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AVIONIC SYSTEMS

**VHF
Transceiver**

RT 3209 - ()

Installation and Operation

Manual		DV 60602.03
Issue	1	August 1997

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Section I GENERAL DESCRIPTION

1.1 Introduction

The following manual describes the VHF transmit/receiver RT 3209 - (). The manuals DV 60602.03 ("Installation and Operation") and DV 60602.04 (Maintenance and Repair") contain the following section :

Section		DV 60602.03	DV 60602.04
1	General Information	X	X
2	Installation	X	X
3	Operation	X	X
4	Theory of operation		X
5	Maintenance and Repair		X
6	Illustrated Parts List		X
7	Modification and Changes		X
8	Circuit Diagrams		x

1.2 Purpose of equipment

This remote-control VHF-transceiver RT 3209 - () is controlled by a CU 5209 - () control unit (or equal). The transceiver enables voice communication on 760 channels in the 118.000 MHz to 136.975 MHz range with a channel spacing of 25 kHz. It complies with the requirements of ICAO Annex 10 valid from 01.01.1995.

1.3 General description

The transceiver is designed for installation in the avionics compartment.

The following are mounted on the connector end.

The equipment connector for connecting to the aircraft system.

The antenna socket for connecting the antenna.

The electronic system of the unit consists of the following circuit boards, which are connected to each other by connectors.

- 1. Audio board
- 2 Connector board
- 3. Receiver board
- 4 Transmitter board
- 5. Processor board

The processor board is secured to the front panel by three bolts. The microcontroller as well as the necessary storage and peripheral components are located on the processor board.

The VHF transceiver is fitted with a single superheterodyne receiver. A squelch (muting) circuit suppresses transmitters or disturbances below a certain field strength. The switching threshold can be set. The squelch function can also be switched off.

The transmitter is designed to be wideband over the 118.000 MHz to 136.975 MHz range. The sidetone is automatically switched to the headphone output during transmission.

The oscillator frequency of the receiver and the transmitting frequency of the transmitter are generated by a VCO (voltage controlled oscillator). This is monitored by a digital frequency evaluation circuit. This digital frequency processing operates in conjunction with a microprocessor.

The microphone inputs are designed for parallel both dynamic and standard microphones. The inputs are connected to a dynamic volume compressor which keeps the modulation voltage constant over a wide input voltage range.

Aircraft internal communication is possible in the IC (intercom) mode. Activation is by means of an external IC button (or switch) which is to be connected to the equipment connector.

The AF auxiliary input enables AF signal switching of auxiliary units in the aircraft. The switched AF signals can, however, only be monitored in the reception mode.

1.6 General data

Frequency range	118.000 MHz to 136.975 MHz
Number of channels	760
Channel spacing	25 kHz
Storage temperature range	-55°C to +85°C
Operating temperature range as per EUROCAE/RTCA ED-14C/DO-160C	-20°C to +55°C short-time +70°C
Operating altitude as per EUROCAE/RTCA ED-14C/DO-160C	50 000 ft
Vibration as per EUROCAE/RTCA ED-14C/DO-160C	Cat. NM
Humidity as per EUROCAE/RTCA ED-14C/DO-160C	Cat. A/ +50°C: 95%, 48 h

1.6.1 Dimensions Weight, Fuse

Front panel	139 mm x 50 mm
Depth of transceiver with mounting plate	253 mm
Weight	1,2 kg
Fuse internal	4 A automatic cut-out

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1.6.2 Receiver data

Type of receiver	Single superhetrodyne receiver
Sensitivity	$\leq 5 \mu\text{V}$ EMF for 6 dB = SINAD (mod. 1000 Hz/30%)
IF bandwidth	$\geq \pm 8$ kHz at 6 dB attenuation
Selectivity	≥ 40 dB at ± 17 kHz ≥ 60 dB at ± 25 kHz
Squelch	Can be adjusted and switched off
AGC characteristic for 5 μV to 100 mV EMF	≤ 6 dB
Distortion m = 85%	$\leq 15\%$
Audio frequency response relative to 1000 Hz	≤ 6 dB 350 Hz to 2500 Hz ≥ 18 dB at 4000 Hz
Intermediate frequency	21.4 MHz
Rated output	
for speaker operation	
at 13.75 V nominal operatingvoltage	≥ 3 W into 4 Ω
at 10.0 V operating voltage (emergency mode)	≥ 1.5 W into 4 Ω
with headset connected	
at 13.75 V nominal operating voltage	≥ 100 mW at 600 Ω
at 10.0 V operating voltage (emergency mode)	≥ 30 mW at 600 Ω
Audio auxiliary input adjustable (regardless of volume)	1 V to 8 V at 600 $\Omega \pm 10\%$

1.6.3 Transmitter data

Transmitter output RT 3209 -(11) at 27.5 V nominal operating voltage at 20.0 V operating voltage (emergency mode)	≥ 10 W at 50 Ω ≥ 10 W at 50 Ω
Transmitter output AR 3209 -(11) at 13.75 V nominal operating voltage at 10.0 V operating voltage (emergency mode)	≥ 6.5 W at 50 Ω ≥ 2 W at 50 Ω
Frequency tolerance	≤ 15 ppm
Duty cycle	1:4 (Min)
Type of modulation	A3E amplitude modulation
Modulation factor	≥ 70% to ≤ 99% (dynamic compressor)
Distortion at 70% modulation	≤ 15%
Modulation bandwidth	350 Hz to 2500 Hz
Frequency response	-6 dB (relative to 1 kHz/0 dB)
Input voltage (m = 70%)	
Dynamic microphone	≤ 2 mV symmetrical 200 Ω (dynamic compressor)
Standard microphone	≤ 120 mV 150 Ω (dynamic compressor)
FM deviation with modulation m = 70% f = 1.25 kHz	≤ 3 kHz
Sidetone	true, adjustable
Automatic shutdown on short circuit of transmit button	after 2 mins of continuous transmission, the transmitter shuts down. Activated by releasing the transmit button and re-pressing.

1.7 Software

The frequency synthesizer and the frequency memory are controlled by a microprocessor.

The associated software was classified as software level 2 in accordance with the guidelines of EUROCAE/RTCA document ED12A/DO-178A:

1.8 Approval and Regulations

LBA-No. 10.911/99JTSO

BAPT-No.: A133570J

Regulations

JTSO - 2C37d, ED-23A, Equipment Class 4

JTSO - 2C38d, ED-23A, Equipment Class C

EUROCAE/RTCA ED-14C/DO-160C

BAPT FTZ 17TR2010

Software EUROCAE/RTCA ED12A/DO-178A level 2

Environmental condition D1-BA(MN)XXXXXXZBABATAXXX

1.9 Environmental Qualification Form

The following performance standards under environmental test conditions have been established in accordance with the procedures set forth in EUROCAE/RTCA Document No. ED-14C/DO-160C.

Environmental condition	ED - 14C DO - 160C	Category	Performance
Temperature	4.0	D1	
Low operating temperature	4.5.1		- 20° C
Low ground survival (storage temperature)			- 55° C
High short-time operating temperature	4.5.2		70° C
High operating temperature	4.5.3		+ 55° C
High ground survival (storage) temperature			85° C
Min. operating pressure (equivalent altitude)	4.6.1		50.000 ft.
Temperature variation	5.0	B	
Humidity	6.0	A	48 hrs at up to 50° C and 95% relative humidity
Shock :	7.0		
Operational shocks	7.2		11 ms at 6 G for all three dimensional axes
Crash safety shocks	7.3		11 ms at 15 G for all three dimensional axes
Vibration	8.0	MN	
Magnetic effect	15.0	Z	Deflection of 1° of compass at a distance of ≥ 30 cm
Power input variation	16.0	B	The equipment functions on a 10-volt emergency power supply
Resistance to voltage spikes on equipment power leads	17.0	A	
Audio-frequency conducted susceptibility	18.0	B	
Susceptibility to induced magnetic and electric • fields at 400 Hz	19.0	A	
Radio-frequency interference susceptibility	20.0	T	
Spurious RF emissions	21.0	A	

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1.10 Scope of delivery

RT 3209 - (11) VHF transceiver	Stock No. 0505.668-910
Operating instructions	Stock No.

1.11 Accessories

Unit connection	
Cable socket 25 pin	Stock No. 0725.021.277
Connector housing	Stock No. 0775.479-277
Antenna plug	Stock No. 0725.706-277
Manuals	
Installation and Operation	Stock No. 0511.560-071
Maintenance and Repair	Stock No. 0511.579-071

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Section II INSTALLATION

2.1 General

The installation of the transceiver depends on the type of aircraft and its equipment. Therefore, only general information can be given in this Section.

2.2 Testing before installation

2.2.1 General

Before installing the transceiver in an aircraft, inspect the unit for signs of transport damage.

2.2.2 Visual examination

Before commissioning, visually examine the unit paying particular attention to the following defects :

1. Dirt, dents, scratches, corrosion or broken attaching parts, damaged paintwork on housing, parts of the housing .
2. Dirt or scratches on the identification plate, or inscriptions.
3. Dirt, bent or broken pins, displaced inserts of plugs and sockets.

2.3 Mechanical installation

2.3.1 Mechanical installation of transceiver.

The transceiver is designed for installation in an avionics compartment. To do this, the mounting plate must first be secured to an appropriate point in the avionics compartment using five bolts. The installation dimensions are given in Fig. 2-1. The transceiver is then pushed into the mounting plate and locked in place by two quick-release bolts.

2.4 Installation wiring

2.4.1 General

The installation wiring is shown in Fig. 2-3.

- (a) Use only cable which is fit for use in aircraft (self extinguishing). AWG 20 for power supply and AWG 22 for other cables.
- (b) Fit rubber sleeves over the solder joints on the equipment connector.
- (c) Protect the power supply with a 7,5 A fuse or circuit breaker.

NOTE

The transceiver is protected internally by a 4 A fuse.

- (d) No HF cables should be included in the cable harnesses of the system and the routing of connecting cables alongside cables which carry audio power or pulses should also be avoided.
- (e) Carefully check the wiring before switching on the unit and check particularly that (+) and (-) have not been reversed.

2.4.2 Microphone connection

The transceiver enables a maximum of two dynamic microphones and two standard microphones (d.c. supply) to be connected at the same time.

NOTE

The dynamic mike input sensitivity can be changed in the service mode.

2.4.3 Speaker connection

A 4 to 8 Ohm speaker can be connected to audio output P2- Pin 1 AF-asym.

CAUTION

The magnetic field of a speaker influences the magnetic compass. When choosing the mounting point, a minimum distance of 1.3 m must be maintained between the speaker and the magnetic compass.

2.4.4 Headphone connection

Up to two headphones with an impedance of 600 Ohm can be connected to the audio output P2 - Pin 2 AF-HI/LO and Pin 3 AFLO.

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2.4.5 Intercom mode "IC connection".

The intercom mode is designed for aircraft with a high noise level and assumes operation using headsets. Additional wiring on the equipment connector with an IC switch is necessary (refer to interwiring diagram).

The normal R/T communication takes place with the IC switch in the OFF position. When the IC switch is set to ON, R/T communication can be carried on as before but intercommunication is also possible between two crew members. The IC is switched off during transmission. The IC volume can be changed in the service mode.

2.4.6 Auxiliary" audio input

The AF-AUX (P2 Pin 4) auxiliary audio input enables the switching of audio signals from other equipment in the aircraft. The switched-in audio signals can, however, only be monitored in the reception mode. The facility to switch two units together will be used particularly in those aircraft which are fitted with a VHF transceiver and an NAV receiver. An audio input voltage of 1 to 8 V, 600 Ohm is necessary for modulation of the audio amplifier (can be adjusted in the "Service" mode).

2.4.7 Setting the squelch sensitivity

The sensitivity of the squelch can be directly set on the VHF transceiver at any time in the SQL function service mode.

2.4.8 Setting the sidetone volume

The sidetone volume can be directly set on the transceiver at any time in the SIDE function service mode.

2.4.9 Internal automatic cut-out

The transceiver is fitted with an automatic cut-out . The released automatic cut-out is reactivated by means of a peaked object.

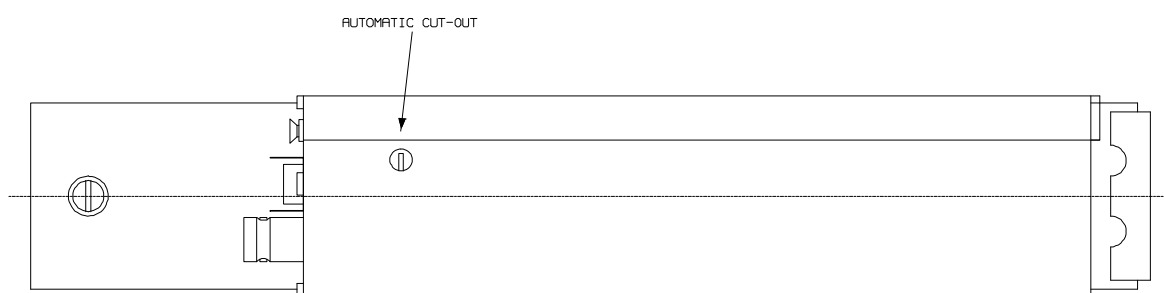


Fig. 2-1 Internal automatic cut-out

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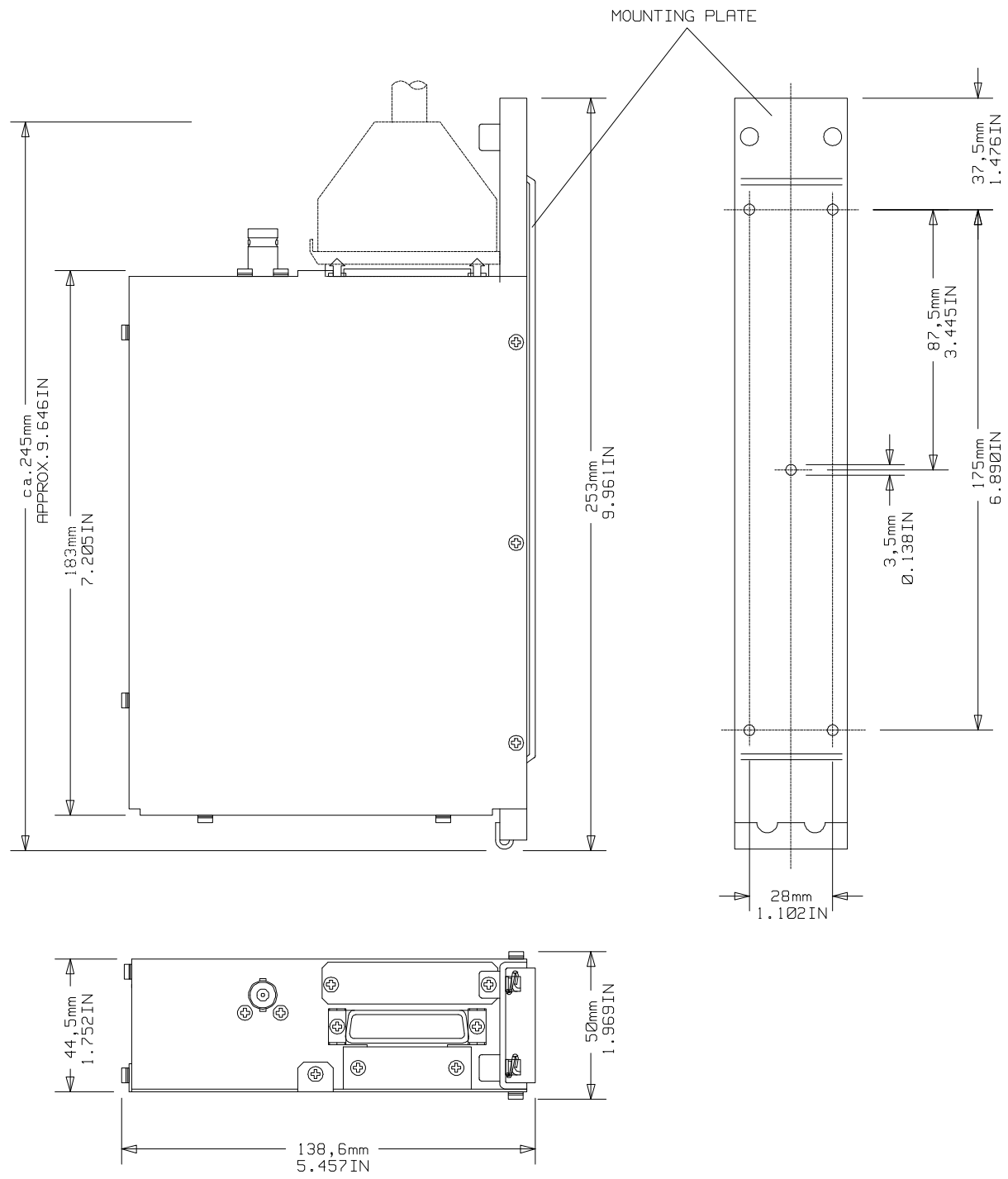


Fig. 2-2 Mounting dimensions transceiver

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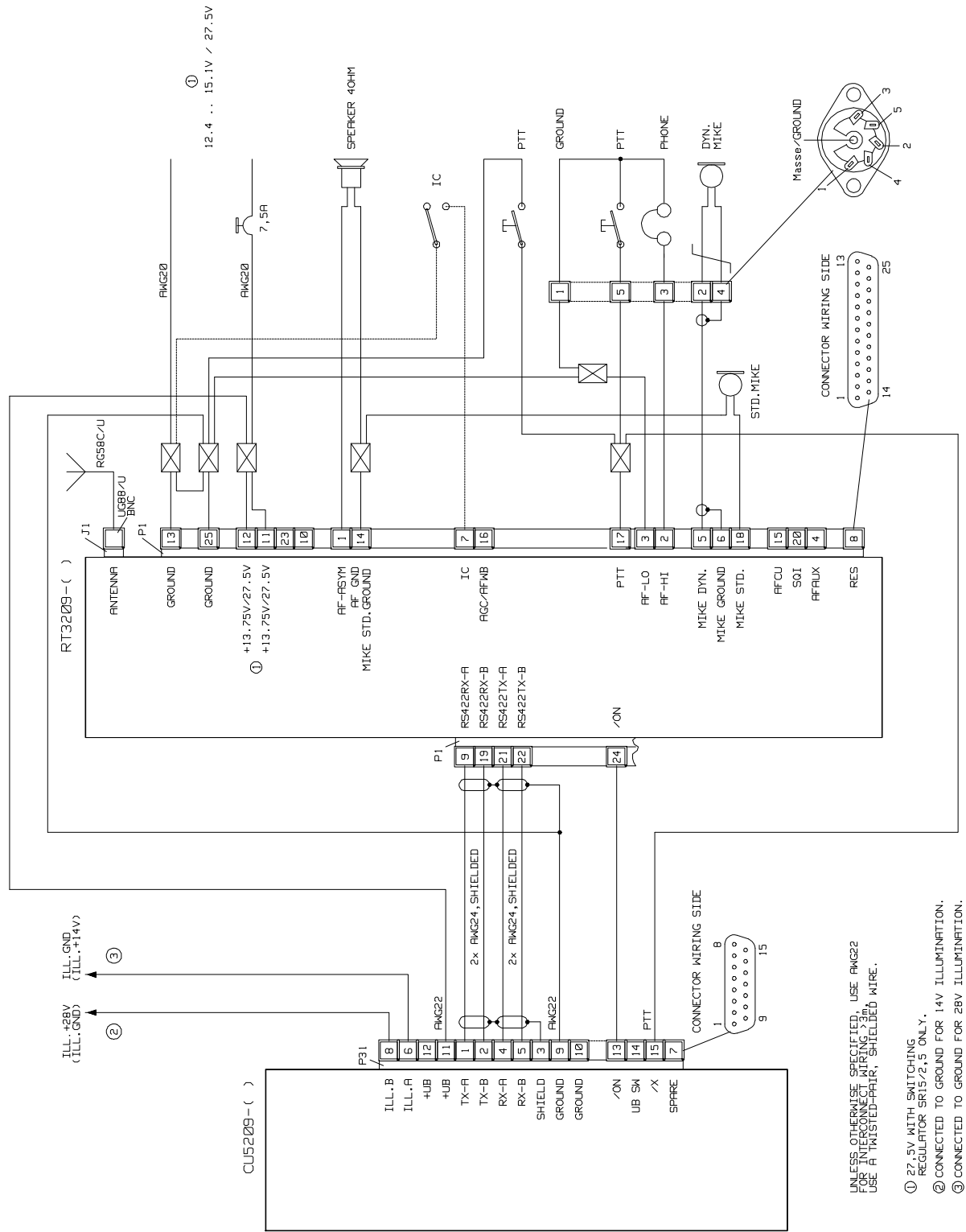


Fig. 2-3 Interwiring of the transceiver RT 3209 - () with control unit CU 5209 - ()

2.5 Testing after installation

2.5.1 Ground test with engine shut down

- (a) After installation of the unit, measure the antenna tuning between the base of the antenna and the antenna connecting cable using a VHF reflection-coefficient meter (voltage standing wave meter).
- (b) The VSWR (voltage standing wave ratio) over the complete frequency range of the unit shall be within 3:1. If this matching value is incorrect, this indicates a mismatch, caused for example by an incorrect or unsatisfactory counterpoise, a cable with an impedance which deviates significantly from 50 Ohm or an incorrectly tuned antenna.
- (c) After the antenna measurement, check the readability by carrying out a speech test with a ground station.

2.5.2 Ground test with engine running

- (a) With the engine running at cruising speed check that the aircraft power supply is within the permissible tolerances.
- (b) When performing the succeeding speech test, ensure that the distance from the ground station is as great as possible, at least 100 m. With the engine at cruising speed, the cabin noise of the aircraft should be only slightly transmitted and communication should be clear and distinct. Hold the microphone close to the lips when speaking.
- (c) Switch on the aircraft intercom using the IC switch (if fitted) and carry out a speech test with the engine running at cruising speed. If necessary, adjust the IC volume (refer to the service mode in the operating instructions (section 3)).
- (d) Switch on the squelch switch and check the squelch function. The point at which the squelch operates is set in the service mode (refer to operating instructions, section 3).

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