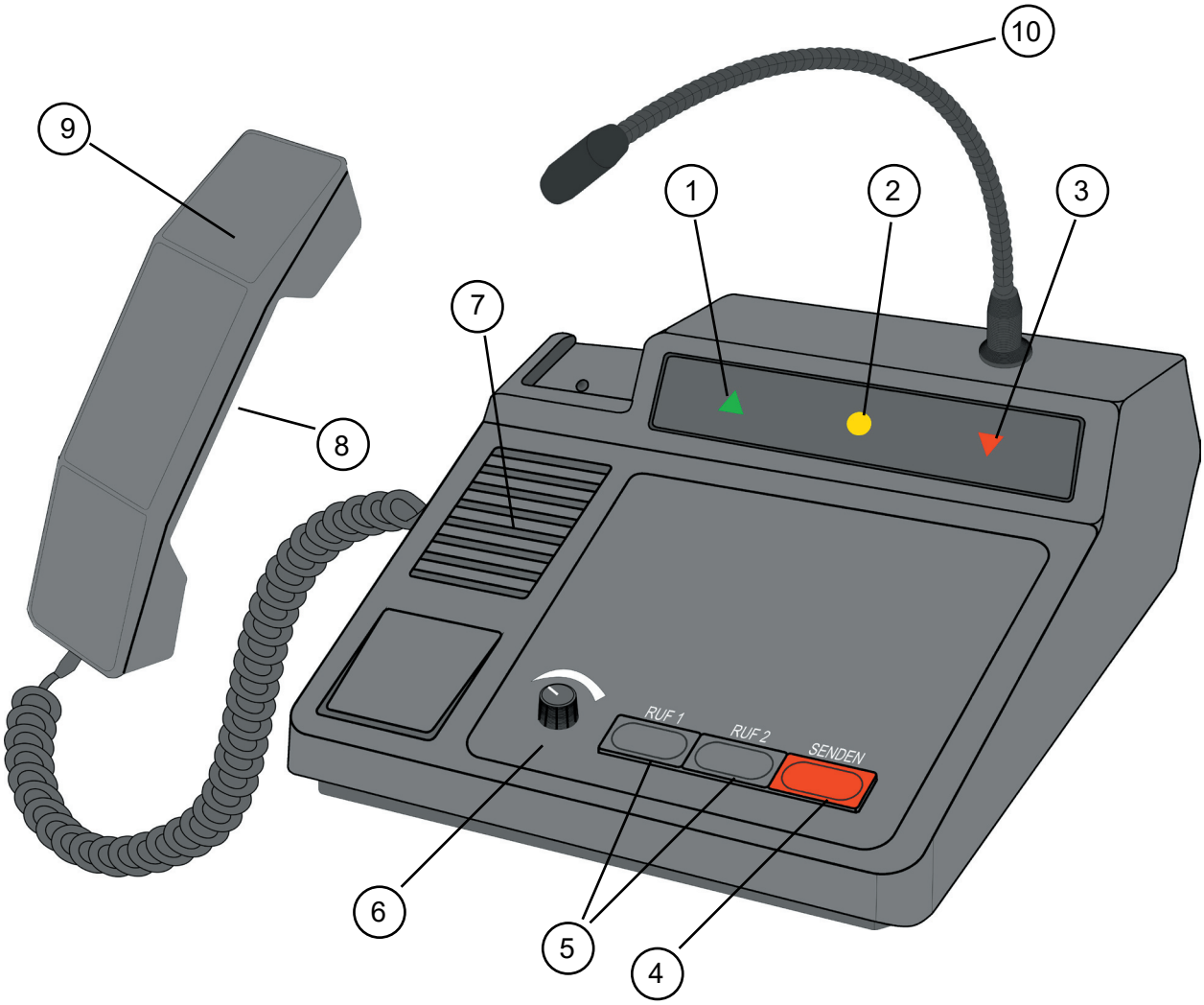
PTT **P**ush **T**o **T**alk

GND **G**rou**ND**

AF **A**udio **F**requency

ST **S**ocke**T**

Control Elements



1 - PTT Display LED ▲

2 - Operation LED ● is on if working current is applied

3 - Carrier display, Squelch ▼

4 - PTT button ("SENDEN", red) for gooseneck microphone or headset

5 - Call buttons for Call 1 („RUF 1“, 1750 Hz) and Call 2 („RUF 2, 2135 Hz)
PTT and tone are activated

6 - Volume control for loudspeaker

7 - Loudspeaker

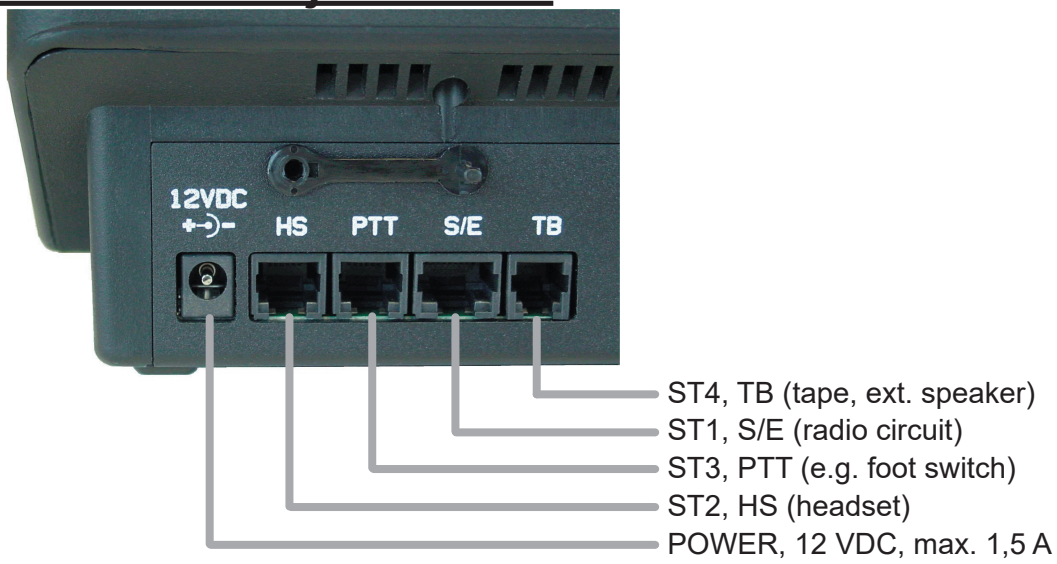
8 - PTT button of the handpiece

9 - Handpiece

Major BOS 1a is also available without the buttons Call 1 and Call 2.

For customer-specific requirements Major BOS 1a could also be equipped with 3 function keys (+integrated LEDs) instead of the two Call buttons.

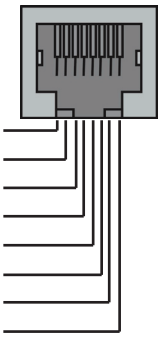
Rearview of Major BOS 1a



Sockets Pinout Major BOS 1a

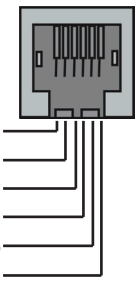
All schemes show the sockets viewed from the back of the Major.

Pinout S/E (radio circuit)
ST1



AF input B	1
AF input A	2
squelch input	3
GND	4
output: +12 V, max. 300 mA	5
PTT in/output	6
AF output A	7
AF output B	8

Pinout HS
ST2

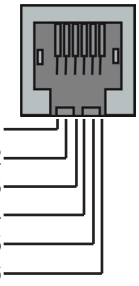


GND	1
AF microphone	2
AF earpiece	3
GND (for earpiece)	4
GND (for mic)	5
PTT, active to GND	6

All AF in/outputs are equipped with transformers and hence potential-free. PIN 5 (+12V) is for supply of external devices (LIM-AC, FT634C, FT633AC, FT630).

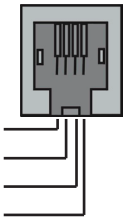
Attention: Do not use PIN 5 to supply a radio. 300 mA output current is not sufficient.

Pinout PTT
ST3



GND	1
GND (für microphone)	2
AF earpiece	3
GND (for earpiece)	4
AF microphone	5
PTT, active to GND	6

Pinout TB (tape)
ST4



ext. loudspeaker +	1
ext. loudspeaker GND	2
tape AF output A (mod. +)	3
tape AF output B (mod. -)	4

The AF outputs A-B are equipped with transformers and hence potential-free.

Major BOS 1a - General Remarks

The Major BOS 1a is a µC-based control set for radios allowing the adjustment of different levels and parameters. The radio is connected to the squelch input, the PTT output and the AF in/output. For operation 12 V DC supply is necessary.

As the AF output is only open during transmission, several Major BOS 1a can be connected in parallel. The PTT output can also be used as an input for muting in order to avoid feedback between control sets placed adjacently to each other.

Talking via the Radio

There are three different ways to talk via a connected radio:

1. by pressing the red PTT button and using the gooseneck or a headset microphone for voice transmission
2. by using the handpiece and its PTT button
3. by using an external PTT button (e.g. foot switch) for talking via headset or gooseneck microphone

In all cases the PTT display LED is activated.

Volume Settings

The volume of the loudspeaker (also for ext. loudspeaker) is set via the volume control knob.

The volume of the handpiece as well as the level of its microphone can be adjusted at the handpiece. The potentiometers are situated near the respective capsules.

The microphone levels for the headset and the gooseneck microphone can be set internally.

Muting of the Loudspeaker

Loudspeaker muting dependencies are configured via JMP4 (see section **Jumpers**). Ex factory, the loudspeaker is muted if the red PTT button is pressed, if external PTT is received (secondary device is connected in parallel) and if the handpiece is taken off.

Tone Call Encoder

The Major BOS 1a has two single tone encoders, Call 1 (1750 Hz) and Call 2 (2135 Hz). The calls are sent using the respective buttons of the control panel. The tone call is sent as long as the button is pressed.

Transmitter Control

The transmitter is switched on with one of the PTT or Call buttons as long as it is pressed. The PTT output can switch to GND as well as to 12 V. Via the open collector output several control sets can be connected in parallel.

Connecting several Control Sets in Parallel

As the NF output is only active during transmission and the NF input can be switched to high-resistance, the connection of several control sets in parallel is possible. Therefor, RJ45 patch sockets can be used (bus wiring or star wiring).

By decoding the PTT output (in this case used as an input) it is possible to mute the Major BOS 1a externally in order to avoid feedback between control sets placed adjacently to each other.

Headset/PTT

An external headset with a suitable foot switch can be connected to the 6-pin Western sockets.

The sockets‘ pinout differs only in the polarity of the electret microphone‘s bias voltage in order to provide the two frequently used pin assignments for headsets with 4/6-pin Western plugs. The two PTT inputs have different functions. Ex factory, the PTT input at the socket **HS** allows PTT using the gooseneck microphone, while the PTT input at socket **PTT** is for the headset microphone.

Tape Connection

For voice recording a tape recorder can be connected to socket ST4. The output level can be set internally.

External Loudspeaker

An external loudspeaker can be connected to ST4. The volume is set with the main volume control knob.

Connection of TETRA digital radios

The Major BOS 1a can also be used with TETRA radios. Via the respective interfaces, Motorola MRTs (MTM800 FuG / MTM5000er Series, interface FT-Nr. 903070) and Sepura MRTs (SRG3900 via Sepura Colour Console, interface FT-Nr. 903060) can be connected. Important: For proper function with the new Sepura interface (PCB-Nr.: MBOSEPA) JMP2b of the Major BOS 1a must be open!

Jumpers

Jumper	Pos.	Function
JMP1a	1-2	**input impedance** AF input 200 ohm, ST1 Pin1-2
JMP1a	2-3	**input impedance** AF input 600 ohm, ST1 Pin1-2
JMP1a	offen	**input impedance** AF input 8 kohm, ST1 Pin1-2
JMP1b	4-5	**squelch input** +5V-12V, ST1 Pin3
JMP1b	5-6	**squelch input** GND, ST1 Pin3
JMP1b	offen	**squelch input** N/A
JMP2a	1-2	**PTT output** to +12V, ST1 Pin6 (JMP2b >> 4-5)
JMP2a	2-3	**PTT output** to GND, ST1 Pin6 (JMP2b >> 5-6)
JMP2a	offen	**PTT output** N/A
JMP2b	4-5	**PTT input** (read back) active high, ST1 Pin6
JMP2b	5-6	**PTT input** (read back) active low, ST1 Pin6
JMP2b	offen	**PTT input** (read back) N/A
JMP3	1-2	**headset detection** off: always uses gooseneck microphone
JMP3	2-3	**headset detection** on: uses gooseneck or headset microphone
JMP3	2-5	**headset detection** off: always uses headset microphone

JMP4 **LS muting** is active, if at least one of the criteria mentioned below is true:
(jumper orientation as depicted in Board Layout on the following page)

as programmed ex factory
(Standard: Muting if PTT pressed or if handset is detached)

no Muting
(loudspeaker always on)

if PTT or
if handset detached

if (own) PTT

if handset detached or
if no squelch

if no squelch

if PTT or if no squelch

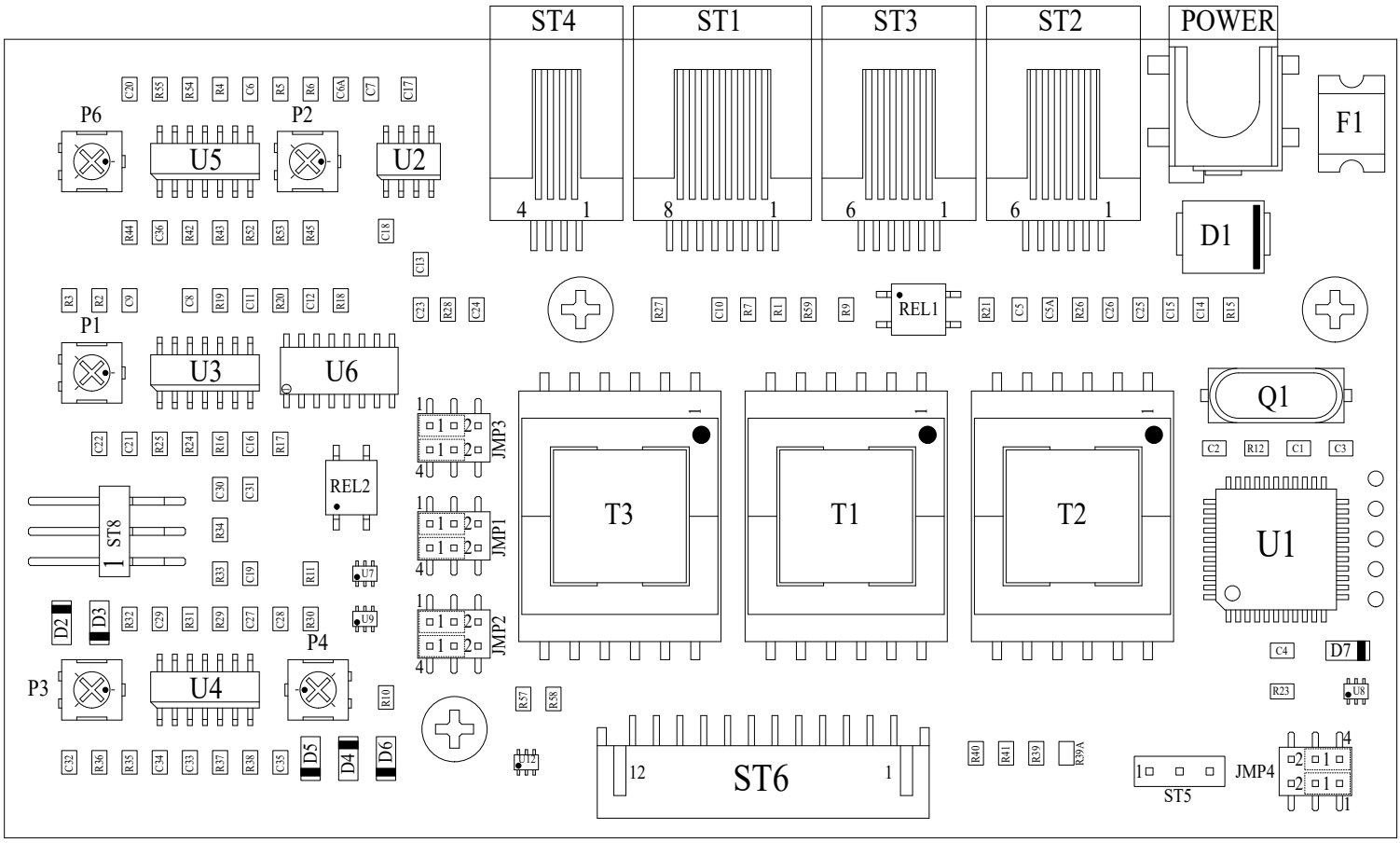
if handset detached

if handset detached or
if PTT or if no squelch

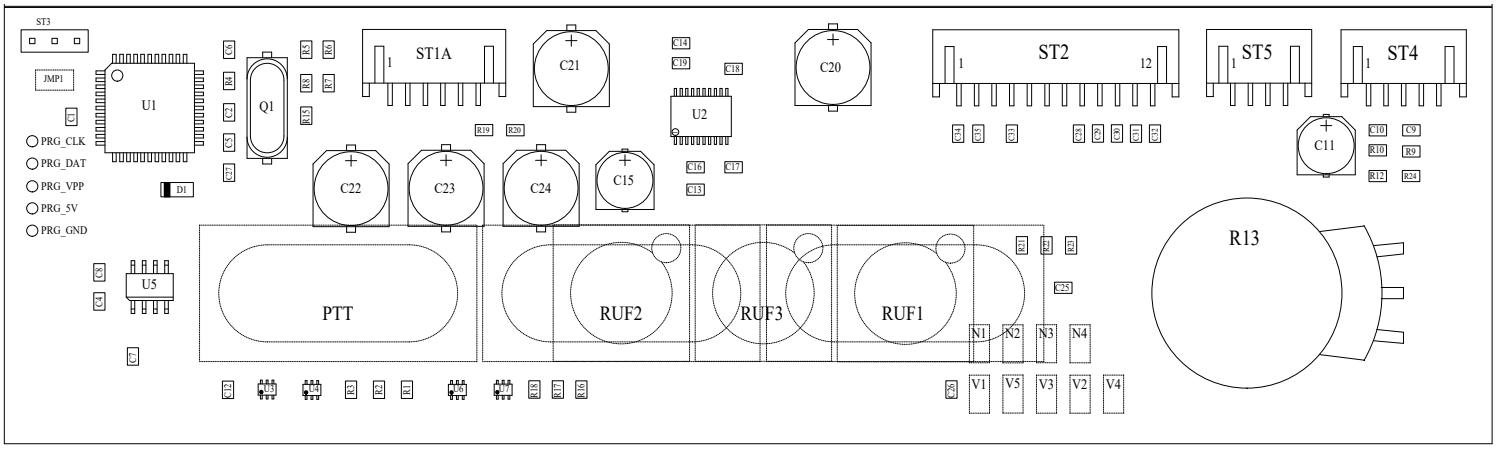
Potentiometers

Poti	Function/Level
P1	AF input sensitivity ST1, pin 1-2
P2	AF output total volume ST1, pin 7-8
P3	sensitivity gooseneck microphone
P4	sensitivity headset microphone
P5	volume poti front plate
P6	AF output level tape ST4, pin 3-4

Board Layout (Main)



Board Layout (Keys)



Solder Jumpers on Key Board

Jumper	Function
N4	closed: max. volume open-end (2,0W, Standard) open: max. volume limited (1,5W)
V4	closed: loudspeaker is off, if potentiometer is at minimum position open: minimum volume remains, if potentiometer is at minimum position (Standard)

Remark: For operation with Major BOS 1a, jumpers N1-3 must be closed and jumpers V1-V3 + V5 must be open (factory settings in Major BOS 1a).

Configuration of Registers

Register	Standard	Functionality
000-002	**01 ; 07 ; 50**	**Generator Frequency 1** (=1750 Hz)
003-005	**00 ; D7 ; D5**	**Generator Frequency 2** (=2135 Hz)
006-008	**01 ; CC ; CD**	**Generator Frequency 3** (=1000 Hz)
009-00B	**01 ; 80 ; 00**	**Generator Frequency 4** (=1200 Hz)
00C-00E	**01 ; 00 ; 00**	**Generator Frequency 5** (=1800 Hz)
	value (hexadecimal) = 117964800 / frequency [Hz]	
00F	**F8**	threshold value for **headset detection** (nn*19,5mV)
010-011	**33 ; 30**	function of **PTT button**
012-013	**11 ; 10**	function of **Ruf1 button** (if applicable)
014-015	**12 ; 10**	function of **Ruf2 button** (if applicable)
016-017	**1B ; 10**	function of **Ruf3 button** (if applicable)
018-019	**31 ; 30**	function for **PTT activation at ST3** (active low)
01A-01B	**3F ; 00**	function for **PTT deactivation am ST3** (passive high)
01C-01D	**30 ; 30**	function for **PTT activation am ST2** (active low)
01E-01F	**3F ; 00**	function for **PTT deactivation am ST2** (passive high)
020-021	**32 ; 30**	function for **PTT activation at the handset**
022-023	**3F ; 00**	function for **PTT deactivation at the handset**
024-025	**90 ; 1F**	function for **Squelch activation**
026-027	**90 ; 0F**	function for **Squelch deactivation**
028-029	**92 ; 10**	function for **Hook activation** (hang up)
02A-02B	**92 ; 01**	function for **Hook deactivation** (take handset)
02C-02D	**91 ; 31**	function for **Mute (reading back PTT) activation**
02E-02F	**91 ; 20**	function for **Mute (reading back PTT) deactivation**

Functions:

1. Stelle **1 = Single Tone Transmission**

2. Stelle 1-5: generator frequency 1-5
9,A,B: FMS(FSK) telegram 1,2,3 (Selling Feature: FMS Encoder)
F: Single Tone off (in case tone was started via input pin)

3. Stelle 0,2: w/o TX criterion; 1,3: with TX criterion (BIT 0)
0,1: no LS mute; 2,3: mute LS (BIT 1)

1. Stelle **3 = PTT**

2. Stelle 0: gooseneck-, 1: headset-, 2: handset-microphone
3: gooseneck or headset-microphone (via headset detection)
F: PTT off (if started via an input pin)

3. Stelle 0,2: w/o TX criterion; 1,3: with TX criterion (BIT 0)
0,1: no LS mute; 2,3: mute LS (BIT 1)
+4: transmit FMS telegram (BIT 2)

1. Stelle **9 = Squelch / Mute / Hook**

2. Stelle **0: Squelch**

3. Stelle 0: Squelch off, 1: Squelch on, F: don't change Squelch

4. Stelle 0: Mute off, 1: Mute on, F: don't change Mute

1. Stelle **9 = Squelch / Mute / Hook**

2. Stelle **1: Mute**
3. Stelle 0,2: Mute off, 1,3: Mute on, 0,1: always, 2,3: only if no own PTT is present
F: don't change Mute
4. Stelle 0: TX-LED off, 1: TX-LED flashing slowly, 2: TX-LED flashing fast
3: TX-LED on, F: don't change TX-LED
(TX-LED is always on if own PTT is present)

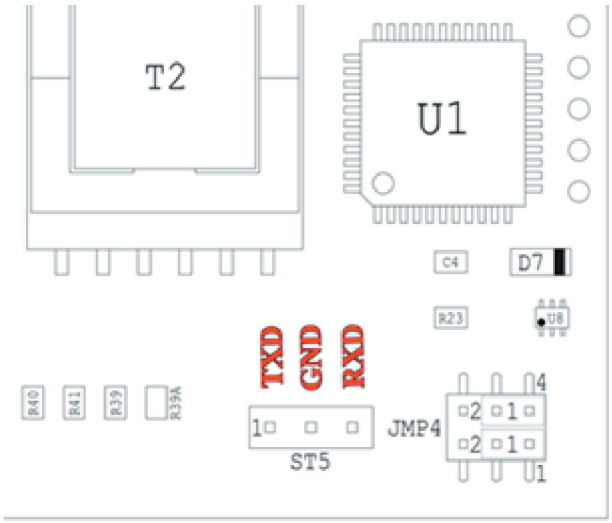
1. Stelle **9 = Squelch / Mute / Hook**

2. Stelle **2: Hook**
3. Stelle 0: Hook off, 1: Hook on, F: don't change Hook
4. Stelle 0: Mute off, 1: Mute on, F: don't change Mute

To configure the Major BOS 1a via the service interface, a 3-wire cable and a TTL / RS232 Interface is needed.

Major TXD 5V ==> TTL / RS232 ==> COM Port RXD
Major RXD 5V <== TTL / RS232 <== COM Port TXD
Major GND <==> COM Port GND

The configuration is done using a terminal program such as Hyperterminal.
Parameters: 9600 Baud, 8 data bits, no parity, 1 stop bit, no handshake.
Connect the Major and press the Enter / Return key to start the service interface.



Calibrating the AF levels

The AF levels are calibrated correctly ex factory. If a recalibration is necessary please follow the steps below:

1) Adjustment of the AF input:

a) apply the AF-level specified by the radio (e.g. 500 mV) at 1000 Hz to the AF input (ST1/pin1+2)

b) adjust P1 to approx. 530 mV at ST5A/pin1 or ST2/pin 3 or ST3/pin 3 (without load, vs. GND)

c) adjust P6 (Tape) to the desired tape level (norm. 500 mV) at ST4/pins3+4 (600 Ohm connection)

2) Adjustment of the AF output:

a) connect the level meter and the radio to the AF output. The desired level (e.g. 520 mV at 200 ohm) is the level of the nominal stroke demanded by the radio

b) press button for call 1 (1750 Hz) and adjust desired level with P2

c) adjust the desired level of the gooseneck microphone using P3 while talking into it normally

d) adjust the desired level of the headset using P4 while talking into it normally

e) adjust the desired level of the handset using the poti near the microphone while talking into it normally

Technical Data

Operating voltage	$+12V_{DC}$ -15% +25%
Current consumption	max. 1200 mA, typ. 500 mA
AF input level (ST1, Pin 1-2)	
nominal	500 mV at 200 Ohm
adjustment range using poti P1	250 - 1000 mV
input impedance	200 Ohm, 600 Ohm or 10 kOhm, ex factory: 200 Ohm
AF output level (ST1, Pin 7-8)	
ex factory	500 mV at 200 Ohm
adjustment range	150 - 630 mV at 200 Ohm 200 - 1000 mV at 600 Ohm
output impedance while transmitting	200 Ohm
output impedance while receiving	high-resistance
AF output level (earpiece of headset, ST2+ST3, Pin 3-4)	
ex factory	350 mV at 200 Ohm
output impedance	ca. 100 Ohm
AF input level (microphone of headset, ST2+ST3, Pin 2-5)	
nominal	4 mV
adjustment range (using Poti P4)	2 - 11 mV
input impedance	700 Ohm
AF output level of ext. loudspeaker (ST4, Pin 1-2)	
output impedance	4-8 Ohm
AF intensity	max. 2 Watt at 4 Ohm
Af output level of tape (ST4, Pin 3-4)	
ex factory	500 mV at 600 Ohm
adjustment range	150 - 800 mV at 600 Ohm
output impedance	600 Ohm
Weight	ca. 1400 g
Dimension	
width x depth x height	245 x 220 x 90 mm, w/o gooseneck microphone

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
GERMANY

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

February 2nd , 2006

Subject to change, Errors excepted

Release Notes

- 17.05.2017 Translation of German manual dated from 07.03.2016

- 10.09.2018 Description of connection to TETRA radios

- 10.01.2022 Description of register configuration added