

BECKER AVIONICS

Remote-Controlled VHF-AM Transceiver

RT6512

Installation and Operation

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The user is responsible for making the final selection of the system and components. The user has to assure that all performance, endurance, maintenance, safety requirements of the application are met and warnings be obeyed.

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Term definition: User in the sense of user, installer, installation company.

Preface

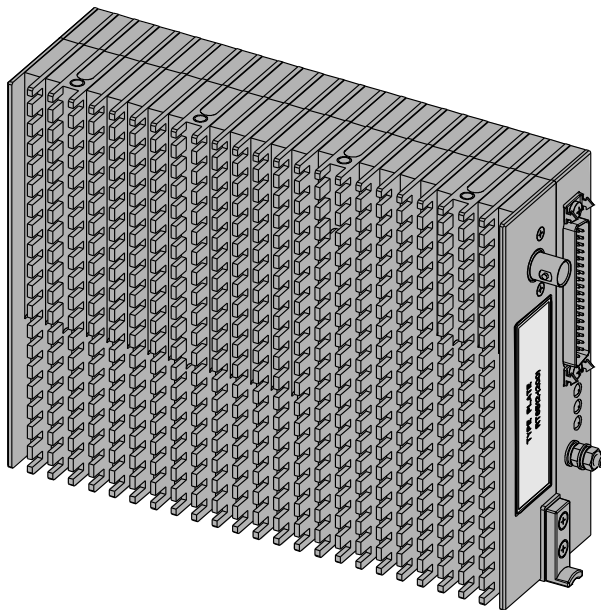
Dear Customer,

Thank you for purchasing a Becker Avionics product. We are pleased that you have chosen our product and we are confident that it will meet your expectations.

For development and manufacturing of our product, the guidelines for highest quality and reliability have been borne in mind, supplemented by selection of high-quality material, responsible production and testing in accordance to the standards.

Our competent customer support department will respond on any technical question you may have. Please do not hesitate to contact us at any time.

Remote-Controlled VHF-AM Transceiver *



RT6512 (Remote Transceiver)
without mounting tray

* design depends on variant.

* Some figures in this manual are for basic understanding and can be different to the actual design.

List of Effective Pages and Changes

Only technical relevant modifications are described in this table.

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Table of Contents

1	General Description	11
1.1	Introduction	12
1.2	Purpose of Equipment	13
1.3	Variants Overview	13
1.4	Associated Devices	13
1.5	Scope of Functionality	14
1.5.1	Receive Mode	14
1.5.2	Transmit Mode	14
1.5.3	Emergency Mode	14
1.5.4	Audio Inputs and Outputs	15
1.5.4.1	Microphone Input	15
1.5.4.2	Audio Input LINE IN	15
1.5.4.3	Audio Output LINE OUT	16
1.5.5	Control Inputs	16
1.5.5.1	/ON (Device Power ON/OFF Control)	16
1.5.5.2	/PTT (Push-To-Talk)	16
1.5.5.3	/COM2 (Com Addressing Line)	16
1.5.5.4	/SEL422 (Serial Interface Selection Line)	16
1.5.5.5	/RX_ATT (External RX Attenuation Control)	17
1.5.5.6	/SERV_EN (Enabling the Setup Modes)	17
1.5.5.7	/TX-ENABLE (Enabling the TX)	17
1.5.5.8	/EMERG (Enabling the Emergency Mode)	17
1.5.6	Status and Control Outputs	18
1.5.6.1	/FAILURE	18
1.5.6.2	RX_AGC (AGC Voltage of the RX-RF-AGC)	18
1.5.6.3	/SQL_EVAL	18
1.5.7	Digital Interfaces to the Control Device	19
1.5.7.1	Interface ARINC 429	19
1.5.7.2	Interface RS422	19
1.6	Safety-Conscious Utilization	20
1.7	Restriction for Use	20
1.8	Technical Data	21
1.8.1	General Characteristics	21
1.8.2	Typical Power Consumption	21
1.8.3	Receiver Data	22
1.8.4	Transmitter Data	23
1.8.5	Dimensions & Weight	23
1.8.6	Software	24
1.8.7	Hardware	24
1.8.8	Continued Airworthiness	24
1.8.9	Environmental Conditions	25
1.8.10	Certifications	26
1.8.10.1	RT6512 meets the requirements of:	26
1.8.10.2	Guidelines for Design and Development	27
1.8.10.3	FCC Approval	28
1.9	Order Code	29
1.9.1	RT6512	29
1.9.2	Accessories	29
1.9.3	Documentation	29
2	Installation	31
2.1	Packaging, Transport, Storage	31
2.2	Device Assignment	32
2.2.1	Scope of Delivery	32
2.2.2	State of Delivery	32
2.2.3	Additional Equipment	32
2.2.4	Registration of the Device	32
2.2.5	Type Plate	33
2.2.6	Software/Firmware Status – Functionality	33
2.2.7	Meaning of Status LEDs	33
2.3	Installation Requirements	34
2.3.1	Mounting Distance	35

2.3.2	Mounting Tray MT6512	35
2.3.3	Grounding.....	35
2.3.4	Antenna Cables.....	36
2.3.4.1	Attenuation: Cable length versus coax cable type	36
2.3.5	Antenna Installation.....	36
2.3.5.1	Required Antenna Type	36
2.3.5.2	Antenna Position	36
2.3.6	Conditions for Installation of two RT6512 in one Aircraft.....	38
2.3.6.1	Radio Setting and Wiring for dual Installation	38
2.4	Dimensions.....	39
2.4.1	RT6512.....	39
2.4.2	RT6512 with Mounting Tray MT6512.....	40
2.5	Connector Pin Assignments.....	41
2.5.1	Connector P1 (RT6512).....	41
2.5.2	Connector J2 (RT6512).....	42
2.6	Equipment Configuration Samples.....	43
2.6.1	RT6512 with RCU6512	43
2.6.2	RT6512 with RMU5000.....	43
2.6.3	RT6512 with ARINC 429 Controller	43
2.7	Aircraft Wiring.....	44
	Wiring Diagram with RCU6512.....	44
	Wiring Diagram with RMU5000	44
	Wiring Diagram with OEM Controller.....	44
2.7.1	RT6512-(XX0) with RCU6512 as Primary Controller.....	45
2.7.2	RT6512-(XX0) with ARINC 429 Controller.....	46
2.7.3	RT6512-(XX1) with ARINC 429 Controller.....	47
2.7.4	RT6512-(XX0) with Controller G7610	48
2.8	Post Installation Check.....	49
2.8.1	Mechanical Installation and Wiring Check.....	49
2.8.2	Power Supply	49
2.8.3	Receiver / Transmitter Operation.....	49
2.8.4	Antenna Check.....	49
2.8.5	Interference Check.....	49
2.8.6	Flight Test Check	51
3	Operation	53
3.1	General.....	53
3.1.1	Registration of the Device	53
3.2	Device Description	53
3.2.1	Device Assignment	53
3.3	Operation with RCU6512	54
3.4	Operation with RMU5000	54
3.5	Operation with OEM Controller	54
3.6	Start-Up	54
3.6.1	Built In Tests (BIT)	54
3.6.1.1	Initiated Built In Test (IBIT).....	56
3.6.1.2	Power On Built In Test (PBIT).....	56
3.6.1.3	Continuous Built In Test (CBIT).....	56
3.6.2	Device Status - Error Indication	57
3.6.2.1	Audible Error Announcement	57
3.6.2.2	Status & Error Indication	57
3.6.2.3	No Error.....	57
3.6.2.4	Test in Progress	58
3.6.2.5	Internal Failure Indication	58
3.6.2.6	External Failure Indication.....	58
3.6.2.7	Failure Indication when an "Internal" or "External" Failure is found.....	59
3.6.2.8	Error History Flags in the Service Set up	59

3.7 RS422 Protocol supported by RT6512 59

3.8 ARINC 429 Protocol supported by RT6512 59

3.9 Read Out and Reset Error/Failure Flags 59

3.10 Warning and Failure Indications 60

3.11 Contact Data 62

4 Index 64

List of Figures

Some figures in this manual are for basic understanding and can be different to the actual design.

Figure 1: Standard Microphone Input Schematic 15

Figure 2: LINE_IN Schematic 15

Figure 3: LINE_OUT 16

Figure 4: /FAILURE Output Schematic 18

Figure 5: Type plate (example) 33

Figure 6: RT6512 with MT6512 - mounting area 35

Figure 7: RT6512 Dimensions (without and with Main Connector) 39

Figure 8: RT6512 with Mounting Tray MT6512 40

Figure 9: RT6512connectors 41

Figure 10: RT6512 with RCU6512 43

Figure 11: RT6512 with RMU5000 43

Figure 12: RT6512 with ARINC 429 Controller 43

Figure 13: RT6512-(XX0) with RCU6512 as Primary Controller 45

Figure 14: RT6512-(XX0) with ARINC 429 Controller 46

Figure 15: RT6512-(XX1) with ARINC 429 Controller 47

Figure 16: RT6512-(XX0) with Controller G7610 48

Figure 17: Thermal Behavior for TX Function 55

List of Abbreviations

List of Abbreviations

A3E	Amplitude modulation double-sideband with full carrier
AGC	Automatic Gain Control
AM	Amplitude Modulation
AOC	Air Operations Centre
ARINC	Aeronautical Radio Incorporated
ARINC 429	Data bus for commercial aircraft
ATS	Air Traffic Services
BIT	Built In Test
BNC	Bayonet Neill Concelman (connector)
CBIT	Continuous Built In Test
CU	Control Unit
DAL	Design Assurance Level
DC	Direct Current
EUROCAE	European Organization for Civil Aviation Equipment
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
IBIT	Initiated Built In Test
LED	Light Emitting Diode
MISE	Ministero dello Sviluppo Economico (Ministry of Economic Development, Italy)
n/a	not applicable
OEM	Original Equipment Manufacturer
PBIT	Power On Built In Test
PSB	Power Supply Board
PTT	Push To Talk
RCU	Remote Control Unit
RMU	Radio Management Unit
RX	Receiver
SSW	Service Software
Std	Standard
TX	Transmitter
VDC	Volts Direct Current
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
TufLok®	Registered trademark. Thread locking patch
ELASTOSIL®	Registered trademark. Silicon products.

Units

Units	
A	Ampere
mA	Milliampere
°C	Degree Celsius
dBm	Power ratio in Decibel referenced to 1 mW
dB	Decibel
ft	Foot
g	Gram
in	Inch
kHz	Kilohertz
MHz	Megahertz
mm	Millimeter
NM	Nautical Mile
kΩ	Resistance kilo Ohm
Ohm (Ω)	Resistance
ppm	Part per million
s	Second
V	Volt
mV	Millivolt
W	Watt
mW	Milliwatt

General Safety Definitions

**DANGER**

Indicates a hazardous situation which, if not prevented, will result in death or serious injury.

**WARNING**

Indicates a hazardous situation which, if not prevented, could result in death or serious injury.

**CAUTION**

Indicates a hazardous situation which, if not prevented, could result in minor or moderate injury.

**NOTICE**

Is used to address practices not related to physical injury.

**SAFETY
INSTRUCTIONS**

Safety instructions (or equivalent) signs indicate specified safety-related instructions or procedures.

Disposal

⚠CAUTION The packaging material is inflammable, by burning toxic fumes may develop.

This product contains materials that fall under the special disposal regulation. We recommend the disposal of such materials in accordance with the current environmental laws.

- Dispose circuit boards by a technical waste dump which is approved to take on e.g. electrolytic aluminium capacitors. Do under no circumstances dump the circuit boards with normal waste dump.

Warranty Conditions

⚠CAUTION The device(s) may be installed on an aircraft only by an approved aeronautical company (e.g. Part 145) which shall also examine the installation.

Any change made by the user excludes any liability on our part (excluding the work described in this manual).

- The device must not be opened.
- Do not make any modifications to the device, except for those described in the manual.
- Make connections to the inputs, outputs and interfaces only in the manner described in the manual.
- Install the devices according to the instructions.
We cannot give any guarantee for other methods.

Conditions of Utilization

With this device you bought a product which was manufactured and tested before delivery with the utmost care.

Please take your time to read the instructions which you ought to follow closely during installation and operation.

Otherwise all claims under the warranty will become void and a decreased service life or even damages must be expected.

⚠CAUTION The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

Additional Conditions of Utilization

Please refer to "Safety-Conscious Utilization", page 20.

Non-Warranty Clause

We checked the contents of this publication for compliance with the associated hard and software. We can, however, not exclude discrepancies and do therefore not accept any liability for the exact compliance. The information in this publication is regularly checked, necessary corrections will be part of the subsequent publications.

1 General Description

In this chapter you can read about:

1.1	Introduction	12
1.2	Purpose of Equipment.....	13
1.3	Variants Overview	13
1.4	Associated Devices	13
1.5	Scope of Functionality.....	14
1.5.1	Receive Mode	14
1.5.2	Transmit Mode	14
1.5.3	Emergency Mode.....	14
1.5.4	Audio Inputs and Outputs	15
1.5.5	Control Inputs.....	16
1.5.6	Status and Control Outputs	18
1.5.7	Digital Interfaces to the Control Device	19
1.6	Safety-Conscious Utilization	20
1.7	Restriction for Use.....	20
1.8	Technical Data	21
1.8.1	General Characteristics	21
1.8.2	Typical Power Consumption	21
1.8.3	Receiver Data	22
1.8.4	Transmitter Data	23
1.8.5	Dimensions & Weight.....	23
1.8.6	Software.....	24
1.8.7	Hardware	24
1.8.8	Continued Airworthiness.....	24
1.8.9	Environmental Conditions.....	25
1.8.10	Certifications	26
1.9	Order Code	29
1.9.1	RT6512	29
1.9.2	Accessories.....	29
1.9.3	Documentation.....	29

This manual describes the Becker Avionics remote-controlled VHF-AM transceiver RT6512-(XXX). The type plate on your device shows the part number for identification purposes (see "Type Plate", page 33).

Before starting operation of the device(s) please read this manual carefully, with particular attention to the description referring to your device(s).

Introduction

1.1 Introduction

The technical information in this document applies to the described product and variants of RT6512-(XXX).

- We also use the term RT6512 for descriptions instead writing the complete model number.
- If a description refers to only one product variant is it specified.

The manuals “Maintenance and Repair” (**M&R**) and “Installation and Operation (**I&O**) contain the sections:

Section	DV17501.04 M&R	DV17501.03 I&O
General	X	X
Installation	X	X
Operation	X	X
Theory of Operation	X	N/A
Maintenance and Repair	X	N/A
Illustrated Parts List	X	N/A
Modification and Changes	X	N/A
Circuit Diagrams	X	N/A
Certifications	X	N/A
Attachments	X	N/A

1.2 Purpose of Equipment

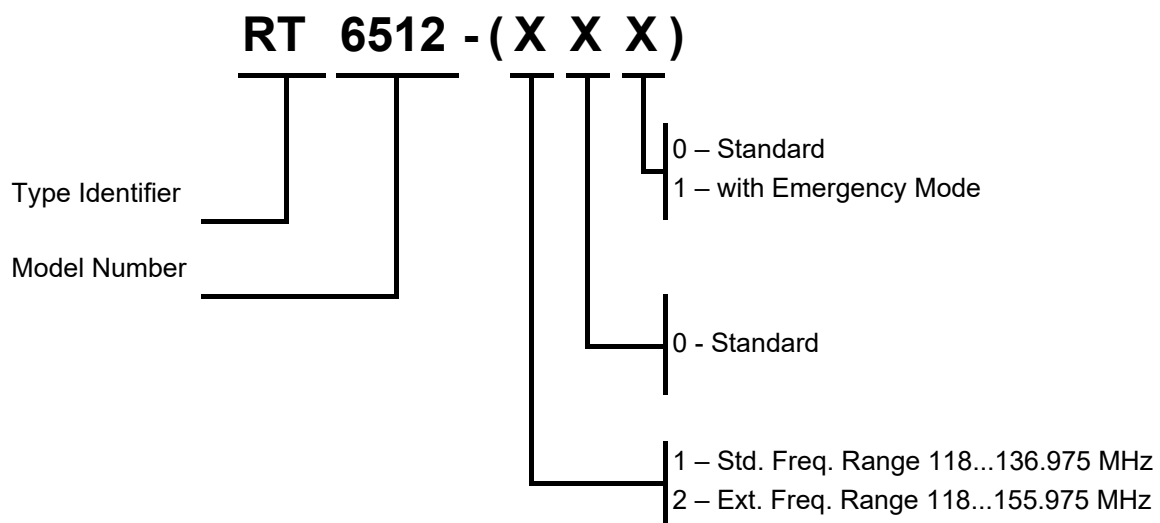
The remote-controlled VHF-AM transceiver RT6512 is made for installation with the related mounting tray in the avionics compartment (non-pressurized and not temperature controlled) in all types of aircraft.

The RT6512 is a simplex voice communication system in the standard avionics VHF frequency range 118.000...136.975 MHz (136.9916 MHz with 8.33 kHz channel spacing) or optional with extended frequency range up to 155.975 MHz and uses standard amplitude modulation (A3E).

It can be operated by the Becker RCU6512 or RMU5000 using the RS422 control bus, or any OEM control device using the ARINC 429 control bus with standard label format.

- The RT6512 can operate in 25 or 8.33 kHz channel spacing and is primarily for aeronautical operational control (AOC) and air traffic services (ATS) safety communications.
- The RT6512 uses ARINC 429 and RS422 interfaces for communication with a control device.
- The RT6512 supplies frequency and mode control, either with the Becker RCU6512 or RMU5000 controller using the RS422 communication port, or with any OEM product using the standard ARINC 429 communication bus.
- The RT6512 has a high transmit power of 20 W and can be used for communication over a range of 200 NM direct line of sight.

1.3 Variants Overview



1.4 Associated Devices

These devices can operate with RT6512:

Device	Function
RCU6512	Becker Avionics Remote Control Unit
RMU5000	Becker Avionics Radio Management Unit
Control device	Gables G7610 (control device for VHF-COMM only)
Control device	Universal RCU
Glass cockpit	Genesys IDU680

This manual describes the RT6512 from Becker Avionics. For other devices please refer to the related manuals.

1.5 Scope of Functionality

- The RT6512 is for AM (amplitude modulation) voice communication.
- The RT6512 does not include a control panel.
- Mechanics:
 - The case serves as heat sink:
 - The front side contains the main connector for connection to the aircraft wiring system, and the antenna jack.
- Three front panel LEDs show basic information about overall equipment status.

1.5.1 Receive Mode

The RT6512 has a high-quality Class C, E and H2 receiver:

- It has a standard sensitivity of 5 μ V, high dynamic range, and high blocking rejection.
- It can receive a weak signal while a 2nd VHF-AM transceiver in the same aircraft is transmitting.
- The RT6512 can operate with offset carrier in 25 kHz and 8.33 kHz channel spacing.

1.5.2 Transmit Mode

The RT6512 has a high-quality Class 3 and 5 transmitters:

- The output power is 20 W under standard operating conditions (VSWR \leq 1.5, 118...137 MHz).
- The output power is 18 W under standard operating conditions (VSWR \leq 1.5, 137...156 MHz).
- The output power is at least 16 W under the specified environmental operating conditions (when using antenna with VSWR \leq 2:1, for VSWR $>$ 3:1 output power decrease, 118...137 MHz).
- The output power is at least 14 W under the specified environmental operating conditions (when using antenna with VSWR \leq 2:1, for VSWR $>$ 3:1 output power decrease, 137...156 MHz).
- The AM depth is $>$ 70% - standard value for airborne application.
- During transmission, the transmitter delivers a natural sidetone signal, which is available on the LINE_OUT output (if enabled).
- The RT6512 has a protective function to prevent from blocking the frequency channel by a stuck transmit button or a short circuit on the key line.
- The RT6512 supports status information if the device transmits through serial protocol (RS422 and ARINC 429). This status can be used to inform the crew about stopped transmission (as required by TSO-C128a/ETSO-2C128).
- The RT6512 transmitter has a protection from overheating. The VSWR on the antenna connector is also monitored. See "Status and Control Outputs", page 18 for details.

1.5.3 Emergency Mode

- The RT6512-(201) variant supports Emergency Mode in which the device is automatically tuned to emergency channel 121.500 MHz in 25 kHz channel spacing.
- External control of transceiver is prohibited with remaining device status monitoring.

Notice: Operators Remark

121.5 MHz = International voice aeronautical emergency.

123.1 MHz = International worldwide voice SAR use (e.g. Italy).

1.5.4 Audio Inputs and Outputs

1.5.4.1 Microphone Input

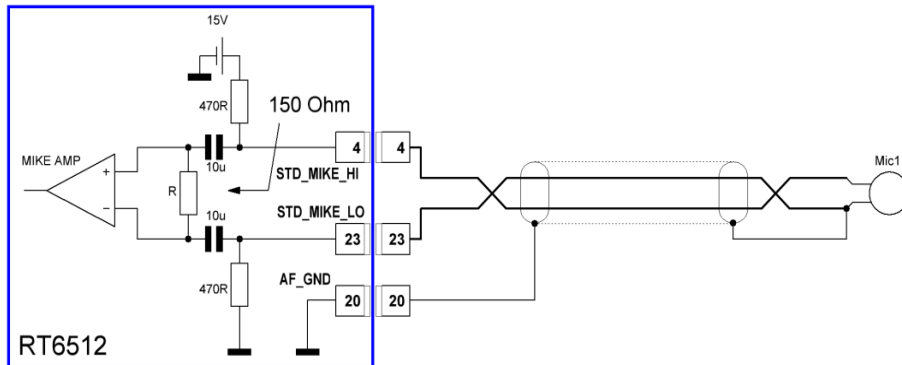


Figure 1: Standard Microphone Input Schematic

The RT6512 can operate with standard microphones:

- Unbalanced,
- DC coupled,
- DC supplied from RT6512.

The bias current for standard microphone is drawn from RT6512 internal source 15 VDC through series resistor 470 Ohm. The input audio signal is routed to a dynamic compressor keeping the modulation factor limited over a wide input voltage range. The microphone input uses the cable guard as ground compensation so microphone input shall be connected exactly as specified on Installation diagrams.

1.5.4.2 Audio Input LINE IN

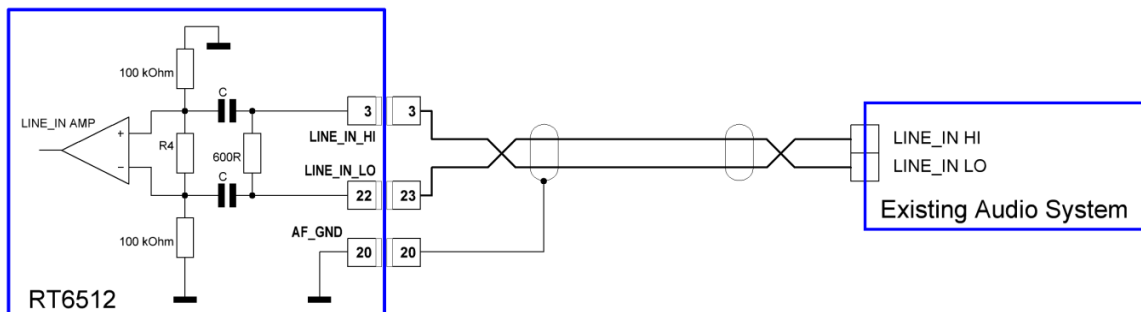


Figure 2: LINE_IN Schematic

The RT6512 symmetrical line input has no DC connection to ground. Input impedance is 600 Ω. The maximum input level without clipping can be set as high as 6 V. The input audio signal is routed to a dynamic compressor keeping the modulation factor limited over a wide input voltage range.

1.5.4.3 Audio Output LINE OUT

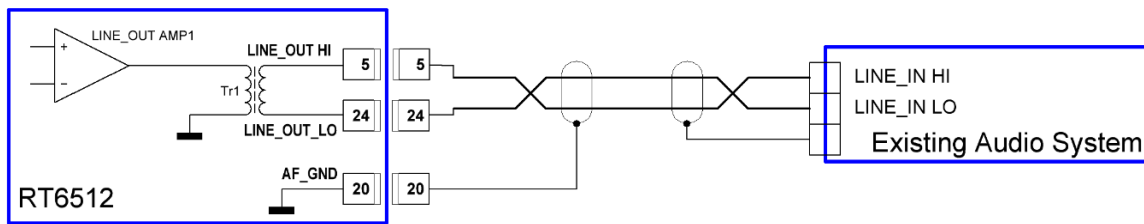


Figure 3: LINE_OUT

The audio output LINE OUT is symmetrical and has no DC connection to ground. If volume set to maximum, the audio output power delivered is 100...125 mW into 600 Ω or 200 mW into 150 Ω .

1.5.5 Control Inputs

1.5.5.1 /ON (Device Power ON/OFF Control)

/ON signal to set ON/OFF the RT6512.

The /ON line is used to activate an internal electronic switch to power-up the device.

It is active if the level on the /ON pin is less than 4.0 V or a resistance of less than 1 k Ω connects to ground.

The /ON line is inactive if the level on the /ON pin is higher than 8.0 V or a resistance higher than 50 k Ω connects to ground.

1.5.5.2 /PTT (Push-To-Talk)

/PTT is used to initiate transmission.

It is active when /PTT-input level is below 4.0 V, or a resistance to ground of less than 1 k Ω .

The /PTT line is inactive if the level on the /PTT-input is higher than 8.0 V, or a resistance higher than 50 k Ω connects to ground.

1.5.5.3 /COM2 (Com Addressing Line)

/COM2 defines device sub address for ARINC communication.

The device detects a LOW state (Active state) on the /COM2 input when an external resistance of lower than 1 k Ω is connected to ground.

The device detects a HIGH state (Inactive state) on the /COM2 input when an external resistance of higher than 50 k Ω is connected to ground.

- Com addressing line bit:
 - LOW (Active) state selects COM2.
 - HIGH (Inactive) state selects COM1.

1.5.5.4 /SEL422 (Serial Interface Selection Line)

/SEL422 selects RS422 or ARINC 429 communication.

The device detects a LOW state (Active state) on the /SEL422 input when an external resistance of lower than 1 k Ω is connected to ground.

The device detects a HIGH state on the /SEL422 input when an external resistance of higher than 50 k Ω is connected to ground.

- Serial interface selection line:
 - LOW (Active) state selects RS422.
 - HIGH (Inactive) state selects ARINC.

1.5.5.5 /RX_ATT (External RX Attenuation Control)

/RX_ATT decreases the RF gain of the RX section by 20 dB to decrease cross talk effects.

The /RX_ATT line is used for an optional desensitization of the RT6512 receiver. The desensitization can be required when a 2nd VHF-AM transceiver in the same aircraft is transmitting. In such case /PTT line from 1st VHF-AM transceiver shall be connected to /RX_ATT input of 2nd device and /PTT from 2nd device shall be connected to /RX_ATT input of the 1st device.

The /RX_ATT is active if /RX_ATT-input level is less than 4.0 V, or a resistance less than 1 k Ω connects to ground.

The /RX_ATT line is inactive if the level on the /RX_ATT-input is higher than 8.0 V, or a resistance higher than 50 k Ω connects to ground.

1.5.5.6 /SERV_EN (Enabling the Setup Modes)

/SERV_EN enables the setup modes.

/SERV_EN is a read/write access for all setup data, not available for standard user

The device detects a LOW state (Active state) on the /SERV_EN input when an external resistance of lower than 1 k Ω is connected to ground.

The device detects a HIGH state (Inactive state) on the /SERV_EN input when an external resistance of higher than 50 k Ω is connected to ground.

1.5.5.7 /TX-ENABLE (Enabling the TX)

/TX-ENABLE enables the transmitter.

The RT6512 detects a low state on the /TX_ENABLE input when an external resistance lower than 1 k Ω connects to ground.

The RT6512 detects a high state on the /TX_ENABLE input when an external resistance higher than 50 k Ω connects to ground. In such case transmission is permanently blocked.

SAFETY INSTRUCTIONS

For an aircraft installation /TX-ENABLE input shall be connected to ground directly on the main connector. /TX-ENABLE line cannot be routed as part of installation cable bundle.

Notice:

Do not apply DC voltage above 5 Volts to /TX_ENABLE to prevent device damage!

1.5.5.8 /EMERG (Enabling the Emergency Mode)

/EMERG enables the Emergency Mode for variant –(201) only.

The RT6512-(201) detects a low state on the /EMERG input when an external resistance lower than 1 k Ω connects to ground. In such case transceiver activates Emergency Mode operation.

The RT6512-(201) detects a high state on the /EMERG input when an external resistance higher than 50 k Ω connects to ground.

1.5.6 Status and Control Outputs

1.5.6.1 /FAILURE

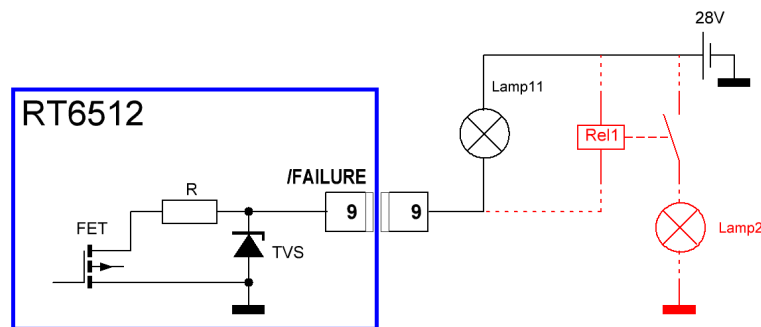


Figure 4: /FAILURE Output Schematic

This /FAILURE output is coupled to the status shown at the status LEDs at the connector side of RT6512. It agrees to the OR function of the red and the yellow LEDs. When the test function **is not ok**, the transistor in the /FAILURE output is ON.

This output is an open collector (drain) type with capability to:

- Pull maximum 100 mA current to ground with a voltage drop of less than 2.5 V (related LEDs are on).
- Pull maximum 0.1 mA current to ground for output voltage 28.0 V when in "inactive" state (related LEDs are off).

It can be used to drive an external relay if 100 mA output current limit at the supply voltage 28.0 V is not sufficient. This /FAILURE output has a protection against spikes produced from a relay. See "**Status & Error Indication**", page 57.

1.5.6.2 RX_AGC (AGC Voltage of the RX-RF-AGC)

The AGC output is a DC coupled output of the RF-AGC used in the receiver.

The output voltage varies monotonically in the range of 0...5 V, when the input level at the antenna input is varied from -105...+13 dBm.

For all antennas input levels from -120...-105 dBm the output voltage is positive and not higher than the output voltage which can be obtained at -105 dBm.

1.5.6.3 /SQL_EVAL

This digital output shows that the audio signal from the receiver is available on the LINE_OUT.

This output is an open collector type with capability to:

- Pull maximum 100 mA current to ground with a voltage drop of less than 2.5 V (related LED(s) is on).
- Pull maximum 0.1 mA current to ground for output voltage 28.0 V when in "inactive" state (related LEDs are off).
- It can be used to drive an external relay, if 100 mA output current limit at the supply voltage 28.0 V is not sufficient.
- This /SQL_EVAL output has a protection against spikes produced from a relay.
- RX indication inactive (HIGH):
 - Squelch ON but no audio goes out on LINE_OUT.
 - RT6512 in TX mode.
- RX indication active (LOW), only possible in RX mode:
 - Squelch ON and audio goes out on LINE_OUT.
 - Squelch OFF (permanent audio out on LINE_OUT).

1.5.7 Digital Interfaces to the Control Device

1.5.7.1 Interface ARINC 429

Name	Function / Remarks
ARI429_RX_A1	1 st ARINC 429 Interface RX Line A
ARI429_RX_B1	1 st ARINC 429 Interface RX Line B
ARI429_TX_A1	1 st ARINC 429 Interface TX Line A
ARI429_TX_B1	1 st ARINC 429 Interface TX Line B
ARI429_RX_A2	2 nd ARINC 429 Interface RX Line A
ARI429_RX_B2	2 nd ARINC 429 Interface RX Line B
ARI429_TX_A2	2 nd ARINC 429 Interface TX Line A
ARI429_TX_B2	2 nd ARINC 429 Interface TX Line B

1.5.7.2 Interface RS422

Name	Function / Remarks
RS422_RX+	RS422 Interface RX Line B (high if idle)
RS422_RX-	RS422 Interface RX Line A (low if idle)
RS422_TX+	RS422 Interface TX Line B (high if idle)
RS422_TX-	RS422 Interface TX Line A (low if idle)

1.6 Safety-Conscious Utilization

⚠ CAUTION The device(s) may be installed on an aircraft only by an approved aeronautical company (e.g. Part 145) which shall also examine the installation.

SAFETY INSTRUCTIONS

- The installation of the device into an aircraft may be carried out only by an authorized installation company. The country regulations always have to be obeyed.
- Use the product only in the specified conditions, see "Technical Data", page 21.
- Power supply:
 - Do not connect the device to AC sources.
 - Make sure that the device is connected to the mandatory DC source, see "Technical Data", page 21.
 - Do not connect the device with reversed polarity to the DC source.
- Circuit breaker:
 - Use the recommended fuses in the power supply line for protection of the application, see "Technical Data", page 21.

NOTICE

Cleaning:

- Do not use aggressive cleaning agents e.g. Acetone.
 - These cleaning agents can cause damages.

NOTICE

Excessive pulses on the DC bus of the aircraft may cause damage on electrical circuits of any installed instrument.

Do not power-on the device during engine start or shutdown.

1.7 Restriction for Use

SAFETY INSTRUCTIONS

The product is to be used inside the declared limits.

1.8 Technical Data

1.8.1 General Characteristics

RT6512		Specifications
Nominal supply voltage		28.0 VDC
Extended supply voltage		22.0...30.3 VDC
Emergency operation		18.0 VDC
Frequency range	RT6512-(100)	118.000...136.9916 MHz
	RT6512-(200)	118.000...155.975 MHz
	RT6512-(201)	118.000...155.975 MHz
Channel spacing		25 kHz
		8.33/25 kHz (default)
Number of channels	8.33 kHz	2280
	25 kHz	760
Storage Temperature range		-55...+85 °C
Operating Temperature range		-40...+70 °C
Operating Altitude		50 000 ft
Vibration		Category S (Curve M) + Category U (Curve G)

1.8.2 Typical Power Consumption

RT6512		Specifications
Receive mode		< 0.6 A
Transmit mode		< 7 A
Power-ON Time (PBIT dependent)		~ 4 s
Recommended power supply protection		10 A (e.g. Klixon 7277-2-10)

Technical Data

1.8.3 Receiver Data

RT6512	Specifications
Sensitivity	≤ -93 dBm for a (S+N)/N ratio of 12 dB
Effective bandwidth (8.33 kHz channel spacing)	± 2.78 kHz at the 6 dB points
	± 7.37 kHz at the 60 dB points
Effective bandwidth (25 kHz channel spacing)	± 8 kHz at the 6 dB points
	± 17 kHz at the 40 dB points
	± 25 kHz at the 60 dB points
Squelch	level adjustable (by RCU6512 only)
AGC characteristics	≤ 6 dB in range -102...+13 dBm
Distortion	$\leq 5\%$ at AM=30% 10 dB below rated output power
	$\leq 15\%$ at AM=85% and rated output power
Audio frequency response (8.33 kHz channel spacing)	≤ 6 dB 350...2500 Hz
	≥ 35 dB at 4000... 10000 Hz (Class H2 Receiver)
Audio noise level (S+N)/N	≥ 25 dB
Rated output power for LINE_OUT	≥ 100 mW into 600 Ω
	≥ 200 mW into 150 Ω
Offset-carrier operation	YES (25/8.33 kHz), Class C and H2 Receiver

1.8.4 Transmitter Data

RT6512	Specifications
Output power into 50 Ω (with and without modulation)	≥ 20 W in normal condition (118...137 MHz); ≥ 18 W in normal condition (137...156 MHz); (≥ 16 W under all specified environmental conditions, 118...137 MHz) (≥ 14 W under all specified environmental conditions, 137...156 MHz)
Frequency tolerance	≤ 5 ppm
Duty cycle	30 s (TX) : 270 s (RX)
Type of modulation	A3E
Modulation capability	$\geq 85\%$ (devices with change index ≥ 03) $\geq 70\%$ (devices with change index 01, 02)
Distortion	$\leq 10\%$ (for 70% of modulation depth) $\leq 25\%$ (for 85% of modulation depth)
Audio frequency response (8.33 kHz channel spacing)	≤ 6 dB, 350...2500 Hz
Audio frequency response (25 kHz channel spacing)	≤ 6 dB, 300...3400 Hz
Line In	200...6000 mV compressor starting point, adjustable
(with compressor)	Input balanced, 600 Ω Clipping level 6 V
Standard microphone	100...3000 mV compressor starting point, adjustable
(with compressor)	Input unbalanced, 150 Ω Clipping level 3 V
Parasitic FM deviation	≤ 1 kHz
Sidetone signal on LINE_OUT	natural, adjustable*
Automatic shutdown of transmit mode (stuck PTT)	Factory configurable 30...180 s (default 30 s)
Transmitter class	Class 3, Class 5

*For detailed information refer to the manual RCU6512 Installation and Operation DV17551.03 (Article No. 0645.230 071)

1.8.5 Dimensions & Weight

RT6512	Specifications
Without cable connector (W x H x D)	60 x 153 x 210.5 mm (2.36 x 6.02 x 8.29 inch)
With cable connector (W x H x D)	60 x 153 x 258 mm (2.36 x 6.02 x 10.16 inch)
Material	AlCuMg1 Nickel Plated
Weight without mounting tray	2150 g
Weight with mounting tray	2400 g

Technical Data

1.8.6 Software

The design and development processes used for VHF transceiver RT6512 software are in compliance with the rules given in EUROCAE/RTCA Document ED-12C/DO-178C.

Design Assurance Level (DAL) C

1.8.7 Hardware

The Complex Electronic Hardware (CEH) included into VHF transceiver RT6512 has been designed in accordance with EUROCAE/RTCA Document ED-80/DO-254; "Design Assurance Guidance for Airborne Electronic Hardware" and satisfy criteria of:

Hardware Assurance Level (HAL) C

1.8.8 Continued Airworthiness

- The RT6512 maintenance is defined as "on condition" only.
- It is recommended to examine the frequency accuracy of the airborne transceiver after 4 years.

1.8.9 Environmental Conditions

The tests were done in accordance with EUROCAE/RTCA Document ED-14G/DO-160G under consideration of the recorded environmental categories and conditions:

Environmental Condition	Section	Category	Remarks
Temperature and Altitude	4	D1	-
Ground Survival Low Temperature and Short-Time Operating Low Temperature Test	4.5.1	D1	Short-Time Operating Low Temperature Test extended to -40 °C
Operating Low Temperature Test	4.5.2	D1	Operating Low Temperature Test extended to -40 °C
Ground Survival High Temperature and Short-Time Operating High Temperature Test	4.5.3	D1	Ground Survival High Temperature +85 °C Short-Time Operating High Temperature Test +70 °C
Operating High Temperature Test	4.5.4	D1	+70 °C
In-Flight Loss of Cooling	4.5.5	Z	No cooling required
Altitude Test	4.6.1	D1	Non-pressurized; 50 000 ft
Decompression Test	4.6.2	X	No test performed
Overpressure Test	4.6.3	X	No test performed
Temperature Variation	5	B	5 °C per minute
Humidity	6	B	-
Operational Shocks & Crash Safety	7	B	-
Vibration	8	S U	Category S – Curve M Category U – Curve G
Explosion Atmosphere	9	X	No test performed
Waterproofness	10	W	-
Fluids Susceptibilities	11	X	No test performed
Sand and Dust	12	X	No test performed
Fungus Resistance	13	X	No test performed
Salt Fog	14	X	No test performed
Magnetic Effect	15	Z	Deflection of 1° of a compass at a distance of < 30 cm
Power Input	16	BXX	Normal: 22.0...30.3 V Abnormal: 20.5...32.2 V Emergency operation: 18.0 V
Voltage Spike	17	A	-
Audio Frequency Conducted Susceptibility	18	B	-
Induced Signal Susceptibility	19	ACX	-

Technical Data

Environmental Condition	Section	Category	Remarks
Radio Frequency Susceptibility	20	WW	Conducted Susceptibility: Cat. W Radiated Susceptibility: Cat. W
Emission of Radio Frequency Energy	21	M	-
Lightning Induced Transient Susceptibility	22	A3Z3XX	Pin tests: Waveform A Level 3 Cable bundle tests: Waveform Z Level 3
Lightning Direct Effects	23	X	No test performed
Icing	24	X	No test performed
Electrostatic Discharge (ESD)	25	A	-
Fire, Flammability	26	X	No test performed

1.8.10 Certifications

SAFETY INSTRUCTIONS

Unauthorized changes or modifications to the RT6512 may void the compliance to the required regulatory agencies and authorization for continued equipment usage.

The remote-controlled VHF transceiver RT6512 is certified.

Device	Approval
RT6512-(XXX)	EASA.210.10060121, FCC identifier B54RT6512
RT6512-(100)	MISE, Fas: 37632
RT6512-(200)	MISE, Fas: 349513
RT6512-(201)	MISE, Fas: 41630

1.8.10.1 RT6512 meets the requirements of:

Number	Description
EASA ETSO-2C169a	"VHF Radio Communication Transceiver Equipment Operating in Radio Frequency Range 117.975 to 137.000 MHz"
FAA TSO-C169a	"VHF Radio Communication Transceiver Equipment Operating in Radio Frequency Range 117.975 to 137.000 MHz"
EASA ETSO-2C128	"Devices That Prevent Blocked Channels Used in Two-Way Radio Communications Due to Unintentional Transmissions"
FAA TSO-C128a	"Equipment That Prevents Blocked Channels Used in Two-Way Radio Communications Due to Unintentional Transmissions"

1.8.10.2 Guidelines for Design and Development

Number	Description
EUROCAE ED-23C RTCA DO-186B	"MOPS for Airborne VHF Receiver-Transmitter Operating in the Frequency Range 117.975 - 137.000 MHz"
EUROCAE ED-67	"MOPS for Devices That Prevent Unintentional or Continuous Transmissions"
EUROCAE ED-18 RTCA DO-170 RTCA DO-214A	"Audio Systems Characteristics and Minimum Performance Specifications"
EUROCAE ED-12C RTCA DO-178C	"Software Considerations in Airborne Systems and Equipment Certification"
EUROCAE ED-14G RTCA DO-160G	"Environmental Conditions and Test Procedures for Airborne Equipment"
RTCA DO-207	"MOPS For Device that Prevent Blocked Channels Used IN 2-Way-Radios Communications due to Unintentional Transmissions"
EUROCAE ED-80 RTCA DO-254	"Design Assurance Guidance for Airborne Electronic Hardware"
FCC Part 87	"FCC-Standard Part 87 – Aviation Services"
ITU Radio Regulations, Volume 1	ITU Radio Regulations.
ARINC SPECIFICATION 429 PART 1-17 GAMA Pub. No 11	Mark 33 Digital Information Transfer System (DITS), Part 1 Functional Description, Electrical Interface, Label Assignments and Word Formats ARINC 429, GENERAL AVIATION SUBSET
EIA-422-B	Electrical Characteristics of Balanced Voltage Digital Interface Circuits, TIA/EIA-422-B

1.8.10.3 FCC Approval

Radiofrequency radiation exposure information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 50 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTICE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTICE:

This device complies with Part 15 of the FCC Rules [and with Industry Canada licence-exempt RSS standard(s)].

Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

NOTICE:

Changes or modifications made to this equipment not expressly approved by Becker Avionics may void the FCC authorization to operate this equipment.

1.9 Order Code

1.9.1 RT6512

Qty	VHF-AM Transceiver	
1	RT6512-(100) Frequency Range 118.000-136.975 MHz	Art.-No.: 0644.927-910
1	RT6512-(200) Frequency Range 118.000-155.975 MHz	Art.-No.: 0637.300-910
1	RT6512-(201) Frequency Range 118.000-155.975 MHz + Emergency Mode	Art.-No.: 0649.643-910

1.9.2 Accessories

Qty	Mounting Tray	
1	Mounting Tray MT6512-(01)*, vertical position	Article-No. 0644.722-284

* install RT6512 with the mounting tray MT6512 to meet the conditions for DO160G, section 7 and 8 (see "Environmental Conditions", page 25).

Qty	Connector Kit	
1	CK6512-C; <ul style="list-style-type: none"> • Connector D-Sub, 37pin, female (crimp version), • Connector housing, • Label "COMM", • SK504; Antenna Connector BNC for coax cable 	Article-No. 0642.568-954
1	CK6512-S; <ul style="list-style-type: none"> • Connector D-Sub, 37pin, female (soldering version), • Connector housing, • Label "COMM", • SK504; Antenna Connector BNC for coax cable 	Article-No. 0642.551-954

Qty	Antenna	
-	Please use only antennas (50 Ohm, vertically polarized with coaxial cable) which are certified to one of the following TSOs: TSO C37 TSO C38 TSO C169.	--

Qty	Software	
1	SSW6512, Service Software for RT6512 <ul style="list-style-type: none"> • Service software (on USB stick) • Connector cable • Description of Service Software (on USB stick) 	Article-No. 0666.467-919

1.9.3 Documentation

Qty	Documentation	
1	DV17501.03 Installation & Operation (English)	Article-No. 0645.702-071
1	DV17501.04 Maintenance & Repair (English)	Article-No. 0645.710-071

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2 Installation

This manual must be available during performance of all tasks.

The installation of the device(s) depends on the type of aircraft and its equipment and therefore only general information can be given in this section.

Any deviations from the instructions in this document are under own responsibility.

In this chapter you can read about:

2.1	Packaging, Transport, Storage	31
2.2	Device Assignment	32
2.2.1	Scope of Delivery	32
2.2.2	State of Delivery	32
2.2.3	Additional Equipment	32
2.2.4	Registration of the Device	32
2.2.5	Type Plate	33
2.2.6	Software/Firmware Status – Functionality	33
2.2.7	Meaning of Status LEDs	33
2.3	Installation Requirements	34
2.3.1	Mounting Distance	35
2.3.2	Mounting Tray MT6512	35
2.3.3	Grounding	35
2.3.4	Antenna Cables	36
2.3.4.1	Attenuation: Cable length versus coax cable type	36
2.3.5	Antenna Installation	36
2.3.5.1	Required Antenna Type	36
2.3.5.2	Antenna Position	36
2.3.6	Conditions for Installation of two RT6512 in one Aircraft	38
2.3.6.1	Radio Setting and Wiring for dual Installation	38
2.4	Dimensions	39
2.4.1	RT6512	39
2.4.2	RT6512 with Mounting Tray MT6512	40
2.5	Connector Pin Assignments	41
2.5.1	Connector P1 (RT6512)	41
2.5.2	Connector J2 (RT6512)	42
2.6	Equipment Configuration Samples	43
2.6.1	RT6512 with RCU6512	43
2.6.2	RT6512 with RMU5000	43
2.6.3	RT6512 with ARINC 429 Controller	43
2.7	Aircraft Wiring	44
Wiring Diagram with RCU6512	44	
Wiring Diagram with RMU5000	44	
Wiring Diagram with OEM Controller	44	
2.7.1	RT6512-(XX0) with RCU6512 as Primary Controller	45
2.7.2	RT6512-(XX0) with ARINC 429 Controller	46
2.7.3	RT6512-(XX1) with ARINC 429 Controller	47
2.7.4	RT6512-(XX0) with Controller G7610	48
2.8	Post Installation Check	49
2.8.1	Mechanical Installation and Wiring Check	49
2.8.2	Power Supply	49
2.8.3	Receiver / Transmitter Operation	49
2.8.4	Antenna Check	49
2.8.5	Interference Check	49
2.8.6	Flight Test Check	51

2.1 Packaging, Transport, Storage

Visually inspect the package contents for signs of transport damage.

⚠ CAUTION The packaging material is inflammable, if it is disposed of improperly by burning, toxic fumes may develop.

Keep the packaging material and use it in the case of a return shipment. Improper or faulty packaging may lead to transport damages.

Make sure to transport the device always in a safe manner and with the aid of suitable lifting equipment if necessary. Do never use the electric connections for lifting. Before the transport, a clean, level surface should be prepared to put the device on. The electric connections may not be damaged when placing the device.

First Device Checkup

- Do a check for signs of damages.
- Please make sure that the indications on the type plate agree with your purchase order.
- Make sure that the equipment is complete ("Scope of Delivery", page 32).

Storage

If you do not install the device immediately, make sure to store it in a dry and clean environment. Make sure that the device is not stored near strong heat sources and that no metal chippings can get into the device.

Storage temperature see "Technical Data, General Characteristics" page 21.

2.2 Device Assignment

This manual is valid for the devices:

- RT6512-(100) + accessories.
- RT6512-(200) + accessories.
- RT6512-(201) + accessories.

2.2.1 Scope of Delivery

- Manuals:
 - Installation & Operation manual (English).
- Device as ordered.
- Authorized Release Certificate (EASA Form 1).

2.2.2 State of Delivery

- The device(s) are ready for use with factory default adjustments.

2.2.3 Additional Equipment

- Mounting tray MT6512 (for RT6512 to meet the conditions for DO-160G section 7 and 8).
- Connector kit + cables.
- Antenna + antenna cables.
- Control device (control and operate the RT6512).

Details see "Accessories", page 29.

2.2.4 Registration of the Device

Obey the national requirements for operation of radio equipment.

2.2.5 Type Plate

The device type is specified by the type plate (on the housing):

Example:



Figure 5: Type plate (example)

Explanation:

P/N:	Type designation: RT6512: Remote-controlled VHF-AM transceiver Options: (100): Frequency range 118...136.9916 MHz (200): Frequency range 118...155.975 MHz (201): Frequency range 118...155.975 MHz + Emergency Mode
S/N:	Unique number of the particular device
A/N:	Article number
DOM:	Date of Manufacturing
	Software: Refer to the version on the device type plate
	Compliance and Certifications Refer to the text and logos on the device type plate

2.2.6 Software/Firmware Status – Functionality

- The software versions are subject to change without notice.

2.2.7 Meaning of Status LEDs

The front panel LEDs show information about the equipment status.

For details, please see "Device Status - Error Indication" page 57.

2.3 Installation Requirements

The installation of the device(s) depends on the type of aircraft and its equipment and therefore only general information can be given in this section.

SAFETY INSTRUCTIONS

The installation of RT6512 into an aircraft may be carried out by an authorized installation company. The country regulations always have to be obeyed.

- The device must not be opened.
- Keep enough distance to devices with integrated ventilator fans to make sure the free circulation of the cooling air.
 - The RT6512 is made for vertical and horizontal installation in an area, with sufficient convection cooling.
 - Make sure that the mounting tray has no direct contact with an external heat source.
 - Forced cooling is not required.
- The installation area must have a minimum distance of 30 cm from the magnetic aircraft compass, to prevent any interference to the magnetic compass.
- Refer to FAA AC 43.13-2B Chapter 2 p. 204 for installation methods.
- Install the RT6512 with the mounting tray MT6512 to agree to the conditions for DO-160, section 7 and section 8. For details see "Environmental Conditions", page 25.

SAFETY INSTRUCTIONS

RT6512 is made for installation in cockpit environment of fixed and rotary wing aircraft.

These limitations apply for the installation:

- The installation must be in accordance with the local aviation authority approved guidelines (e.g. EASA, FAA).
- The installation must be in accordance with the ETSO/TSO standards applicable for the specified type or class of aircraft.
- The equipment is not qualified for installation in areas with fluid contamination.
- Changes or modifications made to this equipment not expressly approved in written form by Becker may void the authorization to operate this equipment.

SAFETY INSTRUCTIONS

- Use only cables which are qualified for aircraft use (self-extinguishing), AWG see "Aircraft Wiring" page 44.
- Interface lines TX-A/TX-B and RX-A/RX-B are each to be laid as 2-core twisted and shielded cables.
- Fit sleeves over the solder joints on the equipment connector.
- HF cable should not be included in the cable harnesses.
- Use the recommended fuses in the power supply line for the protection of the application, see "Technical Data", page 21.

⚠ CAUTION

- Examine the wiring carefully before power up the device(s) and examine particularly correct connection of the power supply lines.

2.3.1 Mounting Distance

Dimensions mm (inch)

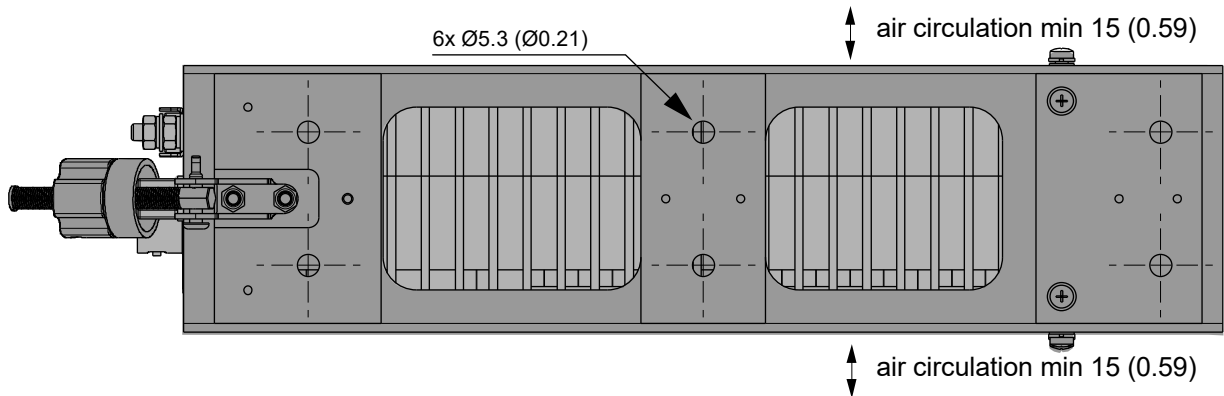


Figure 6: RT6512 with MT6512 - mounting area

2.3.2 Mounting Tray MT6512

Install the RT6512 with the dedicated mounting parts:

- Mounting tray (MT6512).
 - The mounting tray is the fixture for the RT6512 to the aircraft structure.
- Install the mounting tray MT6512 in the aircraft avionics bay.
- Use six M5 (metric) or size 10 (imperial) stainless steel screws with countersunk head.
 - Minimum torque for fixing screws is 3 Nm (28 inch-lbs).
 - Minimum length 20 mm.

Details see "Dimensions", page 39.

2.3.3 Grounding

SAFETY INSTRUCTIONS

Make sure that the grounding contact area is adequate and that the connection has low resistance and low inductance. Never use a grounding point on paint-coated surfaces!

For details, please refer to FAA AC 43.13-2B Chapter 2 p. 207.

The RT6512 has a threaded grounding bolt at the front side of the device.

- Use this point as grounding contact.
 - Type: Threaded bolt M4 (stainless steel).
- Use a ground strap attached to the ground stud and to the airframe.
 - Maximum tightening torque for ground stud screw is 1.5 Nm (14 inch-lbs).
 - Wire cross section: min. 4 mm².
 - Length: max. 150 mm (6 in).

2.3.4 Antenna Cables

- The total attenuation of each antenna connection, including cables, connectors, microwave switch (if used), etc. shall be as low as possible.
- An aircraft installation should be verified for receiving sensitivity in accordance with ICAO Annex 10, Vol. 3, Part II, §2.3.2.2.1
- Observe manufacturer data for characteristic attenuation of the selected cable type, connectors, microwave switch, etc.

NOTICE

All signal characteristics are defined for antenna port of RT6512.

2.3.4.1 Attenuation: Cable length versus coax cable type

Use the data as guideline only.

Cable type	Maximum loss @ 118 MHz	Maximum loss @ 156 MHz
RG400	15.5 dB/100 m	18.1 dB/100 m
RG142	13.6 dB/100 m	15.7 dB/100 m
RG393	7.3 dB/100 m	8.4 dB/100 m
ECS310801	-	4.5 dB/100 m
ECS310701	-	3,5 dB/100 m

2.3.5 Antenna Installation

For antenna installation, refer always to the manufacturer's maintenance documentation for the aircraft. Carry out the antenna installation in accordance with AC 43.13-2B Chapter 3.

NOTICE

Penetration of the pressurized cabin on a pressurized aircraft requires additional data, which are not contained in this installation manual.

CAUTION

Radiation risk:

A safe distance to the installed antenna must be given by related installation measures around to prevent human body damage (e.g. at the eyes) and/or the inflammation of combustible materials by radiated energy.

2.3.5.1 Required Antenna Type

NOTICE

The aircraft's manual for antenna installation has to be observed.

- Vertical polarized 50 Ω broadband aircraft COM antenna.
- The antenna must be able to radiate RF energy evenly and omnidirectional.

2.3.5.2 Antenna Position

Careful planning should be applied to get the performance and reliability of the product. Any deviations from the installation instructions are under the installer's own responsibility.

- The aircraft-certifying inspector could support you in questions about to achieve best results into all directions (installation instructions must be fully complied with).
- For aircraft with metal fuselage, we recommend a rod antenna.
- The antenna is mounted vertically (as possible) on or under the fuselage.
- Location should be even and in a safe distance from horizontally screening metal parts (propeller, undercarriage, vertical metal fins etc.), for maximum radio range into all (horizontal) directions.

- The VHF Com1 and VHF Com2 must be installed with at least $\frac{1}{2}$ wavelength (of the antenna operating frequency) distance between antennas. It is necessary to have an antenna separation of min. 45 dB.
- Distance to other aircraft antennas (COM, NAV antennas), should be at least 1.5 m.
- The antenna mounting area should be as flat as possible.
- When two radios are used:
 - It is required to have an antenna separation of min. 45 dB. This needs to be guaranteed by the installer.
 - It could happen that operational degradations may apply, this needs to be documented from the installer and approved for airworthiness
- Make sure that the metallic contact between aircraft surface/structure and the antenna cable outer conductor (shield) is adequate/solid.
 - Never use a location on paint-coated surfaces!
 - The electrical contact shall remain with low resistance even under vibration.
- For wood and fiberglass (GRP) aircraft (reinforcing the mounting location):
 - 3 or 4 aluminum strips (each 60 cm long/5 cm wide) are recommended.
 - The stripes shall be placed (mostly) horizontally with a shape as a star or cross.
 - These placed counter weights must be centrally screwed together with the antenna socket to make sure a continuous, electrically good contact.
- For aircraft with non-metallic surface structure inside the fuselage:
 - A metal foil (min. 60x60 cm) can be used.
 - The antenna socket should be placed in the foil center, in addition with a metallic ground contact support plate.
- For aircraft with fuselage and/or tail-fin made of non-conductive material:
 - A vertical folded top antenna is suitable.
 - The installation should be made preferably during manufacturing the tail-fin.

NOTICE

Carbon fiber is conducting and may shield the antenna!

- Careful sealing of all holes/openings of the outer skin is mandatory.
 - Make sure, that electrical contacts remain continuously good, even under bad environmental conditions.
 - Use only high quality 50 Ω coax cable type RG400 or higher quality.
 - Prevent any sharp cable bend (radius > 50 mm), and any excessive coax cable length.
 - Place all wiring including antenna cable away from other wiring which carries heavy AC currents and away from any aircraft controls.
- Any operating kinematics, trimming and all control handles must be absolutely free in all directions.
- Make sure the BNC antenna plug is not shortened between inner and outer connector (ohmmeter).
- Check the antenna matching:
 - Using 50 Ω SWR meter over the whole frequency range and check for VSWR < 3:1.
 - It may be helpful or necessary to change slightly the length of the middle radiator, or counter weight length for optimized antenna efficiency and matching.

2.3.6 Conditions for Installation of two RT6512 in one Aircraft

This information gives guidance to installers for installations with two RT6512 radios on-board the same aircraft.

In order to minimize the risk of cross talk issues, special care has to be applied during the installation of the antennas, as described in "Antenna Installation" page 36 of this document. Becker recommends to configure the receiver attenuation functionality in the RT6212 and to do the related wiring as described here.

2.3.6.1 Radio Setting and Wiring for dual Installation

To use the RT6512 in a dual COM installation, an attenuation function can be performed using the following procedure.

Therefore, the "Push-To-Talk" output of transceiver A is wired to the "External Receiver Attenuation Control" input of transceiver (B) and vice versa.

External Receiver Attenuation Control (/RX_ATT)

Pin No.	Pin Name	I/O	Function
P1-26	/RX_ATT	IN	Decreases the RF gain of the RX section ACTIVE state – closed contact to GND

Push-To-Talk (/PTT)

Pin No.	Pin Name	I/O	Function
P1-7	/PTT	IN	Push-To-Talk key ACTIVE state – closed contact to GND

2.4 Dimensions

2.4.1 RT6512

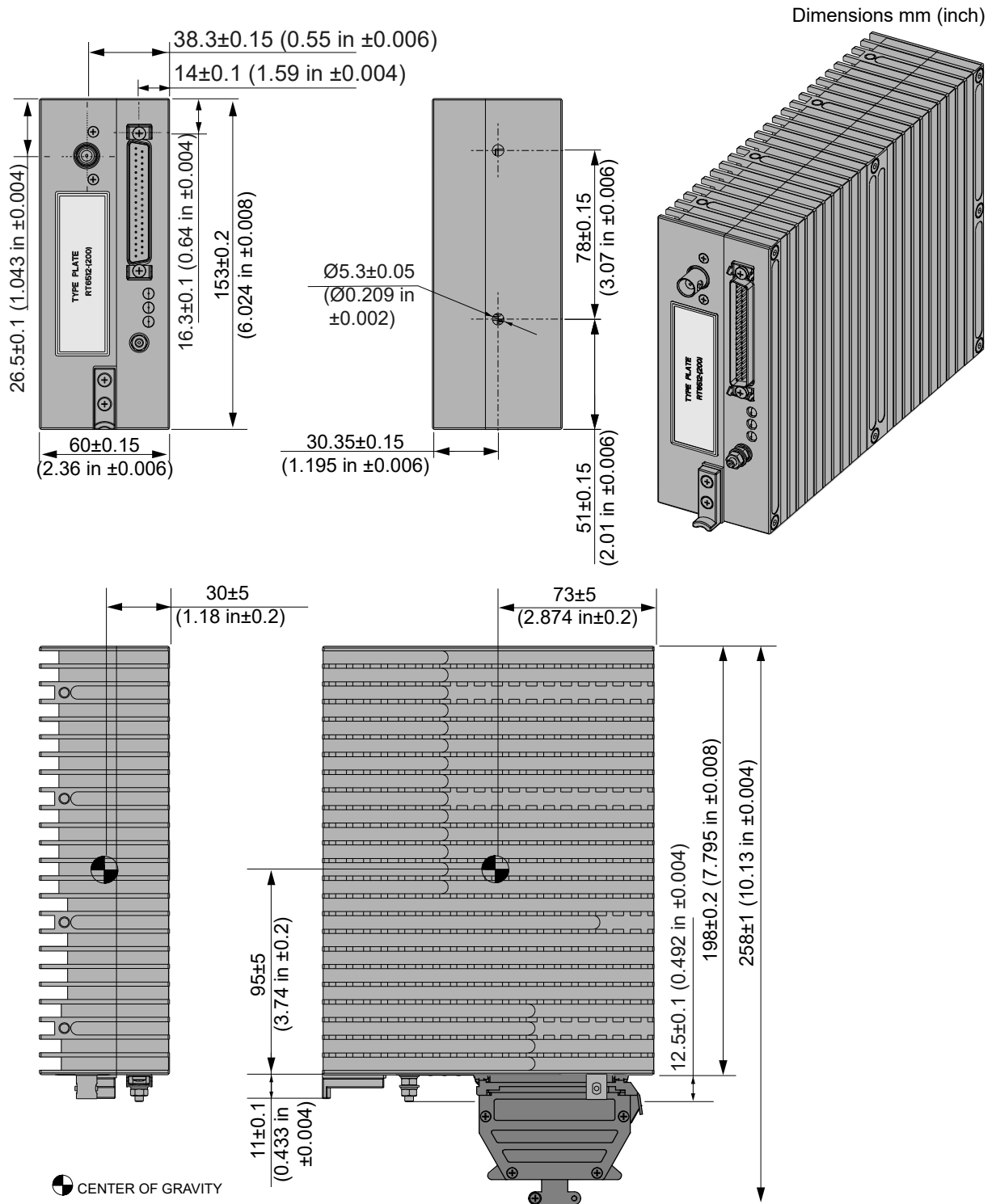


Figure 7: RT6512 Dimensions (without and with Main Connector applied)

Permitted deviation for dimensions without tolerances: DIN ISO 2768 T1 C (dimensions in mm)		
xx...6 (± 0.3)	>30...120 (± 0.8)	>400...1000 (± 2.0)
>6...30 (± 0.5)	>120...400 (± 1.2)	>1000...2000 (± 3.0)

Dimensions

2.4.2 RT6512 with Mounting Tray MT6512

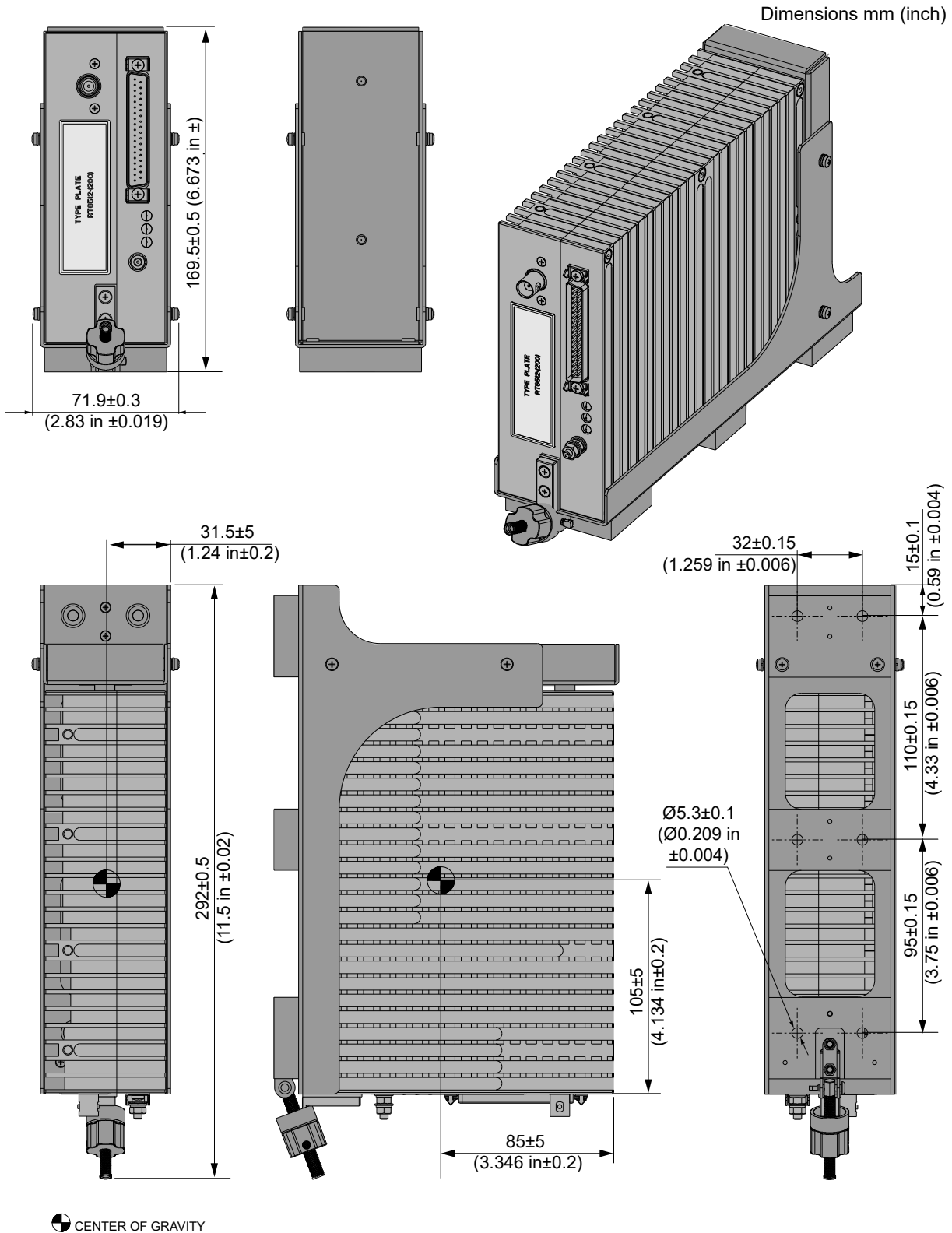
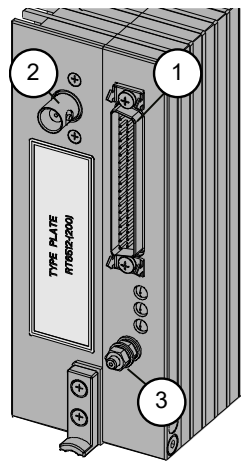


Figure 8: RT6512 with Mounting Tray MT6512

Permitted deviation for dimensions without tolerances: DIN ISO 2768 T1 C (dimensions in mm)		
xx...6 (±0.3)	>30...120 (±0.8)	>400...1000 (±2.0)
>6...30 (±0.5)	>120...400 (±1.2)	>1000...2000 (±3.0)

2.5 Connector Pin Assignments



- ① Main connector: P1
- ② Antenna connector: J2
- ③ Grounding bolt

Figure 9: RT6512connectors

2.5.1 Connector P1 (RT6512)

- Type: D-Sub, 37pin, male.

P1 Pin	Pin Name	Function
1	AF_GND	Audio ground
2	RESERVE	Spare pin for RT6512-(XX0) variants.
	/EMERG	Input which activates the Emergency Mode for RT6512-(201) variant
3	LINE_IN_HI	Balanced Line-In HI
4	STD_MIKE_HI	Standard microphone input HI
5	LINE_OUT_HI	Balanced Line-Out HI
6	SIDETONE	Sidetone output
7	/PTT	PTT signal IN (LO active)
8	RX_AGC	Receivers Automatic Gain Control signal (only for service use!)
9	/FAILURE	Status line (LO signal if red or yellow LED are ON)
10	ARI429_TX_A1	1 st ARINC 429 Interface TX Line A1
11	ARI429_RX_A1	1 st ARINC 429 Interface RX Line A1
12	ARI429_RX_B1	1 st ARINC 429 Interface RX Line B1
13	ARI429_TX_A2	2 nd ARINC 429 Interface TX Line A2
14	RS422_RX+	RS422 Interface RX Line B (HI if idle)
15	RS422_RX-	RS422 Interface RX Line A (LO if idle)
16	/COM2	ARINC addressing line as no. 2 installed in aircraft (LO active)
17	SUPP_28V	Positive power supply line
18	SUPP_28V	Positive power supply line
19	SUPP_GND	Power supply ground (connected to device housing)
20	AF_GND	Audio ground

Connector Pin Assignments

P1 Pin	Pin Name	Function
21	RESERVE	Spare pin, reserved for future use
22	LINE_IN_LO	Balanced Line-in LO
23	STD_MIKE_LO	Standard microphone input LO
24	LINE_OUT_LO	Balanced Line-out LO
25	/TX_ENABLE	Input which enables the transmitter (LO active), when HI the PTT input is inactive. Connect /TX_ENABLE to AF_GND directly on the main connector!
26	/RX_ATT	Decreases RF-Gain of this COM (RX Mode) when connected with PTT of 2 nd COM being in TX mode (LO active)
27	/SQL_EVAL	Output which shows that the receiver receives a signal exceeding the squelch threshold (LO active)
28	/SERV_EN	Input which enables the service mode (LO active). For service purposes only. Do not use in aircraft installation!
29	ARI429_TX_B1	1 st ARINC 429 Interface TX Line B1
30	ARI429_RX_A2	2 nd ARINC 429 Interface RX Line A2
31	ARI429_RX_B2	2 nd ARINC 429 Interface RX Line B2
32	ARI429_TX_B2	2 nd ARINC 429 Interface TX Line B2
33	RS422_TX+	RS422 Interface TX Line B (HI if idle)
34	RS422_TX-	RS422 Interface TX Line A (LO if idle)
35	/SEL422	Select RS422 communication-port (LO active), if not LO then ARINC 429 ports are active.
36	/ON	Remote power ON (LO active)
37	SUPP_GND	Power supply ground (connected to device housing)

2.5.2 Connector J2 (RT6512)

- BNC antenna connector.



② Antenna connector: J2

2.6 Equipment Configuration Samples

NOTICE

- Selection of active controller type shall be done using /SEL422 line.
- ARINC 429 interface or RS422 interface are exclusive (alternative useable).

2.6.1 RT6512 with RCU6512

RT6512 transceiver operated by RCU6512 controller using the RS422 interface.



Figure 10: RT6512 with RCU6512

NOTICE

Dual controller configuration for tandem operations is not available with RCU6512.

2.6.2 RT6512 with RMU5000

RT6512 VHF-AM transceiver operated by one RMU5000 using the RS422 interface.



Figure 11: RT6512 with RMU5000

2.6.3 RT6512 with ARINC 429 Controller

RT6512 VHF-AM transceiver operated by one OEM controller using the ARINC 429 interface



Figure 12: RT6512 with ARINC 429 Controller

2.7 Aircraft Wiring

**SAFETY
INSTRUCTIONS**

The installation of the device(s) depends on the type of aircraft and its equipment and therefore only general information can be given in this section.

It is in the installers responsibility to examine the pin numbers on equipment manufactured by other than Becker Avionics.

The figures show examples of aircraft wiring with RT6512. For further information of aircraft wiring with other devices refer to the related manuals.

⚠ CAUTION

- Do not apply reverse voltage!
- If the device has been powered up with a reverse wiring on the power supply line (ground and DC input reversed) then the device must be sent back to a Becker Avionics service center for inspection.

Wiring Diagram with RCU6512

For detailed information refer to the manual RCU6512 Installation and Operation DV17551.03 (Article-No. 0645.230-071).

Wiring Diagram with RMU5000

For detailed information refer to the manual RMU5000 Installation and Operation DV64301.03 (Article-No. 0541.958-071).

Wiring Diagram with OEM Controller

For detailed information refer to the manual of the respective OEM product.

2.7.1 RT6512-(XX0) with RCU6512 as Primary Controller

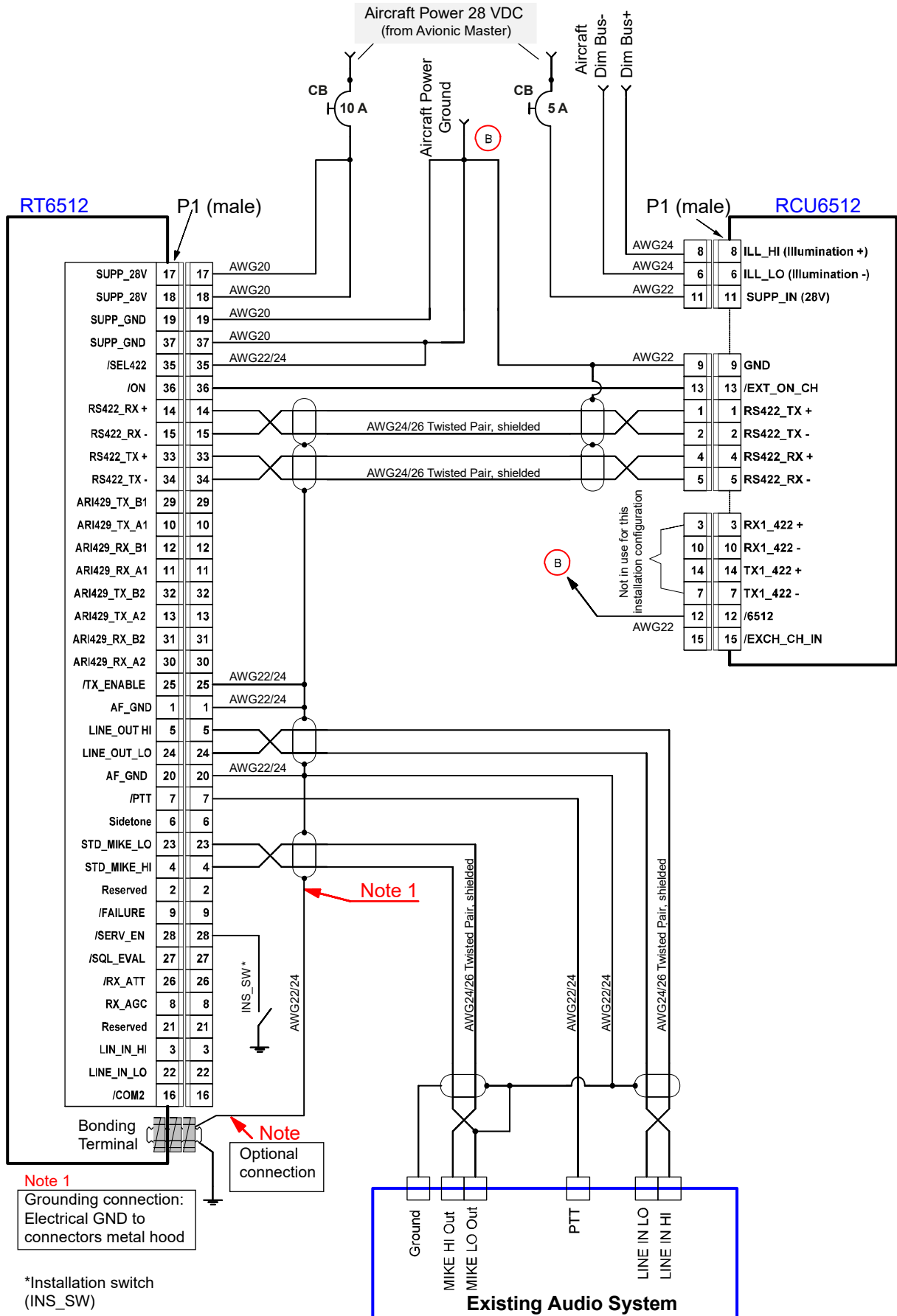


Figure 13: RT6512-(XX0) with RCU6512 as Primary Controller

2.7.2 RT6512-(XX0) with ARINC 429 Controller

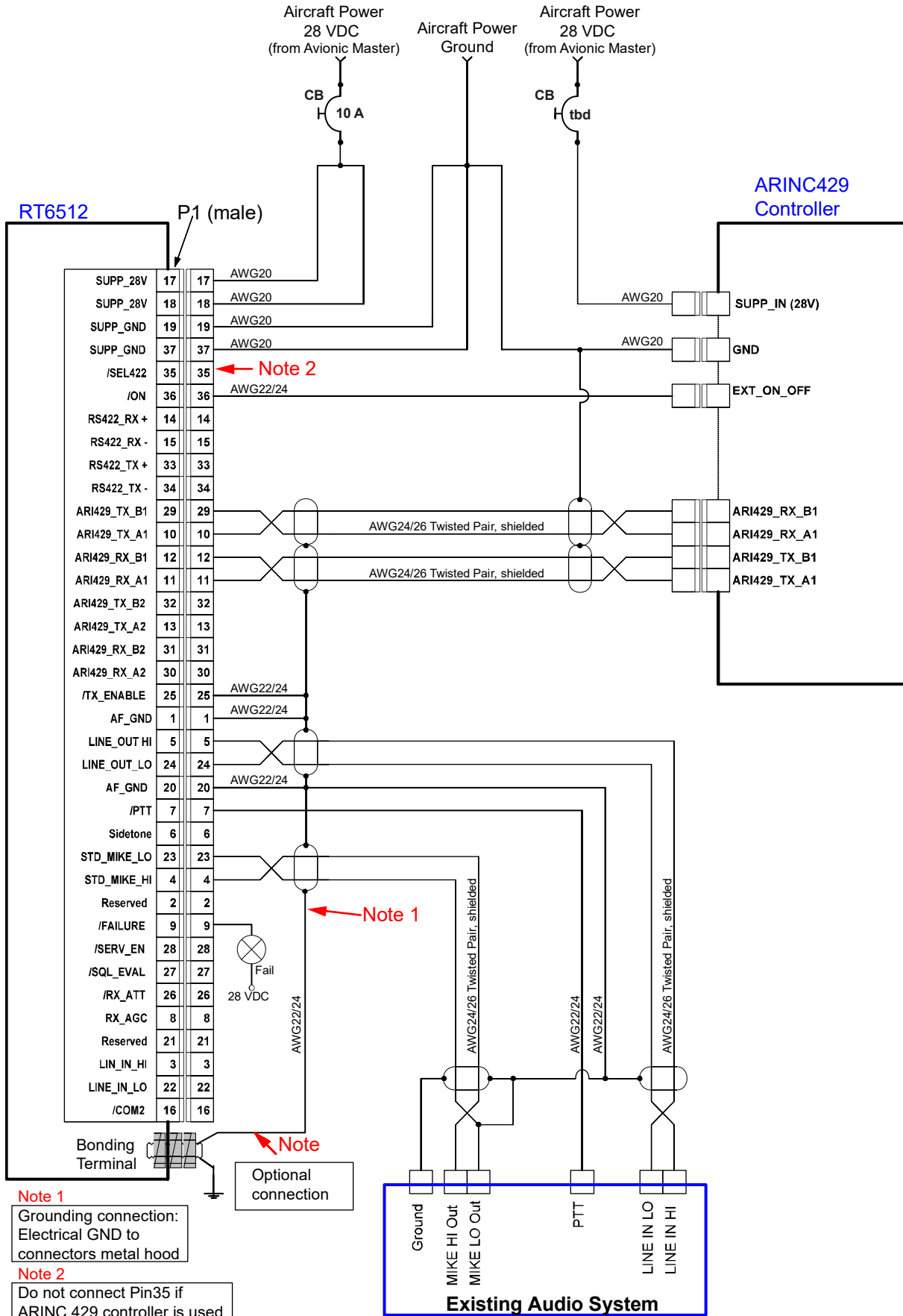


Figure 14: RT6512-(XX0) with ARINC 429 Controller

2.7.3 RT6512-(XX1) with ARINC 429 Controller

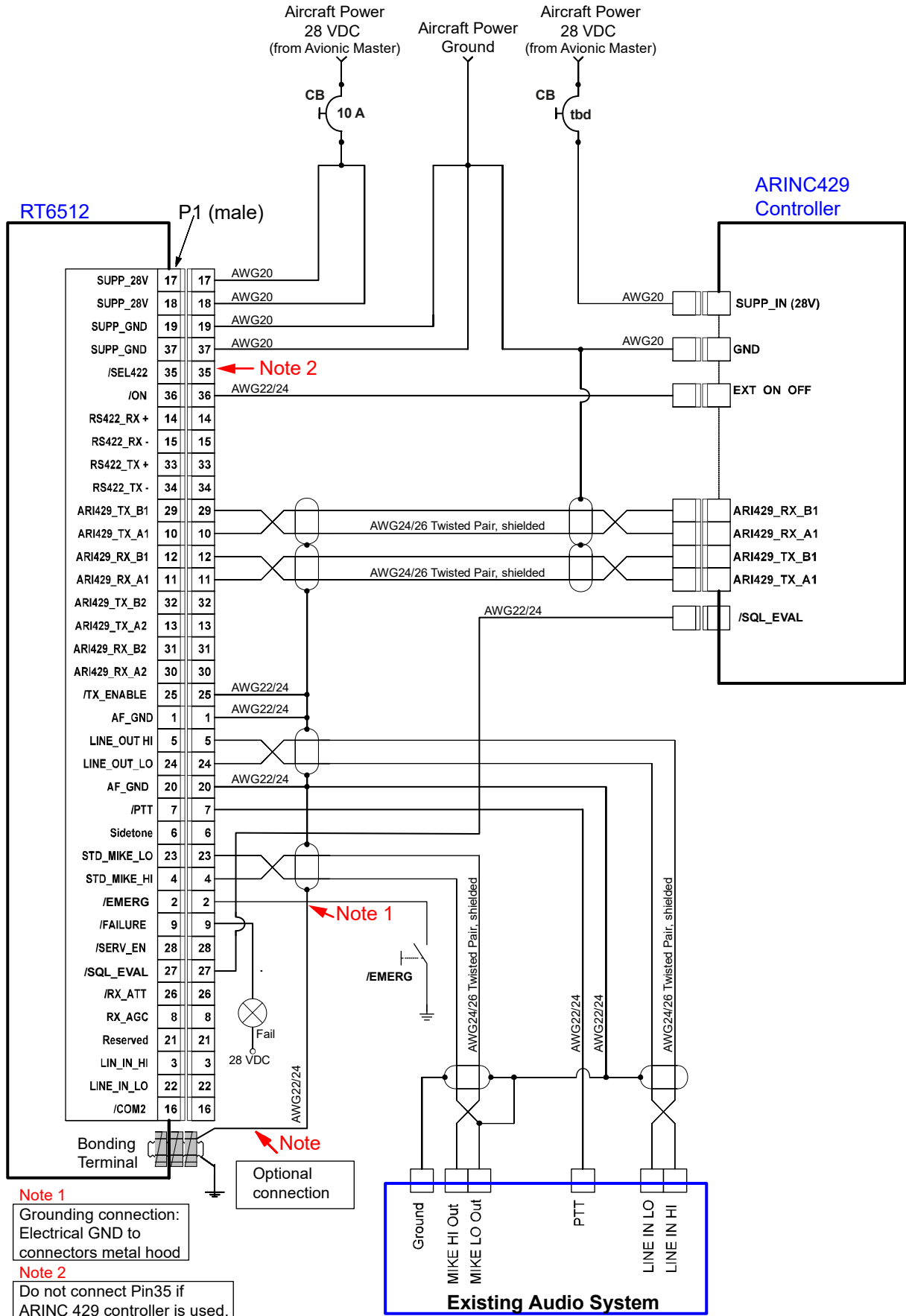


Figure 15: RT6512-(XX1) with ARINC 429 Controller

2.7.4 RT6512-(XX0) with Controller G7610

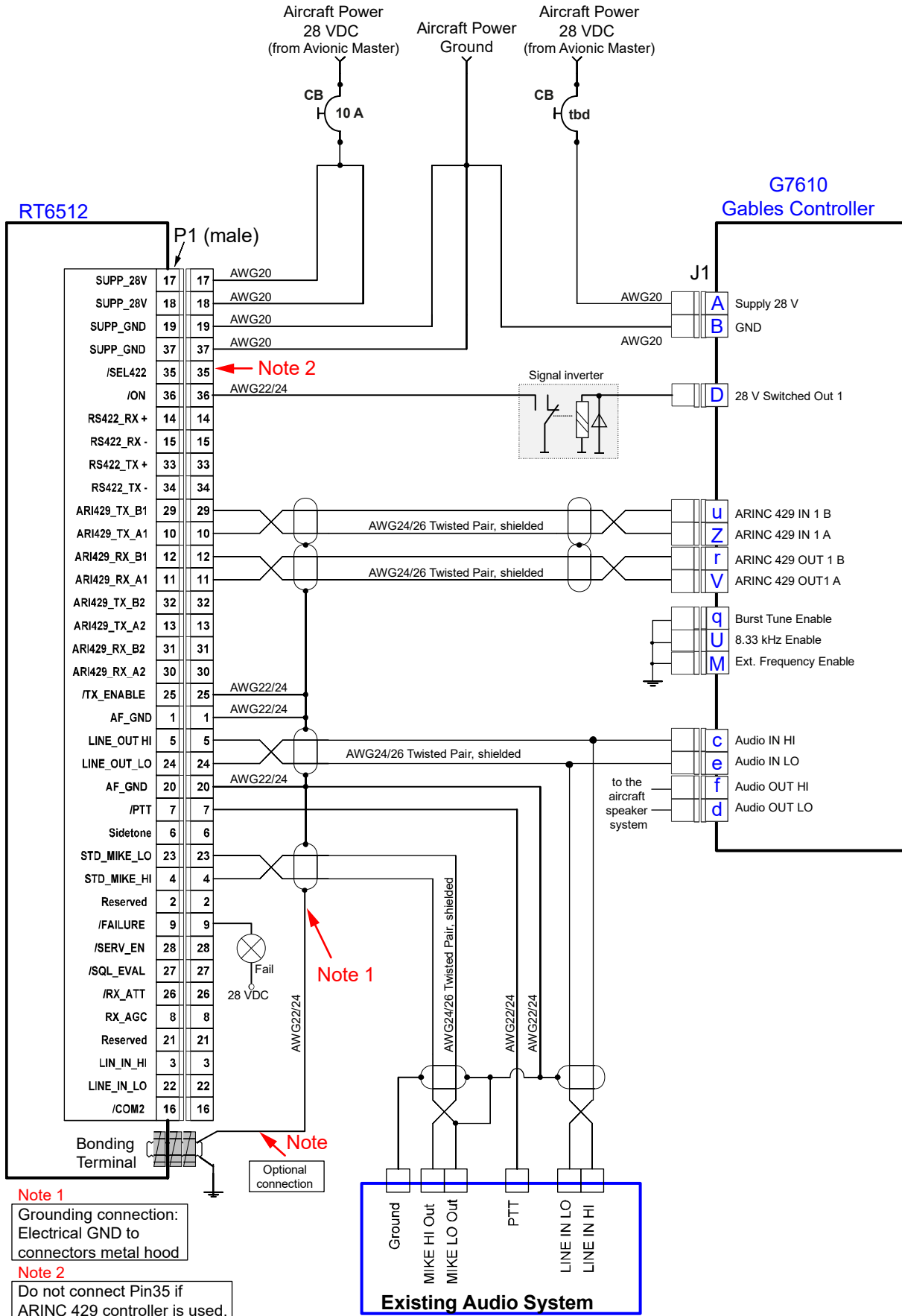


Figure 16: RT6512-(XX0) with Controller G7610

2.8 Post Installation Check

After the device/system is installed completely do a test. Make sure that the compliance with the authority required procedures is obeyed.

The description that follows gives guidance for such tests.

2.8.1 Mechanical Installation and Wiring Check

- Make sure that all cables are attached and the shields are connected to ground.
- Examine the movement of controls to make sure that there is no interference.
- Make sure that all screws are tight and the connectors of the device are secured.

2.8.2 Power Supply

- Examine the power supply lines and the correct polarity.
- Make sure that the power supply is in the specified limits, with and without an engine that is in operation.

2.8.3 Receiver / Transmitter Operation

- Power up the device/system and tune it to a local station for a communication test.
- Make sure that the receiver output supplies a clear and readable audio and ask the local station for correct readability for the transmit signal of the RT6512.
- Repeat this communication test with an airborne station in $\approx 20-40$ NM (Nautical Miles).

2.8.4 Antenna Check

- Examine the VSWR (voltage standing wave ratio) over the complete frequency band (e.g. with a VHF Reflection-Coefficient Meter).
- The VSWR ratio must be less than 2:1 and is not acceptable when exceeding 3:1.

2.8.5 Interference Check

- Examine the device/system while the engine is in operation and power on all other avionics/ electrical systems on the aircraft, to make sure that no significant interference exists.
- Examine that the RT6512 does not cause significant interference with other systems.

The installer's standard test procedure may be used for the interference check and the table that follows can be taken as a reference.

Depending on the individual avionics systems installed in the aircraft, it might be necessary to extend the checklist.

Aircraft System Checklist	Function	
	OK	NOT OK
DME		
Audio		
Generators / Inverters		
GPS System		
Compass 1		
ADF		
VHF / NAV1 all channels		
VHF / NAV 2 all channels		

Post Installation Check

Aircraft System Checklist	Function	
	OK	NOT OK
Marker Receiver		
Motor(s)		
Engine Instruments		
Storm scope		
Transponder		
Air Data Computer		
Autopilot and Servos		

- Power the GPS and make sure that not less than 5 satellites are tracked.
- Do a check for interference between the VHF-COM and the GPS receiver (when activated in NAV mode).
- Select the channels/frequencies as follows on the device and on each frequency stay in TX and RX mode for at least 30 seconds.
- Make sure that the GPS integrity flag is always out of view.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
121.140	121.1416	131.240	131.2416
121.150	121.1500	131.250	131.2500
121.155	121.1500	131.255	131.2500
121.160	121.1583	131.260	131.2583
121.165	121.1666	131.265	131.2666
121.175	121.1750	131.275	131.2750
121.180	121.1750	131.280	131.2750
121.185	121.1833	131.285	131.2833
121.190	121.1916	131.290	131.2916
121.200	121.2000	131.300	131.3000
121.205	121.2000	131.305	131.3000
121.210	121.2083	131.310	131.3083

For the other avionic equipment repeat all interference tests during a flight and include all equipment not before examined on ground. A communication performance check in the low, mid and high frequency band of the device should be included.

- Make sure that the receiver output supplies a clear and understandable audio output.
- Make sure that the transmitter supplies a report of reliable communications by contacting another station.
- Do a range test with a station at least 100 m from your own position.
- Examine the intercom function, speak into the microphone while the engine is in operation at cruising rpm. You should hear yourself and/or your co-pilot loud and clear.
- Set squelch to "ON" and make sure that the normal radio noise, without a present carrier signal, will be constantly suppressed.

NOTICE: The squelch threshold can be set in the pilot menu of RCU6512 only (for details please refer to RCU6512 I&O manual).

2.8.6 Flight Test Check

- It is recommended to do a flight test as final installation verification.
- The performance of the device may be examined by contacting a ground station at a range of at least 50 NM while maintaining an appropriate altitude and over all normal flight attitudes.
- Examine the performance in the low, mid and high band frequencies.

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3 Operation

In this chapter you can read about:

3.1	General.....	53
3.1.1	Registration of the Device.....	53
3.2	Device Description	53
3.2.1	Device Assignment	53
3.3	Operation with RCU6512	54
3.4	Operation with RMU5000.....	54
3.5	Operation with OEM Controller	54
3.6	Start-Up.....	54
3.6.1	Built In Tests (BIT).....	54
3.6.1.1	Initiated Built In Test (IBIT).....	56
3.6.1.2	Power On Built In Test (PBIT).....	56
3.6.1.3	Continuous Built In Test (CBIT)	56
3.6.2	Device Status - Error Indication	57
3.6.2.1	Audible Error Announcement.....	57
3.6.2.2	Status & Error Indication	57
3.6.2.3	No Error.....	57
3.6.2.4	Test in Progress	58
3.6.2.5	Internal Failure Indication.....	58
3.6.2.6	External Failure Indication.....	58
3.6.2.7	Failure Indication when an "Internal" or "External" Failure is found.....	59
3.6.2.8	Error History Flags in the Service Set up.....	59
3.7	RS422 Protocol supported by RT6512	59
3.8	ARINC 429 Protocol supported by RT6512	59
3.9	Read Out and Reset Error/Failure Flags	59
3.10	Warning and Failure Indications	60
3.11	Contact Data	62

3.1 General

This section contains general information and instructions for safe operation.

3.1.1 Registration of the Device

ObeY the national requirements for operation of radio equipment.

3.2 Device Description

The RT6512 is a remote-control device, which does not include a control panel.

It can be operated by the Becker Avionics RCU6512 or RMU5000 using the RS422 control bus, or any OEM control device using the ARINC 429 control bus with standard label format.

3.2.1 Device Assignment

This manual is valid for the devices:

- RT6512-(100) + accessories.
- RT6512-(200) + accessories.

See also page 32.

3.3 Operation with RCU6512

For detailed information refer to the manual RCU6512 Installation and Operation DV17551.03 (Article-No. 0645.230-071).

3.4 Operation with RMU5000

For detailed information refer to the manual RMU5000 Installation and Operation DV64301.03 (Article-No. 0541.958-071).

3.5 Operation with OEM Controller

For detailed information refer to the manual of the related product.

3.6 Start-Up

3.6.1 Built In Tests (BIT)

The RT6512 has an advanced Built-In-Test. It monitors most of internal circuits against failures. In addition, the BIT monitors some external (installation) conditions to increase RT6512's reliability.

There are three types of BIT implemented:

- **PBIT** (starts after Power ON the device),
- **IBIT** (initiated by special command through serial protocol)
- **CBIT** (which continuously monitors transceiver operation).

These functions are examined under BIT:

- Power Supply (PSB Error)
 - The BIT function monitors internal power supply conditions. "*PSB error*" is shown as "Internal Failure".
- Control Unit (CU) Lost Connection Error
 - If the RT6512 does not receive any valid frame through the RS422 serial interface each 5 seconds, then "CU Lost Connection Error" is shown as "External Failure".
 - If the RT6512 is controlled by ARINC 429 interface, and detects that "CU Lost Connection Error" is disabled.
 - If the RT6512 operates in Emergency Mode, and detects that "CU Lost Connection Error" is disabled.
- Channel Error
 - If the RT6512 receives an invalid channel name, then "Channel Error" is shown as "External Failure".
- RX Synthesizer Error
 - The RT6512 monitors the RX synthesizer(s).
 - If there is an error behavior, "RX Synthesizer Error" is shown as "Internal Failure".
- RX AGC Error
 - The AGC voltage of the RX (RF-AGC) is monitored.
 - If there is an error behavior, "RX AGC Error" is shown.

- TX Output Power Error
 - In TX mode, the RT6512 monitors the forward power at the antenna connector.
 - If there is an error behavior, "TX Output Power Error" is shown as "Internal Failure".
 - While the error is shown the RT6512 stays in RX mode.
- TX Synthesizer Error
 - The RT6512 monitors the TX synthesizer while it supplies the TX signal.
 - If there is an error behavior, and the /PTT input is active (low), "TX synthesizer error" is shown as "Internal Failure".
 - While the error is shown is shown the RT6512 stays in TX-Off-condition.
- TX OFF-Overtemp Error

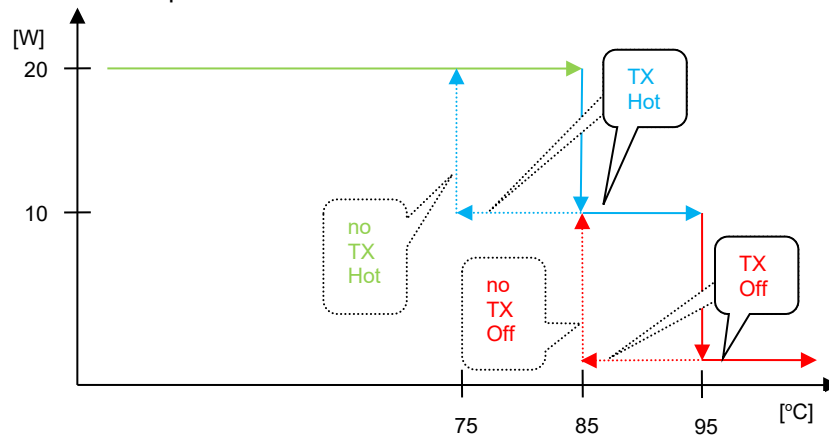


Figure 17: Thermal Behavior for TX Function

- The RT6512 monitors the heat sink temperature.
 - If the heat sink temperature is more than +95 °C at the point of measurement and the /PTT input has low state, "TX OFF-Overtemp Error" is shown as "External Failure"
 - While the error is shown the RT6512 stays in TX-off-condition.
 - The error indication gets out of view when the heat sink temperature is < +85 °C at the point of measurement.
- TX Hot Error
 - The RT6512 monitors the heat sink temperature.
 - If the heat sink temperature is more than +85 °C at the point of measurement and the /PTT input has low state, "TX Hot Error" is shown as warning.
 - While the error is shown the RT6512 stays TX mode, TX output power is decreased to a safe level.
 - The error indication gets out of view when the heat sink temperature is < +75 °C at the point of measurement.
 - Antenna VSWR Error
 - In TX mode, the RT6512 monitors the VSWR at the antenna connector.
 - If the VSWR mismatches to more than 1:8, "Antenna VSWR Error" is shown as "External Failure".
 - While the error is shown the RT6512 stays in TX mode, the output power is decreased to a safe level.
 - Stuck PTT Error
 - When the PTT key is pushed a timer starts (time adjustable see "Transmitter Data" page 23).
 - If there is a "Stuck PTT Error", the RT6512 changes to the RX-mode.
 - While the error is shown the RT6512 stays in a Stuck-PTT-condition.

Start-Up

3.6.1.1 Initiated Built In Test (IBIT)

- The test routine IBIT starts with a special command through serial interface.
- The green LED on RT6512 flashes for approx. 2 s during the IBIT operates.

NOTICE

It is not possible to stop an already started self-test.

The test routine IBIT examine these functions:

- PSB Error
- CU Lost Connection Error
- Channel Error
- RX Synthesizer Error
- RX AGC Error
- TX Output Power Error
- TX Synthesizer Error
- TX OFF-Overtemp Error
- TX Hot Error
- Antenna VSWR Error
- Stuck PTT Error

3.6.1.2 Power On Built In Test (PBIT)

- The PBIT starts automatically and immediately after RT6512 power-on.
- The PBIT examines the same function as in the IBIT. The error indication is the same as for IBIT.
- The RT6512 sends a NOGO audio signal on LINE_OUT after an error is found (depends on software version).

3.6.1.3 Continuous Built In Test (CBIT)

The CBIT operates permanently "in the background" and examine these functions:

- PSB Error
- CU Lost Connection Error
- Channel Error
- RX Synthesizer Error
- TX Output Power Error
- TX Synthesizer Error
- TX OFF-Overtemp Error
- TX Hot Error
- Antenna VSWR Error

3.6.2 Device Status - Error Indication

3.6.2.1 Audible Error Announcement

With software ≤ SCI1025S305 Version 145 only (see device type plate).

⚠ CAUTION Behavior in the event of a fault:
During flight, change to another VHF radio and return the device to a Becker Avionics service center for repair.

The RT6512 sends a NOGO audio signal on LINE_OUT if the error indication is changes from: "No Error" or "Warning" to: "Internal Failure" or/and "External Failure".

The NOGO signal characteristics:

Function	Value
Amplitude	Pulse modulated sine wave
Pulse Frequency	800 Hz
Interrupt duration before first burst	70 milliseconds
Pulse duration	60 milliseconds (3 times)
Interrupt duration	60 milliseconds (3 times)
Interrupt duration after last burst	70 milliseconds
Audio level	Same as in RX mode at (90% AM, -53 dBm, AF-AGC on)

3.6.2.2 Status & Error Indication

The RT6512 error status is shown by three LEDs on front side.

⚠ CAUTION Behavior in the event of a fault:
During flight, change to another VHF radio and return the device to a Becker Avionics service center for repair.

3.6.2.3 No Error

Output / Indicator	Status	Remarks
Green LED	ON	No error found.
Yellow LED	OFF	-
Red LED	OFF	-
RS422	-	All errors accessible via the serial RS422 interface are set to zero.
ARINC 429	-	With software ≥ SCI1025S305 Version 146 (see device type plate): <ul style="list-style-type: none"> All errors accessible via the ARINC429 interface are set to zero.
Status output /FAILURE	inactive	-

3.6.2.4 Test in Progress

Output / Indicator	Status	Remarks
Green LED	blinking	Approx. 0.125 s ON and 0.125 s OFF.
Yellow LED	OFF	-
Red LED	OFF	-
RS422	-	All errors accessible via the serial RS422 interface are set to zero.
ARINC 429	-	With software \geq SCI1025S305 Version 146 (see device type plate): <ul style="list-style-type: none"> All errors accessible via the ARINC 429 interface are set to zero. Self-test in progress is reported in SSM field of ARINC frames.
Status output /FAILURE	inactive	-

After the test is completed, RT6512 automatically changes to receive mode.

3.6.2.5 Internal Failure Indication

⚠ CAUTION

Behavior in the event of a fault:

During flight, change to another VHF radio and return the device to a Becker Avionics service center for repair.

Output / Indicator	Status	Remarks
Green LED	OFF	-
Yellow LED	OFF	Will also be ON if an " <i>External Error</i> " is found at the same time.
Red LED	ON	-
RS422	-	The error is accessible via the serial RS422 interface.
ARINC 429	-	With software \geq SCI1025S305 Version 146 (see device type plate): <ul style="list-style-type: none"> The error is accessible via the serial ARINC 429 interface.
Status output /FAILURE	active	Logical "or" of events above

3.6.2.6 External Failure Indication

⚠ CAUTION

Behavior in the event of a fault:

During flight, change to another VHF radio but if problem remains, use any communication backup mean.

Examine the wiring or the control device.

Output / Indicator	Status	Remarks
Green LED	OFF	-
Yellow LED	ON	-
Red LED	OFF	Will also be ON if an " <i>Internal Error</i> " is found at the same time.
RS422	-	The error is accessible via the serial RS422 interface.
ARINC 429	-	With software \geq SCI1025S305 Version 146 (see device type plate): <ul style="list-style-type: none"> The error is accessible via the serial ARINC 429 interface.
Status output /FAILURE	active	-

3.6.2.7 Failure Indication when an "Internal" or "External" Failure is found

⚠ CAUTION

Behavior in the event of a fault:

During flight, change to another VHF radio and return the device to a Becker Avionics service center for repair.

Output / Indicator	Status	Remarks
Green LED	OFF	-
Yellow LED	ON	-
Red LED	ON	-
RS422	-	The error is accessible via the serial RS422 interface.
ARINC 429	-	With software \geq SCI1025S305 Version 146 (see device type plate): <ul style="list-style-type: none"> The error is accessible via the serial ARINC 429 interface.
Status output /FAILURE	active	-

3.6.2.8 Error History Flags in the Service Set up

- If an error occurs one or more time(s) the related error history flag will be set.
- The error history flag will be available for a time of 10 operating seconds after the error gets out of view.
- The state of all error history flags is stored at each power OFF.
- The error history flags can be read in the service setup.
- The error history flags can be erased from the service setup.

3.7 RS422 Protocol supported by RT6512

Detailed information on request.

3.8 ARINC 429 Protocol supported by RT6512

Detailed information on request.

3.9 Read Out and Reset Error/Failure Flags

- It is possible to read out and reset error flags.
- For this you can use the Becker Avionics remote control unit RCU6512 or the Becker Avionics radio management unit RMU5000 or a connected OEM product.
For detailed information refer to the manual of the related product.

3.10 Warning and Failure Indications

Problem/Symptom	Action/Check*
The device does not power on:	<ul style="list-style-type: none"> • Examine cables, power supply, fuse. Possible sources for failure/error: <ul style="list-style-type: none"> • Power supply < 18 V. • /ON line is not activated by controller. • Controller damaged.
The device does not operate after power on:	<ul style="list-style-type: none"> • Examine if internal error latch is "1". • Examine if TX PSB is "1". Possible sources for failure/error: <ul style="list-style-type: none"> • Device damaged.
No control through the connected controller possible:	<ul style="list-style-type: none"> • Examine cables and installation. • Examine selected serial interface.
Operating channel cannot be changed:	<ul style="list-style-type: none"> • Examine the status of /EMERG line. Possible sources for failure/error: <ul style="list-style-type: none"> • If /EMERG line is active, operation on 121.500 MHz is forced without possibility to change it - disable /EMERG line. • Device damaged.
Weak signals are not received:	<ul style="list-style-type: none"> • Examine the RX_ATT line. • Examine the squelch threshold (adjustable by RCU6512 only). • Examine antenna VSWR error. • Examine antenna and cables. Possible sources for failure/error: <ul style="list-style-type: none"> • Active /RX_ATT line decreases sensitivity by about 20 dB - deactivate /RX_ATT line. • No reception of weak signals because of high setting of the squelch threshold - set lower squelch threshold level. • No reception of weak signals because of incorrect antenna installation.
Too low or too high volume of received signal:	<ul style="list-style-type: none"> • Examine volume setting of the controller or audio system. Set correct value.

Problem/Symptom	Action/Check*
Distortion of received signal:	<ul style="list-style-type: none"> • Examine setting. Incorrect channel name (e.g. from 8.33 spacing instead of 25 kHz spacing) - set correct channel.
No transmission:	<ul style="list-style-type: none"> • Examine cables, installation and PTT switch. • Examine if TX OFF-Overtemp error latch is "1". • Examine if TX Output Power Error latch is "1". • Examine if TX Synthesizer Error latch is "1". • Examine if TX PSB Error latch is "1". <p>Possible sources for failure/error:</p> <ul style="list-style-type: none"> • No transmission because of high temperature > +95 °C (stop transmission for a few minutes). • Device damaged.
Transmission stops after 30... 180 s:	<ul style="list-style-type: none"> • Release the PTT switch and push again. <p>Possible sources for failure/error:</p> <ul style="list-style-type: none"> • Stuck PTT function.
Transmission stops after long, consecutive transmissions:	<ul style="list-style-type: none"> • Examine if TX OFF-Overtemp error latch is "1". <p>Possible sources for failure/error:</p> <ul style="list-style-type: none"> • No transmission because of high temperature > +95 °C (stop transmission for a few minutes).
Transmission is significantly decreased:	<ul style="list-style-type: none"> • Examine if antenna VSWR error latch is "1". • Examine if TX Hot error latch is "1". • Examine antenna and cables. <p>Possible sources for failure/error:</p> <ul style="list-style-type: none"> • Incorrect antenna installation increases the loss during transmission. • High temperature > +85 °C decreases transmitter power (stop transmission for a few minutes).

*For detailed information refer to the related manual e.g. RCU6512 Installation and Operation DV17551.03 (Article No. 0645.230 071)

3.11 Contact Data

In case of additional questions contact your local Becker Avionics dealer or forward your request direct to Becker Avionics "Customer Service".

In the event of damage or a defect, the entire device must be returned for repair. The repair must be done by trained Becker Avionics personnel.

For department and addresses, please see contact info page 2.

Any change by the user excludes any liability on our part (excluding the work described in this manual).

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4 Index

Abbreviations	8	Pressurised cabin	36
Accessories	29	Radiation risk	36
Airworthiness	24	Safety Definitions	9
ARINC 429 Protocol	59	Type Plate	33
Associated Devices	13	Units	9
Conditions of Utilization	10	Variants Overview	13
Dimensions	39	Warning and Failure Indications	60
Error-History-Flags	59	Warranty Conditions	10
Installation Requirements	34	Wiring	44
Non-Warranty Clause	10		

We reserve the right to make technical changes.
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