

f.u.n.k.e.

AVIONICS GMBH

FSG 2T

5W VHF/AM Aviation Transceiver

118.000 ... 136.975 MHz
25 kHz channel spacing



ETSO: EASA.210.1304 Rev.A
FAA: TSO C37d / TSO C38d
FCC ID: BVYFSG2T CE 0682

Installation & Operation

applies for FSG 2T

article no.

F10350

Before installing and operating the transceiver, please read this manual thoroughly!

Please observe the Safety Information!

Keep for further use!

| | |
|----------------|------------|
| Document name: | IM 035.00 |
| Document no.: | FAV_D10048 |
| Revision: | 3.00 |
| Date of Issue | June 2014 |

f.u.n.k.e.
AVIONICS GMBH

f.u.n.k.e. AVIONICS GmbH

Heinz-Strachowitz-Str. 4 ★ 86807 Buchloe ★ Germany
Telephone +49 (0)8241 / 80066-0 ★ Fax +49 (0)8241 / 8066-99
e-mail: info@funkeavionics.de
Internet: www.funkeavionics.de

Manual Revision History

MANUAL IM 035.00
REVISION 3.00

Retain this list in the front of the Installation & Operation Manual as a RECORD OF REVISIONS.

| Revision Dittel | REASON FOR CHANGE | Date |
|--------------------|--|----------|
| 01 | JTSO/ETSO authorization added | 03/07/02 |
| 02 | RegTP document added | 05/08/02 |
| 03 | DFS document added, approval number D – 0002/2002 completed, rear view revised, FCC ID and FCC document added | 18/11/02 |
| 04 | “Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/EC (R&TTE Directive)” document added, “§ A5, Transmitter Specification“ corrected. | 11/02/03 |
| 05 | “EEC TYPE-APPROVAL CERTIFICATE of Kraftfahrt-Bundesamt, D-24932 Flensburg“ added, „Notifikation einer Funkanlage des Bundesamts für Kommunikation, Biel/Schweiz“, added, type label (page 15) updated. | 10/03/03 |
| 06 | New version of document “Declaration of Conformity appropriate to the German law (FTEG) of radio and telecom terminal equipment”. | 12/05/03 |
| 07 | FAA TSO numbers added at front page | 17/09/03 |
| 08 | Pages 34 and 56 were corrected because of AF External (external audio signal is <u>not</u> reduced) | 15/03/04 |
| 09 | New VOL-knob, type label updated | 20/02/08 |
| 10 | Extension of EC-Type Approval (Kraftfahrt-Bundesamt), type label updated, new Certificates of EC-Type Approval and ETSO, new article numbers for A/C Battery box and Charger DL-50A | 28/04/10 |
| 11 | Amended version of “Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/EC (R&TTE Directive)” document added. Changes due to acquisition of full ownership by MARPOSS S.p.A., Italy | 30/04/13 |

| Revision FAV | REASON FOR CHANGE | Datum |
|-----------------|---|------------|
| 1.00 | Initial Release after change to Funkwerk Avionics GmbH; 86807 Buchloe – Germany | 01.09.2013 |
| 2.00 | Change of company name to f.u.n.k.e. AVIONICS GmbH | 04.02.2014 |
| 3.00 | FCC document added | 25.06.2014 |

IMPORTANT NOTE!

- *If installation into an aircraft is made by other than a certified avionics shop, you have to consult your responsible aircraft Avionics Airworthiness Inspector - before the installation – to get authorized certification of your completed installation.*
- *The conditions and tests required for **ETSO** and **FAA-TSO** approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine, that the aircraft installation conditions are within the **ETSO** or **FAA-TSO** standards. If not within these standards, the article FSG 2T may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.*

Table of Contents

| | |
|---|-----------|
| Manual Revision History | 2 |
| Table of Contents | 4 |
| List of Illustrations | 6 |
| Abbreviations | 7 |
| 1 For Your Safety | 9 |
| 1.1 Used Symbols..... | 10 |
| 2 General Description | 11 |
| 2.1 About this document..... | 11 |
| 2.2 General Description..... | 11 |
| 2.2.1 Application..... | 11 |
| 2.2.2 Operation Description..... | 11 |
| 2.3 Technical Description..... | 13 |
| 2.4 System and Type Approval Information..... | 14 |
| 2.5 Re-calibration Information..... | 15 |
| 2.6 Operating License..... | 15 |
| 2.7 Equipment supplied..... | 15 |
| 2.8 Optional Accessories..... | 16 |
| 2.9 Equipment required, but not supplied..... | 17 |
| 2.10 Some words about Microphones..... | 18 |
| 3 Installation | 19 |
| 3.1 General..... | 19 |
| 3.2 Unpacking and Inspecting Equipment..... | 19 |
| 3.3 Pre-installation Test..... | 19 |
| 3.3.1 Particular Remarks to FSG 2T Transmitter Modulation..... | 20 |
| 3.4 Mechanical Installation..... | 23 |
| 3.4.1 Transceiver installation..... | 23 |
| 3.4.2 Compass deviation..... | 23 |
| 3.4.3 Antenna installation..... | 25 |
| 3.5 Airborne wiring..... | 27 |
| 3.5.1 General recommendations..... | 27 |
| 3.5.2 Wiring the Microphone(s)..... | 34 |
| 3.5.2.1 Microphone settings..... | 35 |
| 3.5.2.2 Dynamic Microphone(s)..... | 36 |
| 3.5.2.3 Standard Carbon, amplified Electret, amplified Dynamic Microphone(s)..... | 37 |
| 3.5.3 Intercom (IC)..... | 38 |
| 3.5.4 Loudspeaker / Headset interconnection..... | 38 |
| 3.5.5 OPTIONAL: AF External Operation..... | 39 |
| 3.5.6 Backlighting..... | 40 |
| 3.5.7 Connection to a 28 Vdc airborne system..... | 40 |
| 4 Recommended Set-up Sequence | 41 |
| 4.1 General..... | 41 |
| 4.2 Microphone Set-up..... | 42 |
| 4.2.1 Set-up using Loudspeaker / Junction Box and one (or two parallel, identical) non-amplified Dynamic Microphone(s) at Mic 1 Input, pin 1..... | 42 |
| 4.2.2 Set-up using two non-amplified Dynamic Microphones separate on Mic 1 input, pin 1, and Mic 2 input, pin 3..... | 42 |
| 4.2.3 Set-up using one (or two parallel, identical) amplified / Standard Carbon Microphone(s) on Mic 2 input, pin 3..... | 43 |

| | | |
|----------|--|-----------|
| 4.2.4 | Set-up using two amplified / Standard Carbon Microphones, separate on Mic 1 input, pin 1, and Mic 2 input, pin 3 | 44 |
| 4.2.5 | Set-up using non-amplified microphone(s) on one input and amplified microphones on the other | 45 |
| 4.3 | Adjusting the Headphone Volume and Transmitter Sidetone | 46 |
| 4.4 | If applicable – check the Intercom Mode | 47 |
| 4.4.1 | FSG 2T without AF External capability:..... | 47 |
| 4.4.2 | FSG 2T with AF External capability:..... | 47 |
| 4.5 | Check the RX Loudspeaker / Headphone Volume | 48 |
| 4.6 | Fixing the radio | 48 |
| 4.7 | Testing on the Ground with engine Off..... | 49 |
| 4.8 | Ground checks with engine running (if applicable) | 50 |
| 5 | Functional Description | 51 |
| 5.1 | Introduction..... | 51 |
| 5.2 | Operator's Controls..... | 51 |
| 5.3 | Frequency Display, the 5-digit Liquid Crystal Display (LCD) can be back-lit..... | 54 |
| 5.4 | Error Codes | 55 |
| 5.5 | Connectors and controls on the rear side | 56 |
| 5.6 | Reset..... | 56 |
| 6 | Operation..... | 57 |
| 6.1 | Introduction..... | 57 |
| 6.2 | Turning ON - Selecting Frequency - Audio Volume..... | 57 |
| 6.3 | Receive (Listen) Operation | 59 |
| 6.4 | Transmit (Talk) Operation | 60 |
| 6.5 | Memory Programming | 61 |
| 6.5.1 | Programming while in DIRECT TUNE MODE: | 61 |
| 6.5.2 | Programming while in CHANNEL MODE: | 62 |
| 6.6 | VOX Intercom | 63 |
| 6.7 | Intercom (Option AF EXTERNAL enabled) | 64 |
| 6.8 | OPTION: AF External | 65 |
| 6.9 | Backlighting | 65 |
| 6.10 | Turning OFF | 65 |
| 6.11 | Monitoring the aircraft onboard supply | 66 |
| 6.12 | Operating times of FSG 2T supplied from a 12 V battery only | 67 |
| 6.13 | Emergency Operation | 67 |
| | Appendix A, Technical Data FSG 2T..... | 69 |
| A.1 | General..... | 69 |
| A.2 | Dimensions, Weight..... | 69 |
| A.3 | Power Supply, Fuses..... | 69 |
| A.4 | Receiver Specification | 70 |
| A.5 | Transmitter Specification | 71 |
| | Appendix B, Environmental Performance Classification | 72 |
| | Appendix C, Certificates | 73 |
| | Copyright – Service Information..... | 77 |

List of Illustrations

| Fig. | | Page |
|-------|--|------|
| 3 - 1 | Pre-Installation Test Set-up..... | 22 |
| 3 - 2 | Deviation of a compass by an operating FSG 2T, depends on the distance between compass center and contour of transceiver | 23 |
| 3 - 3 | FSG 2T, Dimensions, Installation Drawing | 24 |
| 3 - 4 | Standard Hook-up Diagram using pre-wired cable harness A/N F10028, one MIC input for 1 - 2 non-amplified Dynamic Microphone(s)..... | 29 |
| 3 - 5 | INTERCOM Hook-up Diagram for two seat application using pre-wired cable harness A/N F10029, one MIC input for 2 non- amplified Dynamic Microphones | 30 |
| 3 - 6 | INTERCOM Hook-up Diagram for two-seat application, using two MIC inputs for 2 non-amplified Dynamic Microphones (hardwired)..... | 31 |
| 3 - 7 | INTERCOM Hook-up Diagram for two-seat application, using two MIC inputs for 2 Amplified / Standard Carbon Microphones | 32 |
| 3 - 8 | INTERCOM + MIC Selector Switch Hook-up Diagram for single or two seat application, using Amplified/Standard Carbon Microphone(s) and non-amplified Dynamic Microphone(s) | 33 |
| 5 - 1 | Operator's Controls and Indicators..... | 51 |

Abbreviations

| | | | |
|-------|--|-------|--|
| A/C | Aircraft | mW | Milliwatt |
| A/N | Article Number | NM | Nautical mile (1 NM = 1.852 km) |
| AGC | Automatic Gain Control | nW | Nanowatt (10^{-9}) |
| Ah | Ampere hour | PEP | Peak Envelope Power |
| AM | Amplitude Modulation | PLL | Phase-Locked Loop |
| ANT | Antenna | ppm | Parts per million |
| Ass'y | Assembly | PTT | Push-To-Talk |
| AWG | American Wire Gauge | pW | Picowatt (10^{-12}) |
| ccw | Counter-clockwise (turn left ↶) | PWR | Power |
| CH | Channel | RF | Radio Frequency |
| cw | Clockwise (turn right ↷) | rms | Effective value (root mean square) |
| dB | Decibel | RX | Receive |
| dia. | Diameter | S+N/N | Signal-to-Noise Ratio |
| EASA | European Aviation Safety Agency | SINAD | Ratio: $\frac{\text{Signal} + \text{noise} + \text{distortion}}{\text{noise} + \text{distortion}}$ |
| EMF | Electromotive Force (voltage of an open circuit) | SPKR | Loudspeaker |
| ESTO | European Technical Standard Order | SQ | Squelch |
| F/CH | Frequency/Channel | STBY | Standby |
| FL | Flight Level | STO | Store |
| g | Acceleration due to gravity | SWR | Standing-Wave Ratio |
| GND | Ground | THD | Total Harmonic Distortion |
| HI | High Power | TOT | Time out timer |
| Hz | Hertz | TX | Transmit |
| ICAO | International Civil Aviation Organization | VCO | Voltage-Controlled Oscillator |
| IF | Intermediate Frequency | Vac | Volts, alternating current |
| kHz | Kilohertz | Vdc | Volts, direct current |
| LCD | Liquid Crystal Display | VFO | Variable-frequency oscillator |
| LED | Light Emitting Diode | VHF | Very-High Frequency |
| LO | Low Power | VOL | Volume |
| LOS | Line-Of-Sight | VSWR | Voltage Standing-Wave Ratio |
| m | Modulation | W | Watt |
| mA | Milliampere | Ω | Ohm |
| MD | Mode | °C | Degrees Centigrade |
| MHz | Megahertz | °F | Degrees Fahrenheit |
| MIC | Microphone | | |

THIS PAGE
INTENTIONALLY
LEFT BLANK

1 For Your Safety

Every radio, when transmitting, radiates energy into the atmosphere that may, under certain conditions, cause the generation of sparks. All users of our radios should be aware of the following warning:

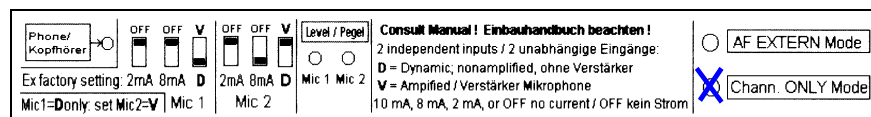
Do not operate this radio in an explosive atmosphere (petroleum fuels, solvents, dust, etc.)!

During normal use, the radio will subject you to radio frequency energy substantially below the level where any kind of harm is reported.

There are no user replaceable parts inside the FSG 2T! If the radio fails it must be returned to a f.u.n.k.e. AVIONICS GmbH approved repair facility!

The licensee of a radio station is responsible at all times for the proper operation of the station. Radio operators should use the following guidelines to make this radio a useful tool for safe and efficient flight:

- **DO NOT** transmit when the antenna is very close to, or touching, exposed parts of the body, especially the face and eyes. Persons with pacemakers should be aware that proper functioning may be affected when in the vicinity of the antenna!
- **DO NOT** transmit without antenna connected.
- **DO NOT** operate the radio on an unprotected power supply. Replace a blown fuse only against correct type with specified nominal value. Investigate the cause.
- **DO NOT** transmit on a busy channel.
- **DO NOT** press the transmit (PTT) key when not actually desiring to transmit.
- **DO NOT** transmit with the antenna inside aircraft or vehicle. This may cause malfunction of onboard avionics, trigger the vehicle airbag or interfere onboard instruments! Always operate the radio FSG 2T with a suitable outdoor / external antenna! Assure appropriate lightning protection / grounding where (elevated) outdoor antennas are used.
- **DO NOT** operate the radio whilst driving. It should also be noticed that even the use of a hand held microphone while driving could constitute an offence under the Road Traffic Regulations in certain countries.
- **DO NOT** allow children to play with any radio equipment containing a transmitter.
- **DO NOT** use a radio FSG 2T for airborne operation which is marked as "Chann. ONLY Mode":



- Always switch OFF the radio first when installing the unit into vehicles, aircraft or carrying cases, or when removing from it!
- Always switch OFF the radio before starting an aircraft or vehicle engine!
- When operating the FSG 2T on a 24 Vdc / 28 Vdc source a suitable Voltage Converter 24 Vdc / 12 Vdc of at least 3 Amps must be used!
- The FSG 2T should be used exclusively for aviation related communication purposes.
- Unauthorized modifications and changes of the system are **forbidden**.

- Sufficient speech volume is very important. While the lips are very close and facing the microphone, speak loud and clear. Proper speech level is indicated by the yellow flickering LED on the FSG 2T front panel.
- In aircraft / vehicles a suitable noise canceling microphone or headset shall be used.
- A backup microphone should always be carried during any flight. Even new microphones can fail!
- Prior to any flight verify proper FSG 2T functions by means of a short radio check. It has however to be taken into account that with a faulty antenna or its cable this COM test may absolutely turn out positive at the airfield or in short distance to the ground station. But at a distance of 2 to 6 miles, a faulty antenna and / or cables will cause communication breakdown!
- Push-to-Talk keys may stick occasionally.
The transmission signaling RED or flickering YELLOW LED shall be turn to CLEAR or GREEN when releasing the PTT key.
However, after more than two minutes continuous transmitting (by stuck button or operator caused), the built-in transmit time-out-timer disables the transmitter in order to avoid continuous channel blocking. A continuously flashing display warns the user.
Refer to appropriate hints in this manual.

1.1 Used Symbols

In this manual the following symbols are used:



WARNING!

describes an immediate threatening danger! Failing to observe the note may cause death or heaviest injuries.



CAUTION!

describes a special note for operation. Failing to observe the note may cause damage of the transceiver and / or stored data may be deleted!



IMPORTANT!

describes explanations and other useful hints. Failing to observe the note may cause degraded performance and / or unsatisfying operation!

2 General Description

2.1 About this document

This installation and operation manual IM 035.00 refers to a FSG 2T, Article Number F10350, and contains instructions and descriptions for application, installation, presetting, operation and testing, as well as hook-up diagrams for the universal / multi-use FSG 2T VHF/AM Transceiver of **f.u.n.k.e. AVIONICS GmbH**, Avionics Division, 86807 Buchloe, Germany.

Additionally, the following Maintenance Manual MRM 035.00 contains Circuit Description, Overhaul and Maintenance Instructions, Alignment Procedures, Testing Instructions, and an Illustrated Parts List.

2.2 General Description

The FSG 2T VHF/AM COM is a miniaturized, lightweight, panel mounted (also for helicopters no shockmounts are required), single block transceiver operating in the VHF/AM airband radio frequency range 118.000 MHz ... 136.975 MHz, thus providing 760 channels with 25 kHz channel spacing, covering a standard communications distance of ca. 100 NM (nautical miles) at FL 70.

2.2.1 Application

The equipment is approved for airborne operation as COM 1, COM 2, COM 3 in **Fixed Wing** and **Helicopter** aircraft, and for ground use in any Portable, Fixed Based or Mobile operation.

Ultra low power consumption in conjunction with extremely wide DC supply voltage range, small dimensions and wide scope of accessories allow universal airborne applications in any powered aircraft, motor glider and Ultralight, and in glider and balloon, for primary or (also battery supplied) backup operation.

Universal use in ground vehicle, as well as for compact portable cases and for desk-top or rack mounted, local or remote controlled, fixed base primary, or (also battery supplied) backup operations, are further applications. Please always ensure suitable antenna solutions!

2.2.2 Operation Description

The transceiver fits into a standard 2¼ in. / 58 mm diameter instrument hole and is fixed by four (4) screws M4. Installation depth behind the front panel including connectors and wiring is 240 mm.

Connections on the rear panel to the electrical environment are achieved via a locked Standard DB-15 male connector using a wiring harness, and a BNC antenna connector.

All operational control and display elements are located on the night-design front panel:

Transmit / Receive Mode, modulation level or Intercom is indicated by a 3-color Status signaling LED on the front panel.

The back-lit Liquid Crystal Display (LCD) shows the active frequency, onboard supply or memory channel number as well as ERROR codes (if applicable). During switch-on the firmware version is shown and a display check is performed.

For **airborne and ground application** two display modes are user selectable:

FREQUENCY MODE: **Active Frequency and actual onboard voltage** are shown on the display. Turning / pushing the F/CH knob changes Frequency.

CHANNEL MODE: **Active Channel Number (1 ... 20) and associated Frequency** are shown on the display. Turning the F/CH knob changes preset Channel Number and associated Frequency. Reprogramming without restriction.

Only for ground based operation:

Optionally a particular mode can be set where the operation is limited to use only preset channels. To set this mode the radio has to be opened. **This may only be performed by an approved repair facility!**

20 preset memory channels and the last operating setting remain all stored in a non-volatile memory. Switching OFF or power failure does not result in loss of memory information.

Turning the left inner knob adjusts loudspeaker or headset audio level. Full ccw position turns the radio OFF.

The continuously variable SQ-knob (left, outer ring) adjusts the Squelch threshold. Full ccw position turns the SQ circuit OFF (full Receiver sensitivity, continuous RX noise is audible during RX Mode).

On the rear panel a 15-pin SUB-D connector for the aircraft wiring is located. It contains two independent microphone inputs which can be set individually by (covered) DIL switches suitable either for

- Dynamic non-amplified microphones,
- Amplified Dynamic / Electret / Standard Carbon Microphones, with or without DC supply, or
- one input for a Dynamic non-amplified microphone and the other input for an Amplified Dynamic / Electret / Standard Carbon Microphone.

For each MIC input, the microphone signal can be adjusted by potentiometer #1 and #2 to modulate the transceiver properly. Additionally, supply current for amplified or Standard Carbon Microphones for each MIC input can be set by DIL switches to 2 mA, 8 mA, 10 mA, or none.

Phone audio output is adjustable by potentiometer #3 on the rear panel.

For two seat aircraft and noisy environment, the voice activated (VOX) Intercom is a long expected feature. It eliminates constant background noise since it is only active when you talk.

2.3 Technical Description

Both Transmitter and Receiver use the same digital frequency synthesizer and an accurate reference crystal. The transmit frequency is tuned simultaneously with the Receive frequency (Simplex operation).

The single superhet Receiver offers high immunity against in-band and out-of-band RF interference, intermodulation and cross modulation, including ICAO Annex 10 FM immunity / intermodulation.

The automatic Receiver AM / FM noise Squelch threshold is continuously adjustable on the front panel by the SQ knob. Full cw position of the SQ knob requires maximum -93 dBm / 5 μ V / 50 Ω to open the Squelch. Full ccw position of the SQ knob offers maximum Receiver gain, the Squelch is always open and RX noise is continuously audible while in RX Mode.

The transceiver can be supplied directly from any properly fused 9 – 16.1 Vdc power source (aircraft, vehicle, etc.) with sufficient current supply capability.

As a specific FSG 2T feature, integral controls enable full transceiver operation without any degradation even during Emergency Supply Condition between 9 Vdc and 11 Vdc.

A suitable DC regulator is required for supply from 28 Vdc-buses.

In Ultralights, Gliders, Balloons or Portables without onboard electric power generation system, long-term operation from a 12 Vdc battery (min. 6 Ah) is appropriate.

The onboard voltage is monitored continuously. When supply voltage drops below 11 Vdc, the Supply Indication on the LC display starts flashing as a low supply warning.

Below 8.5 to 9 Vdc, the FSG 2T turns OFF itself, but will come back into operation when the supply voltages increases / returns to more than some 10.3 Vdc. The last used settings remain however active.

An audio low pass filter for areas using CLIMAX operation with 25 kHz channel spacing is incorporated in the FSG 2T, to suppress multi-carrier beat audio tones.

The audio amplifier provides AF power to the speaker (4 Watts into 4 Ohms and 50 mW into 300 Ohms for headphones).

The solid state temperature-controlled transmitter is wideband tuned from 118 to 137 MHz and delivers some 5 Watts transmitter RF carrier power.

A keyed transmitter, without or with too low microphone modulation input voltage, is indicated RED by the status LED on the FSG 2T front panel. Detailed information regarding TX modulation, monitoring and setting is given in § 4.2, Microphone Set-up.

In Receive Mode for Intercom purposes (Intercom selector switch), the microphone input level enables voice activated (VOX) pilot / crew intercommunication. This allows in Receive Mode a voice activated intercommunication (no additional accessories needed) between pilot and crew when using the Intercom wiring harness, headsets, proper mike input setting and sufficient speech volume.

Intercom phone audio volume can be adjusted individually by the VOL knob on the front panel. In addition, VOX ON is optically indicated by the GREEN TX/RX Status LED on the front panel.

During Intercom, as long as a Receive signal exists, the Intercom audio level is reduced by 6 dB / half level, and the Receiver audio dominates therefore.

The FSG 2T is equipped also with a transmit time-out timer. This avoids blocked channel after 2 minutes continuous TX (stuck button does not block a channel continuously) and is indicated by a continuously blinking display. Should such stuck button malfunction continue, the FSG 2T is ready for another 2 minute transmission period when turning OFF and ON the unit again (e.g. for emergency or blind transmission).

OPTION: The external AF input allows interconnection of 1 Volt / 600 Ω audio source(s) especially in aircraft using other COM, VOR / LOC, DME, MKR and / or electric variometers. This allows signal monitoring during Receive Mode by speaker, and / or headphone in Intercom Mode. This option can only be enabled by an internal solder bridge (performed by an approved Avionics Service Shop, marked on the information label). This increases the Standby current consumption up to 200 mA. In addition the VOX Intercom Function is then disabled.

External AF input, Receive and Intercom audio listening through headphone(s) is simultaneously possible in Receive / Standby Mode.

2.4 System and Type Approval Information

The VHF/AM Airband Transceiver FSG 2T complies with ICAO 25 kHz channel spacing and also meets applicable National and International Type Approval requirements, for any airborne operation:

- JTSO Authorization LBA.O.10.911/103 ETSO (LBA Luftfahrt-Bundesamt), replaced by ETSO Authorization EASA.210.1304 RevA, is based on EUROCAE ED-23B Airborne requirement (25 kHz ONLY CH spacing).
- FM Immunity requirements according to ICAO ANNEX 10 against FM Broadcast RF Interference.
- Audio filtering required in areas with CLIMAX operation in 25 kHz channel spacing.
- Associated EUROCAE ED-14D / RTCA DO-160D Environmental requirements for Fixed Wing and Helicopter aircraft.
- Associated EUROCAE ED-12B Software requirements based on ED-12B, Level C.
- CE Conformity Nr. 0682 requirements for ground operation, meeting ETSI EN 301 489-1 V1.9.2 and ETSI EN 301 489-22 V1.3.1.
- FCC Compliance with Part 15 (receiver) and Part 87 (transmitter), FCC ID: BVYFSG2T.
- FAA / TSO Authorization.

2.5 Re-calibration Information



IMPORTANT!

- **For airborne applications**, no frequency re-calibration is necessary, since applications in the 25 kHz channel spacing require a frequency accuracy tolerance of less than ± 20 ppm.
- **For the first time after three years**, FSG 2T **equipment for ground applications** requires checking and re-calibration of the high precision reference frequency (tolerance better than ± 10 ppm).
- **All tolerances include the full operating temperature range of $-20^{\circ}\text{C} \dots +55^{\circ}\text{C} / -4^{\circ}\text{F} \dots +131^{\circ}\text{F}$.**
- **Checking and re-calibration must be performed by the equipment manufacturer or through authorized and approved avionics services!**

2.6 Operating License



IMPORTANT!

- ***Depending on national regulations, VHF/AM airborne and / or VHF/AM ground operation may require an individual national operating license. Such license is usually granted by the responsible National Telecommunications Authority, through suitable application forms.***
- ***Besides aircraft registration, operator's name, address and operating license payment details, state radio type / model, Serial number, ETSO number EASA.210.1304 Rev.A***

Example:

VHF/AM Transceiver **FSG 2T** Ser.No. 90702314 Art.No. F10350-(Mod.0C)
 FAA TSO-C37d FAA TSO-C38d
 ETSO-2C37e ED-23B Class 4 Software ED-12B Level C
 ETSO-2C38e ED-23B Class C EASA.210.1304 Rev.A Weight 0.6 Kg
 ED-14D Categories D1-BAB[(SBM)(RG)]XXXXXXXXZBBBATHXXXX 9-16 VDC / 2 A



FCC ID: BVYFSG2T



2.7 Equipment supplied

| Description | A/N |
|---|--------|
| 5-Watt VHF/AM Transceiver FSG 2T, Installation and Operation Manual, Operating Instructions, 4 screws M4 x 20 | F10350 |

2.8 Optional Accessories

Wide accessory scope allows FSG 2T installation and operation in aircraft, in ground systems; fixed, portable and mobile into vehicles.

| Description | A/N |
|---|--------|
| Connector kit, SUB-D 15-pin, incl. mounting hardware | W00009 |
| BNC antenna connector, solder type | E08980 |
| Cable Harness Set, 3.2 m / 10.5 ft, numbered and color-coded cables, polarized connectors, for use with Loudspeaker / Junction Box | F10028 |
| Intercom Cable Harness Set, 3.2 m / 10.5 ft, numbered and color-coded cables, polarized connectors, for use with Loudspeaker / Junction Box, comes with panel mount Intercom Switch | F10029 |
| Loudspeaker / Junction Box, 4 Ω / 30 Watt, small, sturdy housing, two 5-pole DIN jacks to connect 2 dynamic microphones or headsets in parallel, terminal for PTT key(s), fits harness F10028 or F10029, | F10061 |
| Dynamic headset, noise canceling, coiled cord, 4-pole plug U-174/U | W00048 |
| Adapter cable for headset W00048, to fit 5-pole DIN jack | F10036 |
| Dynamic gooseneck (boom) microphone 600 Ω , 3 m / 9.8 ft cable, 5-pole DIN connector, especially for gliders and motor gliders | F10039 |
| Dynamic microphone, for PC portable and car mobile use, metal housing, coiled cord, PTT key, 5-pole DIN plug | F10041 |
| Retaining bracket, fits microphone F10041 | E24907 |
| Dynamic hand microphone, 500 Ω , coiled cord, PTT key, 5-pole DIN plug | F10346 |
| Microphone bracket, to keep microphone F10346 | W00087 |
| Dynamic microphone-loudspeaker, coiled cord, PTT key, 5-pole DIN plug, sealed | F10042 |
| PTT key, 3.5 m / 11.5 ft cable, permanent installation on the control stick | F10050 |
| Inline PTT key U-94A/U, coiled cord, 5-pole DIN plug, connects directly to Loudspeaker / Junction Box or Portables and headset A/N W00048, clip allows attaching to clothing | F10125 |
| Battery Box, 12 Vdc / 7.2 Ah lead battery, sturdy steel / aluminum case, mount plate for quick removal, 6.3 A circuit breaker, 5-LED battery test set, 3-pole DIN socket, 3-pole DIN plug | F10382 |
| Automatic battery charger DL-50A, 115 / 230 Vac. Output 13.8 Vdc / 600 mA. For airborne and portable 12 Vdc lead batteries, 3-pole DIN plug | F10385 |
| Vehicle mount bracket, permits the FSG 2T to be mounted under or above the dash of a vehicle / aircraft | F10058 |

2.9 Equipment required, but not supplied

- a) VHF aircraft antenna with coax cable RG-58 C/U and BNC connector (male)
- b) Headphone (8 ... 600 Ohms, typical) and / or loudspeaker (4 ... 16 Ohms)
- c) Non-amplified dynamic microphone, (4 ... 600 Ohm), and/or amplified / Electret / Standard carbon microphone, with or without PTT key (separate MIC inputs amplified / non-amplified, sensitivity adjustable)
- d) Alternatively to b) and c) headsets with similar specifications
- e) Battery power supply unit 12 Vdc, minimum 7.2 Ah, for aircraft without electrical system
- f) Push-to-talk key, e.g. stick mounted (if microphone without PTT key is used)
- g) Pre-wired cable harness F10028 or F10029 (Intercom)
- h) 15 pole SUB-D connector type DB-15 S and cover, if no pre-wired cable harness is used.

2.10 Some words about Microphones



IMPORTANT

- a) *Radio performance and system reliability significantly depend on quality acoustic accessories, and their proper audio leveling adjustments. Please avoid use of low quality / low performance accessories.*
- b) *After installation completion, optimized acoustics performance requires proper mike audio system selection and its appropriate level adjustment (non-amplified dynamic, or Standard Carbon Microphone(s) system).*
- c) *Since the radio FSG 2T has got two (2) separate microphone inputs, it is possible to connect and adjust different microphone types / techniques on separate MIC inputs.
Furthermore two microphones can be connected in parallel to one input, but then*
 - *make sure that only microphones of identical type / characteristics may be interconnected in parallel and appropriately together adjusted/ matched.
If a microphone is, however, removed, then the setting is too sensitive for the remaining microphone (because of a missing attenuation by the 2nd mike) and therefore should be adjusted optimally once more in noisy aircraft.*
- d) *Dynamic microphones require shielded wiring and galvanic separation of mike grounds from any other signal ground (e.g. DC input / DC output, Dimmer, Speaker, Phone, PTT, and external AF input ground).*
- e) *Standard Carbon / compatible amplified microphones may employ Dynamic or Electret acoustics transducers. Amplified microphone ground may be connected together with other grounds, e.g. for DC input / switched output, speaker, phone, PTT, dimmer, external audio input.*
- f) *Operation of amplified microphone systems close to the RF radiating antenna (on portable case or located close to the cockpit) may be heavily interfered from own radiated strong antenna RF field strength and become unstable, oscillates or causes modulation distortion. Verify such effects, which are possibly caused by RF, by replacing the radiating antenna against an artificial antenna / RF dummy load temporarily.*

3 Installation

3.1 General

This section contains instructions and suggestions to be considered before installing the radio FSG 2T into an aircraft. Close adherence to these suggestions will assure more satisfactory performance from the equipment.

Information in this section is intended for certified avionics shops only. Work such as installation, wiring and testing should only be carried out by a qualified technician!



IMPORTANT!

- *If installation into an aircraft is made by other than a certified avionics shop, you have to consult your responsible aircraft Avionics Airworthiness Inspector - before the installation – to get authorized certification of your completed installation.*
- *The conditions and tests required for **ETSO** and **FAA-TSO** approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine, that the aircraft installation conditions are within the **ETSO** or **FAA-TSO** standards. If not within these standards, the article FSG 2T may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.*

3.2 Unpacking and Inspecting Equipment

Unpack the equipment carefully and inspect each item for evidence of damage incurred during shipment. FSG 2T serial number must comply with relevant details mentioned in Airworthiness Approval Tag and delivery note details attached to the shipment.

If a damage claim must be filed, save the shipping container and all packing materials to substantiate your claim. The claim should be filed with the transportation company as soon as possible.

If a damage is noted after the first test, notify the transportation company in writing with advance e-mail, phone or fax advice about hidden transport damage.

A copy of such a claim including all information from the type label is to be forwarded without delay also to **f.u.n.k.e. AVIONICS GmbH**.


3.3 Pre-installation Test

Before installing the radio into an aircraft, vehicle or portable carrying case, a short but comprehensive functional bench test through a certified avionics shop is recommended.

- Interconnect the radio with a test wiring harness (according to Figure 3 - 1) to the test bench setup. For FSG 2T set supply to 13.8 Vdc on radio input terminals. Turn ON the radio with the **VOL** switch on front panel. Switch OFF the Squelch by rotating the **SQ** knob to fully counter-clockwise position.

Verify, whether on all channels within 118 ... 136.975 MHz almost identical, strong,

continuous Receiver acoustic noise without strange or rhythmic characteristic is audible.

- b) In Receive Mode, cw (clockwise) rotate / adjust the dot marking of the **SQ** knob on the dot  marked on front panel.

Verify, whether Receiver sensitivity on all channels complies with technical data (make sensitivity tests covering the whole frequency range).

At almost full ccw and full cw position, the Squelch threshold shall be within approximately 0.5 μ V / -113 dBm and 5 μ V / -93 dBm / 50 Ohms (vary signal generator output level).

- c) Connect a 50 Ohm Wattmeter and a 20 dB or 30 dB throughline RF attenuator pad. Key the transmitter and check RF output level (approximately 5 W carrier).
- d) For **Amplified / Standard Carbon Microphone(s)** adjust the audio generator to 1,000 Hz and apply signal via decoupling capacitor to the Standard Carbon MIC input. With 80 mV to 100 mV rms input, the transmitter shall achieve more than 70% AM (depends on MIC sensitivity setting). Increase AF input to 500 mV rms, observe modulation envelope, no overmodulation shall occur, depth of modulation must remain less than 95%.
- e) For **Dynamic Microphone(s)** adjust the audio generator to 1,000 Hz and apply signal via attenuator to the Dynamic MIC input. With some 0.5 mV to 3 mV rms input, the transmitter shall achieve more than 70% AM (depends on MIC sensitivity setting). Increase AF input to 15 mV rms and observe modulation envelope. No overmodulation shall occur; depth of modulation must remain less than 95% AM.

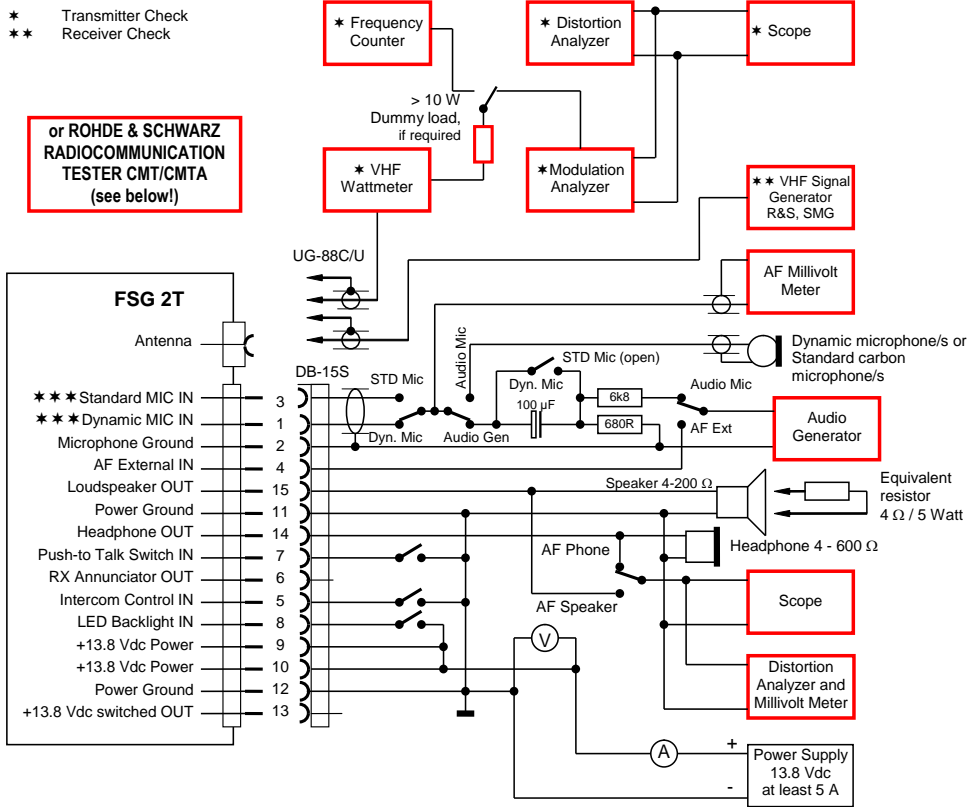
***NOTE** Proper modulation input level setting is indicated, when the (time delayed) control LED on the front panel just changes from red (too low modulation level) to yellow (appropriate modulation level setting).*

3.3.1 Particular Remarks to FSG 2T Transmitter Modulation

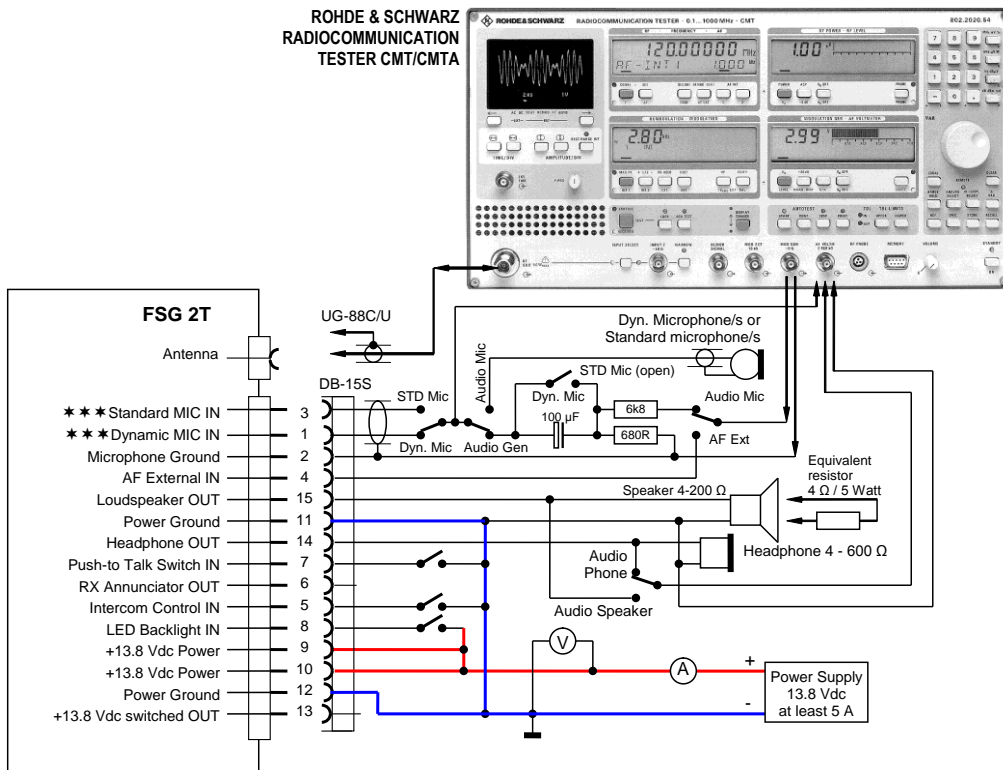
Highly demanding, specific requirements shall be comprehensively considered as follows:

1. Voice modulation with its typical dynamic peaks (fast and large level changes) shall modulate the transmitter with peak AM depth of not more than some 85%.
2. Factory setting of the very specific FSG 2T voice processor results in a remarkable **AVERAGE of approximately 80% AM depth with voice and Sine modulation!** Thus, optimized usage of the RF carrier is achieved.
3. Do not change this setting, otherwise the stringent (25 kHz) Transmitter RF Emission Spectrum Mask is no longer maintained.
4. The FSG 2T incorporates a special VOICE PROCESSOR, which is matched best to meet the requirements of the particular environmental noise level situation.
 - a) This ensures an always loud and clear transmitter modulation, under consideration of specific test requirements.
 - b) Even under these very specific conditions, fulfillment of the critical, highly demanding RF Emission Spectrum Mask is achieved.

- c) The correct microphone level setting is achieved when – slightly time delayed – the front signaling LED changes from RED to flickering YELLOW, while speaking in Transmit Mode loud, clear and close to the microphone transducer element.
5. Although due to the specific voice processor compression of modulation peaks, when tested with maximum sine wave modulation signal, a conventional testing of "standard modulation distortion measurements" is possible. This does however refer only to sine waveform testing. It will therefore result in higher than the usual 2% ... 10% sinus modulation distortion, but will stay far below the maximum allowed 25% modulation distortion factor with sinus modulation.
6. Therefore, judgment of the effectively occupied total transmitter band width (spectrum mask) is the only true, real measurement method. Such measurements can be made only with specific test setup. However, the front LED assists optically.
7. For tests of the FSG 2T modulation capability, a sine modulation signal is useful only at or below some 85% AM depth, and is on the other hand helpful only in determining of possible overmodulation, but is not applicable to judge "voice distortion" anymore.



OR



*** for MIC setting, refer to § 3.5.2.1

Fig. 3 - 1 FSG 2T
Pre-Installation Test set-up

3.4 Mechanical Installation

3.4.1 Transceiver installation

Any radio installation into an aircraft shall be coordinated with both the licensed Inspector who certifies the installation, and with the aircraft manufacturer's installation instructions.

Certifying the aircraft installation may be subject to specific National Regulations.

The FSG 2T VHF/AM transceiver is designed to be installed rigid into the instrument panel or operating console from its rear side into a standard 2¼ inch / 58 mm diameter instrument hole. Shock-mounts are not required, even not for helicopter installation. For dimensions and positioning of the 4 fixing holes refer to Figure 3 - 3.

Select a radio location distant to heat sources. All equipment controls shall be readily accessible from the pilot's normal seated position. The appropriate operator / crew member(s) shall have an unobstructed view of the display and access to the control knobs when in the normal seated position.

Sufficient room (at least 220 mm / 9 inches) behind front panel must be left for wiring accommodation. Fixing of the transceiver is achieved by use of 4 cross recessed Pan head screws M4 x 20 mm (supplied). These screws are sufficient for panel thickness between 3 mm and 7 mm (1/8 ... 5/16 inch).

3.4.2 Compass deviation

Compass deviation caused by FSG 2T is less than 30 cm for 1° deflection.

(Category Z in accordance with EUROCAE ED-14D / RTCA DO-160D environmental test conditions).

| Compass Deviation | Distance |
|-------------------|-------------------|
| 0.5° | 12 cm / 4.73 in. |
| 1.0° | 7 cm / 2.76 in. |
| 1.5° | < 7 cm / 2.76 in. |
| 2.0° | < 7 cm / 2.76 in. |
| 2.5° | < 7 cm / 2.76 in. |
| 3.0° | < 7 cm / 2.76 in. |

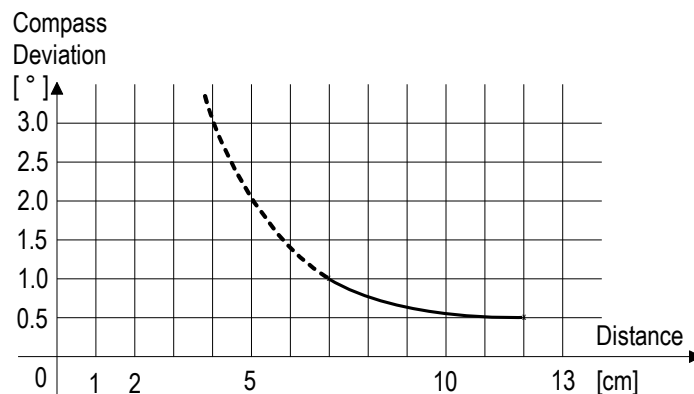


Fig. 3 - 2: Deviation of a compass by a transmitting FSG 2T; depends on the distance between compass center and contour of transceiver

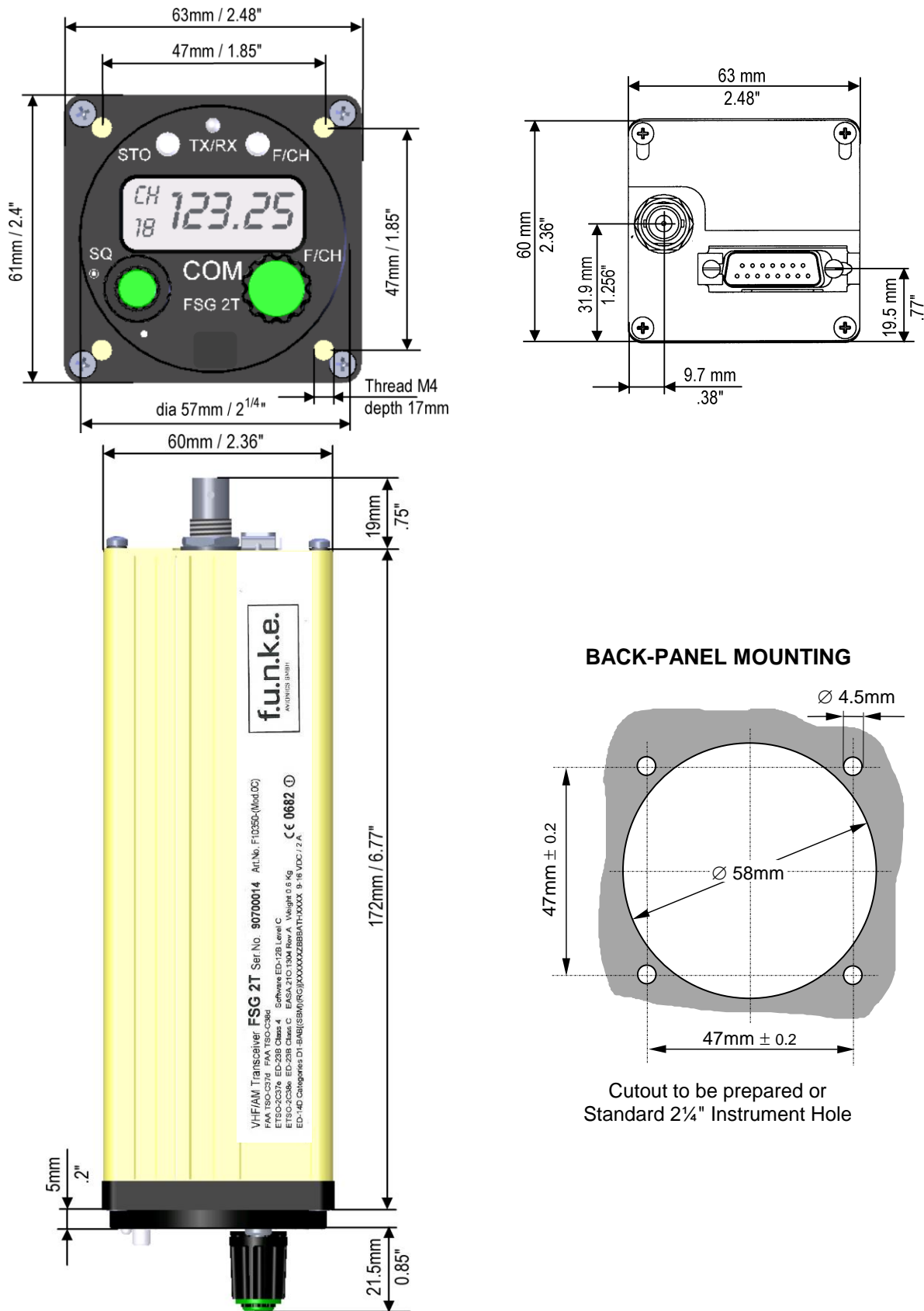


Fig. 3 - 3 FSG 2T
 Dimensions
 Installation Drawing

3.4.3 Antenna installation

Your radio FSG 2T is only as good as the antenna!

For operation, a vertical polarized 50 Ohm broadband aircraft COM antenna is required. The antenna must be able to radiate RF energy evenly and omni-directional:

- First of all, look up the aircraft's manual for antenna installation instructions.
- The antenna installation location must be carefully planned. It would be the best to consult the Aircraft Certifying Inspector. In order to achieve best results into all directions, installation instructions must be fully complied with.
- For aircraft with metal fuselage, we recommend a rod antenna. This antenna is mounted vertically (as possible) on or under the fuselage. Location should be even away from horizontally screening metal parts like propeller, undercarriage, vertical metal fins etc., for maximum radio range into all (horizontal) directions.
- Distance to other aircraft antennas, like another COM or NAV antenna, should be at least 1.5 m / 5 feet. When using two radios FSG 2T, a distance of 1 m / 3.3 feet between COM antennas is sufficient.
- The antenna mounting area should be as flat as possible.
- The metallic contact between aircraft surface / structure and the antenna cable outer conductor (shield) must be durable and robust. The electrical contact shall remain continuously good and safe against vibration and corrosion.
- For wood and fiberglass (GRP) aircraft, 3 or 4 aluminum counter weight strips (ea. 60 cm / 2 feet long - 5 cm / 2 inches wide) are recommended, but shall be placed (mostly) horizontally in the shape of a star.
- These stellate counter weights must be centrally screwed together with the antenna socket. Care for a permanent good electrical contact.
- Alternatively, for aircraft with non-metallic surface structure inside the fuselage, a metal foil (min. 60 x 60 cm / 2 x 2 feet) can be stuck in. The antenna socket will then be placed in the foil center, together with a metallic ground contact support plate. Consult aircraft manufacturer's instructions to verify proper antenna location.
- For aircraft with fuselage and / or tail-fin made of non-conductive material, a vertical folded top antenna is suitable. Installation is made preferably during manufacturing the tail-fin. **IMPORTANT: Carbon fiber is conducting and may shield the antenna!**
- Careful sealing of all openings of the outer skin is mandatory. Make sure, that electrical contacts remain permanent good, even under bad environmental conditions.
- Use only high quality 50-Ω coax cable type RG-58 C/U. Avoid any sharp cable bend (radius > 50 mm), mounting pressure, strain, and any excessive coax cable length.
- Place all wiring including antenna cable distant to other wiring which carries heavy AC currents, and distant to any aircraft controls.
- Any operating kinematics, trimming and all control handles must be absolutely free in all directions.

- Ensure the BNC antenna plug is not shortened between inner and outer conductor (Ohmmeter). Resistance 0.0Ω indicates a short inside the antenna connector, while some 0.6 to 1Ω indicates the antenna cable resistance while an internally (static) protected antenna is used. A simple rod antenna is tested for low resistive contact between inner cable conductor and radiator, and outer conductor to counter weight.
- **You should possess a reasonable knowledge of antenna installations and the importance of ground planes before attempting the following:** Check the antenna matching using $50\text{-}\Omega$ VSWR meter over the whole frequency range for VSWR less than 3:1. It may be helpful / necessary to cut slightly the length of the radiator or counter weight length for optimized antenna efficiency and matching.
- **REMEMBER: A good antenna is the best RF amplifier!**

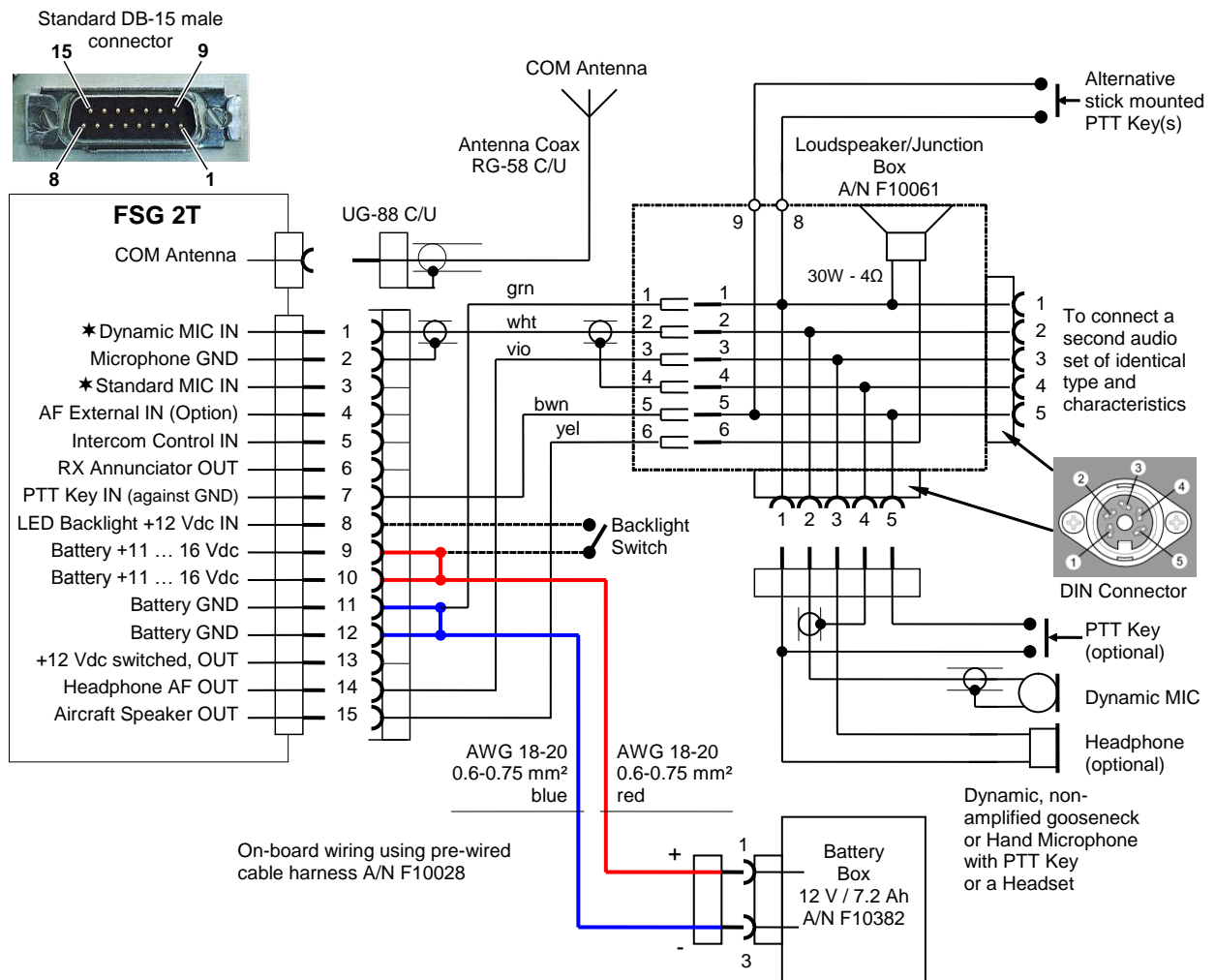
3.5 Airborne wiring

Refer to Figures 3 - 4 to 3 - 8 of on-board wiring.

3.5.1 General recommendations

- Always ensure permanent good, stable electrical contacts, and efficient RF interference suppression of all electrical systems like generator / alternator, ignition, electronic variometer, anti-collision light, etc., especially consider vibration and corrosion effects. Consult the Aircraft Installation Licensing Inspector.
- Connect the positive (+12 Vdc) power wire (normally red) to pins 9 and 10. Because of current requirements it is essential that the connection is made to both pins, otherwise problems may arise. The positive wire must be connected to the aircraft power via a circuit breaker (inline fuse 3.15 amps or automatic circuit breaker 3 amp) and through a radio master switch, not direct to the battery. Do not connect to power until installation is complete and cross-checked.
- Connect the negative (-12 Vdc) ground wire (normally blue or black) to pins 11 and 12. Because of current requirements it is essential that the connection is made to both pins, otherwise problems may arise. The ground wire must be connected to a good clean contact that provides a durable path to the aircraft ground. Prefer a ground wire direct to the battery's negative terminal.
- Power bus circuit breakers are to be mounted in the A/C breaker panel or instrument panel such that they will be accessible in flight and safe from physical damage.
- **Do not** allow the harness to droop between clamps.
- **Do not** allow the wires in the harness to come in contact with sharp surfaces or ride against any movable part.
- **Do not** install without allowing for service loops / strain relief, this will help to prevent undue stress on the connectors and allow for easier repair of wire terminations.
- **Do not** allow harness to route through high heat areas without adequate protection.
- **Do not** install harnesses in areas that are subject to chemical damage.
- Radio wiring shall be located most distant to other, high AC currents carrying leads. Route all wiring including antenna cable distant from aircraft control and handling components. Place DC power lines at least 15 cm (6 inches) away from compass.
- Use only aviation grade wiring material (LN 9251 resp. LN 9253) in self-extinguishing quality, and with > 500 Volt isolation.
- Prescribed cable diameters must be complied with.
- Ground loops must be avoided. Route shielding of dynamic mike(s) separate from other grounds or shields.
- Cables are soldered to the Standard DB-15 female connector. Solder joints shall be supported by shrinking or rubber sleeves. Connector back shell must not clamp or damage the cables.
- Secure the radio connector by the sliding lock to avoid unwanted connector loosening.

- Pre-wired cable harness assemblies are color coded for simple plug-in installations when used with optional loudspeaker / junction boxes and dynamic microphones for all kind of aircraft.
- Electronic variometers seldom comply with airborne RF environmental type approval requirements. All of the known models at printing time of this manual have to our knowledge a (some even far) too high radiated RF interference emission. In FSG 2T Transmit Mode, the operator may even be faced with radio energy based functional variometer influence. Slight improvement may be achieved when the variometer wiring is both shielded and routed not in parallel but distant to the radio wiring. Eventually, short but bulky grounding contacts between all radio and variometer cases may improve this E-variometer RF susceptibility capability. Further measures to improve RF immunity may be obtained from the variometer manufacturer and in some cases also from the aircraft manufacturer.



NOTES:

DO NOT wire other pins than noted! Connections which are not required for your installation may be left unterminated!

All wires are #22 AWG (0.3 - 0.4 mm²) unless otherwise noted

* **For MIC setting, refer to § 3.5.2.1 and § 4.2**

Built-in Automatic Circuit Breaker provided when using Battery Box A/N F10382

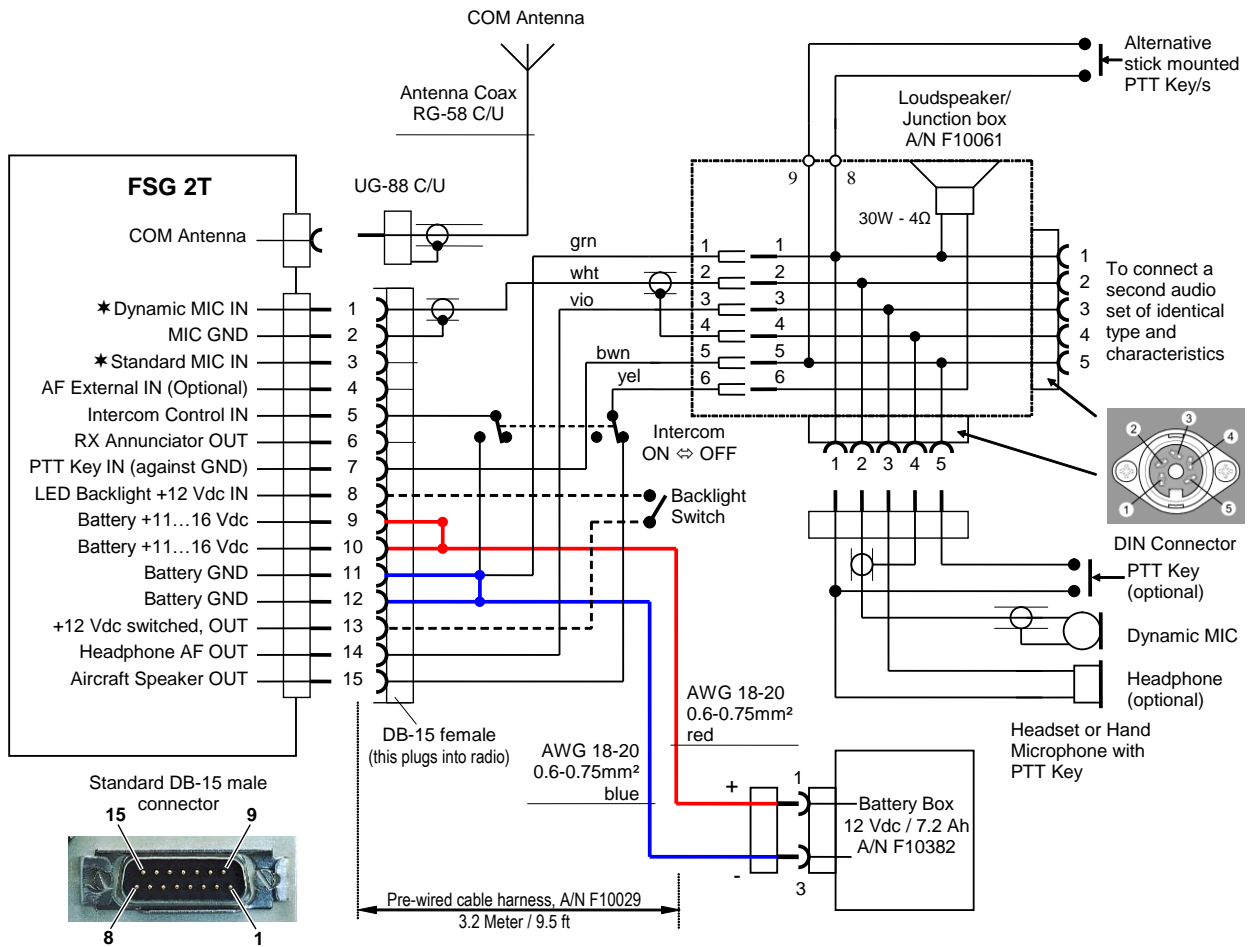
Length of pre-wired cable harness F10028: 3.2m / 9.5ft

----- and coax antenna cable are **not** included in pre-wired cable harness A/N F10028

Fig. 3 - 4 FSG 2T

Standard Hook-up Diagram using pre-wired cable harness A/N F10028

- one MIC input, for
- one non-amplified Dynamic Microphone, or
- two non-amplified Dynamic Microphones (identical) in parallel



NOTES:

DO NOT wire other pins than noted! Connections which are not required for your installation may be left unterminated!

All wires #22 AWG (0.3 - 0.4 mm²) unless otherwise noted

★ **For MIC setting, refer to § 3.5.2.1 and § 4.2**

Intercom operation requires microphones which provide audio OUT with the PTT key de-energized (not keyed)

Built-in Automatic Circuit Breaker provided when using Battery Power Supply A/N F10382

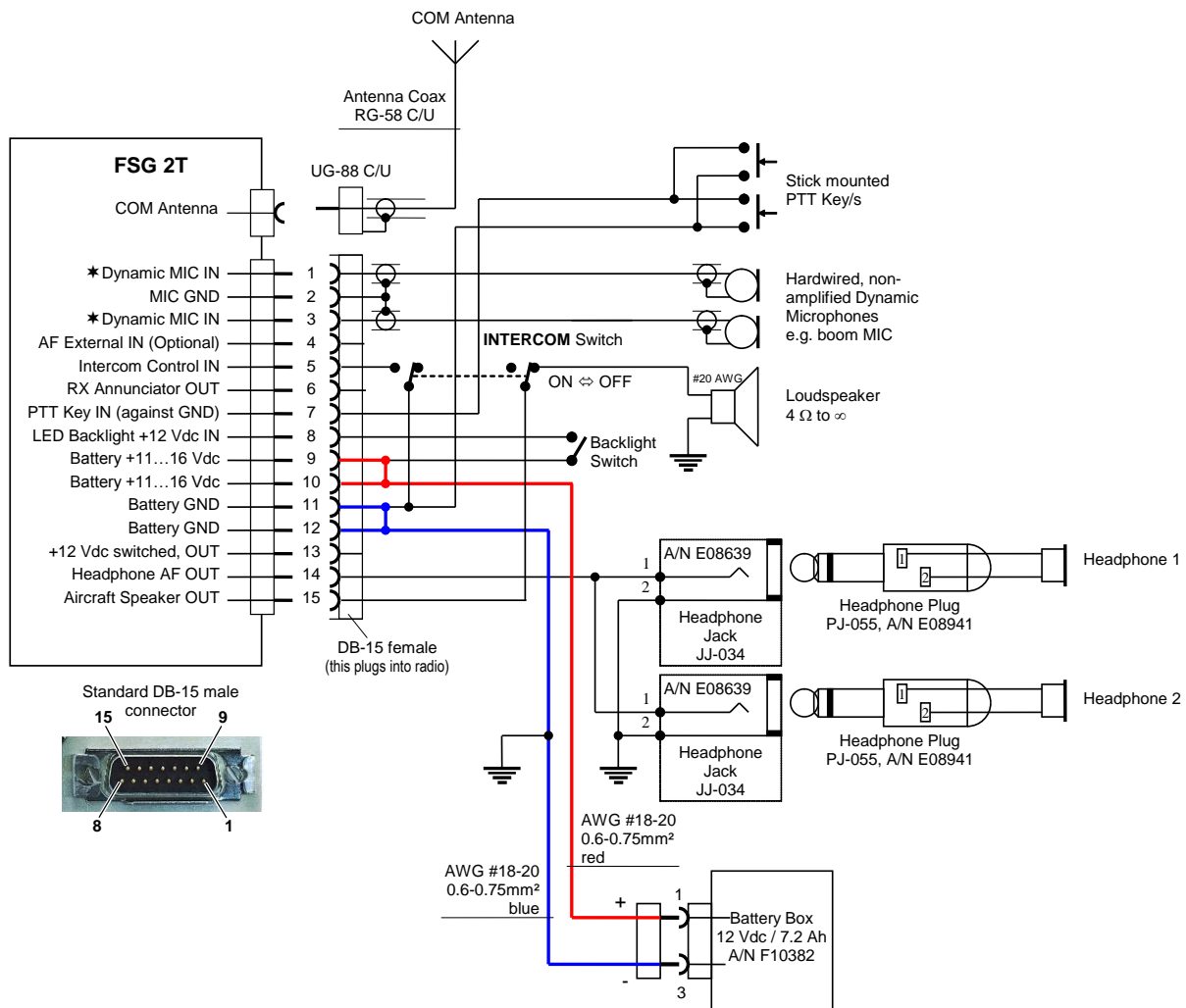
Length of pre-wired cable harness F10029: 3.2m / 9.5ft

----- and coax antenna cable are **not** included in pre-wired cable harness A/N F10029

Fig. 3 - 5 FSG 2T with INTERCOM

Hook-up Diagram for two-seat application using pre-wired cable harness A/N F10029

- one MIC input, for
- two non-amplified Dynamic Microphones (identical) in parallel



NOTES:

DO NOT wire other pins than noted! Connections which are not required for your installation may be left unterminated!

All wires #22 AWG (0.3 - 0.4 mm²) unless otherwise noted

* **For MIC setting, refer to § 3.5.2.1 and § 4.2**

Microphone shielding should only be connected to MIC ground at the radio end and insulated against common ground at the MIC end.

INTERCOM operation requires a selector switch, double pole, double throw

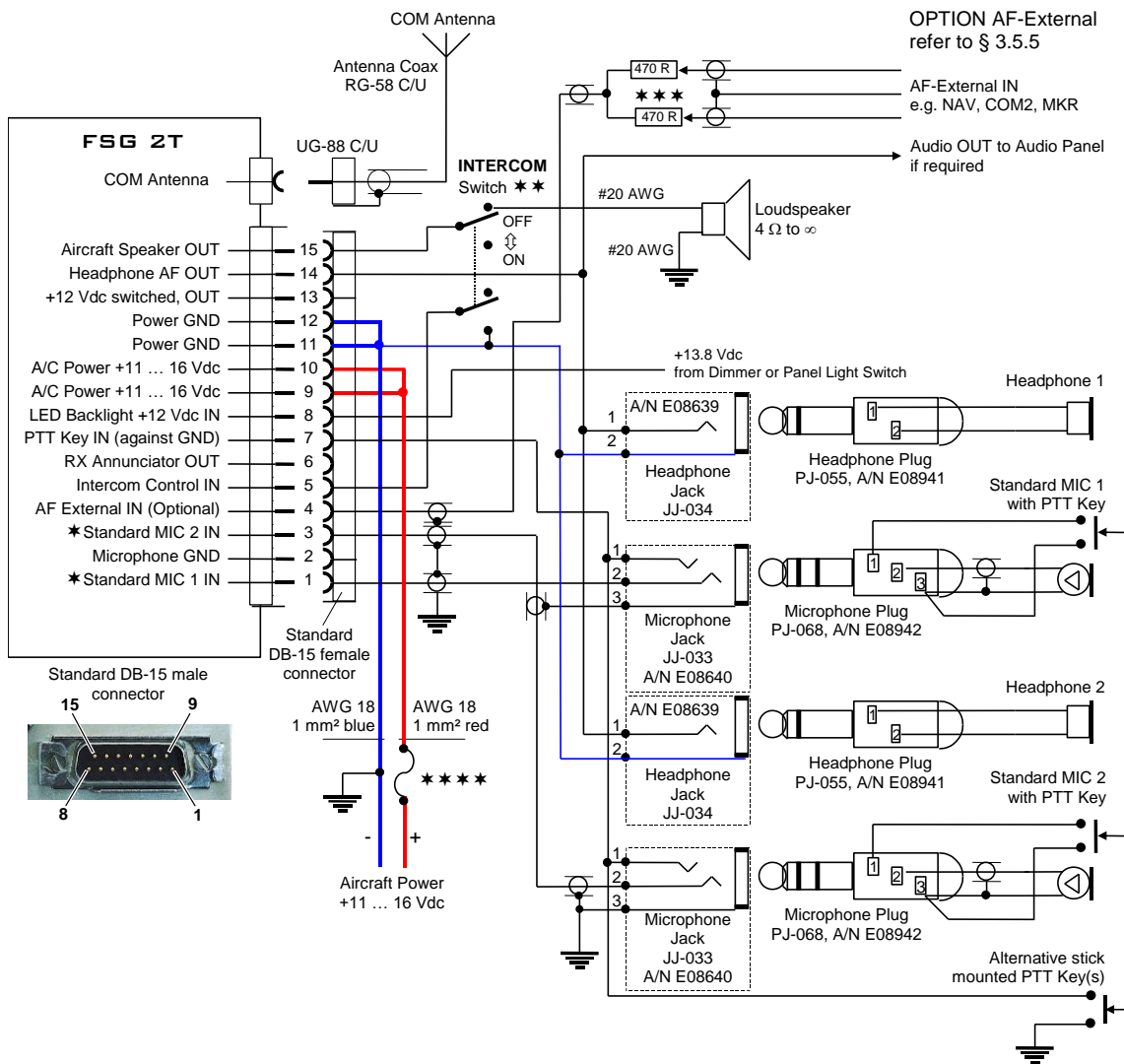
Wiring without **INTERCOM**: connect loudspeaker direct to pin 15.

Built-in Automatic Circuit Breaker 6.3 A provided when using Battery Box A/N F10382

Fig. 3 - 6 FSG 2T with INTERCOM

Hook-up Diagram for two seat application, using

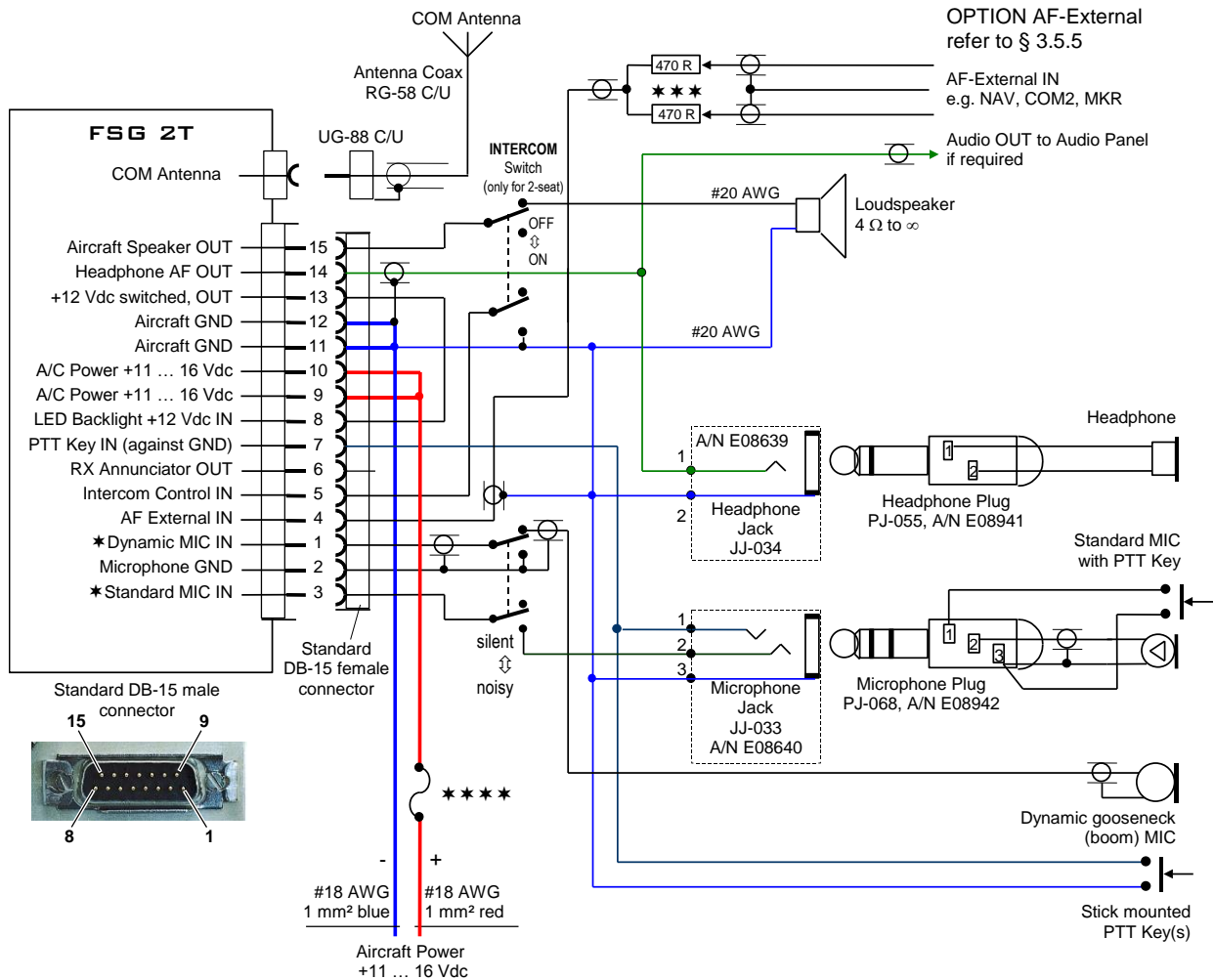
- two MIC inputs, for
- two separate (different, hardwired) non-amplified Dynamic Microphones



NOTES:

- **DO NOT** wire other pins than noted! Connections which are not required for your installation may be left unterminated!
- All wires #22 AWG (0.3 - 0.4 mm²) unless otherwise noted
- All power Grounds are airframe grounds
- Intercom operation requires a microphone which provides audio OUT with the PTT key de-energized (not keyed)
- Intercom operation requires a selector switch, double pole, double throw
- Power bus circuit breakers are to be mounted in the A/C breaker panel or instrument panel such that they will be accessible in flight and safe from physical damage.
- * **For MIC setting, refer to § 3.5.2.1 and § 4.2**
- ** Wiring without Intercom: connect A/C speaker direct to pins 11 and 15.
- *** If more than one AF source, isolation resistors 470 Ohm shall be installed.
- **** Fuse 3.15-Amp quick acting, or circuit breaker 3 Amp.

Fig. 3 - 7 FSG 2T with INTERCOM
 Hook-up Diagram for two seat application, using
 • two MIC inputs, for
 • two separate (even different) Amplified / Standard Carbon Microphones



- **DO NOT** wire other pins than noted! Connections which are not required for your installation may be left unterminated!
- All wires #22 AWG (0.3 - 0.4 mm²) unless otherwise noted
- All power Grounds are airframe grounds
- **For two-seat application connect second audio set (headphone, Standard MIC, boom MIC) and PTT key in parallel to the first one. Both audio sets must be of the same type.**
- Intercom operation requires microphones which provide audio OUT with the PTT key de-energized (not keyed)
- Intercom operation requires a selector switch, double pole, double throw
- Terminate audio shields at radio end only.
- Power bus circuit breakers are to be mounted in the A/C breaker panel or instrument panel such that they will be accessible in flight and safe from physical damage.
- * **For MIC setting, refer to § 3.5.2.1 and § 4.2**
- ** Wiring without Intercom: connect A/C speaker direct to pins 11 and 15.
- *** If more than one AF source isolation resistors 470 Ohm shall be installed.
- **** Fuse 3.15-Amp quick acting, or circuit breaker 3 Amp.

Fig. 3 - 8 FSG 2T with MIC Selector Switch and INTERCOM

Hook-up Diagram for single or two seat application, using

- Amplified / Standard Carbon Microphone(s) during self launching (noisy) and
- non-amplified Dynamic Gooseneck Microphone(s) during soaring (silent)

3.5.2 Wiring the Microphone(s)



IMPORTANT!

- *Radio performance and system reliability significantly depend on quality acoustic accessories, and their proper audio leveling adjustments.*
- *After installation completion, optimized acoustics performance requires proper mike audio system selection and its appropriate initial level adjustment (non-amplified dynamic, or Standard carbon microphone(s) system).*
- *It is possible to connect two microphones in parallel, but: make sure that only microphones of identical type / characteristics may be interconnected in parallel and appropriately together adjusted / matched. Please avoid use of low quality / low performance accessories.*
- *Dynamic microphones require shielded wiring and galvanic separation of mike grounds from any other signal ground (e.g. DC input / DC output, Speaker, phone, PTT, and external AF input ground). The MIC GND should only be connected at the radio's end!*
- *Standard Carbon / compatible Amplified microphones may employ Dynamic or Electret acoustics transducers. Amplified microphone ground may be connected together with other grounds, e.g. for DC input / switched output, speaker, phone, PTT, dimmer, external audio input.*
- *Operation of amplified microphone systems close to the RF radiating antenna (on portable case or located close to the cockpit) may be heavily interfered from own radiated strong antenna RF field strength and become unstable, oscillates or causes modulation distortion. Verify such effects, which are possibly caused by RF, by replacing the radiating antenna against a temporarily connected artificial antenna / RF dummy load.*

3.5.2.1 Microphone settings

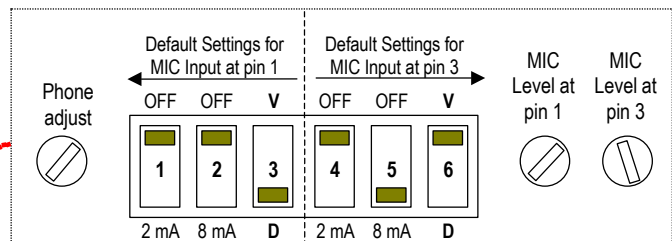
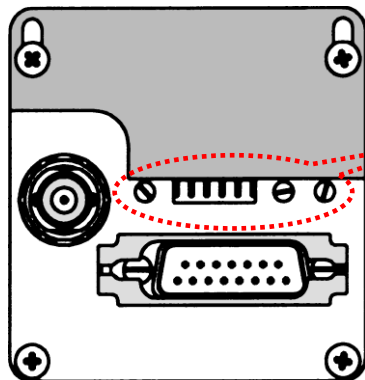


IMPORTANT!

- ***Both microphone inputs must either be terminated with appropriate microphone(s), or the not used MIC input must be set for Amplified Microphone (position V).***
- ***To get easy access to the potentiometers and DIL Switches on the rear the radio should not be fixed in the instrument panel at that time!***
- ***Loosen the upper cross-recessed screws of the rear panel and move up cover to get access to the potentiometers and DIL Switches.***

The FSG 2T offers two separate selectable and adjustable MIC inputs. You have the choice of connecting one or two dynamic (non-amplified) microphones and/or one or two Standard Carbon (amplified) microphones to the radio. The MIC inputs pin 1 and 3 are selectable by DIL switches on the rear. Use a suitable tool to set the switches. The pin no. refers to the Standard DB-15 connector.

- ▷ When using Dynamic Microphone(s) on input pin 1 set DIL switch 3 to **D** (default)
- ▷ When using Dynamic Microphone(s) on input pin 3 set DIL switch 6 to **D**
- ▷ When using Amplified Microphone(s) on input pin 1 set DIL switch 3 to **V**
- ▷ When using Amplified Microphone(s) on input pin 3 set DIL switch 6 to **V** (default)



3.5.2.2 Dynamic Microphone(s)

Due to the extremely wide mike input level adjustment range, it is mandatory to understand that correctly matched FSG 2T mike input sensitivity will be good ONCE FOREVER for this configuration. This guarantees a stable operation without audio feedback and maximum modulation at the best background noise attenuation.



IMPORTANT!

- **NEVER** use a 3-pole mike jack type PJ-068 for non-amplified dynamic microphones because common ground is used both for mike and for PTT. This creates a ground loop and causes unstable / distorted modulation.
- Dynamic (non-amplified) microphones connected to a Standard Carbon MIC input will not work on that input!
- Dynamic MIC input range = 0.5 mV ... 15 mV.

The FSG 2T default input for dynamic microphone(s) is pin 1 of the Standard DB-15 receptacle.

Our pre-wired cable harness assemblies are color coded for simple plug-in installations when used with optional Loudspeaker / Junction boxes. Up to two dynamic microphones of identical type and characteristics can be connected by 5-pole DIN jacks to the Loudspeaker / Junction Box (refer to Figures 3 - 4 / 3 - 5).

Up to two dynamic microphones for pilot and copilot can be hardwired to the radio. Even two low impedance (5 Ohm) dynamic microphones may be connected in parallel as well. However, for microphones with less than 30 Ohms, it may be necessary to use a suitable microphone transformer due to their low output level.

When hardwiring two microphones they may be connected to two different inputs of the radio FSG 2T (refer to § 3.5.2.1, Microphone setting). Use single core shielded wires, connect the conductor of MIC 1 to pin 1, the conductor of MIC 2 to pin 3 and the shield of both cables to pin 2 (MIC GND) of the radio's receptacle (refer to Figure 3 - 6). The shielding should only be connected to MIC GND at the radio's end and insulated against aircraft ground at the microphone end. When the microphones contain PTT keys two additional wires for each PTT key must be connected to pin 7 and pins 11/12 or against aircraft ground.

Never use the MIC GND as ground for PTT key, Intercom, audio or power!

3.5.2.3 Standard Carbon, amplified Electret, amplified Dynamic Microphone(s)



IMPORTANT!

- *Panel jacks of PJ-068 type may only be used with amplified / carbon type microphones!*
- *Clean the PJ-068/PJ-55 connector system regularly and check contacts for sufficient spring-loaded force. This is especially mandatory under vibration operating conditions.*
- *A Standard Carbon (amplified) Microphone connected to a Dynamic MIC input will dramatically overmodulate the transmitter!*
- *Standard Carbon MIC input range = 80 mV ... 500 mV.*

The FSG 2T default input for Standard Carbon microphone(s) is pin 3 of the Standard DB-15 receptacle.

For tandem configuration two Standard Carbon microphones can be connected parallel to pin 3 of radio FSG 2T. But since matching can be a problem we recommend to connect the second microphone to pin 1 of the receptacle. **Refer to § 3.5.2.1 for microphone setting!** This allows individual adjustment of the MIC sensitivity for each MIC input (refer to hook-up diagram Figure 3 - 7).

3.5.3 Intercom (IC)

INTERCOM is suitable for two seat aircraft with noisy cockpit. Intercom as well as radio operation should employ suitable aircraft headsets and must be matched properly to the transceiver (refer to § 4.2, Microphone Set-up).

Hand-held microphones in combination with earphones can be used for Intercom as well, provided that the MIC audio output is not switched by the PTT function. Otherwise keying the mike audio may cause awful cracks, depending on mike technology, and will accidentally activate the transmitter.

To control the Intercom capability, aircraft radio wiring must have a double pole toggle selector switch (refer to Figures 3 - 5 to 3 - 8). The Intercom switch disconnects the loudspeaker during Intercom operation in the IC **ON** position. Simultaneously, pin 5 of the 15-pole connector is set to ground to select Intercom ON by continuously activating the microphone signal input (amplifier).

There are two operating modes of Intercom:

- **Voice / VOX controlled:** at sufficient voice audio volume (MIC signal) the threshold opens and intercommunication takes place. The GREEN TX/RX LED indicates sufficient microphone level. This feature is only available when the AF External input is disabled (default setting).
- **Continuously:** Intercommunication is possible continuously. Any MIC signal is then amplified and audible through the headphone, also noise. This Intercom operating Mode is available when the AF External input is enabled by an approved Avionics workshop. The GREEN TX/RX LED indicates sufficient microphone level.

During RX the Intercom audio level is reduced by 6 dB (half level).

3.5.4 Loudspeaker / Headset interconnection

Two separate AF outputs are available:

The speaker output pin 15 can supply one 4-Ohm (or two 8-Ohm) speaker.

The headphone audio output Pin 14 can accommodate two (2) or more headphones each with some 30 to 600 Ohms.

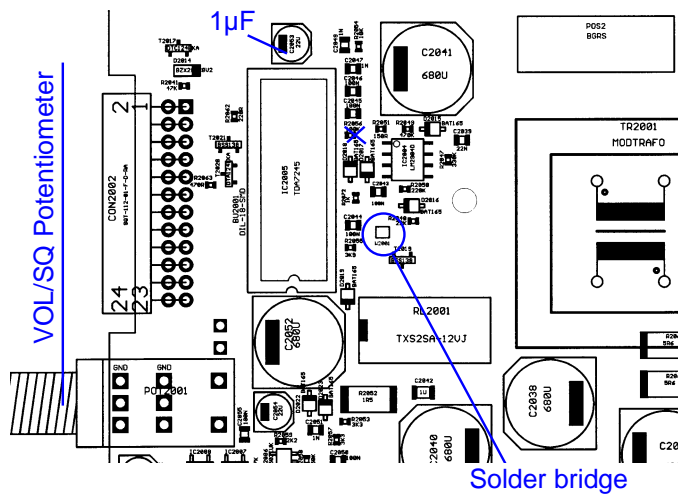
When no loudspeaker is installed, pin 15 may remain open, no spare load is required.



CAUTION!

- ***Your magnet compass may be deflected by the speaker's magnetic field. Therefore, when using the f.u.n.k.e. Loudspeaker / Junction Box F10061, a minimum distance of 1.3 m / 4.3 ft. between compass and Box is required.***

3.5.5 OPTIONAL: AF External Operation



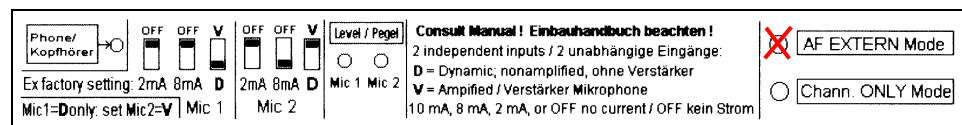
On the TX/RX module, the optional AF External Mode is enabled by making a solder bridge across two small solder pads, remove one resistor and change one capacitor. To get access, the radio FSG 2T must be opened (refer to Maintenance/ Overhaul Manual FSG 2T)!

Enabling AF EXTERNAL causes increased current consumption during Standby, and disables the VOX Intercom threshold!



IMPORTANT!

- **The Option AF EXTERNAL can be enabled by an approved Avionics workshop (see Maintenance/ Overhaul Manual FSG 2T, Circuit Diagram, Fig. 10-6m and Location of Components, Fig. 10-7) by making a solder bridge! The Information Label of the radio must then be marked accordingly.**



The AF External Input Pin 4 may be connected to any external (selectable) audio output of any other audio source. An input of 1 Volt rms (approx. 10 kOhm input impedance) is required to obtain maximum audio volume. Higher AF input may cause audio distortion. External AF will be audible only in Receive Mode and in Standby Mode, and may be heard in the speaker or headphone. During Transmit, the External AF Input is disabled.

Interconnection of external audio source(s) will be suitable especially in aircraft using just one COM and one NAV. The NAV headphone output may then be connected directly to the FSG 2T External AF input.

This allows – in addition to the receiving and Intercom function – also simultaneous listening of COM and NAV audio either by headphones or speaker.

Interconnection of more than one external audio source requires additional external decoupling / isolation resistors (470 Ohms, refer to Figures 3 - 7 / 3 - 8).

The individual audio volume is set directly at the particular external equipment and may be reduced by the transceiver's VOL knob.

For audio wiring use only shielded cables to avoid interference from strong electrical fields. An eventually magnetic interference coupling shall be especially regarded (distance required from high current carrying wiring).

3.5.6 Backlighting

**IMPORTANT!**

- *Backlighting of the display and front panel is turned ON or OFF via a separate input, but can be controlled by the radio's VOL switch, if desired (refer to Figure 3 - 8).*
- *In order to save current while supplied from a battery an external suitable illumination switch is suggested.*

The FSG 2T includes a LED backlight (night design). Pin 8 may be connected either directly to the 13.8 Vdc A/C power (perhaps via a suitable dimmer), or to the switched DC output Pin 13 (refer to Fig. 3 - 8).

3.5.7 Connection to a 28 Vdc airborne system

Interconnection of the FSG 2T transceivers to a 28 Vdc supply requires a capable voltage converter. Interconnection wiring shall be according to instructions of the DC converter manufacturer.

For backlighting from a 28 Vdc aircraft supply, insert a 230 Ohm resistor / 1 W, connected in series.

4 Recommended Set-up Sequence



IMPORTANT!

- **To get easy access to the potentiometers and DIL Switches on the rear the radio should not be fixed in the instrument panel at that time!**
- **Loosen the upper cross-recessed screws of the rear panel and move up cover to get access to the potentiometers and DIL Switches.**
- **Make all settings in the usual environmental noise (e.g. engine in cruising rpm)!**
- **During adjustment of Microphone Level and TX Sidetone the transmitter is keyed. Carry out this setting quickly!**
- *When using two headsets, make sure the second headset is also connected. If the second headset is not worn, the headset boom mike shall be moved as far as possible away from earphone transducer and / or well padded in order to avoid acoustic feedback. It would be even better if a second person is wearing the second headset during microphone and phone level adjustment.*
- *Parallel operated microphones and / or earphones must have the same specifications. The following adjustment has to be repeated when changing microphones (brand, type or number)*
- *It should be noted that use of two microphones connected in parallel significantly reduces the microphone(s) output level (particularly important when in an installation both microphones can be plugged).*

4.1 General



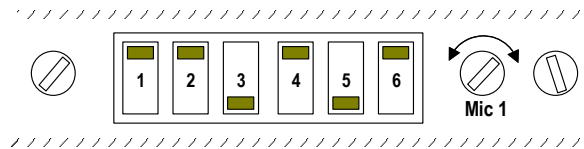
CAUTION!

- **The FSG 2T should be turned ON after engine start-up. This is a simple precaution which helps to protect the solid state circuitry and extends the operating life of your avionics equipment.**
- Turn the radio FSG 2T ON by rotating the VOL knob clockwise. For a short time the TX/RX LED lights up green and all segments of the display are visible to verify their operation. After indicating the Firmware version, the last used operating mode and frequency are displayed.
- Select an appropriate (test) frequency, e.g. 122.90 MHz.
- Check the SQ control. From the full counter-clockwise position (RX noise, signaling TX/RX LED lights GREEN) rotate the SQ knob until the noise stops and – without received signal – the TX/RX LED turns clear. When receiving air traffic communication the TX/RX LED stays GREEN. Set the RX volume of the aircraft loudspeaker or headphone to a convenient level by rotating the VOL knob.

4.2 Microphone Set-up

4.2.1 Set-up using Loudspeaker / Junction Box and one (or two parallel, identical) non-amplified Dynamic Microphone(s) at Mic 1 Input, pin 1.

- Verify the settings of the DIL switches on the rear of the radio (DIL switch "Mic 1" set to **D**, DIL switch "Mic 2" to **V**, all others "OFF").



- Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and close into one microphone. Observe the TX/RX LED, it should flicker YELLOW.
- **IF NOT**, turn with a suitable screwdriver "Level Mic 1" potentiometer till the TX/RX LED flickers YELLOW while transmitting and speaking. When you stop talking the TX/RX LED should light steady RED!
- Release the PTT key, the TX/RX LED must turn to clear (no reception) or to GREEN (RX signal).
- If applicable check the MIC level setting of the second microphone by repeating the steps above. If readjustment is necessary check again with first microphone. When the MIC levels differ find a compromise in setting or try with another identical microphone.

4.2.2 Set-up using two non-amplified Dynamic Microphones separate on Mic 1 input, pin 1, and Mic 2 input, pin 3

- Verify the settings of the DIL switches on the rear of the radio (DIL switch "Mic 1" set to **D**, DIL switch "Mic 2" to **D**, all others "OFF").



- **Setting the MIC Level of microphone connected to pin 1 of DB-15 connector:** Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and close into the corresponding microphone. Observe the TX/RX LED, it should flicker YELLOW.
- **IF NOT**, turn with a suitable screwdriver "Level Mic 1" potentiometer till the TX/RX LED flickers YELLOW while transmitting and speaking. When you stop talking the TX/RX LED should light steady RED!
- Release the PTT key, the TX/RX LED must turn to clear (no reception) or to GREEN (RX signal).
- **Setting the MIC Level of microphone connected to pin 3 of DB-15 connector:** Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and

close into the corresponding microphone. Observe the TX/RX LED, it should flicker YELLOW.

- **IF NOT**, turn with a suitable screwdriver "Level Mic 2" potentiometer till the TX/RX LED flickers YELLOW while transmitting and speaking. When you stop talking the TX/RX LED should light steady RED!
- Release the PTT key, the TX/RX LED must turn to clear (no reception) or to GREEN (RX signal).

4.2.3 Set-up using one (or two parallel, identical) amplified / Standard Carbon Microphone(s) on Mic 2 input, pin 3

- **This test must be performed with headphone(s) to evaluate the volume/quality of the MIC signal via Transmit Sidetone.**
- Standard MIC input for amplified / Standard Carbon Microphones is pin 3 of DB-15 connector (on the Information Label indicated as "Mic 2").
- Verify the settings of the DIL switches on the rear of the radio (DIL switch "Mic 1" set to V, DIL switch "Mic 2" to V, DIL switches 1, 2 and 4 to "OFF", DIL switch 5 to "8mA").



- Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and close into one microphone. Observe the TX/RX LED, it should flicker YELLOW. Listen to the TX Sidetone in your headphone, it should be clear and undistorted.
- **If no Sidetone is audible or TX Sidetone is distorted** try to increase audio quality and volume by switching DIL switches "Mic 2" either to "2mA" or to 10 mA ("2mA" + "8mA").
- **IF the TX/RX LED does not flicker**, turn with a suitable screwdriver "Level Mic 2" potentiometer till the TX/RX LED flickers YELLOW while transmitting and speaking. When you stop talking the TX/RX LED should light steady RED!
- Release the PTT key, the TX/RX LED must turn to clear (no reception) or to GREEN (RX signal).
- If applicable check the MIC current and MIC level setting of the second microphone by repeating the steps above. If readjustment is necessary check again with first microphone. When the MIC levels differ find a compromise in setting or try with another identical microphone.

4.2.4 Set-up using two amplified / Standard Carbon Microphones, separate on Mic 1 input, pin 1, and Mic 2 input, pin 3

- **This test must be performed with headphones to evaluate the quality of the MIC signals via Transmit Sidetone!**
- Verify the settings of the DIL switches on the rear of the radio (DIL switch "Mic 1" set to **V**, DIL switch "Mic 2" to **V**, DIL switches 1 and 4 to **"OFF"**, DIL switches 2 and 5 to **"8mA"**).



- **Setting the MIC Level of microphone connected to pin 1 of DB-15 connector:** Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and close into the corresponding microphone. Observe the TX/RX LED, it should flicker YELLOW. Listen to the TX Sidetone in your headphone; it should be clear and undistorted.
- **If no Sidetone is audible or TX Sidetone is distorted** try to increase audio quality by switching DIL switches "Mic 1" either to **"2mA"** or to 10 mA (**"2mA" + "8mA"**).
- **If the TX/RX LED does not flicker**, turn with a suitable screwdriver **"Level Mic 1"** potentiometer till the TX/RX LED flickers YELLOW while transmitting and speaking. When you stop talking the TX/RX LED should light steady RED!
- Release the PTT key, the TX/RX LED must turn to clear (no reception) or to GREEN (RX signal).
- **Setting the MIC Level of microphone connected to pin 3 of DB-15 connector:** Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and close into the corresponding microphone. Observe the TX/RX LED, it should flicker YELLOW. Listen to the TX Sidetone in your earphone; it should be clear and undistorted.
- **If no Sidetone is audible or TX Sidetone is distorted** try to increase audio quality by switching DIL switches "Mic 2" either to **"2mA"** or to 10 mA (**"2mA" + "8mA"**).
- **If the TX/RX LED does not flicker**, turn with a suitable screwdriver **"Level Mic 2"** potentiometer till the TX/RX LED flickers YELLOW while transmitting and speaking. When you stop talking the TX/RX LED should light steady RED!
- Release the PTT key, the TX/RX LED must turn to clear (no reception) or to GREEN (RX signal).

4.2.5 Set-up using non-amplified microphone(s) on one input and amplified microphones on the other

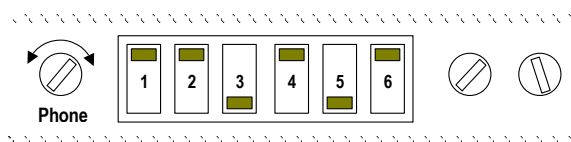
- Verify the settings of the DIL switches on the rear of the radio according to your configuration.
- Set microphone level and microphone current separate for each input according to the individual procedures described above.

4.3 Adjusting the Headphone Volume and Transmitter Sidetone



IMPORTANT!

- **This setting determines the maximum headphone audio volume during Receive, Transmit (Sidetone), Intercom and AF External (if applicable)!**
 - **Transmitter Sidetone is not adjustable by the VOL knob!**
 - *Before adjusting the Transmitter Sidetone volume, the microphone sensitivity should be adjusted correctly (refer to § 4.2).*
 - *Only during Transmit TX Sidetone is audible via headphone(s)/headset(s).*
 - *When using two headphones their characteristics should be identical, otherwise their audio volume will differ.*
 - *Prior to Sidetone level adjustment set volume control(s) on each headset to maximum, if applicable.*
 - **During this adjustment the transmitter is active. Carry out adjustment(s) quickly!**
- Select an appropriate (test) frequency, e.g. 122.90 MHz.
 - Press the PTT key. The TX/RX LED should light steady RED. Speak loud, clear and close into one microphone. Observe the TX/RX LED, it should flicker YELLOW. Listen to the TX Sidetone in your headphone; it should be clear and undistorted.
 - **If the TX Sidetone is too quiet or too loud**, turn with a suitable screwdriver "Phone" level potentiometer till the TX Sidetone audio volume is at a convenient level while transmitting and speaking.



- **If the TX Sidetone is distorted** the microphone amplifier may be interfered by the own radiated transmitting power, especially when the microphone is very close to the antenna. To find out check the following:
 - a. Vary the position of the headset/microphone cable(s) against the antenna while transmitting and listening to the TX Sidetone.
 - b. Operate the transmitter temporary on a 50-Ohm dummy load instead of the antenna. No acoustical difference may occur between transmitting with antenna and transmitting into the dummy load.
 - c. Check the quality of the TX Sidetone using another type of microphone (first adjust the microphone sensitivity according § 3.5.2.1 and § 4.2).
- Try another type of headphone to find out if the earphone capsules cause the distortion. Vary the headphone volume by turning the phone level potentiometer at steady way of speaking.

4.4 If applicable – check the Intercom Mode



IMPORTANT!

- *Before testing the Intercom Mode, the microphone sensitivity should be adjusted correctly (refer to § 4.2).*
- *Intercom is only possible when using headphones/headsets.*
- *The characteristic of the headphones should be identical.*

To check the Intercom Mode, switch ON the panel mounted Intercom switch. This activates the Intercom capability, while the A/C speaker is disabled.

There are two operating modes of Intercom:

4.4.1 FSG 2T without AF External capability:

Intercom Voice / VOX controlled: at a sufficient voice volume (MIC signal) the threshold opens and intercommunication takes place. This feature is only available when the optional AF External Function is disabled (default setting).

- Without RX signal, speak loud, clear and close into the microphone of the first headset.
- Listen to the earphone of the headset and observe the **TX/RX** LED on the front panel. Your voice should be clearly audible in the earphone when the **TX/RX** LED change from clear to steady GREEN. Turn **VOL** knob to adjust Intercom audio volume.
- Stop speaking; after approximately one second the radio switches back to Standby (**TX/RX** LED is clear).
- If signals are received during Intercommunication, the Intercom audio volume is reduced by half to increase the intelligibility of the reception.
- While receiving the **TX/RX** LED is steady GREEN.
- Repeat the test above using microphone of the second headset.

4.4.2 FSG 2T with AF External capability:

Intercom continuously: Both MIC inputs are continuously open. Any MIC signal is therefore amplified and audible through the headphones, also cabin noise. This Intercom operating Mode is available when the AF External input is enabled by an approved Avionics workshop.

- Without RX signal, speak loud, clear and close into the microphone of the first headset.
- Listen to the earphone of the headset and observe the **TX/RX** LED on the front panel. Your voice should be clearly audible in the earphone and the **TX/RX** LED should change from clear to steady GREEN while talking. Turn **VOL** knob to adjust Intercom volume.
- If signals are received during Intercommunication, the Intercom audio volume is reduced by half to increase the intelligibility of the reception.
- While receiving the **TX/RX** LED is steady GREEN.
- Repeat the test above using microphone of the second headset.

4.5 Check the RX Loudspeaker / Headphone Volume



IMPORTANT!

- *When using two headsets the characteristics of both should be identical.*
- On a busy channel listen to the radio traffic.
- Turn the **VOL** knob from fully counter-clockwise to fully clockwise position. The audio volume audible in the A/C loudspeaker and/or the headphone should increase accordingly. Set **VOL** knob to get a convenient audio level.
- This radio contains an audio-leveling circuit. If the audio level is adjusted once it will keep the volume almost constant when receiving different signals with a modulation of at least 30% AM.

4.6 Fixing the radio



IMPORTANT!

- ***After finishing all settings move cover to its place and fix the screws!***
- ***This shielding is absolutely necessary because of required immunity against high energy RF interference!***
- Check for proper fixing of the DB-15 Standard connector (sliding lock).
- Check for proper fixing of the UG-88 C/U Antenna Connector (bayonet lock).
- Fix the radio on instrument panel using the four cross recessed screws M4 × 20 mm.

4.7 Testing on the Ground with engine Off

Verification after installation completion.

After installing the unit, check all aircraft control movements to be sure no electrical cable interfere with their operation. All aircraft and radio functions shall be tested after installation completion to identify, whether malfunctions caused by mechanical and / or electrical installation work occurs. Remove all foreign parts.

This verification must be performed by an authorized Aircraft Electronics Inspector.

Testing of antenna matching between the FSG 2T antenna socket (BNC) and the BNC antenna cable connector is required, using a suitable 50 Ohm VHF Reflectometer (VSWR meter), or a directional Wattmeter.

The VSWR must be less than 3:1 over the full frequency range, tested at least in 1 MHz steps (reflected power shall be less than 25% of the forward RF power output). If this limit is exceeded, this indicates a mismatched antenna and may be caused by wrong antenna radiator or counter weight length / dimensions, poor contacts, or damaged or unsuitable (other than 50 Ohm) coaxial cable.

In order to optimize radio range, it is suggested to care for a VSWR of less than 2:1 (reflected power shall be less than 11% of the forward RF power output).



IMPORTANT!

- *If the antenna is belly mounted, perform antenna matching measurements if possible in flight, or at least while the fuselage is lifted upwards, using wood / non metallic supporting material. This avoids antenna mismatch caused from ground proximity.*

Using known, but distant located fixed stations (VOLMET, ATIS) will also help in determining the radio receiving range, especially in comparison with known radio range results of another aircraft at the same position on the ground at a known airfield location, outside of the hangar, trailer or workshop.

4.8 Ground checks with engine running (if applicable)

Make sure that the aircraft's electrical DC system voltage on the FSG 2T input terminals is within the tolerances permitted for 14 Vdc systems (or 28 V with DC converter). Systems supplied only by a battery may operate from 9 to 16.1 Vdc. Such testing requires normal RPM rated at cruising speed.

This testing evaluates the audio / noise influence, and the RF radio range, at least from 10 to 30 km distance to the ground radio station.

At cruising RPM and properly adjusted microphone sensitivity, cabin noise background content shall almost not exist. Instead, loud and clear communications shall be achieved.

In both Transmit and Intercom Mode the microphone shall be placed right at the lips in order to obtain maximum voice level at lowest cabin noise content. Always speak loud and clear. Verification of proper microphone sensitivity setting can be controlled visually by observation of the TX/RX LED flickering YELLOW according to the voice modulation. Adjustments are to be made once while on ground, prior to the first flight.

It is recommended to verify the FSG 2T communications quality as well as Radio Range / Distance on both the low and high end of the VHF COM frequency band.

If noise (both with Squelch ON and OFF) occurs only with the engine running, and if its frequency varies with the engine revolutions, this may be caused by an inadequate suppressed ignition system or alternator / voltage regulator equipment, or by a poorly stabilized on-board power supply.

In Receive Mode it is easier to determine between RF and AF (interference carried on the lines) by temporary removing the antenna plug from the transceiver. RF interference, which usually comes from the ignition or generator / regulator, or which are caused by other onboard RF emitting sources, or even caused by RF interference emission sources located in close proximity to the aircraft will then disappear.

According to Section 18 of the ED-14D / RTCA DO-160D environmental power supply conditions requirements, the Category B limits for ripple voltages at 14 Vdc supplies are $0.28 V_{rms}$ at 0.2 ... 1 kHz, or $0.7 V_{rms}$ at 1 ... 15 kHz. Double these limits for 28 V systems.

Ripple on the lines can be detected with an oscilloscope. Its source is usually the generator equipment in conjunction with a poor battery, or poor wiring like bad contacts, wrong fuse, defective switches, inadequate wiring dimensions, ground loops (more than one ground connection to the airframe), or from corroded power supply (fuselage ground) contacts.

Often will bad contacts in the antenna system, or other vibration dependent metal parts contacts also varying with the engine RPM, cause RF interfering distortion. A noise attenuating headphone assists in typical acoustic failure characteristics identification.

5 Functional Description

5.1 Introduction

This Section contains a functional description of each switch, push button, knob, indicator, display and connector located on the front or rear of the FSG 2T together with operating instructions.

5.2 Operator's Controls

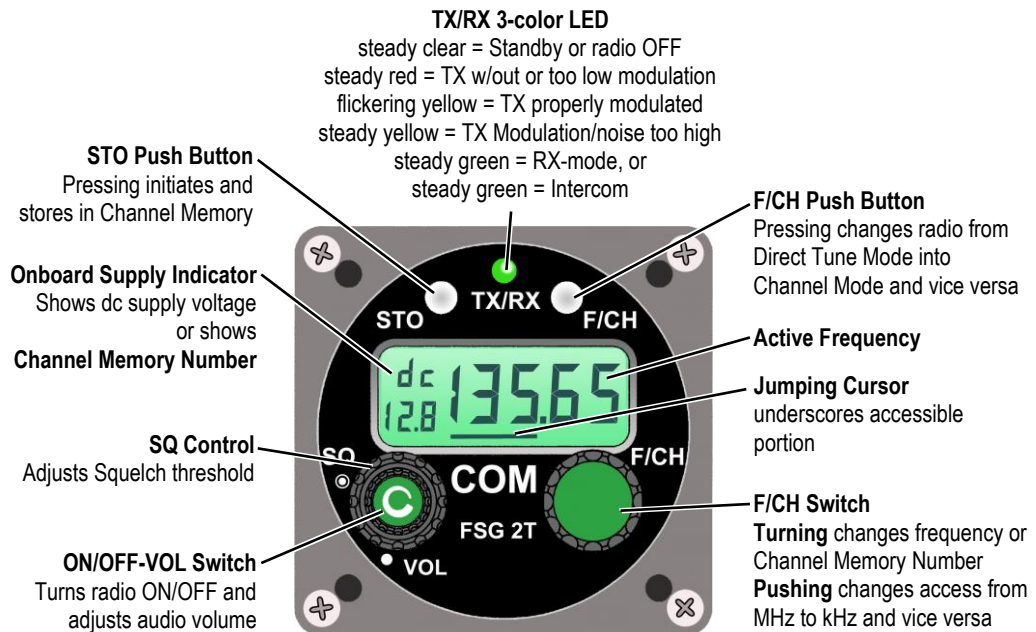









Fig. 5 - 1

| Control | Description / Function |
|---|---|
| <p>VOL</p>  | <p>Rotary switch and control (inner knob)</p> <p>To turn ON the radio, rotate the VOL knob clockwise from the OFF position (dot). When power is activated</p> <ul style="list-style-type: none"> the front panel TX/RX LED lights up green momentarily, then all segments of the display are visible for a short time, to verify their operation. The display shows the firmware version and then the operating mode, which was used before last turning OFF or Power OFF: The radio is now ready for use. <p>Rotating the VOL knob clockwise (cw) increases - turning counter-clockwise (ccw) decreases the audio volume of the A/C loudspeaker (Receive and AF External) or of the plugged headphone (Receive, AF External and Intercom audio, <u>not</u> TX Sidetone).</p> <p>To turn OFF the radio rotate the VOL knob fully counter-clockwise (ccw) to the OFF position (dot). Blank display.</p> |

| | |
|--|---|
| <p>SQ (SQUELCH)</p>  | <p>Rotary control (outer ring)</p> <p>After turning ON the radio FSG 2T the automatic squelch is active depending on the SQ knob position.</p> <ul style="list-style-type: none"> • Standard Operating Mode: Set the SQ knob to the dot  position, the Squelch (mute) threshold is approximately 1 µV. No Receiver noise should be audible during Standby. Only received signals above the SQ threshold are audible. • Rotating the SQ knob fully counter-clockwise (ccw) puts the radio into the SQ-OFF mode (overrides the automatic squelch). Basic receiving noise is then audible during Standby. This adjustment gives maximum receiving range. Slightly increased current consumption. • Rotating the SQ knob clockwise (cw) achieves Receiver muting. • To eliminate ignition noise or RF interference adjust the SQ knob up to the full clockwise (cw) position. This gradually increases the required RF signal to exceed the SQ threshold (max. threshold 5 µV / -93 dBm). |
| <p>F/CH Button</p>  | <p>Push button</p> <p>When pressing the F/CH button</p> <ul style="list-style-type: none"> • while in DIRECT TUNE MODE (MHz or kHz is underscored), this will change the radio into CHANNEL MODE, <u>or</u> • while in CHANNEL MODE (Channel number is underscored), this will change the radio into DIRECT TUNE MODE. |
| <p>TX/RX LED</p>  | <p>The TX/RX 3-color Status LED on the front panel indicates the following:</p> <p>CLEAR.....indicates a Standby condition or radio is OFF.</p> <p>STEADY REDindicates a Transmit condition without or too low modulation.</p> <p>FLICKERING</p> <p>YELLOWindicates a Transmit condition with proper microphone signal / modulation.</p> <p>STEADY</p> <p>YELLOWindicates a Transmit condition with too much modulation or background noise (microphone sensitivity too high)</p> <p>STEADY GREENindicates a Receive condition; Squelch is open automatically (or set OFF manually).</p> <p>STEADY GREENindicates a sufficient microphone level while in the Intercom condition</p> |

| | |
|---|---|
| <p>F/CH Knob</p>  | <p>Rotary control <u>and</u> push button = dual function</p> <p>Pressing the F/CH knob once</p> <ul style="list-style-type: none"> • while in the DIRECT TUNE MODE changes the access from kHz to MHz or vice versa from MHz to kHz. The active access to MHz or kHz is underscored by a cursor. • While in the CHANNEL MODE pressing the F/CH knob is without function. <p>Rotating the F/CH knob</p> <ul style="list-style-type: none"> • while in the DIRECT TUNE MODE will increment or decrement the MHz or kHz portion of the active frequency with rollover at each band edge. • while in the CHANNEL MODE changes the channel memory number and associated frequency. All channel numbers (1 to 20) can be used. |
| <p>STO (STORE)</p>  | <p>Push button</p> <p>When pressing the STO button (within approx. one minute)</p> <ul style="list-style-type: none"> • storing of a frequency in one of the memory channels is initiated, or • storing of a frequency is confirmed (at least 1 sec) <p>20 frequencies may be programmed in non-volatile memory channels. The channel memory numbers (1 ...20) are user programmable.</p> |



IMPORTANT!

- **Only ONE control element may be operated at a time. If more than one element is operated simultaneously, function change is blocked.**

5.3 Frequency Display, the 5-digit Liquid Crystal Display (LCD) can be back-lit.

Frequency display complies with ICAO rules.

- a) Initial boot at Switch-ON / Power ON
- Displays all segments for 2 seconds
 - Clear Display for 0.5 seconds
 - Shows Firmware Version for 0.5 seconds
 - Goes to last user setting

- b) **DIRECT TUNE MODE**, Normal Operation:



Example:

Display shows an active frequency of 129.350 MHz.

Turning the F/CH knob will either increase or decrease the MHz-portion of the frequency.

Normal on-board Supply 13.8 Vdc (11 ... 16 Vdc)

- c) **CHANNEL MODE**, Normal Operation:



Example:

Display shows Channel no. 3 with its associated active frequency of 126.275 MHz. Turning the F/CH knob will either increase or decrease the Channel number.

- d) **DIRECT TUNE MODE** (continuously flashing Dc value, **Emergency Operation**):



Example:

Display shows an active frequency of 134.800 MHz.

Turning the F/CH knob will either increase or decrease the MHz-portion of the frequency.

Low on-board supply: 9.7 Vdc (indicator is flashing!)

- e) **CHANNEL MODE, Emergency Operation:**

Steady display for
25 seconds:



Example:

Display shows Channel No. 4 with an active frequency of 118.975 MHz.

Low on-board supply: 9.9 Vdc (indicator is flashing!)

Flashing supply indicator
for 5 seconds:



IMPORTANT!

- **During Emergency Operation (low on-board supply) no storing of frequency is possible!**

5.4 Error Codes

Display in all Modes



High Voltage: Continuously slightly too high supply voltage changes value indication into 'HI' (above 16.1 Vdc / below 16.5 Vdc).

Above approximately 16.5 Vdc, the radio automatically switches OFF itself, at no display indication. When supply is reduced to between 16 Vdc and 10.5 Vdc, the FSG 2T comes back into operation.



Temperature Error: The whole LC display flashes. Temperature of the Transmitter Power Amplifier is too high. The keyed transmitter will be disabled. Switch OFF the radio, wait a few seconds and switch ON again.



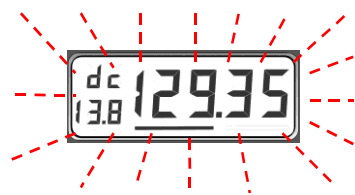
Process Error: The whole LC display flashes. A severe process error must have occurred. Try to revive the radio by switching OFF and ON again.

If the same error occurs contact a f.u.n.k.e. AVIONICS approved repair facility!



Out-Of-Lock Error: The whole LC display flashes. A severe frequency error must have occurred. Try to revive the radio by switching OFF and ON again.

If the same error occurs contact a f.u.n.k.e. AVIONICS approved repair facility!



2 Minutes TOT Time-Out-Timer: After two minutes continuous transmitting the transmitter of the FSG 2T switches OFF itself and the whole LC display flashes as long as the PTT key is pressed.

When the PTT key stuck accidentally it can be received with the adjusted frequency although the display is flashing. After switching the radio OFF and ON again it can be transmitted for another 2 minutes followed by receive mode.

5.5 Connectors and controls on the rear side

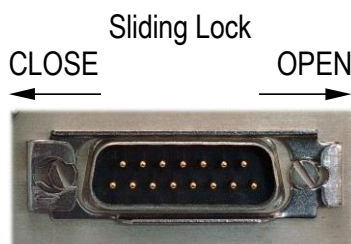


50-Ω BNC jack,

mating plug: BNC plug, UG-88 C/U

Connects a suitable COM broad-band antenna with a frequency range of at least 118 - 137 MHz.

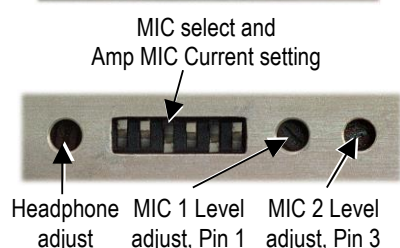
Refer to § 3.4.3 for Antenna Installation.



Standard DB-15 male connector with sliding lock retainer.

Mating plug: 15-pole SUB-D, female, DB-15S, (A/N W00009: solder type, including back shell and mounting hardware).

Refer to § 3.5 for airborne wiring.



Default setting of DIL switches:

Microphone 1 input, pin 1: Dynamic / non-amplified

Microphone 2 input, pin 3: Standard / Amplified

Current MIC 1: 0 mA

Current MIC 2: 8 mA

Refer to § 3.5.2.1, Microphone setting!

5.6 Reset



CAUTION!

- **Every RESET to the factory setting deletes all your pre-set memory channels!**

To reset the transceiver proceed as follows:

- Turn OFF the radio (VOL knob fully ccw).
- **For a few seconds PUSH and HOLD simultaneously the buttons F/CH and STO, then turn ON the radio** (rotate VOL knob clockwise, approximately mid position).
- All segments of the display appear for a short moment.
- Wait till the firmware version is displayed.
- Release both buttons.
- While in the **DIRECT TUNE MODE** the last used frequency remains.
- While in the **CHANNEL MODE** the last used memory channel shows "118.00 MHz". All other memory channels of the FSG 2T are set to 118.00 MHz as well.



IMPORTANT!

- *The settings for the headphone(s) and microphone(s) by potentiometer(s) and DIL switches are **not concerned** by the RESET!*

6 Operation

6.1 Introduction

This section contains basic operating procedures for the FSG 2T transceiver. This instruction is only applicable for a radio which is

- correctly installed and wired by a certified avionics shop or aircraft manufacturer
- checked together with the aircraft system, and
- optimized by the set-up procedure (refer to Section 4, **Recommended Set-up Sequence**).



WARNING!

DO NOT OPERATE THIS RADIO IN AN EXPLOSIVE ATMOSPHERE (PETROLEUM FUELS, SOLVENTS, DUST, ETC.).

6.2 Turning ON - Selecting Frequency - Audio Volume



CAUTION!

- **The FSG 2T should be turned ON after engine start-up. This is a simple precaution which helps to protect the solid state circuitry and extends the operating life of your avionics equipment.**

Turn the radio FSG 2T ON by rotating the VOL knob clockwise. For a short time the TX/RX LED lights up green and all segments of the display are visible to verify their operation. After indicating the Firmware version, the last used operating mode and frequency are displayed.

No warm-up period is required. However, at temperatures of approx. -20°C / -4°F, the LC display needs approximately one second until it is fully visible when the frequency or operating mode is changed.

To change the operating mode and therefore the display: Press the F/CH button.

Example:



STANDARD: DIRECT TUNE MODE

After switching ON the radio, either the MHz portion or the kHz portion of the displayed frequency is underscored. The underscore indicates accessibility to this portion.

Assume the MHz is underscored: Select the appropriate **MHz** portion by **rotating** the F/CH knob. A clockwise rotation will increment the previous frequency in 1 MHz steps (130, 131, 132 etc.) while a counter-clockwise rotation will decrement the previous frequency in 1 MHz steps (128, 127, 126 etc.) with rollover at each band edge (118.XX → 136.XX or 136.XX → 118.XX).

Press the F/CH knob once, the cursor will jump to underscore the kHz portion.



The underscored kHz portion of the frequency indicates accessibility to kHz selection.

Select the appropriate **kHz** portion by **rotating** the **F/CH** knob. A clockwise rotation will increment the previous frequency in 25 kHz steps (37, 40, 42 etc.) while a counter-clockwise rotation will decrement the previous frequency in 25 kHz steps (32, 30, 27 etc.) with rollover at each MHz and band edge (121.97 → 122.00 or 121.00 → 121.97).

This is the new **active frequency!**

EXAMPLE:



CHANNEL MODE:

Important: The appropriate operating frequency must be stored already in a memory channel (refer to § **6.5 Memory Programming**).

Select appropriate channel memory number together with the associated frequency by **rotating** the **F/CH** knob. A clockwise rotation will increment (4, 5, 6 etc.) while a counter-clockwise rotation will decrement (2, 1, 20 etc.) the previous channel number with rollover at each edge.

This is the **new active frequency** and its associated channel memory number!

- Rotate **VOL** knob clockwise, about half way.

Continue with either

- 6.3 Receive (Listen) Operation, or**
- 6.4 Transmit Operation**
- 6.5 Memory Programming**
- 6.6 VOX Intercom**
- 6.7 Intercom (Option AF External enabled)**
- 6.8 OPTION: AF External**

6.3 Receive (Listen) Operation

- After turning the radio ON the automatic squelch is either ON or OFF depending on **SQ** knob position.
- Squelch ON means that – without received signal – the receiver noise is blocked, the **TX/RX** LED is clear. When normal signals are received, the **TX/RX** LED turns to green; weak signals and interfering pulses are disabled.
- Set the RX volume of the aircraft loudspeaker or earphone to a comfortable level by rotating the **VOL** knob.
- Weak signals can be received if the squelch circuit is switched OFF by rotating the **SQ** knob fully counter-clockwise. Then typical RX noise is continuously heard during communication breaks.
- Rotating the **SQ** knob more cw clockwise switches the squelch circuit ON again.
- **DO NOT** press the PTT (Push-To-Talk) key if you want to receive! During RX the **TX/RX** LED **must not** light RED or flicker YELLOW!

This radio contains an audio-leveling circuit. So if you change the frequency or you receive another station you should get an almost constant audio volume (the received signal must be at least modulated by 30% AM).



IMPORTANT!

- ***Switching OFF the Squelch only makes sense if long range reception shall take place. Thus the radio is noisy during Standby operation, but no weak signals are suppressed and the full receiving range is available!***
- ***Notice increased current consumption when battery operated!***

6.4 Transmit (Talk) Operation



IMPORTANT!

- *Please keep radio discipline!*
- *Transmit only on a clear channel.*
- *Do not transmit on 121.50 as this is the international emergency frequency!*
- *Care for an all-round obstacle free antenna location; the called station should be within "line-of-sight" distance.*
- *Never place the radio such as the antenna gets very close to, or touching, exposed parts of the body, especially the face, shoulder or the eyes.*

1. If the operating mode shall be changed: Push the F/CH button.
2. If the active frequency shall be changed: refer to § 6.2 Turning ON - Selecting Frequency - Audio Volume.
3. Transmitting is normally performed on a clear channel (no communication audible).
4. Press and hold the PTT (Push-To-Talk) key. Talk in a loud, clear voice with the microphone opening 2 to 4 cm (1" - 2") from your lips. Make each transmission as brief as possible. As long as the PTT key is pressed the TX/RX LED on the front lights red! When modulated properly, the red TX/RX LED turns to flickering yellow.
5. Release the PTT key to end transmission and to clear the channel for reception; the TX/RX LED must turn to clear (Standby) or green (Receive / Intercom).



IMPORTANT!

- *The radio is equipped with a transmit TOT time out timer. This is used to limit the duration of transmissions to approximately 2 minutes. When the transmitter is keyed continuously longer than 2 minutes the display of the FSG 2T starts flashing and transmission is disabled. Although the display is flashing receiving on the displayed frequency is possible!*
- *If you have to make calls longer than 2 minutes, momentarily release the PTT key and press again.*
- *Should the TOT disable the transmitter accidentally (e.g. stuck PTT key) and you have to transmit, **turn radio OFF and ON again**. This allows another 2 minutes to transmit.*

6.5 Memory Programming



IMPORTANT!

- *Memory programming is disabled at a supply voltage below 11 Vdc.*
- *When storing a frequency into a memory the "old" frequency will be overwritten without warning!*

Up to 20 non-volatile memories can be user-programmed. They are accessible after calling up the respective **CHANNEL MODE**.

6.5.1 Programming while in DIRECT TUNE MODE:

Example:



Turn the **F/CH** knob to change the underscored portion of the frequency to the desired frequency.



Press the same knob once and note that the cursor has jumped to underscore the other portion of the frequency. Turn the **F/CH** knob to select the desired frequency.



Press the **STO** button to initialize storing.



Release the **STO** button. The "dc" display disappears, a flashing "CH" together with the underscored last used channel number is shown. The active frequency is now ready within 1 minute to be stored in any of the 20 memory channels. Use the **F/CH** knob to select the desired memory location.



Press and hold the **STO** button for at least 1 second. The flashing "CH" should change to steady "St" and the underscore disappears indicating that it has been stored into memory successfully.



Release the **STO** button and the radio returns to **DIRECT TUNE MODE**. The stored frequency is now the active frequency.

6.5.2 Programming while in CHANNEL MODE:



IMPORTANT!

- **While in the CHANNEL MODE only pre-programmed Channel Numbers with its corresponding frequencies can be stored in other memory locations!**

Example:



Turn the **F/CH** knob to change the underscored Channel Number to the desired Channel Number to be stored in another memory location.



Press the **STO** button to initialize storing.



Release the **STO** button. A flashing "CH" is shown. The active Channel Number and its frequency is now ready within 1 minute to be stored in any of the other 19 memory channels. Turn the **F/CH** knob to select the desired memory location.



Press and hold the **STO** button for at least 1 second. The flashing "CH" should change to steady "St" and the underscore disappears indicating that it has been stored into the new memory successfully.



Release the **STO** button and the radio returns to **CHANNEL MODE**. The stored Channel Number is now the active Channel Number with its corresponding frequency.

6.6 VOX Intercom



IMPORTANT!

- ***When the Option AF EXTERNAL was activated by an approved Avionics workshop voice controlled Intercom is not possible!***
 - *The built-in VOX voice controlled microphone threshold control will mute microphones during speech pauses.*
 - *Intercom headset audio volume may be adjusted through installation and should also include, if applicable, the individual earphone volume adjustments on the headset phone capsule.*
1. Switch ON Intercom. This activates the microphone VOX capability, while the speaker is disabled.
 2. In Receive Mode, through acoustic accessories (earphones with microphones), the FSG 2T allows voice-activated intercommunications between pilot(s) and / or other crew members. Always speak loud and clear, while the microphone opening is located close to the lips.
 3. The Intercom audio volume may be adjusted by setting the front panel **VOL** knob.
 4. Once a suitable mike signal opens the VOX, it will stay open one further second after the last spoken syllable, and then closes the mike inputs.
 5. When Receiving, the Intercom audio is reduced in volume by 6 dB / half level. This allows safer listening to the Receive signal.
 6. By pressing the PTT key the radio switches to transmit – without switching OFF the Intercom – but disables the VOX threshold temporarily. The transmitter modulation Sidetone is audible in all connected headphones. The **TX/RX** LED on the front panel flickers according to the speech volume. This also allows optical monitoring of transmission quality (time constant controlled).
 7. Releasing the PTT key turns the radio into VOX Intercom Mode again.

6.7 Intercom (Option AF EXTERNAL enabled)



IMPORTANT!

- **When the Option AF EXTERNAL is activated voice controlled Intercom is not possible!**
 - *To achieve best cabin noise suppression, especially during speech pauses, optimized microphone sensitivity adjustment must be performed once during Installation Procedure.*
 - *Intercom headset audio volume may be adjusted through installation and should also include, if applicable, the individual earphone volume adjustments on the headset phone capsule.*
1. Switch ON Intercom. This disables the speaker.
 2. In Receive Mode, through acoustic accessories (earphones with microphones), the FSG 2T allows continuous intercommunications between pilot(s) and / or other crew members. Always speak loud and clear, while the microphone opening is located close to the lips.
 3. The Intercom audio volume may be adjusted by setting the front panel **VOL** knob.
 4. Receive, Intercommunication and External Audio are audible while Intercom is ON. When Receiving, Intercommunication is reduced by 6 dB / half level in volume. This allows safer listening to the RX signal.
 5. By pressing the PTT key the radio switches to transmit – without switching OFF the Intercom – but disables the VOX threshold temporarily. The transmitter modulation Sidetone is audible in all connected headphones. The **TX/RX** LED on the front panel flickers according to the speech volume. This also allows optical monitoring of transmission quality (time constant controlled).
 6. Releasing the PTT key turns the radio into Intercom Mode again.

6.8 OPTION: AF External



IMPORTANT!

- ***The Option AF EXTERNAL can easily be enabled! Refer to FSG 2T Service Manual, Circuit Diagram, page 10 - 28 and Location of Components, page 10 - 30, just make a solder bridge across W2001. Then mark the radio accordingly!***
- *Enabling AF EXTERNAL causes increased current consumption during Standby!*

In Standby, Receive and Intercom Mode, audio signals of additional units (other COM, VOR, Localizer, Marker, ADF, electric variometer, etc.) are audible simultaneously.

Audio volumes of external audio signals have to be adjusted on the external units individually but their volume may be reduced by the radio's **VOL** knob.

The External AF Input is disabled during transmit.

6.9 Backlighting

Depending on aircraft wiring, lighting the frequency display as well as the radio's front panel (night-design) is either activated by turning ON the panel mounted lighting switch or dimmer, or by turning ON the FSG 2T radio.

6.10 Turning OFF

Turn OFF the radio by rotating the **VOL** switch to the full ccw position to prevent unnecessary discharge of your A/C (or portable case etc.) battery.

If the backlight is wired via panel mounted dimmer or lighting switch remember to turn this OFF as well, otherwise your battery will go flat.

6.11 Monitoring the aircraft onboard supply

The transceiver FSG 2T includes a 3 digit display of the actual onboard supply voltage level. At dc levels below 11 V the voltage digit value starts automatically flashing for low supply warning!

Radio supplied from a 13.75 Vdc / 7.2 Ah battery bus:

The following operating times may be obtained depending on battery's capacity and transmitter duty cycle:

| | |
|--|--|
| Reference: | Approximately +20°C / +68°F, battery 7.2 Ah, only radio is supplied. |
| Duty cycle: | 10% Transmit, 20% Receive, 70% STBY |
| Flashing Dc value only in Transmit: | ca. 4 hrs left |
| Flashing Dc value also during Receive: | ca. 45 min. left. Recommendation: Reduce utmost transmitting! |
| Short-time flashing Dc value during Standby (SQ ON, clear channel) | ca. 45 min. left in Standby. Cease transmitting! |
| Continuous flashing Dc value during Standby (SQ ON, clear channel) | Radio will soon switch OFF itself! Recharge battery as soon as possible (refer to § 6.13, Emergency Operation) |

Remark: These transitions are fluent. Recovery effect after load reduction may be possible. Low battery temperature reduces operation time.

Radio supplied from a 13.75 Vdc generator bus (aircraft or vehicle supply):

| | |
|--------------------|---|
| Flashing Dc value: | Urgently check aircraft's or vehicle's electrical system (generator, battery, regulator) and / or installation! |
|--------------------|---|

Radio supplied from a 28 / 14 V Regulator (28 Vdc aircraft or vehicle supply):

| | |
|--------------------|---|
| Flashing Dc value: | Urgently check 28 / 14 V Regulator, aircraft's or vehicle's electrical system (generator, battery, regulator, fuse) and installation! |
|--------------------|---|

6.12 Operating times of FSG 2T supplied from a 12 V battery only

The following duty cycle of Transmit (TX), Receive (RX) and Standby (STBY) results in available operating time (hours). Both the worst and the most favorable operation conditions are considered, e.g. maximum receiver volume combined with maximum speaker load.

Higher current consumption will degrade the nominally available battery capability, as well as lower temperatures. The following tables show significant time differences depending on current consumption during Receive, and at temperatures.

Condition: only headset operated

Max. current drain .05A 1.35A .26A .05A 1.35A .26A .05A 1.35A .26A .05A

| Lead Accumulator 12 Volts 7.2 Ah | STBY, w/out RX | 5% TX | 5% RX | 90% STBY | 10% TX | 20% RX | 70% STBY | 20% TX | 40% RX | 40% STBY |
|-------------------------------------|-------------------|----------|----------|-------------|-----------|-----------|-------------|-----------|-----------|-------------|
| Temperature -20°C/-4°F | 76 hrs | 30 hrs | | | 16 hrs | | | 9 hrs | | |
| Temperature +20°C/+68°F | 131 hrs | 52 hrs | | | 29 hrs | | | 16 hrs | | |
| Temperature +50°C/+122°F | 139 hrs | 55 hrs | | | 30 hrs | | | 16 hrs | | |

Condition: maximum RX audio volume (Loudspeaker)

Max. current drain .05A 1.35A .8A .05A 1.35A .8A .05A 1.35A .8A .05A

| Lead Accumulator 12 Volts 7.2 Ah | STBY, w/out RX | 5% TX | 5% RX | 90% STBY | 10% TX | 20% RX | 70% STBY | 20% TX | 40% RX | 40% STBY |
|-------------------------------------|-------------------|----------|----------|-------------|-----------|-----------|-------------|-----------|-----------|-------------|
| Temperature -20°C/-4°F | 76 hrs | 25 hrs | | | 11 hrs | | | 6 hrs | | |
| Temperature +20°C/+68°F | 131 hrs | 44 hrs | | | 20 hrs | | | 10.5 hrs | | |
| Temperature +50°C/+122°F | 139 hrs | 46 hrs | | | 21 hrs | | | 11 hrs | | |

6.13 Emergency Operation

Without degradation the FSG 2T can be operated on a dc source between 11 Vdc and nearly 9 Volts. This however will **NOT** reduce the TX output level, RX sensitivity, and audio output power, due to internal supply regulation. Below 11 Volts the dc indicator flashes continuously as a low supply warning.

Since the current drawn from battery will increase with lowered Dc supply voltage, the automatic shut-down will speed-up.

If the supply voltage drops below 9 Vdc the FSG 2T switches OFF itself. This automatic feature avoids battery damage due to deep discharging, even if the radio is left switched ON for months! This is true for all types of 12 Vdc batteries.

If the battery recovers and voltage exceeds approximately 10.5 Vdc, the radio returns to operation with the last used setting.

THIS PAGE
INTENTIONALLY
LEFT BLANK

Appendix A, Technical Data FSG 2T

A.1 General

| | |
|----------------------|--|
| Type: | FSG 2T, article-number F10350 Amplitude modulated (AM) VHF Avionics Transceiver |
| Frequency range: | 118.000 ... 136.975 MHz |
| Channels: | 760 channels, 25 kHz spacing |
| Frequency selection: | VFO, digital |
| Frequency display: | 5 digit 7-segment LCD display (backlit) |
| Frequency control: | PLL frequency synthesizer, microprocessor controlled |
| Memories | 20, stored in a non-volatile EPROM |

A.2 Dimensions, Weight

| | |
|---------------------------------|---|
| Exposed dial face | 57 mm / 2¼ inches dia, fits into standard instrument hole |
| Overall dimensions | Width = 63 mm, Height = 61 mm, Length = 217.5 mm W = 2.48", H = 2.4", L = 8.6" |
| Installation depth behind panel | 240 mm / 9.5 inches incl. 50 mm / 2 inches for harness |
| Weight | 600 grams / 1.32 pounds, without harness and mating plugs |

A.3 Power Supply, Fuses

| | | | | | | | | |
|--|---|-------|---|-------|-----------------|--------|---------------|-------|
| Power supply voltage | Nominal 13.8 Vdc (normal 11.0 ... 16.1 Vdc) | | | | | | | |
| Emergency Operation | 9 Vdc ... 11 Vdc (flashing display), no performance degradation | | | | | | | |
| Automatic Turn-OFF | At approx. 8.5 ... 9 Vdc, comes back at approx. 10.5 Vdc | | | | | | | |
| Current Consumption at: | 9 Vdc | | 11 Vdc | | 13.8 Vdc | | 16 Vdc | |
| Squelch ON, no AF volume | 80 mA | | 65 mA | | 50 mA | | 40 mA | |
| Receive, Intercom and / or AF External, Headphone | 400 mA | | 330 mA | | 260 mA | | 210 mA | |
| Receive, max. volume, Loudspeaker (30% ... 85% AM) | 1400 mA | | 1150 mA | | 800 mA | | 600 mA | |
| Transmit Mode (carrier /70% AM) | 1.8 A | 2.2 A | 1.45 A | 1.7 A | 1.1 A | 1.35 A | 0.9 A | 1.2 A |
| Backlighting | add 60 mA | | | | | | | |
| Dc supply voltage metering status | ≥ 12.7 Vdc ≥ 12.0 Vdc | | Battery full Battery ca. ½ capacity | | | | | |
| Emergency operation | < 11.0 Vdc | | Battery is nearly flat, display starts flashing between 11 V and 9 Vdc supply | | | | | |
| External Fuse | Cartridge fuse 3.15 Amp, quick acting, or automatic circuit breaker 3 Amp | | | | | | | |
| Internal Fuse, protects switched Dc Output | 315 mAmp, medium time lag, resettable fuse | | | | | | | |

A.4 Receiver Specification

| | |
|---|--|
| Receiver Type | Single Superhet |
| IF Frequency | IF 21.4 MHz, high injection |
| Sensitivity (m = 30% / 1,000 Hz) | $\leq 1 \mu\text{V}$ ($\leq -107 \text{ dBm} / 50 \Omega$) for 6 dB S+N/N |
| Selectivity (AGC method) | $\leq 6 \text{ dB}$ at $\pm 8 \text{ kHz}$ $\geq 60 \text{ dB}$ at $\pm 17 \text{ kHz}$ $\geq 70 \text{ dB}$ at $\pm 25 \text{ kHz}$ |
| Squelch Type, manual override | Automatic (FM noise /Carrier override), adjustable on front panel |
| AGC (m = 30% / 1 kHz) | $\leq 6 \text{ dB}$, $1 \mu\text{V}$ (-107 dBm) to 1 V (+13 dBm / 50Ω) |
| AGC Delay (RX), m = 30%/1 kHz | $\leq 0.2 \text{ sec}$, 5 mV (-33 dBm) to $5 \mu\text{V}$ (-93 dBm / 50Ω) |
| AGC Recovery after TX | $\leq 0.1 \text{ sec}$ at $5 \mu\text{V}$ (-93 dBm / 50Ω), after TX end |
| Transfer time RX to TX | $\leq 50 \text{ msec}$ |
| Modulation distortion | $\leq 10\%$, 350 ... 3,400 Hz (m = 85%) |
| Audio Frequency Response / AF Fidelity | $\leq 6 \text{ dB}$ (+2 dB / -4 dB), 350 ... 3,400 Hz, $\geq -20 \text{ dB}$ at 4 kHz, 25 kHz Ch spacing (Climax Offset Operation) |
| Nominal AF Output (Speaker) | $\geq 4 \text{ Watt}$ into 4Ω (at 9 Vdc ... 16.1 Vdc supply) |
| Nominal AF Output (Phone) | $\geq 50 \text{ mW}$ into 300Ω (at 9 Vdc ... 16.1 Vdc supply) |
| AF Noise Level, normal operation (under environmental conditions) | $\geq 35 \text{ dB}$ ($\geq 25 \text{ dB}$), m = 30% / 1,000 Hz at $100 \mu\text{V}$ to 5 mV / -67 dBm to -33 dBm / 50Ω |
| AF External Input (OPTION) | ca. 1 Volt into 600Ω for rated AF output |
| Receiver Immunity Spurious Response for $\leq 6 \text{ dB}$ S+N/N (m = 30% / 1 kHz) | $\geq 5 \text{ mV}$ (-33 dBm / 50Ω) a) 108 - 156 MHz (any 25 kHz Test Channel $\leq \pm 8 \text{ kHz}$), except assigned channel and adjacent channels b) 50 kHz – 1,215 MHz, except 108 - 156 MHz |
| Cross Modulation | Max. AF output level $\geq 10 \text{ dB}$ below nominal AF output level: a) Wanted signal $10 \mu\text{V}$ (-87 dBm) to $250 \mu\text{V}$ (-59 dBm / 50Ω), unmodulated at assigned RX channel, plus additional b) Unwanted signal 5 mV (-33 dBm), m = 30% / 1000 Hz, frequency 100 - 156 MHz (assigned channel $\pm 2 \text{ RX}$ channels) |
| Intermodulation (FM Immunity) | $\leq 6 \text{ dB}$ AF Quieting (-5 dBm / 50Ω , 87.5 - 107.9 MHz), 2 signals |
| RF Intermodulation within the VHF Frequency Band | $\geq 70 \text{ dB}$, for 6 dB AF Quieting (unmodulated test signals) Any VHF / AM Ch +1/+2 Ch, -1/-2 Ch, +1/+2 MHz, -1/-2 MHz |
| Desensitization | $\geq 6 \text{ dB}$ S+N/N, at wanted signal $10 \mu\text{V}$ (-87 dBm), at RX frequency, m = 30% / 1,000 Hz, in the presence of: Unwanted signal A 5 mV (-33 dBm / 50Ω), unmodulated, any frequency 108 ... 156 MHz, except used CH and $\pm 1 \text{ RX}$ CH, <u>or</u> Unwanted signal B 100 mV (-7 dBm / 50Ω); minimum 5 mV (-87 dBm), unmodulated, frequency 50 kHz – 1,215 MHz, except 87.5 MHz ... 156 MHz, <u>or</u> Unwanted signal C 125 mV (-5 dBm), unmodulated, frequency 87.5 ... 156 MHz |
| Receiver Spurious Emission | $\leq 141 \mu\text{V} / 400 \text{ pW} / -64 \text{ dBm}$ (50 kHz ... 8 GHz) |
| Channel Selection Time | $\leq 0.4 \text{ sec}$, AF level within 3 dB, max. 20 Memory Channels |
| Receiver Muting, Squelch (CLIMAX RX Operation) | Simultaneous input of: a) Wanted Signal A : $5 \mu\text{V}$ (-93 dBm) +8 kHz (m = 30% / 1,000 Hz), Squelch is open. b) Unwanted Signal B : More than $12 \mu\text{V}$ (-85 dBm), m = 30% / 1000 Hz. While this channel frequency is varied slowly from -8 kHz to +4 kHz, Squelch must remain open. |

A.5 Transmitter Specification

| | |
|--|--|
| TX RF Output Power (also during emergency operation) | approximately 5 Watts / 50 Ω (carrier), 18 Watts PEP, at 9 Vdc ... 16.1 Vdc, -0.5 dB ... + 1,5 dB |
| TX Duty Cycle | 1 : 4 (1 minute TX / 4 minutes RX) |
| Frequency Tolerance | ≤ 10 ppm (-20°C ... + 55°C / -4°F ... + 131°F) ≤ 5 ppm (0°C ... + 40°C / +32°F ... + 104°F) |
| Modulation | Amplitude modulation, AM (7K00A3EJN) |
| Depth of Modulation | 85% ± 2%, approx. 60-70% AM <u>average</u> with Voice modulation |
| Modulation Distortion | ≤ 10%, m = 70% / 1,000 Hz ≤ 15%, m = 70% / 350 ... 3,400 Hz |
| Modulation Audio Frequency Response | ≤ 6 dB (+2 dB / -4 dB), 350 ... 3,400 Hz |
| Modulation AF Input for m = 70% Located on the rear panel DIL switches and potentiometers allow proper customized microphone type selection and proper modulation adjustment for each MIC input | Standard factory setting: Mike 1: Dynamic Microphone: ≤ 1 ... 10 mV symmetrical, sensitivity adjustable. Mike 2: Amplified / Carbon Microphone: ≤ 80 ... 500 mV unsymmetrical, sensitivity adjustable. Note: One, or two <u>identical</u> , dynamic <u>or</u> Standard Carbon microphone(s) may be used on each mike input. For Standard Carbon microphone(s) the supply current can be set to 2 mA, 8 mA, 10 mA, or none. |
| Transmit Audio Sidetone | ≥ 50 mW into 300 Ω (at 9 Vdc ... 16.1 Vdc supply) average phone volume is adjustable on equipment's rear side |
| Carrier Noise Level | ≥ 35 dB (m = 70% / 1000 Hz) |
| Emission of RF Energy (≤ 1 GHz) | ≤ 0.25 μW (-36 dBm) / 71 dBμV / 3.54 mV / 50 Ω ≤ 25 nW (-46 dBm) / 61 dBμV / 1.12 mV / 50 Ω, from 47 ... 68, 87.5 ... 108, 162 ... 244, 328 ... 336, 470 ... 862 MHz |
| Emission of RF Energy (≥ 1 GHz) | ≪ 1 μW / ≪ -30 dBm / ≪ 77 dBμV / ≪ 7 mV / 50 Ω |
| Transmitter Spectrum Mask | ≥ 70 dB attenuation at 1,250 Hz modulation / m = 60%, + 10 dB |
| Channel Selection Time | ≤ 0.1 sec |
| Unwanted Frequency Modulation | ≤ 1.0 kHz at m = 70% / 1000 Hz |
| TX Intermodulation | ≥ 45 dB |
| TX Time-Out-Timer (TOT) | After 2 minutes in continuous transmit Mode the transmitter is disabled. The LC display flashes as time-out warning. RX now possible. |
| Antenna Mismatching | VSWR ≤ 3 : 1, normal operation At VSWR 3 : 1 the requirements for modulation distortion, spurious and harmonics output as well as frequency stability are met. In addition, the RF output is ≥ 40 % / ≥ 2 Watt into 50 Ω At VSWR ≤ 5 : 1 Transmitter is still functional. |

Appendix B, Environmental Performance Classification


Statement of the Level of Compliance with appropriate JAR TSO.

EUROCAE ED-14D / RTCA DO-160D (29 July 1997), including Change 1 December 2000.
 ENVIRONMENTAL CONDITIONS AND TEST PROCEDURES FOR AIRBORNE
 EQUIPMENT PERFORMANCE STANDARD.

NOTE: *The following information provides examples only. It is not intended to be a comprehensive listing of all test conditions.*

| Conditions | Section | Description of Conducted Tests | Category |
|--|-------------------------|---|--|
| Temperature and Altitude | 4.3 | Equipment tested to Category | D1 |
| Low Temperature | 4.5.1 | Operation - 20 °C / Storage -55 °C | |
| High Temperature | 4.5.2 | Operation +55 °C / Storage +85 °C | |
| In-flight Loss of Cooling | 4.5.4 | No auxiliary cooling required | – |
| Altitude | 4.6.1 | 50,000 ft / 15,240 m | |
| Decompression | 4.6.2 | No test required in Category D1 | |
| Over Pressure | 4.6.3 | No test required in Category D1 | |
| Temperature Variation | 5.2 | Equipment tested to Category, 5°C / min. | B |
| Humidity | 6.0 | Equipment tested to Standard Category | A |
| Shock | 7.1.1 7.2 7.3 | Equipment tested to Category Operational shocks 6g Crash Safety 20g without damage | B |
| Vibration (for Helicopter use, the vibration testing included 4 sets of Unknown Frequencies of Cat. U). | 8.5.1 8.5.2 8.8.1 | Equipment tested to Fixed Wing Aircraft Category Equipment tested to Fixed Wing Aircraft Category Equipment tested to Helicopter Aircraft Category | S Curve B S Curve M R Curve G |
| Explosion | 9.0 | No test required | X |
| Waterproofness | 10.0 | No test required | X |
| Fluids Susceptibility | 11.0 | No test required | X |
| Sand and Dust | 12.0 | No test required | X |
| Fungus | 13.0 | No test required | X |
| Salt Spray | 14.0 | No test required | X |
| Magnetic Effect | 15.0 | Equipment tested to Category | Z |
| Power Input | 16.0 | Equipment tested to Category | B |
| Voltage Spike | 17.0 | Equipment tested to Category | B |
| Audio Frequency Susceptibility | 18.0 | Equipment tested to Category | B |
| Induced Signal Susceptibility | 19.0 | Equipment tested to Category | A |
| Radio Frequency Susceptibility | 20.0 | Equipment tested to Category | T |
| Radio Frequency Emission | 21.0 | Equipment tested to Category | H |
| Lightning Induced Susceptibility | 22.0 | No test required | X |
| Lightning Effects | 23.0 | No test required | X |
| Icing | 24.0 | No test required | X |
| Other Test | ---- | No test required | X |

Appendix C, Certificates

 **European Aviation Safety Agency**

**EUROPEAN TECHNICAL STANDARD ORDER
(ETSO) AUTHORISATION**

EASA.210.1304, REV. A

This European Technical Standard Order (ETSO) Authorisation is issued by EASA, acting in accordance with Regulation (EC) No. 216/2008 on behalf of the European Community, its Member States and of the European third countries that participate in the activities of EASA under Article 66 of that Regulation, subject to conditions specified below, to

FUNKWERK AVIONICS GmbH
HEINZ-STRACHOWITZ-STRASSE 4
86807 BUCHLOE
GERMANY

in accordance with Commission Regulation (EU) No. 748/2012, Part 21, Section A, Subpart O and JTSO-2C37E, JTSO-2C38E for

VHF Transceiver FSG 2T
P/N F10350-()
DDP No. 035.1.00, ISSUE A or Subsequent Revisions


Remarks:
This authorisation supersedes approval EASA.210.1304 due to a name change of the approval holder.

Conditions:

1. The above ETSO Authorisation holder is only authorised to identify an Article with this ETSO marking whilst remaining in compliance with the conditions retained for the issue of this Authorisation.
2. This ETSO Authorisation does not constitute an installation approval. It is the responsibility of those installing this article to determine that the aircraft installation conditions are within the ETSO standards.

This ETSO Authorisation shall remain valid until surrendered or revoked.

For the European Aviation Safety Agency,
Date of issue: 30 August 2013


Markus GOERNEMANN
Certification Manager
Parts & Appliances

EUROPEAN TECHNICAL STANDARD ORDER (ETSO) AUTHORISATION - 10029625, REV. A - FUNKWERK AVIONICS GmbH
TE ETSO 00052 002 - Copyright European Aviation Safety Agency. All rights reserved.

1/1

| | |
|--|--|
| <p>f.u.n.k.e. AVIONICS GMBH</p> <p><small>f.u.n.k.e. means - fabrication - utilities - network - know-how - engineering</small></p> | |
| <p>Maßnahmen zur effizienten Nutzung des Funkfrequenzspektrums means of the efficient use of the radio frequency spectrum</p> | <p>Einhaltung der grundlegenden Anforderungen auf andere Art und Weise ... other means of demonstrating conformity with the essential requirements ...</p> |
| <p>Harmonisierte Normen ... Harmonised standards ...</p> | <p>ETSI EN 300 676-1 V1.5.2 and ETSI EN 300 676-2 V1.5.1 1-6011/13-01-02</p> |
| <p>Standards</p> | |
| <p>Test Report No.</p> | |
| <p>Ort, Datum Place & date of issue</p> | <p>D-86807 Buchloe, 12. März 2014</p> |
| <p>Name und Unterschrift Name and signature</p> | <p> Dr. Thomas Willig Accountable Manager</p> |
| | 2(2) |

| | |
|--|---|
| <p>f.u.n.k.e. AVIONICS GMBH</p> <p><small>f.u.n.k.e. means - fabrication - utilities - network - know-how - engineering</small></p> | |
| <p>f.u.n.k.e. AVIONICS GmbH Heinz-Strachowitz-Str. 4, D-86807 Buchloe phone: +49 (0)9241-90066-0 fax: +49 (0)9241-90066-99</p> | <p>Konformitätserklärung Declaration of Conformity</p> |
| <p>gemäß dem Gesetz über Funkanlagen und Telekommunikationsendgeräte (FTEG) und der Richtlinie 1999/5/EG (R&TTE) Declaration of Conformity appropriate to the law of radio and telecom terminal equipment</p> | <p>VHF/AM FLUGFUNKGERÄT VHF/AM Aeronautical Voice Communications Transceiver</p> |
| <p>f.u.n.k.e. AVIONICS GmbH Heinz-Strachowitz-Str. 4 D-86807 Buchloe</p> | <p>FSG 2T <input checked="" type="checkbox"/> Funkanlage radio equipment</p> |
| <p>erklärt, dass das Produkt declares that the product</p> | <p>II. Geräteklasse, equipment class</p> |
| <p>Typ (ggf. Anlagenkonfiguration mit Angabe der Module): Type (if applicable, configuration including the modules)</p> | <p><input type="checkbox"/> Telekommunikations(TK-)Endeinrichtung telecommunications terminal equipment</p> |
| <p>VHF Bodenfunkstelle, tragbar, stationär, mobil; Ground-based VHF Transceiver, portable, fixed, mobile</p> | <p>bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des § 3 und den übrigen entschließlichen Bestimmungen des FTEG entspricht. complies with the appropriate essential requirements of the FTEG and the other relevant provisions, when used for its intended purpose.</p> |
| <p>Verwendungszweck, intended purpose</p> | <p>Gesundheit und Sicherheit Health and Safety requirements</p> |
| <p>Harmonisierte Normen ... Harmonised standards ...</p> | <p>Einhaltung der grundlegenden Anforderungen auf andere Art und Weise ... other means of demonstrating conformity with the essential requirements ... IEC 60950-1:2005 (2nd Edition)/A1:2009 and EN 60950-1:2006/A11:2009/A1:2010/A12:2011 CE, AA, WC 34 1-6011/13-01-06</p> |
| <p>Standards</p> | |
| <p>Test Procedure</p> | |
| <p>Test Report No.</p> | |
| <p>Schutzanforderungen in Bezug auf die elektromagnetische Verträglichkeit Protection requirements with respect to electromagnetic compatibility</p> | <p>Einhaltung der grundlegenden Anforderungen auf andere Art und Weise ... other means of demonstrating conformity with the essential requirements ... ETSI EN 301 489-1 V1.9.2 and ETSI EN 301 489-22 V1.3.1 1-6011/13-01-04</p> |
| <p>Harmonisierte Normen ... Harmonised standards ...</p> | |
| <p>Standards</p> | |
| <p>Test Report No.</p> | |
| | 1(2) |

Product Characteristics:

Aeronautical ground-based VHF, mobile transceiver

Carrier Frequency : 118.000-136.975 MHz

RF-Output (pulse power) : 37 dBm (5 Watt)

Number of channels : 760

Type of Modulation : AM (8K00A3E) 25kHz separation

Antenna : BNC socket

Power supply : 13.8V DC

Temperature range : -20°C to +55°C

Conformity Details:

| Requirement | Standard, test report number, date & laboratory |
|----------------|--|
| Safety | EN 6095-0-1:2006/A1:2009/A1:2010/A12:2011 -No. : 1-6011/13-01-07 dated 2013-04-10 and issued by CETECOM ICT Services GmbH |
| EMC | EN 301 489-1 V1.9.2 EN 301 489-22 V1.3.1 -No. : 1-6011/13-01-04 dated 2013-04-09 and issued by CETECOM ICT Services GmbH |
| Radio spectrum | EN 300 676-2 V1.5.1 EN 300 676-1 V1.5.2 -No. : 1-6011/13-01-02 dated 2013-03-26 and issued by CETECOM ICT Services GmbH |

Miscellaneous:

TCF according to the application

Annex 1 to Expert Opinion – Registration No. E81684A-EO



CETECOM
SOLUTIONS FOR THE AVIATION INDUSTRY

CE Identification Number 0682
authorized by the German Government to
issue CE Certificates of Conformity (COC) for
R&TE Products (EN 6095-0, EN 301 489)

Identifizierungsnummer
BNC-A4-8291-52

Certificate Holder: Dittel Messtechnik GmbH
Eplinger Str. 3b
88899 Landsberg / Germany

Product Designation: Aeronautical ground-based VHF, mobile transceiver

Model(s): FSG 2T

Conformity Assessment:

| Essential requirements | Examined documentation | Result |
|-------------------------------------|---|---------|
| Health R&TE, Article 3.1a | Technical documentation including test report | conform |
| Safety R&TE, Article 3.1a | Technical documentation including test report | conform |
| EMC R&TE, Article 3.1b | Technical documentation including test report | conform |
| Radio Spectrum R&TE, Article 3.2 | Technical documentation including test report | conform |

Expert Opinion:
Our opinion in accordance with Annex IV of Council Directive 1999/5/EC on radio equipment and telecommunications equipment and the mutual recognition of their conformity is that the evaluation of the submitted documents related to the apparatus identified above complies with the requirement of that directive stated in the above scope.

Marking:
The product shall be marked with CE, our Notified Body Number and the Class II Identifier (Not-Sign) as shown in beside picture.

Annexes:
The scope of this evaluation relates to the submitted documents only.
The certificate is only valid in conjunction with the following **number** of annexes: 1

Certificate Registration No.: E81684A-EO

Place, issue date
Saarbrücken, 2013-04-28

Authorized signature / title

Authorized signature / title

CE 0682 

GERMAN NOTIFIED BODY
DEUTSCHE ZERTIFIZIERUNGSGESellschaft
Fahnenstraße
68169 Mannheim
2013.03.15 1039/25 - 02/09

CETECOM ICT Services GmbH
Fahnenstraße
68169 Mannheim
2013.03.15 1039/25 - 02/09

68117 Saarbrücken - Germany - www.cetecom.com

FCC - OET EAS Form 731 Grant of Equipment Authorization <https://apps.fcc.gov/oetcf/eas/reports/Eas731GrantForm.cfm?mod...>

COPY

FEDERAL COMMUNICATIONS
COMMISSION
WASHINGTON, D.C. 20554
GRANT OF EQUIPMENT
AUTHORIZATION
Certification

COPY

f.u.n.k.e. AVIONICS GmbH
Heinz-Strachowitz-Str. 4
86807 Buchloe,
Germany

Date of Grant: 11/28/2002
Application Dated: 09/06/2002

Attention: Erik Wischmann

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: BVYFSG2T
Name of Grantee: f.u.n.k.e. AVIONICS GmbH
Equipment Class: Licensed Non-Broadcast Station Transmitter
Notes: VHF/AM COM Transceiver FSG 2T
Modelar Type: Does not apply

| | | | | | |
|--------------|----------------|-----------------------|--------|-----------|------------|
| Grant Notes: | FCC Rule Parts | Frequency Range (MHZ) | Output | Frequency | Emission |
| AG | 87 | 118.0 - 136.975 | Watts | Tolerance | Designator |
| | | | 5.0 | 5.0 PM | 7K00A3E |

AG: Acceptable for airborne mobile use under Part 22 with receiver designed to automatically revert to the signaling channel frequency upon completion of a call.

Mail To:

EAS47527

Copyright – Service Information

Copyright © 2014 f.u.n.k.e. AVIONICS GmbH

All rights reserved. This document contains proprietary information and such information may not be disclosed to others for any purpose nor used for manufacturing purposes without prior written permission of the manufacturer f.u.n.k.e. AVIONICS GmbH, 86807 Buchloe, Germany.

In this document no mention is made of patents, trademark rights, or other proprietary rights which may attach to certain words or entries. The absence of such mention, however, in no way implies that the words or entries in question are exempt from such rights.

Service Information

Should any unusual problem arise or further information be desired, please contact the f.u.n.k.e. AVIONICS GmbH, Avionics Division, Heinz-Strachowitz-Str. 4, 86807 Buchloe, Germany.

The information in this Operator's Manual does not profess to include all the details of design, production, or variation of the equipment, or to cover all the possible contingencies which may arise during operation or maintenance. We welcome your comments concerning this Manual. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the Operator's Manual article number, paragraph or figure number, and the page number.

Send your comments to Publications Department
 f.u.n.k.e. AVIONICS GmbH
 Heinz-Strachowitz-Str. 4
 86807 Buchloe
 Germany
or by e-mail to: info@funkeavionics.de

THIS PAGE
INTENTIONALLY
LEFT BLANK