



**TSE 6802  
System Operation**

## TSE 6802

### System Operation

The set is designated for a monophonic or stereophonic wireless audio signal transmission within 420 MHz band to a distance according to the transmitting power and field conditions. Due to digital modulation, a better audio transmission quality is acquired during a weak signal in the noise threshold in comparison with the analogue systems. The set is designed as a frequency tunable unit. In a case of interference, it is possible to retune to another RF channel.

The transmission is continuous without amplitude modulation of the carrier. This limits the possibility of undesired penetration of the signal into other electronic devices (e.g. car radio, walkman, etc.). During interference, no characteristic audio effects occur, as known in e.g. mobile phones.

An unauthorized listening is practically eliminated by digital transmission, method of coding and encryption. A regular AM or FM receiver indicates the signal as an increased level of noise only. A data word of the encrypted audio signal does not contain any obvious signs such as e.g. start or stop bites, which makes the possibility of undesired decoding far more difficult. An encryption table to the individual transmitters is being designated during manufacturing.

The remote control takes place at the single frequency in the 150 MHz band, equal for all manufactured transmitters. The desired transmitter is located by a digital code being transmitted at every command. When the transmitter is controlled, it is identified by its assigned address, which is a number from 0 to 255.

For transmission of the remote control signals the same antennas are used like in case of an audio signal transmission. Therefore, the equipment may simultaneously receive as well as transmit by a single antenna on the transmitter and the receiver too. This is permitted by a frequency separator installed in both devices.

On the transmitter, a filter has been mounted midway on the antenna in order to optimize it to the two frequencies, Audio Signal Transmission and Remote Control respectively.

### System Specifications

Audio bandwidth	300 Hz – 9 kHz (for decrease - 3dB)
Sampling frequency	20.306 kHz
Supporting information transfer	Transmitter battery voltage, table key
Audio-channel RF carrier	410 to 427 MHz (up to 64 channels)
Audio-channel modulation	FSK: Df $\pm$ 38 kHz, 122kb/s (Mono) Df $\pm$ 53 kHz, 244kb/s (Stereo)
Audio-channel coding	100 $\mu$ s pre-emphasis, 8-bite quantization, digital compression to 5 Bites
Audio-channel encryption	32x32 fields binary table – no. of combinations: 2.6x1035
Remote control RF carrier	149.125MHz
Remote control modulation	FSK $\pm$ 4 kHz, 2/1 asynchronous Manchester code
Transmitter identification	Address: 0 to 255 – transmitter serial number

Channel	Average Freq. MHz	Channel	Average Freq. MHz
0	410.267	32	418.552
1	410.526	33	418.811
2	410.785	34	419.070
3	411.044	35	419.329
4	411.303	36	419.588
5	411.562	37	419.847
6	411.821	38	420.106
7	412.080	39	420.364
8	412.339	40	420.623
9	412.598	41	420.882
10	412.856	42	421.141
11	413.115	43	421.400
12	413.374	44	421.659
13	413.633	45	421.918
14	413.892	46	422.177
15	414.151	47	422.436
16	414.410	48	422.695
17	414.669	49	422.953
18	414.928	50	423.212
19	415.187	51	423.471
20	415.445	52	423.730
21	415.704	53	423.989
22	415.963	54	424.248
23	416.222	55	424.507
24	416.481	56	424.766
25	416.740	57	425.025
26	416.999	58	425.284
27	417.258	59	425.542
28	417.517	60	425.801
29	417.775	61	426.060
30	418.034	62	426.319
31	418.293	63	426.578

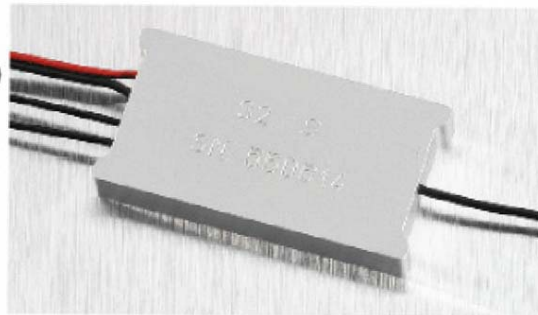
### Transmitting Units

#### LOKE STANDARD TRANSMITTER

Dynamics compressor                      Rising time approx. 0.1 s, falling time approx. 4s  
 Switch-off time in VOX regime          13 seconds after acoustic stimulus dies away  
 Crosstalk between audiochannels      40 dB (depending on audio frequency)  
 RF power / DC consumption (typical values)

HI Power	300mW / 130mA - supply voltage 12V (max) 170mW / 95mA - supply voltage 6V (nominal) 80mW / 90mA - supply voltage 3.6V (min)
LO Power	15mW / 54mA - supply voltage 12V (max) 12mW / 52mA - supply voltage 6V (nominal) 10mW / 50mA - supply voltage 3.6V (min)
Spurious RF products	< 40dBc (non harmonics)
VOX consumption	0.4mA - average value (without activation stimuli)
INACTIVE consumption	0.14mA - average value
Battery polarity reversal	Without any damage – protection by serial Schottky diode
Climate operating conditions	-10°C to +60°C / 14F to 140F, humid environment
Dimensions	57.5x29.5x8 mm / 2.2x1.1 x0.3 inches

Supply +3.6 - 12 V  
Microphone R (Mono)  
Microphone L



Antenna 149 / 420 Mhz

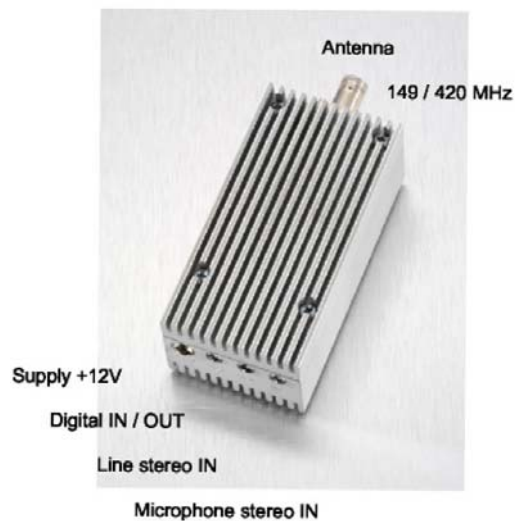
After connection to a supply the transmitter will switch into an initial start mode. Change of this setting will be made by a remote control on the receiver side.

**Antenna** - Since the antenna's quality basically influences the real emitted RF power, a special whip antenna made of two insulated conductors 17 cm long with a filter between is recommended. It must be pulled straight forward in the direction from the antenna transmitter pin. Open space around the antenna is recommended for the best RF radiation. Other conductors connected to the transmitter (microphones, batteries) must be directed to the opposite side of the antenna in order to establish a suitable balance to the antenna itself. Under hard conditions (e.g. on a human body) it is necessary to experimentally set the antenna.

**Supply voltage** - A maximum allowed value is 12V. The minimum value to keep the internal stabilizer functional may not drop below 3.6V. A recommended voltage is 6V (2 x lithium battery cells), at which the transmitter reaches the best efficiency (i.e. ratio of RF power / DC consumption). On the contrary, the maximum emitted RF power (regardless of the efficiency) is reached under a supply voltage up to 12V. For installation of the transmitter in a car it is necessary to implement a stabilizer. A random polarity reversal of the supply voltage is being treated and does not lead to any destructive consequences.

## Loke High Power Transmitter – 2W

Stereo inputs:	Audio line 0.7V (ef) Microphone (electret, 3V bias introduced through 4.7kΩ resistor)
Digital input/output:	TTL audio signal data stream input TTL remote control signal output
Dynamics compressor:	Rise time 0.1s (approx.), fall time 4s (approx.)
Switch-off time in VOX mode:	13 seconds after acoustic stimulus or data stream dying down
RF power:	HI Power: 2.5W LO Power: 0.2W
Spurious RF products:	< 55dBc (non-harmonic components) < 60dBc (harmonic components)
Supply:	+12V (min. 8V, max. 15V) / max. 0.8A – DC/DC converter used
Reversal of battery poles:	Without transmitter damage – serial Schottky diode protection
Climatic operating conditions:	-10 to +60°C, humid Environment
Size:	100×51×39mm / 3.9×2.0×1.5 inches



After connection to a supply the transmitter will switch into an initial start mode. Change of this setting will be made by a remote control on the receiver side.

**Microphone inputs** – The connector is wired by standard method, similarly as, e.g. any microphone input in the computer audio adapter. Herein the DC bias is introduced for the microphones supplying. This is equipped for two wires microphone connection.

**Line input** – It is being utilized for processing the signal of a standardized line level from other audio devices, e.g. various recording instruments, etc.

**Digital input/output** – This connector is being utilized for the direct data interconnection with the LOKE receiver and this way a repeater station may be created.

**Output cascade** may be remote switched either to high or low power. This power is internally stabilized so it does not depend on the supply voltage. It changes only during channel retuning. It is slightly decreasing on higher channels.

**Antenna** – A mobile two-band or a special two-band whip antenna has to be connected to the transmitter. We recommend the same mobile antenna with magnetic base as that one delivered with the receiver. The role of output cascade protection circuits is to prevent the output cascade destruction in case of antenna disconnection. Regardless, we recommend avoid the transmitter operation without the antenna connected.

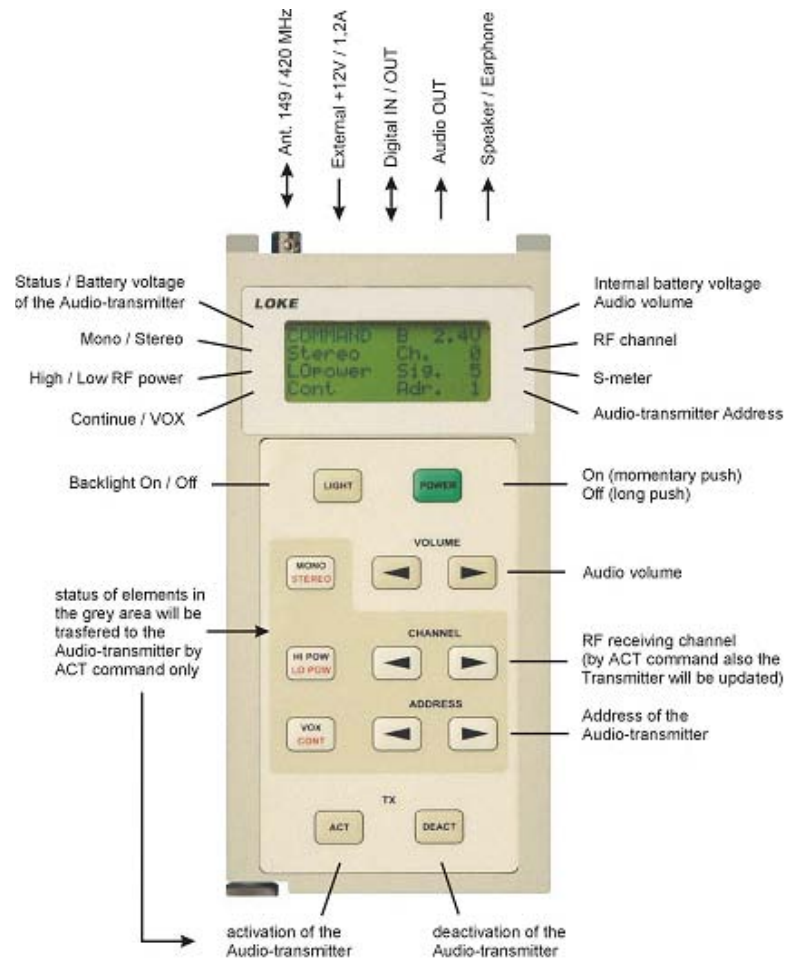
**Supply voltage** – The maximum allowed operating supply voltage value is 15V, the minimum one, under which the internal stabilizer not operate, is approx. 8V. The switched DC/DC converter holding stable operation conditions in the mentioned supply range is used in the transmitter. It is necessary to realize the maximal current consumption from the power supply occurs in case of minimum operating voltage due to this circuit influence!!!

**Cooling** – The transmitter consumption from the power supply may be up to 10W and most part of this power converts to heat energy. Therefore sufficient transmitter packet cooling has to be ensured. We do not recommend placing the transmitter to confined areas without sufficient air circulation and other extraction of radiated heat energy. Accidental reversal of source poles is treated and it has no destructive consequences.

### Receiving Unit

Receiver sensitivity	1 $\mu$ V (Mono), 1.5 $\mu$ V (Stereo) - listening without noticeable defects 0.8 $\mu$ V (Mono); 1.2 $\mu$ V (Stereo) - good speech intelligibility 0.5 $\mu$ V (Mono), 0.8 $\mu$ V (Stereo) - listening on the edge of intelligibility
RF signal processing	Double mixing, 1.MF=159.825MHz, 2.MF=10.7MHz, PLL detector
S-meter	Displayed value from 0 up to 100 (see the picture below this table)
Data synchronization	Bites - hardware PLL Frames - to maximum average of parity
Synchronization time	< 0.1 s
Noise squelch	After data stream loss, No noise
Receiver digital output	TTL, updated copy of received data for retransmission
Receiver line output	0.7V
Receiver repro output	4W, 1 W
Remote control RF power	0.7 W (according to battery voltage, external source, resp.)
External source voltage	12V nom. (8V min., 15V max.)
Current consumption:	110 mA from external power supply (+50mA – display backlighting) 200 mA from internal 3V battery (+90mA – display backlighting)
Internal battery	2 x AA

Receiving operating period	Up to 10 hours depending on battery quality and use of remote control command (without display backlight)
Ext. source polarity reversal	May lead to a damage - not permitted!
Int. battery polarity reversal	May lead to a damage - not permitted!
Climatic oper. Conditions	-10°C to +60°C / 14F to 140F, internal environment without Humidity
Dimensions	205x95x40mm / 8.1x3.7x1.5 inches (without connectors)



**Device switch-on** is done by pushing the green button referred to as POWER. Switch off is done by holding this push button down a little longer. After the device is switched off, you must allow at least 5 seconds or longer before switching on again. When switched on, a status is displayed showing the data, which appeared before the device was switched off.

**Display lighting** - is always activated for a period of 5 seconds from the time of switching on. After this period has passed the display lighting is automatically turned off. A permanent lighting of the display may be activated and deactivated by using the LIGHT push button.

**Encryption table** – 32 x 32 fields binary table – number of combinations  $2.6 \times 10^{35}$   
 Sound volume in speakers or earphones is selected by VOLUME push buttons. During the time they are pushed down numerical information about the sound volume appears on the display on the right upper side instead of an internal battery voltage.

**Remote control function** - Push buttons on the keypad are limited by a darker field. Their immediate status is shown on the display. A flashing COMMAND sign on the upper left side indicates the display initial command regime. Terms of the remote control status push buttons.

MONO / STEREO	Switches between one - and two channel transmission.
HI POW / LO POW	High or Low RF power of the audio-transmitter.
VOX / CONT	Voice activation (VOX) or permanent transmission (CONT).
ADDRESS	Particular serial number of the transmitter that to be controlled.
CHANNEL	Immediate tuning of the receiver to a selected channel, which shall also be transferred by command into the audio-transmitter.

All push buttons in a dark field on the keypad are only "status-displayed" - they have no influence until the command ACT or DEACT push buttons are used, when the factual transmission of a remote control command only occurs. The exception is the CHANNEL push button that is also used to select an immediate choice of the channel being received. It is necessary to note that by switching over the MONO-STEREO, only the signal processing on the audio transmitting side is directly being controlled. The receiver automatically recognizes the type of signal being received at the time, regardless of immediate position of the command push button. This is important if the signal from one audio transmitter is being simultaneously listening to at more receivers.

**Antenna** - A mobile two-band antenna radiator, and a two-band whip antenna is being delivered as part of the set. The mobile antenna has a gain of approx. 0 dB within 150 MHz band (remote control), and about 3 dB gain within 420 MHz band (audio-signal). For its proper tuning, the antenna requires a conducting fundamental base (e.g. car roof)! It can be installed on a magnetic or solid automobile holder delivered as a component of the set. The antenna must be located on the car roof in a vertical position. The RF coaxial cable coming to the receiver must be as short as possible to avoid any unnecessary signal loss.

**Antenna input / output** - A signal captured by the antenna is being directed to the receiver input. At the receiver supplying circuit, limiting elements are used so that a random antenna connector short circuit has no destructive effects (only 12mA short-circuit current). Due to a dual-direction utilization of the antenna, it is impossible to use regular amplifiers. A special type with a frequency splitter is necessary to be used that can be developed upon request only by the set manufacturer.

**Digital input / output** - The receiving block is equipped with a connector for dual direction of serial data transmissions for the purposes of potential RF retransmissions, should this option be required in the future. At present this connector is only equipped with an output for timely updated copies of the data received.

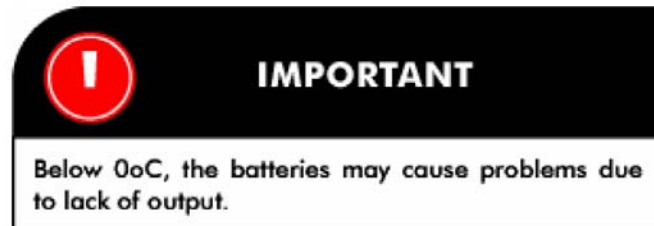
**Audio output** - An audio-signal of 0.7V nominal effective voltage may be connect e.g. to a recording equipment. This line outlet is on a constant level and not influenced by adjustable volume of sound.

**Speakers, earphones** - An outlet from the terminal sound amplifier. A speaker with 4 up to 8~ impedance or regular Low-Ohm earphones may be connected. The audio-signal level is controlled by VOLUME push buttons.



**Batteries** – The unit is supplied by 2 AA cells. By choosing high quality batteries like Duracell Ultra M3, the receiver will be able to operate up to 10 hours (with a limited use of the remote control functions).

The batteries will be electronically disconnected if an external power supply is used.



**External supply voltage** - The maximum allowed voltage value is 15V and the minimum is 8V. A direct connection to an automobile board DC-network is possible if the alternator-regulator system of the vehicle is in good condition and the car battery contacts are in properly functioning. We recommend first to measure a maximum voltage of the car DC-network when the car is running so the limit values are not exceeded.



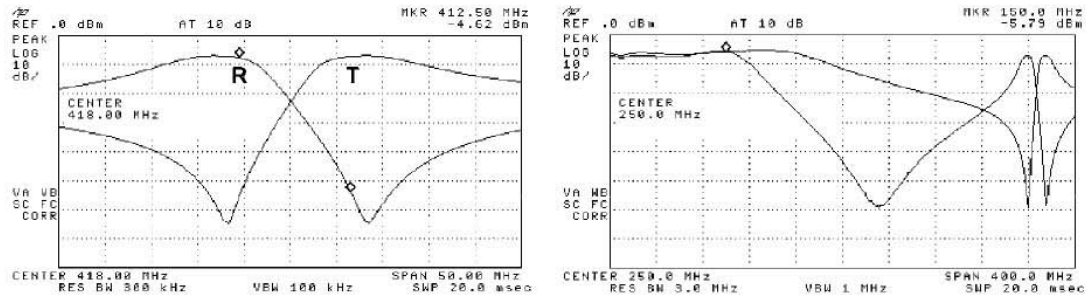
**Antenna Filter (Diplexer) (For repeater function only)**

**Specification – type R:**

Through attenuation:	1.5dB within 150MHz band (remote control) 2.5dB in channels 0 to 9
Undesired channels suppression:	>45 dB in channels 54 – 63

**Specification – type T:**

Through attenuation:	1.5dB within 150MHz band (remote control) 2.5dB in channels 54 to 63
Undesired channels suppression:	>45dB in channels 0 to 9



In a **repeater unit** the filter is being utilized for preventing of a strong signal penetration back to the receiver. It comprises the combination of a band pass and band-stop filters and is precisely tuned up to required channels. This filter has to be installed in the repeater unit both on the transmitting and receiving sides. By reason of easy recognition the filter is marked by the letter "R" = receiving, or "T" = transmitting.

### Recommend Operational Procedures

Push the CHANNEL buttons to find a free RF channel where no interference (jamming) is present (S-meter indicates low numerical values). An option of automatic channel selection may be utilized:

By simultaneously pushing both CHANNEL buttons, the band scanning is initiated. After 5 seconds the channel with the minimal interference will be founded automatically. However, for proper results it is necessary for the audio transmitter to be inactive (not transmitting), because its signal should not influence the scanning result. It is also necessary to notice that PC's standing too close to the scene usually jam all the bands!

To set further regime-parameters require using push buttons in the darker field on the keypad (ADDRESS, MONO-STEREO, HIPOW-LOPOW, VOXCNT)

Via these regime-parameters the transmitter is activated by pushing the ACT button. WARNING (!!!) - After every change of the regime-parameters it is necessary to execute the activation (update) again by using the ACT push button in order to transfer the changes transferred to the audio transmitter. The transfer of one command takes 0.5 second, following which a test of valid response is immediately performed on the receiver side. The acceptance of response takes about 0.2 second, and during this time the receiver audio output is being blocked. If the response is not valid, the command transmit is automatically repeated. However, not more than 4 times. The number of commands transmitted per minute in average is also limited by the software in order to avoid the terminal RF amplifier overheating.

If the command transfers were completed successfully, the audio transmitter battery voltage is displayed on the upper left side. After a moment this information is modified to ACTIVE. This sign informs the user that the audio transmitter has recorded this setting indicated on the display in its memory. If the successful transfer is not confirmed, a flashing COMMAND sign reappears on the display informing the user that the command has not been successfully accepted, and that the status indicated on the display has not been transferred to the audio transmitter. After the command acceptance is successfully completed, the update of current encryption table in the receiver is also performed (if authorization assigned by Gamma).

If the remote transmitter was activated in a VOX regime, then after 13 seconds it gets put in an idle (sleeping) regime (refer to hereunder), from which it may be made awake either by an acoustic impulse or new remote control command.

A de-activation of the audio transmitter from operation is made possible by pushing a DEACT button. If the transfer was successfully completed, the display indicates the audio transmitter battery voltage at its left upper section.

Note that you may need a distance of min. 5 meters between receiver and transmitter in order to avoid potential jamming.

### **Operation in Repeater Mode**

The principle is the signal reception on one channel and its repeated transmission on the other one. This mode is favorable in cases when no direct connection between the transmission and receiving sites exists; however, a third one is available with connection to the both terminal sites. Usually, it is located at some uphill place where so called "repeater point" can be built.

Based on customer's request the repeater station was developed that transfers a digital data directly (thus without voice quality loss), inclusive a remote control command repeater. In order to remove necessity to invest resources to other special unit purchase the concept was selected utilizing the existing receiver and LOKE Power transmitter. A digital line according to the diagram will interconnect both of these units and this way the repeater station will be created.

The first (primary) radio route segment has always been tuned up to anyone of channels nr. 0 to 9. The second (secondary) segment is always bound with the primary segment by a 54-channel bounce up, so it operates on channels nr. 54 to 63. The special set of arrow separated channel pairs is reserved on the receiver display for this reason. The number on arrow's left means the primary route segment channel. The arrow indicates the signal transfer direction. Thereafter, the secondary route channel number is displayed on arrow's right.

In order to ensure the entire system operation without the repeater station receiver input congestion by the own transmitter it is necessary to use antenna filters suppressing this signal. At the same time, both repeater station antennas have to be sufficiently spaced. We recommend 2m and more. System software is designed so that the repeater station is remote controlled and it has also its own address alike every other LOKE Transmitter.

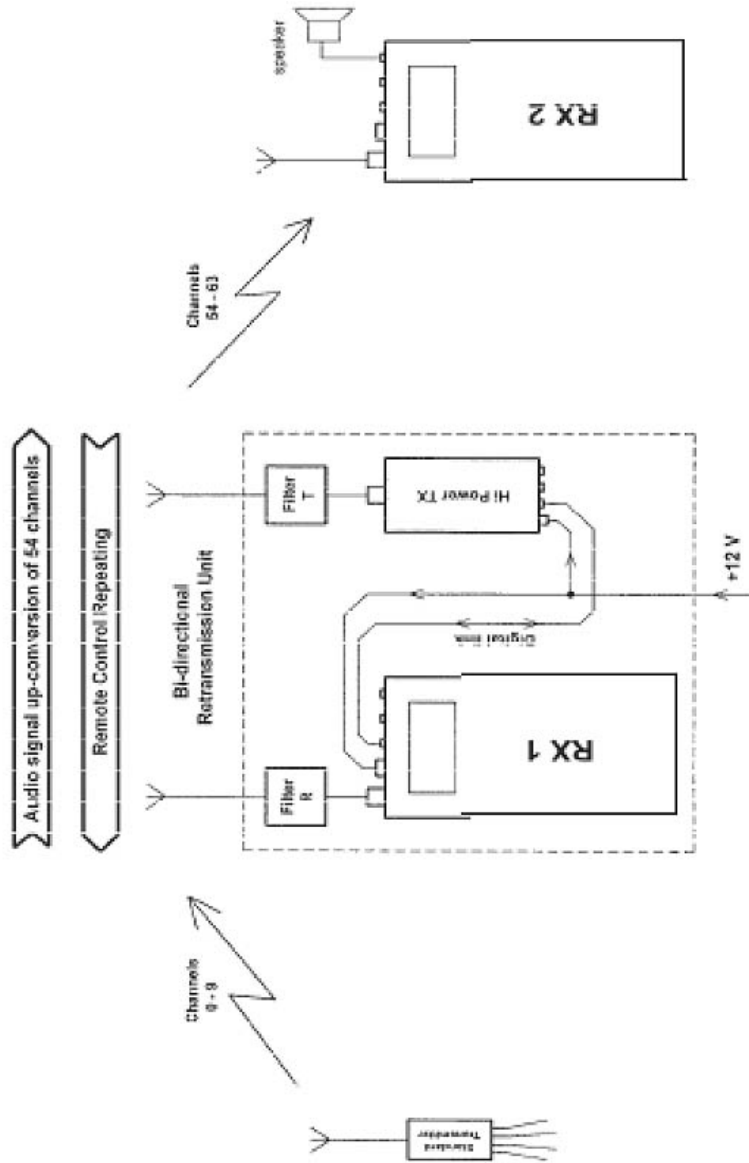
For this reason, it is necessary to set the address equal with the own transmitter on the repeater receiver (!!!). Only this way the both units will correctly respond to the remote control commands and will mutually co-operate.

After an addressable reception of a valid command for the repeater station the last will be automatically set out. However, after the reception of a command with any other address than the one of the repeater station the command will be modified and sent once again (repeated) provided the originally received command contained the channel pair. The repeater does not response to the commands with omitted channel pair.

### Repeater Set-Up

(See figure on next page)

1. Connect RX 1 and High power TX with mini jack mini jack cable
2. Connect filter "T" to High power TX. Connect antenna to filter "T"
3. Connect power supply to High power TX and the battery to Standard TX.
4. Connect filter "R" to RX 1. Connect antenna to filter "R"
5. Switch on the RX 1. Set the address so it corresponds to the address engraved on the backside of the High power TX.
6. Switch on the RX 2. Set the channel between 0 – 54 and 9 – 63. Choose the channel with the lowest signal / noise "sig".
7. Set the RX 2 address so it corresponds to the High power address (see item 5)
8. Set the RX 2 to the wanted settings for the Hi Power TX :VOX/CONT, MONO/STEREO, HI POW/LO POW
9. IMPORTANT: press "ACT"
10. The RX 2 will deliver 2 beeps if above has been carried out correctly.
11. Set the RX 2 address so it corresponds to the address engraved on the backside of the Standard TX.
12. Set the RX 2 to the wanted settings for the Standard TX: VOX/CONT, MONO/STEREO, HI POW/LO POW
13. Press "ACT".



## Notes

### Working Temperature

LOKE is being set-up and adjusted at Gamma's premises under room temperature for which the specifications are referred to in the introduction. Although LOKE is constructed for operations in increased working temperature ranges, the temperature changes can cause the transmission specifications to get slightly worse. In order to accomplish the best possible results, it is recommended to place the receiver in a room temperature environment.

### Interference (Jamming)

In the 410 to 427 MHz bands, a number of various services are available. Therefore, it is bilaterally beneficial to work only at channels determined by the user to be long-term unoccupied within the given territory (look at the frequency table). It was further discovered in practice that a very strong interference is caused by personal computers. It is necessary to avoid their existence in the receiving location.

### Unfavorable Conditions of Radio Signal Transmission

Although a suitable location was successfully found for the antenna in order to ensure a clear receiving, it does not mean that the situation will not change. A multi-direction propagation with a lot of echoes is an event that changes in time. It is necessary to realize that any, even minor, changes in a path of the signal reaching a dimension of the wavelength are already noticeable. This regards e.g. movement of vehicles on the road, but also movement of trees in wind, persons and objects in the room, etc.

The fact that this regards just this type of receiving with a number of echoes, the user of LOKE set finds out so that, when the transmitter is being retuned between 0 up to 63 channels, the receiving intensity substantially fluctuates. Strong minimums and maximums of the signal being received are considerable. For a short-term activity this phenomenon can even be used as an advantage if the user chooses a channel at which, due to echoes, the receiving is the strongest. However, such case is a consequence of multidirection radio-waves propagation, and, therefore, in time a long-term nonstability in reception quality can be expected.

### Warranty

The warranty period is 12 months from date of expedition. During this period Gamma will provide free repair of failures (particularly caused by defects of materials). Only Gamma is authorized to make any repairs and maintenance.

Warranty is not valid when any of the below mentioned event occurs:

1. Damage caused by a regular wear
2. Damage during transportation
3. Damage due to improper storage environment
4. Malfunction caused by any overloading applied to the device (high temperature, high voltage, high power, short-circuit, etc.)
5. Destruction caused by water, chemicals, fire, natural disaster, etc.
6. Crackdown b unauthorized personnel
7. Improper attendance in conflict with User Manual



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