FT638
Digital Radio Box

Manual

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1. FT638 – Digital Radio Box

The **FT638 – Digital radio box** is a v**oice-over-IP (VoIP) interface** for 2 TETRA or DMR digital radios (e.g. TETRA: **Sepura SRG3900**, **Motorola MTM800 FuG (ET)** or **MTM5X00 series**, respectively – DMR: **Motorola DM4000 series** / **Kenwood NX5000 series** / **Hytera MD785 series**)). For TETRA operation the FT638 also allows for bidirectional PEI-AT access of additional applications via its internal PEI AT multiplexer. Furthermore, an analogous multi-wire connector is available for each of the connected radios, enabling the connection of e.g. Major BOS 1a/2a/2b/4a/8a or Commander ZBO (handset).

FT638 in flange housing

FT638 – 19'' rack version

2. Order information

Article No.	Description
638000	FT638 – Digital radio box (TETRA/DMR-IP-interface, **standard** version)
638001	FT638 – Digital radio box (TETRA-IP-Interface, **IN/OUT** version)
638010	FT638 – Digital radio box (TETRA/DMR-IP-Interface, **standard** version, **19''**)
638011	FT638 – Digital radio box (TETRA-IP-Interface, **IN/OUT** version, **19''**)
638091	Option ACCESS (PEI AT access via ethernet, 1x access via FT protocol)
638092	Option EXTENDED (PEI AT access via ethernet, 4x access via FT protocol)
638093	Option FULL (PEI AT access via ethernet, complete access via FT protocol)
638900	Connection cable FT638 to MTM800 FuG ET or MTM5500 or MTM5200/5400 with Data Expansion Head Enhanced
638905	Connection cable FT638 tn SRG3900/SCG2229
638911	Connection cable FT638 to Kenwood DMR/NEXEDGE (NX-5000 series)
638920	Connection cable FT638 to Hytera MD785(i/G) w/ active RS232/TTL converter
638910	Connection cable FT638 to audio-USB interface
900020	Audio-USB interface
900920	Connection cable Audio-USB-Interface to DM4600

3. Interfaces

3.1. FT638 – standard version

The FT638 allows for the connection of 2 mobile radio terminals (**MRT1** + **MRT2**), that can be accessed by up to 8 control sets via Ethernet(**ETH1+2**). If only a single mobile radio terminal (MRT) is connected, the maximum amount of control sets increases to 16.

Furthermore, the FT638 has an integrated PEI-AT multiplexer enabling the connection of additional third party PEI-AT applications (routing apllications, status panels, operation control software,...). In the standard version, one additional connector per MRT is available. For MRT1 this is a standard 9-pin COM socket. If a third party device is to be connected here, the cables made for MTM800 FuG ET or MTM5500 (or MTM5200/5400 with Expansion Head Enhanced) can be used. Due to the different protocols of DMR connections, no PEI multiplexer is available for DMR.

In case that another PEI-AT device needs to be connected to MRT2, the socket RS232 has to be used. If the counterpart also needs a standard COM socket, our connection cable 635090 can be used. Here, only the 3-pin interface (RXD, TXD and GND) is available (see also **4. Pin layout**).

3.2. FT638 – IN/OUT version (TETRA only)

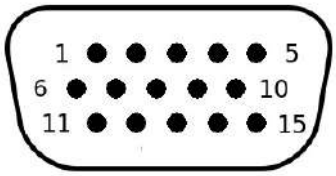
Besides the standard version, the FT638 can also be ordered as IN/OUT version. Here, up to 3 PEI-AT participants can be connected to one MRT (in addition to voice-over-IP participants). Hence, the connector **MRT2** is implemented as a female socket in this case.

3.3. Rear view

4. Pin layout

Connectors MRT1 and MRT2 / PEI-IN

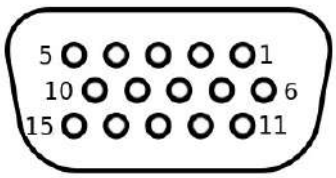
Connection of TETRA/DMR digital radios



1	--- / CONS_TXD for IN/OUT version
2	--- / CONS_RXD for IN/OUT version
3	ON_SIG (output)
4	POWER (input)
5	AF_IN_A
6	AF_IN_B
7	AF_OUT_A
8	AF_OUT_B
9	RS232_DCD (input)
10	RS232_RXD (input)
11	RS232_TXD (output)
12	RS232_RTS (output)
13	RS232_CTS (input)
14	RS232_DTR (output)
15	GND

Connector MRT2 / PEI-Out (only for TETRA IN/OUT version)

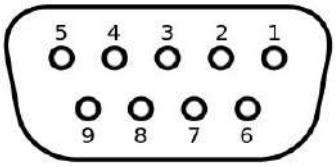
Connection of TETRA applications (audio + PEI-AT)



1	CONS_TXD (input to SRG3900)
2	CONS_RXD (output from SRG3900)
3	ON_SIG (input to SRG3900)
4	POWER (output from SRG3900)
5	AF_OUT_A
6	AF_OUT_B
7	AF_IN_A
8	AF_IN_B
9	RS232_DTR (output)
10	RS232_TXD (output)
11	RS232_RXD (input)
12	RS232_CTS (input)
13	RS232_RTS (output)
14	RS232_DCD (input)
15	GND

Connector COM

Connection of additional PEI-AT participants (>> MRT1)

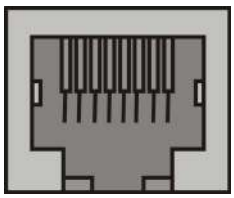


1	---
2	TXD (output)
3	RXD (input)
4	---
5	GND
6	---
7	CTS (input)
8	RTS (output)
9	---

Connector RS232

Connection of additional PEI-AT participants (for MRT2 if STD-Version, for MRT1 if I/O-Version) and programmable I/Os

1.....8

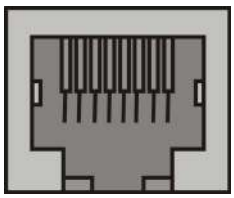


1	TXD (output)
2	RXD (input)
3	GND
4	I/O 0
5	I/O 1
6	I/O 2
7	I/O 3
8	I/O 4

Connectors A1 and A2

Analogous multi-wire connection. (A1 >> MRT1, A2 >> MRT2)

1.....8



1	AF_OUT_A
2	AF_OUT_B
3	SQL (output)
4	GND
5	BUSY (optional +12V output)
6	PTT (input)
7	AF_IN_A
8	AF_IN_B

5. Configuration via web interface

For configuration of the FT638 a self-explanatory web interface is used. The factory defaults regarding the most important ethernet settings of the FT638 are as follows:

Benutzername:	**ft638**
Kennwort:	**radio**

IP network 1 / ETH1

Local IP address:	192.168.16.191
Target IP VoIP 1:	192.168.16.192
Subnet mask:	255.255.255.0
Audio / AF port:	10000, UDP
Data port:	10001, TCP
Web server port:	80, TCP

IP network 2 / ETH2

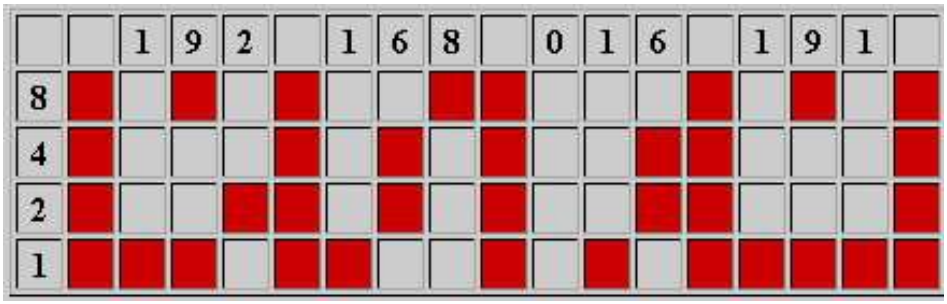
Local IP address:	192.168.17.191
Target IP VoIP 13:	192.168.17.192
Subnet mask:	255.255.255.0
Audio / AF port:	10000, UDP
Data port:	10001, TCP
Web server port:	80, protocol TCP

Attention! A connection can only be established between devices that are members of the same subnet of the IP network!

5.1. What if I don't nkow the IP address of the FT638?

After power-on, the front LEDs A-D show the IP address of the device. For this, each number is BCD-coded and displayed for two seconds (LED A represents the most significant bit). As a delimiter between the groups of three digits, all 4 LEDs are switched on. In case of a 0, all LEDs are switched off.

As an example, the default IP address 192.168.16.191 is displayed as follows:



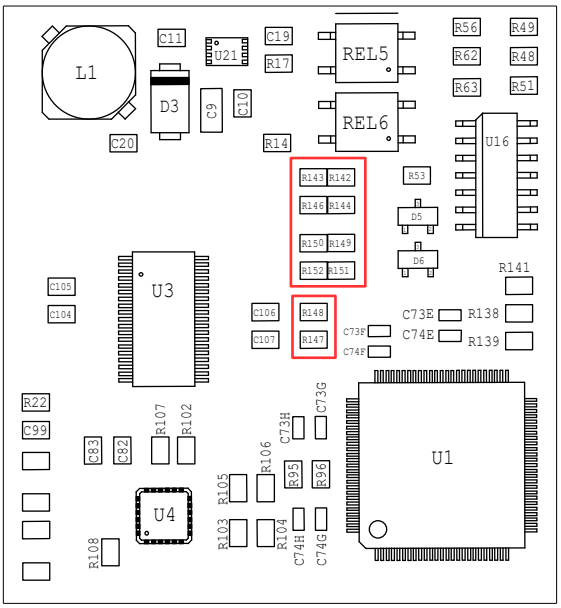
6. Mainboard configuration

6.1. RS232 levels (connection of MRT1 + MRT2)

Ex factory, a radio with a data communication operating on real RS232 levels is expected (e.g. SRG3900, MTM800 FuG ET / MTM5500). If TTL levels need to be used (e.g. MTM800 FuG / MTM5200/5400 without COM connector), the following changes need to be performed:

MRT1: - move R143 to R142
- move R146 to R144
- remove R147

MRT2: - move R150 to R149
- move R152 to R151
- remove R148



6.2. SQL configuration (connectors A1 + A2)

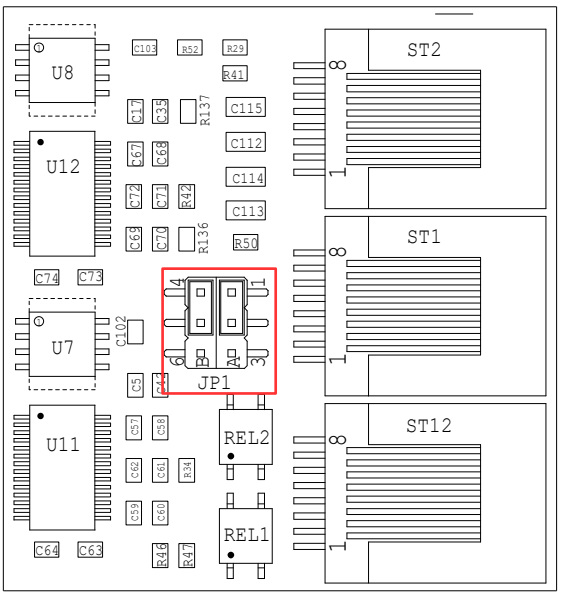
The SQL outputs can be configured using JP1 A+B. Ex factory, on incoming transmissions SQL switches to +12V.

JP1 A for connector **A1**:

Pin 1+2 connected	SQL to +12V
Pin 2+3 connected	SQL to GND

JP1 B for connector **A2**:

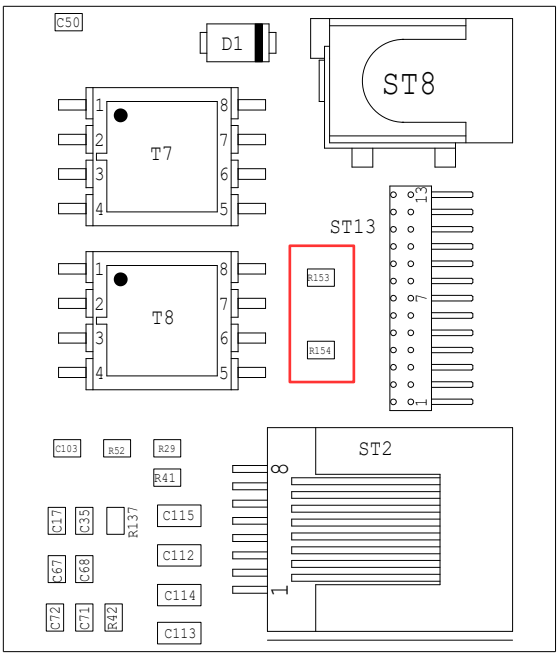
Pin 4+5 connected	SQL to +12V
Pin 5+6 connected	SQL to GND



6.3. BUSY or +12V (Connectors A1 + A2)

Ex factory, pin 5 of sockets A1 and A2 is configured for BUSY signalling (not implemented, yet). In order to supply voltage (+12V) to a connected device, positions R153 (A1) and / or R154 (A2) have to be equipped with a zero sequence resistance.

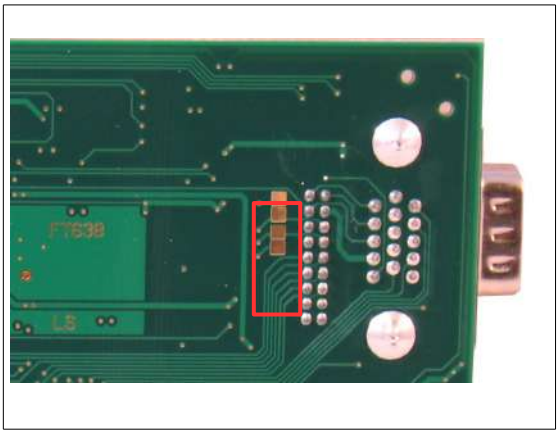
Attention: If pin 5 is configured for output of supply voltage, a Major BOS must not be connected to sockets A1 or A2 because its BUSY output would be destroyed!!



6.4. Solder bridges (back of PCB)

In order to connect a Sepura console via FT638 IN/OUT version the two solder bridges on the backside of the board have to be closed.

Attention: With the standard configuration as described in **8.1 Sepura SRG3900**, the proper audio line from FT638 is not used when a call is started via PEI commands! Please contact us if you need to apply a configuration like this, so we can find a suitable solution.



7. PEI multiplexer

7.1. General remarks

The PEI multiplexer enables multiple devices to connect to the same TETRA MRT. As answers are distributed to all connected devices, it is possible to receive telegrams that were initiated by other participants. Hence, it is important – as is specified for the PEI AT interface - to neglect unknown and/or unwanted telegrams. However, we cannot guarantee that every combination of devices and/or software is feasible. An equivalent functionality for DMR radios is not supported.

7.2. Standard version

Besides the connected VoIP control panels (e.g. Major BOS 4VD/8VD) one more PEI AT participant can be connected to the FT638 (see as well **3.Interfaces** and **4.Pin layout**). Option ACCESS or higher is needed, if using the PEI AT interfaces of both MRTs via ethernet shall be possible. The PEI AT connection can be assigned to any of the VoIP connections.

7.3. IN/OUT version

Besides the connected VoIP control panels (e.g. Major BOS 4VD/8VD) three more PEI AT participants can be connected to the FT638. Connector *MRT2* is for use as a complete PEI (AT data and audio in/out, connector style as for Sepura SRG3900 / see as well **3.Interfaces** and **4.Pin layout**). Option ACCESS or higher is needed, if using one or two PEI AT interfaces via ethernet shall be possible. Both PEI AT connections can be assigned to any of the VoIP connections.

8. Configuration of MRTs

The following configurations are necessary for proper performance with the digital radio. In the following the most important parameters are given for **Sepura SRG3900** and **Motorola MTM800 FuG / MTM5X00 series**. For operation with SRG3900 the selling option **Audio License (Line-Out/Line-In)** is necessary!

8.1. Sepura SRG3900

Parameter 8153:

(Product >> Product Specific >> Hardware/Accessories >> General PEI Parameters)
"Accessory type on PEI" to **"Line In Audio Accessory"**

Parameter 8084:

(Product >> Product Specific >> Hardware/Accessories >> Audio Presentation)
"Gain Setting for Line In Audio" to **"30 dB"** (standard gain setting)

Parameter 8080:

(Product >> Product Specific >> Hardware/Accessories >> Audio Presentation)
"Line Out Source" auf **"RX Only"**

Parameter 8161:

(Profile >> PEI Parameters >> General PEI Parameters)
"Serial Port Usage" auf **"Swapped (PD on phys. Port 1)"**

Parameter 8150:

(Profile >> PEI Parameters >> General PEI Parameters >> Parameter)
"Standard Hayes Baud Rate" auf **"38400"**

As an alternative, the baud rate at the MRT connector of FT638 can be configured differently.

Attention: The connection of FT638 together with a Sepura console on the same MRT interface via a Console Interface Box is not possible!

8.2. Motorola MTM800 FuG (ET) / MTM5X00 series

Function Flags

- **"External Device"**: Must be activated!
- **"Home-Mode":** Must be deactivated, if the display of the Home-Mode via FT638 is to be used (SDS with PID 220)!

Transceiver Accessories

- **"Line-Out level"**: 0dBr Point

Transceiver Accessories >> Config. of Transceiver Accessories

- **"Rear Line-In Accessory"**: LINE-IN

Data Services >> PEI Parameters

- **"Baudrate"**: *38400* (FT638 standard, can be configured differently, if necessary)
- **"Move RS232 from DB9 to Motorola Accessory Connector"**: Must be activated, if a MTM800 FuG / MTM5X00 without 9-pin COM connector is to be used! In this case, the RS232 interface of the FT638 must be configured to TTL levels (see **6.1.RS232 levels (connection of MRT1 + MRT2)**), as no RS232 levels are supported at the 26-pin Motorola Accessory Connector.

8.3. DMR Radios

- **Data Connection**: UART/RS232 at 9600, 8, n, 1 (Kenwood + Hytera)

  Attention: In first DMR versions, the setting in FT638 is fixed to 9600 baud, disregarding the web interface setting!

9. Techncal Data

Operating voltage	12 V
Current consumption	ca. 250 mA
Weight	ca. 520 g
Dimensions W x D x H	105mm x 140mm x 44mm

MRT1/2

Input impedance	1 kOhm
Output impedance	200 Ohm
Input level	max. 2 dBm
Output level	max. 2 dBm

A1/2

Input impedance	1 kOhm
Output impedance	200 Ohm
Input level	max. 2 dBm
Output level	max. 2 dBm
AF codec	PCM, 8bit, 64 kBit/s, A-Law, G.711

10. General Safety Instructions

Please read the manual carefully before installation and setup of your device.

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 connection 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 und 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 distributor.
- The installation and setup have to be carried out by professional personnel.

11. 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 August 2015, the purchasers or users are obliged to return old equipment 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
Breitwiesenstr. 4
36381 Schlüchtern
GERMANY

>>> Important: Freight forward deliveries cannot be accepted by us!

Subject to change, errors excepted!

12. Release Notes

02.11.17 - translation of German manual dated from 11.08.17

18.07.18 - further remarks about PEI multiplexer functionality
- product versions with new functionalities added
- configuration for voltage supply / BUSY on connectors A1/A2 added

06.02.19 - description of solder bridges on the backside
- additional remarks regarding the connection to Sepura SRG3900

29.04.22 - descriptions for DMR support