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 (4 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 = 30 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. 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.

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 speaker.

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

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

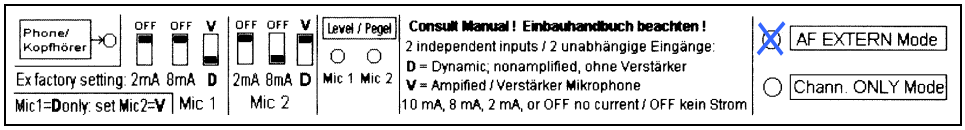
CAUTION!

- ***Your magnet compass may be deflected by the speaker's magnetic field. Therefore, when using the WALTER DITTEL 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

IMPORTANT!

- ***The Option AF EXTERNAL has to be enabled by an approved Avionics workshop! The Information Label of the radio will then be marked accordingly.***



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

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 RX the External AF audio level is reduced by 6 dB (half level). 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.

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!

- *Lighting is turned ON or OFF via a separate input, but can be controlled by the radio, if desired.*
- *In order to save current while supplied from battery an external suitable illumination switch is suggested.*

The **FSG 2T** includes a LED Backlight. 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.

CAUTION!

- ***For backlighting from a 28 Vdc aircraft supply, insert a 230 Ohm resistor / 1 W, connected in series. This way of matching to 28 Volt is only suitable for the lighting!***
- ***The FSG 2T always requires a 9 to 16 Volts DC supply.***

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 lighting interconnection refer to § 3.5.6.

Section 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!***
- ***Remove the self-adhesive metallic foil at the rear panel to get access to the potentiometers and DIL Switches. Keep for further use!***
- ***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 <u>after</u> 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 identical) non-amplified Dynamic Microphone(s)

- Verify the settings of the DIL switches at the rear of the radio (DIL switch "**Mic 1**" set to **D**, DIL switch "**Mic 2**" to **V**, all others any).
- 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 on MIC input pin 1 and MIC input pin 3

- Verify the settings of the DIL switches at the rear of the radio (DIL switch "**Mic 1**" set to **D**, DIL switch "**Mic 2**" to **D**, all others any).
- **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 identical) amplified / Standard Carbon Microphone(s) on MIC input pin 3

- **This test should be performed with headphone(s) to evaluate the 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 at 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 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 on MIC input pin 1 and MIC input pin 3

- **This test should be performed with headphones to evaluate the quality of the MIC signals via Transmit Sidetone!**
- Verify the settings of the DIL switches at 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 at 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 Transmitter Sidetone

IMPORTANT!

- ***This setting determines the maximum headphone audio volume during Receive, TX Sidetone, Intercom and AF External (if applicable)!***
- *Before adjusting the Transmitter Sidetone volume, the microphone sensitivity should be adjusted correctly (refer to § 4.2).*
- *TX Sidetone is only audible during Transmit via headphone(s).*
- *When using two headphones their characteristics should be identical.*
- *If applicable – prior to Sidetone level adjustment – set volume control(s) on each headset to maximum.*
- ***During this adjustment the transmitter is active. Carry out adjustment(s) quickly!***

- 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 an convenient level while transmitting and 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 simultaneously the Intercom capability, while the speaker is disabled.
There are two operating modes of Intercom:

Applicable for FSG 2T without AF External capability:

Intercom Voice / VOX controlled: at a sufficient voice audio 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 second 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. Turn **VOL** knob to adjust Intercom audio volume.
- Stop speaking; after some seconds 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 and headphone of the first one.

Applicable for 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 headphone of the second 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. 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 and headphone of the first one.

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 an 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 cover all openings at the rear panel of the radio by a self-adhesive metallic foil!***
- ***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 × 12 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 (no 50 Ohm) coaxial cable.

In order to optimize radio range, it is suggested to care for an 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 at 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 both the audio / noise influence, and 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 at 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.

Section 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.

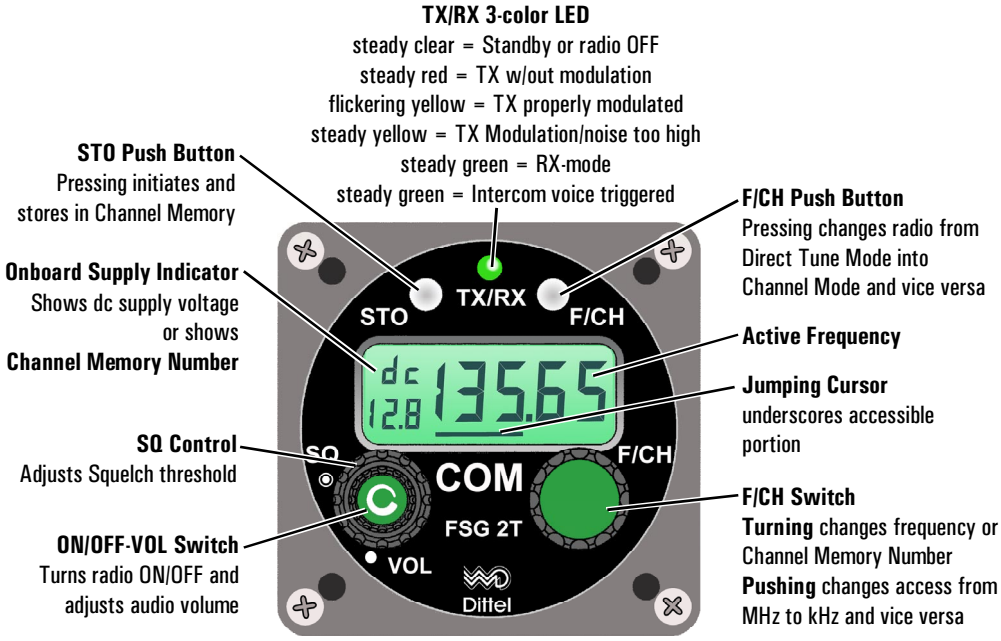
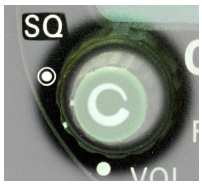
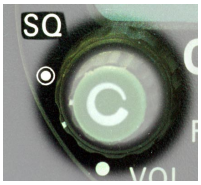
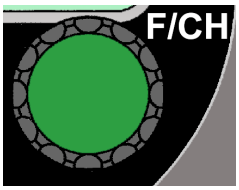


Fig. 5 - 1

5.2 Operator's Controls

Control	Description / Function
VOL 	Rotary switch and control (inner knob) To turn ON the radio, rotate the **VOL** knob clockwise from the OFF position (dot). When power is activated • 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. Rotating the **VOL** knob clockwise (cw) increases - turning counter-clockwise (ccw) decreases the audio volume audible in the A/C loudspeaker (Receive only) or in the connected headphone (all TX Sidetone, Receive and Intercom audio). To turn OFF the radio rotate the **VOL** knob fully counter-clockwise (ccw) to the OFF position (dot). Blank display.
SQ (SQUELCH) 	Rotary control (outer ring) After turning ON the radio **FSG 2T** the automatic squelch is active depending on the **SQ** knob position. • **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).
F/CH Button 	Push button Repeatedly pushing the F/CH button • while in DIRECT TUNE mode (MHz or kHz is underscored), this will change the radio into CHANNEL mode, **or** • while in CHANNEL mode (CH number is underscored), this will change the radio into DIRECT TUNE mode.
TX/RX LED 	The **TX/RX** 3-color Status LED indicator on the front panel signals the following: **CLEAR** ..... indicates a Standby condition or radio is OFF. **STEADY RED** ..... indicates a Transmit condition without or too low modulation. **FLICKERING YELLOW**..... **indicates a Transmit condition with proper microphone signal / modulation.** **STEADY YELLOW**..... indicates a Transmit condition with too much modulation or background noise **STEADY GREEN** ..... indicates a Receive condition, Squelch is opened automatically (or set OFF manually). **STEADY GREEN** ..... indicates a sufficient microphone level while in the voice / VOX triggered Intercom condition (not true when option AF External is enabled).
F/CH Knob 	Rotary control and push button = dual function **Pressing the F/CH knob once** • 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. **Rotating the F/CH knob** • 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.
STO (STORE) 	Push button 20 frequencies may be programmed in non-volatile memory channels. The channel memory numbers (1 …20) are user programmable. **NOTE:** 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 Software 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

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):

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**:

Steady display for 25 seconds:

Flashing supply indicator for 5 seconds:

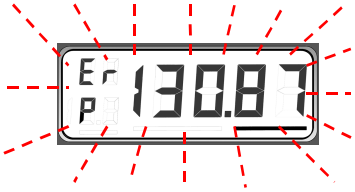
Example:
Display shows Channel No. 4 with an active frequency of 118.975 MHz.
Low on-board supply: 9.9 Vdc (indicator is flashing!)

5.4 Error Codes

Display in all Modes

High Voltage: Continuously slightly too high supply voltage changes value indication into High (Hi) above 16.1 / below 16.5 Vdc. Above 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 Walter Dittel 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 Walter Dittel approved repair facility!

5.5 Connectors and controls at rear side

50-Ω BNC jack,

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

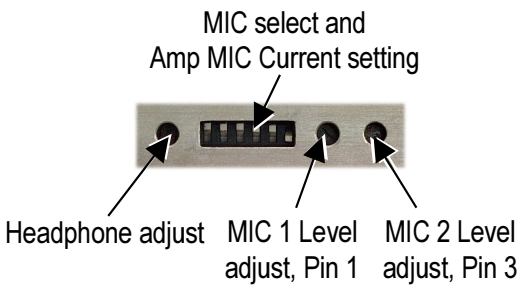
Connects a suitable COM broad-band antenna with a frequency range of at least 118 - 137 MHz.

Refer to § 3.4.3 for Antenna Installation.

Standard DB-15 male connector with sliding lock retainer.

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

To connect the aircraft wiring: 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

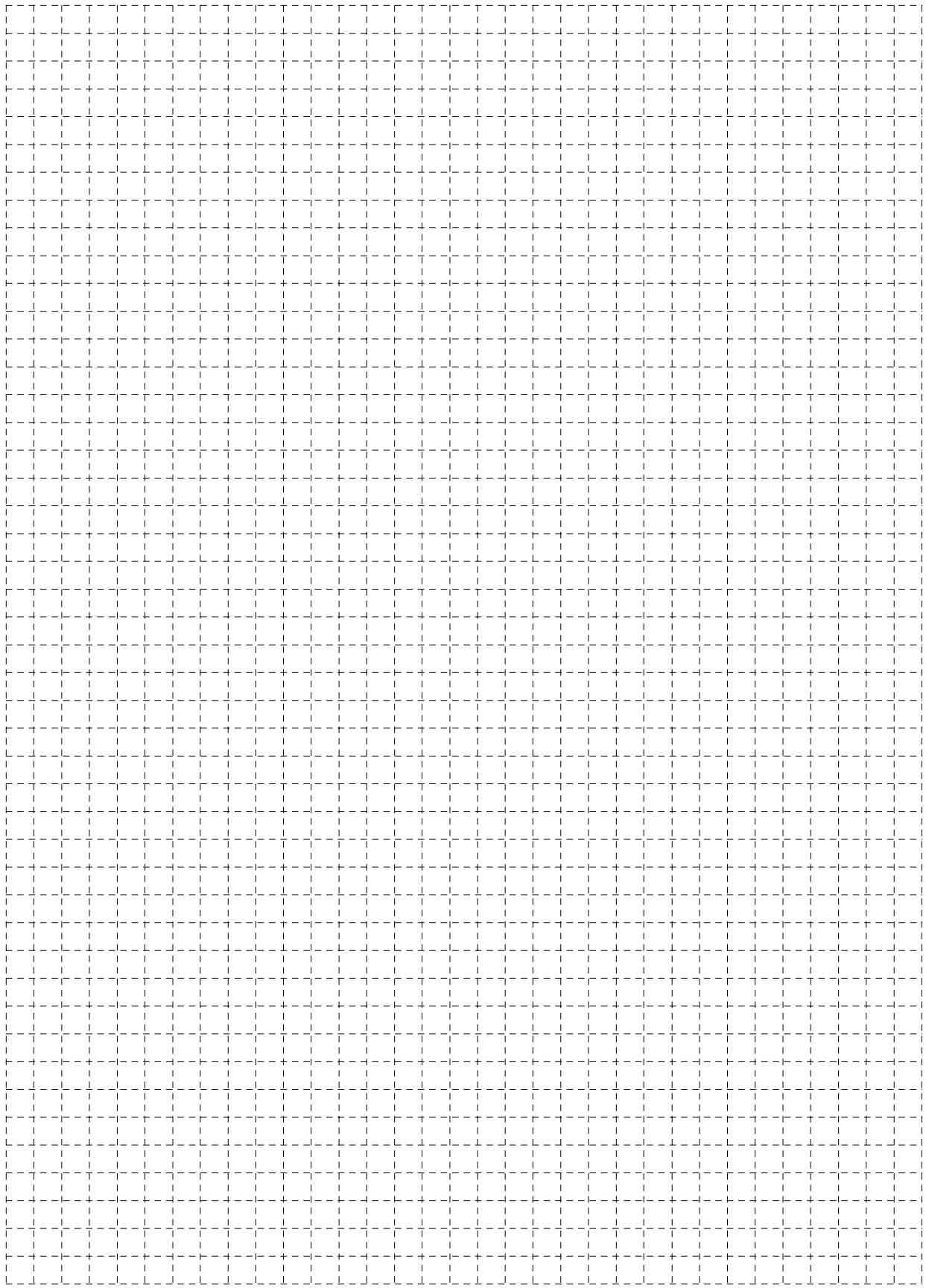
CAUTION!

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

To reset all adjustments proceed as follows:

- Turn OFF the radio (**VOL** knob fully ccw).
- **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 then the display gets blank.
- Release the buttons.
- The **TX/RX** LED Indicator will light up momentarily.
- The VHF radio **FSG 2T** is now operable in the factory setting (except audio and MIC settings at the rear panel).

Notes:



Section 6 Operation

6.1 Introduction

This section contain 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 <u>after</u> 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 for the transmitter 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 underscored portion 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 (129, 130, 131 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.

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 (35, 37, 40, 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.

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 channel** and its associated frequency!

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

Continue with either Receive or Transmit Operation

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! **TX/RX** LED **must not** light RED or flicker YELLOW!

This radio contains an audio-leveling circuit. So if you change the frequency or channel 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!***

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 distress 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 at 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 2 minutes. When the transmitter is keyed continuously longer than 2 minutes the display of the **FSG 2T** starts flashing and transmission is disabled.*
- *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.
The active frequency is now ready within 1 minute to be stored in any of the 20 memory channels.

Release the **STO** button. The "dc" display disappears, a flashing "**CH**" together with the underscored last used channel number is shown. 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.
The active Channel Number and its frequency is now ready within 1 minute to be stored in any of the other 19 memory channels.

Release the **STO** button. A flashing "**CH**" is shown. 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 <u>voice controlled</u> Intercom is not possible!***
- *The built-in VOX voice controlled microphone threshold control will mute microphones during speech pauses.*
- *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 at the headset phone capsule.*

1. Switch ON Intercom. This activates simultaneously 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 some 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 Intercom Mode again.

6.7 Intercom (Option AF EXTERNAL enabled)

IMPORTANT!

- ***When the Option AF EXTERNAL is activated by an approved Avionics workshop 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 at 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 and External Audio signals are 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 has to be enabled by an approved Avionics workshop! If it is enabled the radio is marked accordingly!***
- *Enabling AF EXTERNAL causes increased current consumption during Standby!*
- *The voice controlled (VOX) Intercom is thus disabled!*

In Standby and Receive Mode audio signals of additional units (other COM, VOR, Localizer, Marker, ADF, electric variometer, etc.) are audible simultaneously.
Audio volume of external audio signals have to be adjusted on the external units individually.

The **VOL** control on the **FSG 2T** front panel is not affected by external audio sources, and vice versa. 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 Checking the aircraft onboard supply

The transceiver **FSG 2T** include 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 / 6.5 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 6.5 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.

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: Maximum RX audio volume, OPTION AF External enabled

Max. current drain	**.11A**	**2.5A**	**1.0A**	**.11A**	**2.5A**	**1.0A**	**.11A**	**2.5A**	**1.0A**	**.11A**
Lead Accumulator 12 Volts **6.5 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**	38 hrs	12.30 hrs			6.00 hrs			3.10 hrs		
Temperature **+20°C/+68°F**	62 hrs	20.10 hrs			10.00 hrs			5.20 hrs		
Temperature **+50°C/+122°F**	66 hrs	22.10 hrs			11.10 hrs			6.00 hrs		

Condition: Minimum RX audio volume

Max. current drain	**.08A**	**2.5A**	**.25A**	**.08A**	**2.5A**	**.25A**	**.08A**	**2.5A**	**.25A**	**.08A**
Lead Accumulator 12 Volts **6.5 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**	57 hrs	15.50 hrs			8.50 hrs			4.40 hrs		
Temperature **+20°C/+68°F**	85 hrs	26.10 hrs			14.30 hrs			7.50 hrs		
Temperature **+50°C/+122°F**	90 hrs	28.40 hrs			16.20 hrs			8.40 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.

Appendix A Technical Summary

A1 General

Type:	Amplitude modulated (AM) Avionics Transceiver
Channels:	760 channels, 25 kHz spacing, 118.000 … 136.975 MHz
Frequency selection:	VFO, digital
Frequency display:	5 digit 7-segment LCD display (backlit)
Frequency control:	PLL frequency synthesizer, microprocessor controlled
Memories	20, stored in non-volatile EPROM

A2 Dimensions, Weight

Exposed dial face	57 mm / 2¼ inches dia, fits into standard instrument hole
Overall dimensions	Width = 63 mm, Height = 61 mm, Length = 227 mm W = 2.48 H = 2.4 L 8.9 inches
Installation depth behind panel	241 mm / 9.5 inches incl. 50 mm / 2 inches for harness
Weight	600 grams / 1.32 pounds, without harness

A3 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 … 9.5 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	65 mA		50 mA		40 mA		30 mA	
Intercom and / or AF External	400 mA		300 mA		250 mA		200 mA	
Receive max. (30% … 85% AM)	1400 mA		1150 mA		900 mA		800 mA	
Transmit Mode (carrier /70% AM)	1.6 A	2 A	1.3 A	1.7 A	1.1 A	1.4 A	0.9 A	1.3 A
Backlighting	add 60 mA							
Dc supply voltage metering status	≥ 12.7 Vdc Battery full ≥ 12.0 Vdc 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, auto-reset fuse							

A4 Receiver Specification

Receiver Type	Single Superhet
IF Frequency	IF 21.4 MHz, high injection
Sensitivity (m = 30% / 1,000 Hz)	≤ 1 µV (≤ -107 dBm / 50 Ω) for 6 dB S+N/N
Selectivity (AGC method)	≤ 6 dB at ± 8 kHz ≥60 dB at ± 17 kHz ≥70 dB at ± 25 kHz
Squelch Type, manual override	Automatic (FM noise /Carrier override), adjustable on front panel
AGC (m = 30% / 1 kHz)	≤ 6 dB, 1 µV (-107 dBm) to 1 V (+13 dBm / 50 Ω)
AGC Delay (RX), m = 30%/1 kHz	≤ 0.2 sec, 5 mV (-33 dBm) to 5 µV (-93 dBm / 50 Ω)
AGC Recovery after TX	≤ 0.1 sec at 5 µV (-93 dBm / 50 Ω), after TX end
Transfer time RX to TX	≤ 50 msec
Modulation distortion	≤ 10%, 350 … 2 500 Hz (m = 85%)
Audio Frequency Response / AF Fidelity	≤ 6 dB (+2 dB / -4 dB), 350 ... 3 400 Hz, ≥ -20 dB at 4 kHz, 25 kHz Ch spacing (Climax Offset Operation)
Nominal AF Output (Speaker)	≥ 4 Watt into 4 Ω (at 9 Vdc …16.1 Vdc supply)
Nominal AF Output (Phone)	≥ 25 mW into 600 Ω (at 9 Vdc …16.1 Vdc supply)
AF Noise Level, normal operation (under environmental conditions)	≥ 35 dB (≥ 25 dB), m = 30% / 1 000 Hz at 100 µV to 5 mV (-67 dBm to -33 dBm / 50 Ω)
AF External Input	≤ 1 Volt into 600 Ω for rated AF output
Receiver Immunity Spurious Response for ≤ 6 dB S+N/N (m = 30% / 1 kHz)	≥ 5 mV (-33 dBm / 50 Ω) a) 108 - 156 MHz (any 25 kHz Test Channel ≤ ± 8 kHz), except assigned channel and adjacent channels b) 50 kHz – 1,215 MHz, except 108 - 156 MHz
Cross Modulation	Max. AF output level ≥ 10 dB below nominal AF output level: a) Wanted signal 10 µV (-87 dBm) to 250 µV (-59 dBm / 50 Ω), unmodulated at assigned RX channel, plus additional b) Unwanted signal 5 mV (-33 dBm), m = 30% / 1000 Hz, frequency 100 - 156 MHz (assigned channel ± 2 RX channels)
Intermodulation(FM Immunity)	≤ 6 dB AF Quieting (-5 dBm / 50 Ω, 87.5 - 107.9 MHz), 2 signals
RF Intermodulation within the VHF Frequency Band	≥ 70 dB, for 6 dB AF Quieting (unmodulated test signals) Any VHF / AM Ch +1/+2 Ch, - 1/- 2 Ch, - 1/-2 MHz
Desensitization	≥ 6 dB S+N/N, at wanted signal 10 µV (-87 dBm), at RX frequency, m = 30% / 1000 Hz, in the presence of: Unwanted signal **A** 5 mV (-33 dBm / 50 Ω), unmodulated, any frequency 108 ... 156 MHz, except used CH and ± 1 RX CH, or Unwanted signal **B** 100 mV (-7 dBm / 50 Ω); minimum 5 mV (-87 dBm), unmodulated, frequency 50 kHz – 1,215 MHz, except 87.5 MHz ... 156 MHz, or Unwanted signal **C** 125 mV (-5 dBm), unmodulated, frequency 87.5 ... 156 MHz
Receiver Spurious Emission	≤ 400 pW / -64 dBm (50 kHz ... 8 GHz)
Channel Selection Time	≤ 0.4 sec, AF level within 3 dB, max. 20 Memory Channels

Receiver Muting, Squelch (CLIMAX RX Operation)	Simultaneous input of: a) Wanted Signal **A**: 5 µV (-93 dBm) +8 kHz (m = 30% / 1000 Hz), Squelch is open. b) Unwanted Signal **B**: More than 12 µV (-85 dBm), m = 30% / 1000 Hz,. While this channel frequency is varied slowly from -8 kHz to +4 kHz, Squelch must remain open.

A5 Transmitter Specification

TX RF Output Power (also during emergency operation)	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 average with Voice modulation
Modulation Distortion	≤ 10%, m = 70% / 1000 Hz ≤ 15%, m = 70% / 350 ... 3400 Hz
Modulation Audio Frequency Response	≤ 6 dB (+2 dB / -4 dB), 350 ... 3400 Hz
Modulation AF Input for m = 70% Located at 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, Mike 2: Amplified / Carbon Microphone: ≤ 80 ... 500 mV unsymmetrical, sensitivity adjustable in SETUP. ***Note*:** One, or two identical, dynamic or 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	≥ 25 mW into 600 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)	≤ 25 nW (-36 dBm) / 71 dBµV / 3.54 mV / 50 Ω ≤ 4 nW (-45 dBm) / 62 dBµV / 1.25 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 unkeyed. The LC display flashes as time-out warning
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 Low Temperature High Temperature In-Flight Loss of Cooling Altitude Decompression Over Pressure	4.3 4.5.1 4.5.2 4.5.4 4.6.1 4.6.2 4.6.3	Equipment tested to Category Operation - 20°C / Storage -55°C Operation +55°C / Storage +85°C No auxiliary cooling required 50,000 ft / 15,240 m No test required in Category D1 No test required in Category D1	**D1** –
Temperature Variation	5.2	Equipment tested to Category, 5ºC / 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

CETECOM ICT Services GmbH

CETECOM™

CERTIFICATE OF CONFORMITY

Registration-No.: **E812984O-CC** Number of annexes: ---

Certificate Holder: **Walter DITTEL GmbH**
Luftfahrtgerätebau
Erpftinger Str. 36

D-86899 Landsberg

Product Designation: **FSG 2T**

Product Description: **VHF/AM Air Band Transceiver for ground based applications**

Product Manufacturer: **Walter DITTEL GmbH**
Luftfahrtgerätebau
Erpftinger Str. 36

D-86899 Landsberg

Specifications and test reports:

Specification	Test report no. & date	Name of test laboratory	Notes
EN 301 489-1, Aug. 2000 EN 301 489-22, Dec. 2000	2-2603-01-02/01 dated 20.11.2001	CETECOM ICT	conform
EN 300 676, May 2000	2-2603-A/01 dated 03.09.2001	CETECOM ICT	conform

Statement **This equipment fulfils the requirements or parts thereof in the above mentioned specifications.**

By decree Vfg 28/2000, issued in the Official Journal 6/2000 of the Regulierungsbehörde für Telekommunikation und Post, CETECOM ICT Services is authorized to act as Notified Body in accordance with the R&TTE Directive 1999/5/EC of 09. March 1999

Saarbrücken, 18.03.02
Place, Date of Issue

Signed by Ernst Hussinger
Notified Body

GERMAN NOTIFIED BODY · DEUTSCHE BENANNTE STELLE ·

CETECOM ICT Services GmbH, Untertürkheimer Straße 6-10, D-66117 Saarbrücken, Germany

CETECOM ICT Services GmbH

EC Identification number 0682

authorized by the German Government

with decree Vfg 28/2000 , issued in the Official Journal 6/2000
of the Regulierungsbehörde für Telekommunikation und Post,
to act as Notified Body in accordance with the R&TTE Directive 1999/5/EC of 09. March 1999.

CERTIFICATE
EXPERT OPINION

Registration-No.: **E812984O-EO**

Certificate Holder: **Walter DITTEL GmbH**
Luftfahrtgerätebau
Erpftinger Str. 36

D-86899 Landsberg

Product Designation: **FSG 2T**

Product Description: **VHF/AM Transceiver for aeronautical mobile service**

Product Manufacturer: **Walter DITTEL GmbH**
Luftfahrtgerätebau
Erpftinger Str. 36

D-86899 Landsberg

Essential requirements	Specifications / Standards	Submitted documents	Result
EMC (FTEG, § 3, (1), 2.)	EN 301 489-1, Aug. 2000 EN 301 489-22, Dec. 2000	Test Report	conform
Radio spectrum (FTEG, § 3, (2))	EN 300 676, May 2000	Test Report	conform

Marking: **The product shall be signed with CE, our notified body number and the Class II identifier (Alert sign) as shown right hand.**

CE 0682 !

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

Number of annexes: 1

Saarbrücken, 18.03.02
Place, Date of Issue

Signed by Ernst Hussinger
Notified Body

GERMAN NOTIFIED BODY · DEUTSCHE BENANNTE STELLE ·

CETECOM ICT Services GmbH, Untertürkheimer Straße 6-10, D-66117 Saarbrücken, Germany
http://www.cetecom.de

Annex 1 of the Certificate „EXPERT OPINION"
Registration no.: E812984O -EO Date: 18.03.02
Page 1 of 1

Product Characteristics:

Mobile, portable or fixed VHF/AM air band transceiver (analog voice communication) for ground based applications

Frequency Characteristics	:	118.000 – 136.975 MHz
RF-Output Power (conducted)	:	5 W
ITU-Designation	:	7K00A3E
Number of Channels	:	760
Channel Spacing	:	25 kHz
Antenna-Access	:	RF-connector (load 50 Ω)

Conformity Details:

Evaluated testreports	
Requirement	**Standard, test report number, date & laboratory**
EMC	**EN 301 489-1, Aug. 2000** **EN 301 489-22, Dec. 2000** **Test Report 2-2603-01-02/01 issued 20.11.2001 by CETECOM ICT**
Radio spectrum	**EN 300 676, May 2000** **Test Report 2-2603-A/01 issued 03.09.2001 by CETECOM ICT**

Miscellaneous:

- TCF according to the application dated 06.03.2002

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Warranty - Copyright – Service Information

Warranty

The details and data in this operator's manual correspond to the respective state of technology on the day of printing. We reserve our right to change without prior notice due to new technological design or corresponding new production technology.

WALTER DITTEL GMBH takes no guarantee for these documents with respect to application and interpretation.

WALTER DITTEL GMBH ("Warrantor") warrants to the purchaser of new radio equipment of the warrantor's manufacture that such equipment shall be free from defects in material and workmanship for a period of 24 month from the date of delivery. Equipment and accessory items not manufactured by the Warrantor carry the standard warranty of the manufacturer thereof.

This warranty does not cover equipment which has been

1. **damaged or not maintained as reasonable and necessary,**
2. **modified in any way,**
3. **improperly installed,**
4. **repaired by someone other than the warrantor or an authorized warranty avionics shop, or**
5. **used in a manner or purpose for which the equipment was not intended.**

This warranty shall not extend to incidental or consequential damage arising from operation of the equipment or from any claimed breach of this warranty.

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Service Information

Should any unusual problem arise or further information be desired, please contact your nearest WALTER DITTEL representative or the WALTER DITTEL GMBH Avionics Department, Erpftinger Strasse 36, D-86899 Landsberg, 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
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