

**Remote -
Controlled VHF-AM
Transceiver**

RT5202

RT5202-(01)

RT5202-(02)

Installation and Operation

Manual DV68001.03

Issue 02 November 2015

Article-No. 0566.731-071

Preface

Dear Customer,

Thank you for purchasing a BECKER product.

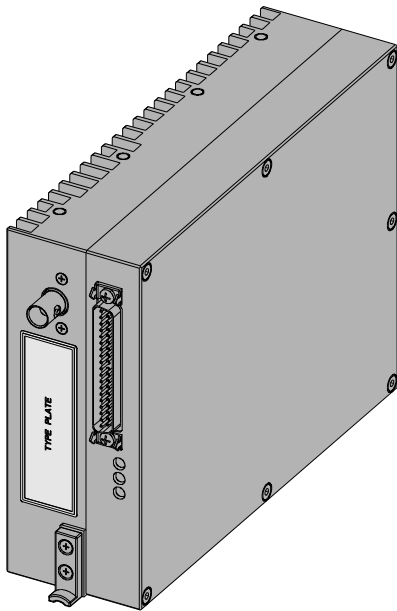
We are pleased that you have chosen our product and we are confident that it will meet your expectations.

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 ISO 9001 and DIN EN 9100 standards.

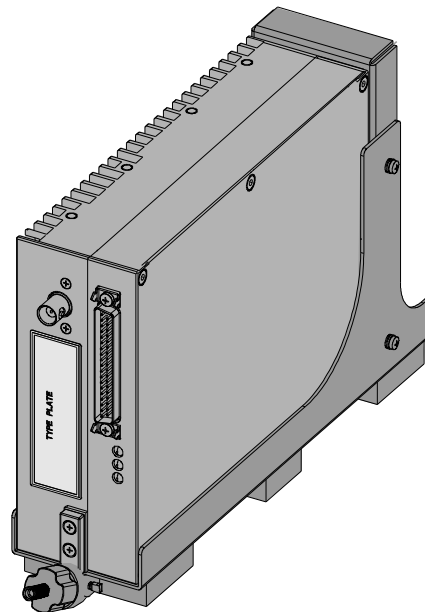
Our competent customer support department will respond on any technical question you may have.

Please do not hesitate to contact us at any time.

Remote - Controlled VHF-AM Transceiver



RT5202



RT5202
with mounting frame MT5202

Table of Contents

1. General Description	9
1.1. Introduction.....	9
1.2. Purpose of Equipment.....	10
1.3. Variants Overview	10
1.4. General Description.....	10
1.4.1. Receive Mode	10
1.4.2. Transmit Mode	10
1.4.3. Audio Inputs / Outputs.....	11
1.4.4. Control Inputs / Outputs	11
1.4.5. Status and Control Outputs.....	12
1.4.6. Serial Interface to the Control Unit.....	12
1.5. Mechanical Construction	13
1.6. Power on BIT (PBIT)	13
1.7. Continuous BIT (CBIT)	13
1.8. Test mode IBIT	15
1.9. Technical Data.....	17
1.9.1. Transceiver Data.....	17
1.9.2. Receiver Data.....	17
1.9.3. Transmitter Data	18
1.9.4. Dimensions & Weight.....	19
1.9.5. Environmental Condition	20
1.10. Software	20
1.11. Order Code.....	21
1.11.1. RT5202.....	21
1.11.2. Accessories	21
2. Installation	23
2.1. Packaging, Transport, Storage.....	23
2.1.1. Packaging Material and Transport	23
2.2. Device Assignment.....	24
2.2.1. Scope of Delivery	24
2.2.2. Additional Required Equipment.....	24
2.2.3. Type Plate	25
2.3. Mounting Requirements	26
2.3.1. Order of Installation	26
2.4. Dimensions.....	27
2.4.1. RT5202.....	27
2.4.2. Mounting Frame	28
2.5. Electrical Installation.....	29
2.5.1. Connector Pin Assignments.....	29
2.5.2. Microphone Connection	30
2.5.3. Audio Input	30
2.5.4. Audio Output	30
2.5.5. Sidetone	31
2.5.6. Control Inputs.....	31
2.5.7. Status and Control Outputs.....	31
2.5.8. SQL_EVAL	31
2.5.9. RX_AGC (AGC Voltage of the RX-RF-AGC).....	32
2.6. Interfaces.....	32
2.6.1. RS422 - Serial Interface to the Control Unit.....	32
2.6.2. ARINC 429 - Serial Interface to the Control Unit	45
2.6.3. RS232 - Serial Interface to the Control Unit.....	46
2.7. Wiring Diagrams	47
2.7.1. Interface ARINC 429 Sym. Audio Output.....	47
2.7.2. Interface RS422 Sym. Audio Output.....	48

2.7.3.	Interface ARINC 429 Asym. Audio Output.....	49
2.7.4.	Interface RS422 Asym. Audio Output.....	50
2.7.5.	Interface RS232 Control via Personal Computer	51
3.	Operating Instructions	53
3.1.	Device Description	53
3.1.1.	Device Assignment	53
3.1.2.	Packing, Transport, Storage	53
3.1.3.	Scope of Delivery.....	53
3.1.4.	Type Plate.....	53
3.1.5.	Controls and Indications	54
3.2.	Operating.....	54
3.2.1.	Optical Indication	54
3.2.2.	Channel name to Frequency and Channel Spacing Assignment.....	55
3.2.3.	Antenna Input / Output.....	55
3.2.4.	Warning or Failure Indication Test Routine IBIT	55
3.2.5.	NOGO-Signal at the LINE_OUT	57
3.2.6.	Serial Interface.....	57
4.	Index	60
Figure 1:	Type plate (example).....	25
Figure 2:	Dimensions RT5202-(XX).....	27
Figure 3:	Dimensions mounting frame MT5202-01	28
Figure 4:	Wiring - ARINC 429 sym. audio output	47
Figure 5:	Wiring - RS422 sym. audio output	48
Figure 6:	Wiring - ARINC 429 asym. audio output	49
Figure 7:	Wiring - RS422 asym. audio output	50
Figure 8:	Wiring - RS232 control via personal computer.....	51
Figure 9:	RT5202-(XX) controls and indications	54

List of Abbreviations

List of Abbreviations

AGC	Automatic Gain Control
ARINC	Aeronautical Radio Incorporated (USA)
ASCII	American Standard Code for Information Interchange
AWG	American Wire Gauge
BIT	Built In Test
BCD	Binary Coded Decimal
CBIT	Continuous Built In Test
CU	Control Unit
IBIT	Initiated Built In Test
LFR	Low Frequency Radio Range
LSB	Less Significant Bit
LSD	Less Significant Digit
MSB	Most Significant Bit
MSD	Most Significant Digit
MTBF	Mean Time Before Failure

List of Abbreviations

PBIT	Power on Built In Test
PCB	Printed Circuit Board
PTT	Push To Talk
RTCA	Radio Technical Commission for Aeronautics
RX	Receiver
SINAD	Signal-to-noise and distortion ratio
SP	SPACE
SQL	Squelch
TX	Transmitter
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

Units

Units

A	Ampere
mA	Milliampere
°C	Degree Celsius
cm	Centimetre
cd/m ²	Candela Per Square Meter (1 cd/m ² = 1 nit)
dBc	Power Ratio (Decibels Relative To The Carrier Signal)
dBm	Power Ratio In Decibel
dB	Decibel
g	Gram
kg	Kilogram
kHz	Kilohertz
MHz	Megahertz
Mbps	Mega Bits Per Second
mm	Millimetre
Nm	Newton Metre
Ohm (Ω)	Resistance
s	Second
V	Volt
mV	Millivolt
W	Watt
mW	Milliwatt
"	Inch

General Safety Definitions

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

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

⚠ CAUTION Indicates a hazardous situation which, if not avoided, 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 specific safety-related instructions or procedures.

Disposal

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

This product contains materials that fall under the special disposal regulation, which corresponds to the EC directive for dangerous disposal material. We recommend disposing of the respective materials in accordance with the respectively valid environmental laws. The following table states the materials suitable for recycling and the materials which have to be disposed of separately.

Material	Suitable for recycling	Disposal
Metal	yes	no
Plastics	yes	no
Circuit boards	no	yes

Dispose of the circuit boards:

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

Warranty Conditions

User Conversions and Changes are Not Permitted

Any change made by the user excludes any liability on our part (excluding updates for the navigation data base).

- 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.
- Fix the devices according to the mounting instructions.
We cannot provide any guarantee for other mounting methods.

Conditions of Utilization

General introductory notes

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 following notes which you ought to follow closely during installation and operation.

Unless, all claims under the warranty will become void and a reduced 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.

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.....	9
1.2. Purpose of Equipment.....	10
1.3. Variants Overview	10
1.4. General Description	10
1.4.1. Receive Mode	10
1.4.2. Transmit Mode	10
1.4.3. Audio Inputs / Outputs	11
1.4.4. Control Inputs / Outputs	11
1.4.5. Status and Control Outputs	12
1.4.6. Serial Interface to the Control Unit	12
1.5. Mechanical Construction.....	13
1.6. Power on BIT (PBIT).....	13
1.7. Continuous BIT (CBIT).....	13
1.8. Test mode IBIT.....	15
1.9. Technical Data	17
1.9.1. Transceiver Data.....	17
1.9.2. Receiver Data	17
1.9.3. Transmitter Data	18
1.9.4. Dimensions & Weight.....	19
1.9.5. Environmental Condition.....	20
1.10. Software	20
1.11. Order Code.....	21
1.11.1. RT5202	21
1.11.2. Accessories.....	21

1.1. Introduction

The following manual describes the remote controlled VHF-AM transceiver RT5202.

The technical information in this manual applies to all variants of the described product. Therefore, we name the product generally "RT5202". If a description refers to only one of the product variants its full name, e.g. "RT5202-(01)", will be used.

The manuals "Maintenance and Repair" (M&R), "Installation and Operation (I&O) contain the following sections:

Section		DV68001.03 I&O
1	General	X
2	Installation	X
3	Operation	X
4	Theory of Operation	N/A
5	Maintenance and Repair	N/A
6	Illustrated Parts List	N/A
7	Modification and Changes	N/A
8	Circuit Diagrams	N/A
9	Certifications	N/A
10	Attachments	N/A

1.2. Purpose of Equipment

The remote-controlled VHF-transceiver RT5202 is for half duplex voice communication in the VHF frequency range 118.000 MHz...155.975 MHz.

RT5202-(01) = 118.000-136.975 MHz.

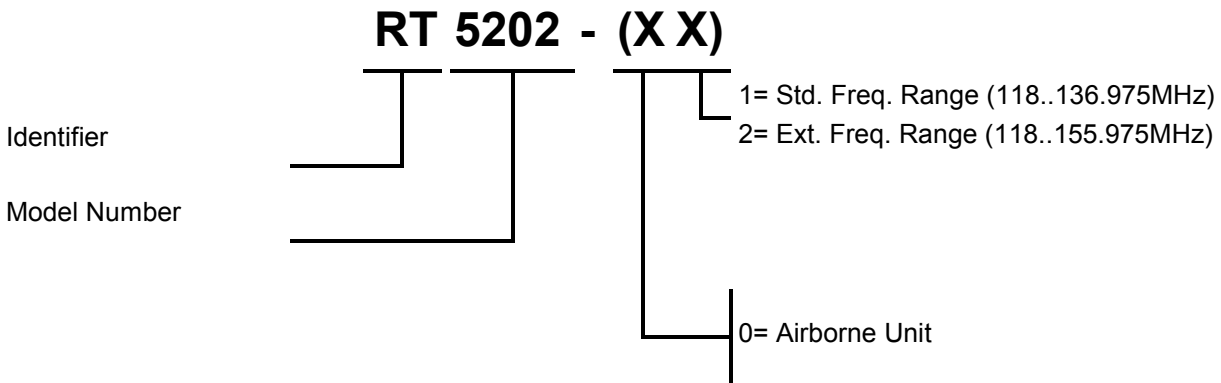
RT5202-(02) = 118.000-155.975 MHz.

The RX and the TX operate at the same frequency. The VHF-transceiver has the capability to work with the 25 kHz channel spacing and with the 8.33 kHz channel spacing.

The RT5202 is remote controlled by a control unit via an interface RS232, RS422 or via an interface ARINC 429. The RT5202 can cooperate with an Audio Selector Panel.

1.3. Variants Overview

Within the part number, the meaning of "-(XX)" is:



List of available variants:

Part-No.	Article-No.:	Frequency range
RT5202-(01)	0552.984-910	118.000-136.975 MHz
RT5202-(02)	0552.992-910	118.000-155.975 MHz

1.4. General Description

The mechanical design of the RT5202 is robust and well-suited for installation in the avionics compartment with a mounting frame (non-pressurised and in a temperature controlled location) in all types of aircraft. The RT5202 is developed to meet RTCA and EUROCAE airworthiness requirements. In the environmental categories for which it is qualified, there are no restrictions for use in any aircraft. The front of the transceiver contains the main connector "male" for connection to the aircraft wiring system, and the antenna jack "female". The green LED indicates the system is operable. The red and yellow LED indicates that a failure has occurred.

1.4.1. Receive Mode

The transceiver has a very high blocking rejection. The receiver can receive a weak signal while the second aircraft transceiver is transmitting. The transceiver operates with a double side band amplitude modulation (A3E).

1.4.2. Transmit Mode

The transceiver is equipped with a transmitter output power of 20 W under standard operating conditions. The transceiver is equipped with an output power of at least 16 W under the specified environmental operating conditions. During transmission, the transmitter provides a real sidetone signal. The sidetone signal is applicable at the LINE_OUT (if enabled) and additionally at the output SIDETONE.

The transceiver is equipped with a protective circuit for over temperature.

- When the heat sink temperature exceeds +85 °C, then the TX-output power is reduced.
- When the heat sink temperature exceeds +95 °C, then the TX mode is switched off.
- When the heat sink temperature is below +85 °C, then the TX mode is switched on again with reduced TX-output power.

The transceiver is fitted with a protective circuit to protect against jamming of the transmit button or a short circuit on the key supply line. The time limit setting for the "Stuck PTT" is variable between 30 s and 3 minutes. The time limit settings are given in the factory setup. The "Stuck PTT Error protection" can enabled/ disabled in the factory setup.

1.4.3. Audio Inputs / Outputs

1.4.3.1. *Standard Microphone Input*

The transceiver is designed for a standard microphone, unbalanced, DC coupled, providing the power supply for the mike. The input is connected to a dynamic volume compressor which keeps the modulation factor constant over a wide input voltage range.

1.4.3.2. *Audio Input LINE IN*

The transceiver is designed for a symmetrical line input which has no DC connection to ground. Input impedance is 600 Ω. The maximum input level without clipping is 6 V.

1.4.3.3. *Audio Output LINE OUT*

The audio output is designed for symmetrical line output. The output power is 100 mW into 600 Ω or 200 mW into 150 Ω with the maximum audio power setting (Volume).

1.4.3.4. *Sidetone Output*

This additional sidetone output is a direct DC coupled output, which is linear to the square root of the forward power. The output resistance is < 5000 Ω.

1.4.4. Control Inputs / Outputs

1.4.4.1. */ON Line (Device ON/OFF Input)*

The ON/OFF line is active if the level on the ON-input is less than 4.0 V or a resistance less than 1000 Ω is connected to ground.

The ON/OFF line is inactive if the level on the ON-input is higher than 8.0 V or a resistance higher than 50 kΩ is connected to ground.

1.4.4.2. */PTT Line (PushTo Talk Input)*

The PTT line is active if the level on the PTT-input is less than 4.0 V or a resistance less than 1000 Ω is connected to ground.

The PTT line is inactive if the level on the PTT-input is higher than 8.0 V or a resistance higher than 50 kΩ is connected to ground.

1.4.4.3. */RX_ATT (External RX Attenuation Control)*

The RX_ATT line is active if the level on the RX_ATT-input is less than 4.0 V or a resistance less than 1000 Ω is connected 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 kΩ is connected to ground.

1.4.4.4. */TX_ENABLE (Enabling the TX)*

The TX_ENABLE line is active if the level on the TX_ENABLE-input is less than 4.0 V or an external resistance lower than 1000 Ω is connected to ground.

The TX_ENABLE line is inactive if the level on the TX_ENABLE-input is higher than 8.0 V or an external resistance higher than 50 kΩ is connected to ground.

1.4.4.5. */SERV_EN (Enabling the Setup Modes)*

The SERV_EN line is active if the level on the SERV_EN-input is less than 4.0 V or an external resistance lower than 1000 Ω is connected to ground.

The SERV_EN line is inactive if the level on the SERV_EN-input is higher than 8.0 V or an external resistance higher than 50 k Ω is connected to ground.

1.4.5. Status and Control Outputs

1.4.5.1. TEST_OK

These outputs are coupled to the status shown at the status LEDs mounted at the connector side of the transceiver.

TEST_OK corresponds to the status of the green LED

- The green LED is displayed when the test result in the transceiver is ok.
- As long as the test key is pressed, the green LED will flash.

FAILURE corresponds to output of the OR function of the red and the yellow LED

- The red LED is displayed when the failure is internal in the transceiver.
- The yellow LED is displayed when the failure is external.

The output line /TEST_OK and /FAILURES are open collector type.

- If the test function is ok the transistor in the /TEST_OK line is ON. If the current 100 mA at the supply voltage 27 V is not sufficient, then an external control relay must be inserted.
- When the test function is not ok the transistor in the /failure line is ON. When the current 100 mA at the supply voltage 27 V is not sufficient, then an external control relay must be inserted.
- The outputs are protected against spikes produced from a relay which could be connected to this output.

1.4.5.2. 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 within the range of 0...5 V when the input level at the antenna input is varied from -105...+13 dBm. The output resistance is less than 5000 Ω .

1.4.5.3. SQL_EVAL

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

The output is an open collector type with capability to:

- Sink min. 100 mA current to ground with a voltage loss of less than 2 V (corresponding LED is on).
- Sink max. 0.1 mA current to ground for output voltage 28.0 V when in "inactive" state (LED off).
- The output is protected against spikes produced from a relay which could be connected to this output.

1.4.6. Serial Interface to the Control Unit

1.4.6.1. Serial Interface ARINC 429

- ARINC 429 Interface RX_A
- ARINC 429 Interface RX_B
- ARINC 429 Interface TX_A
- ARINC 429 Interface TX_B

1.4.6.2. **Serial Interface RS422**

- RS422 Interface RX Line +
- RS422 Interface RX Line –
- RS422 Interface TX Line +
- RS422 Interface TX Line –

1.4.6.3. **Serial Interface RS232**

- RS232 Interface RX Line
- RS232 Interface TX Line

1.5. **Mechanical Construction**

The device circuits are placed on several printed circuit boards "PCBs" which are connected to each other by connectors.

At the front of the transceiver you will find connectors for aircraft wiring and antenna and three LEDs for status indication of the RT5202.

1.6. **Power on BIT (PBIT)**

The PBIT is automatically triggered and performed immediately after the transceiver is switched on.

The PBIT checks the same function as described in the IBIT. The error indication is the same as IBIT.

The transceiver immediately produces a NOGO-Audio Signal at the LINE_OUT if a failure is detected.

1.7. **Continuous BIT (CBIT)**

The CBIT test runs permanently "in the background" while RT5202 is operating. Following functions will be checked:

- Power supply (PSB error)
This error is indicated as an "internal failure".
- Control unit connection
When RT5202 does not receive any correct frame over the serial interface for a longer time than 5 s then the "control unit lost connection error" appears. This error is indicated as an "external failure".
- Channel error
When RT5202 receives an invalid channel name then the "channel error" appears. This error is indicated as an "external failure".
- RX synthesizer error
RT5202 monitors the RX synthesizer (s). If error behaviour is detected, then a "RX synthesizer error" appears. This error is indicated as an "internal failure".
- TX output power error
In TX-mode RT5202 is monitoring the forward power out going of the antenna connector. If error behaviour is detected, then a "TX output power error" is indicated. This error is indicated as an "internal failure".
If "TX output power error" appears in the TX-mode the transceiver is switched to the RX-mode. As long as the "TX output power error" is indicated, the transceiver stays in TX-off-condition.
- TX synthesizer error
RT5202 is monitoring the TX synthesizer (s) used for generating the TX-signal. If error behaviour is detected and on the /PTT input a low state is detected, RT5202 indicates "TX synthesizer error". This error is indicated as an "internal failure".
As long as the "TX synthesizer error" is indicated, RT5202 stays in TX-Off-condition.

- **TX OFF - over temp. error**
 RT5202 is monitoring the heat sink temperature. If the heat sink temperature exceeds +95 °C at the point of measurement and on the /PTT input a low state is detected, RT5202 indicates a "TX Off - over temp. error". As long as the "TX Off -over temp. error" is indicated, RT5202 stays in TX-Off-condition.
 The error indication disappears when the heat sink temperature has fallen below +85 °C at the point of measurement. This error is indicated as an "external failure".
- **TX hot error**
 RT5202 is monitoring the heat sink temperature. If the heat sink temperature exceeds +85 °C at the point of measurement and on the /PTT input a low state is detected, RT5202 indicates a "TX hot error".
 The error indication disappears when the heat sink temperature has fallen below +75 °C at the point of measurement.
 This error is indicated as a warning. As long as the "TX hot error" is indicated and RT5202 is in TX-mode, than TX output power is reduced.
- **Antenna VSWR error**
 In TX-mode RT5202 is monitoring the VSWR at the antenna connector. If the VSWR is mismatched, "Antenna VSWR Error" is indicated.
 If Antenna VSWR Error" is detected, RT5202 stays in TX-mode. As long as the error is indicated, the output power is reduced. This error is indicated as an "external failure".
- **Jamming of the transmit button**
 When the PTT-key is pressed, a timer is started. The time limit setting is adjustable in the factory setup from 30...180 s. The "Stuck PTT error detection" can be enabled/ disabled in the factory setup.
 When the "Stuck PTT error" is detected, RT5202 switches to the RX-mode. As long as this error is indicated RT5202 stays in a Stuck-PTT-condition.
- **Audible error announcement**
 RT5202 immediately produce NOGO-audio signal at the LINE_OUT if a failure is detected. The NOGO-signal has the following characteristics:

Pulse modulated sine wave:	800 Hz
Interrupt duration before first burst:	70 ms
Pulse duration:	60 ms (3 times)
Interrupt duration:	60 ms (3 times)
Interrupt duration after last burst:	70 ms
Level:	The same as in RX mode (90% AM, -53 dBm, AF-AGC on)

1.8. Test mode IBIT

- The test routine IBIT is activated by pressing the test button on the control unit.
 - During the automatic test (ca. 2 s) the green LED is flashing (front).

NOTICE

It is not possible to interrupt a started selftest.

When the test result is positive

- Green LED is on (front)
- Yellow LED is off (front)
- Red LED is off (front)
- All errors accessible via the serial RS422 interface are zero
- Status output /TEST_OK is active
- Status output /FAILURE is inactive

In the test phase of the selftest:

- Green LED is blinking (front)
The blinking period is 0.125 s on/0.125 s off
- Yellow LED is off (front)
- Red LED is off (front)
- All errors accessible via the serial RS422 interface are zero
- Status output /TEST_OK is blinking (like the green LED)
- Status output /FAILURE is inactive

Internal failure indication

- Green LED is off (front)
- Yellow LED is off, except when an "external error has been indicated" (front)
- Red LED is on (front)
- Error is be accessible via the serial RS422 interface
- Status output /TEST_OK is inactive
- Status output /FAILURE is active

External failure indication

- Green LED is off (front)
- Yellow LED is on (front)
- Red LED is off, except when an "internal error has been indicated" (front)
- Error is accessible via the serial RS422 interface
- Status output /TEST_OK is inactive
- Status output /FAILURE is active

Failure indication in the case that an "internal failure" and an "external failure" is indicated

- Green LED is off (front)
- Yellow LED is on (front)
- Red LED is on (front)
- Error is accessible via the serial RS422 interface
- Status output /TEST_OK is inactive
- Status output /FAILURE is active

When the the test is finished the transceiver goes to receive mode.

The test routine IBIT checks the following functions:

- Test-channels
- PSB error
- Control unit lost connection error
- Channel error
- RX synthesizer error
- RX AGC error
- TX output power error
- TX synthesizer error
- TX OFF-over temp. error
- TX hot error
- Antenna VSWR error
- Stuck PTT error
- TX-test-signal
- Error-history flags in the service setup

All errors which occur one or more time(s) set the corresponding error-history-flag.

The error-history-flag stays set for a time of 10 operating hours after the error has disappeared. The state of all error-history flags is stored at power off. The error-history-flags are readable in the service setup. The error history-flag can be cleared immediately at service setup.

1.9. Technical Data

RT5202	Specifications
Power supply	28 VDC (22...30.3 V)
Emergency voltage	18 V
Current consumption	< 0.6 A receive < 7 A transmit
Power-up time	4 s
Frequency range	118.000...136.975 MHz (standard) 118.000...155.975 MHz (extended)
Channel spacing	25 kHz / 8.33 kHz
Recommended overload protection	10 A
Mean Time Before Failure (MTBF)	12 000 h

1.9.1. Transceiver Data

RT5202	Specifications
Switch on time	< 4 s
Channel selection time	< 700 ms
Switching time RX to TX	< 50 ms
Switching time TX to RX	< 50 ms
Antenna impedance	50 Ω

1.9.2. Receiver Data

RT5202	Specifications
Sensitivity (at 30% modulation&1000 Hz)	\leq -102 dBm for 12 dB SINAD
Dynamic range (AGC characteristic)	-102...+ 13 dBm for < 6 dB audio power change
Band width 8.33 kHz	\geq \pm 2.78 kHz (6 dB pass band) \leq \pm 7.37 kHz (60 dB stop band)
Band width 25 kHz	\geq \pm 8 kHz (6 dB pass band) \leq \pm 25 kHz (60 dB stop band)

RT5202		Specifications
Adjacent channel rejection	25 kHz 8.33 kHz	≥ 70 dB (SINAD reduction 12 dB \rightarrow 6 dB) ≥ 60 dB (SINAD reduction 12 dB \rightarrow 6 dB)
Spurious response rejection		≥ -23 dBm for 6 dB (S+N)/N
Intermodulation rejection		against FM: -5 dBm \rightarrow (S+N)/N < 6 dB Two Tone Test: 70 dB
Cross modulation rejection		≥ 80 dB (SINAD reduction 30 dB \rightarrow 20 dB)
Blocking level (S+N)/N of wanted signal > 6 dB		-87 dBm wanted signal -33 dBm unwanted signal at Df < 100 kHz -7 dBm unwanted signal at 100 kHz < Df < 3 MHz +10 dBm unwanted signal at Df > 3 MHz
Squelch (threshold levels)	Noise squelch Carrier override squelch	6...23 dB adjustable - 93...-87 dBm adjustable
Squelch attack times	Noise squelch Carrier override squelch	< 60 ms < 50 ms
Audio output power at LINE_OUT Symmetrical audio output		adjustable from: < 1.0...> 100 mW (ca. 40 dB) 100 mW/600 Ω , 200 mW/150 Ω
Audio response 8.33 kHz reference 0 dB, 1 kHz		350...2500 Hz – 2 dB <ripple< +4 dB
Audio response 25 kHz reference 0 dB, 1 kHz		300...2500 Hz – 2 dB <ripple< +4 dB
Audio noise		> 40 dB (S+N)/N at -13 dBm
Harmony distortion		< 5% 350...2500 Hz, 10 mW < 15% 350..2500 Hz, 100 mW

1.9.3. Transmitter Data

RT5202		Specifications
TX power output (carrier level)		≥ 16 W Reduction of not more than 6 dB during the application of the short time high temperature test ≥ 20 W at 28 V
TX output power for VSWR = 3:1		$\geq 40\%$ of the manufactures declared value
Modulation type		A3E

RT5202		Specifications
Modulation factor		$\geq 85\%$, $\leq 90\%$
Frequency deviation		$\leq 0.0005\%$ (± 5 PPM)
Modulation distortion		$\leq 10\%$
Adjacent channel power	25 kHz	≤ 50 dBc
	8.33 kHz	≤ 60 dBc
Standard microphone asymmetric line input		100 mV...3 V at 150 Ω 200 mV...6 V / 600 Ω
Emission of harmony and spurious energy		$\leq 2.5 \times 10^{-5}$ W
Spurious emissions within the 108...117.95 MHz range		$\leq 2 \times 10^{-7}$ W
Audio-frequency response		< 6 dB variance of output carrier modulation over an audio input range of 350...2500 Hz
Distortion at 85% modulation		$\leq 10\%$
Sidetone audio output symmetrical		internally adjustable up to 100 mW 600 Ω
Carrier noise level		35 dB below detected output when output carrier is 70% modulated at 1000 Hz

1.9.4. Dimensions & Weight

RT5202		Specifications
Dimensions HxWxD		153 mm x 60 mm x D see "Dimensions", page 27
Dimensions with cable connector HxWxD		60 mm x 153 mm x D see "Dimensions", page 27
Weight without mounting frame		≤ 2100 g
Weight mounting frame		≤ 450 g

1.9.5. Environmental Condition

The device has been designed to be compliant with the following categories of EUROCAE/RTCA Document No. ED-14C/DO-160D.

Condition	Section	Cat.	Description
Temperature	4.0	D1	
Low Operating Temperature	4.5.1		-40 °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 Temperature (Storage Temperature)			+85 °C
Min. Operating Pressure (Equivalent Altitude)	4.6.1		50 000 ft.
Decompression	4.6.2		from 8000...50 000 ft. altitude
Overpressure	4.6.3		-15 000 ft.
Temperature Variation	5.0	B	
Humidity	6.0	A	48 h at up to 50 °C and 95% relative humidity
Shock:	7.0		
Operational Shocks dimensional	7.2	B	only mounting: 11 ms at 6 G for all three dimensional axes
Crash Safety Shocks dimensional	7.3		only mounting: 11 ms at 20 G for all three axes
Vibration	8.0	SU	only mounting: Category S – Curve M Category U - Curve G
Magnetic Effect	15.0	Z	Deflection of 1° of compass at a distance of ≤ 30 cm

1.10. Software

Synthesis, storage and indication of frequencies are microprocessor controlled. The corresponding software has been assigned to criticality level.

Essential as defined in the guidelines of RTCA document DO-178B.

1.11. Order Code

1.11.1. RT5202

Qty	Device	
1	RT5202-(01), 118.000-136.975 MHz	Article-No. 0552.984-910
1	RT5202-(02), 118.000-155.975 MHz	Article-No. 0552.992-910

1.11.2. Accessories

Qty		
1	Mounting kit MT5202-01	Article-No. 0567.221-284

Qty	Connector kit complete soldering version	Article-No. 0775-215-954
1	Cable connector 37pol female (soldering version complete)	
1	Connector housing with sliding closure	

Qty	Connector kit complete crimp version CK5202-C	Article-No. 0588.229-954
1	Cable connector 37pol female	
2	Looking device	
1	Connector housing	

Qty		
1	Coaxial connector (antenna)	Article-No. 0725.706-277

Qty		
1	Transmit button, PTT-key 10 mm US509	Article-No. 0481.556-278

Qty	Available Documentation	
1	Manual Installation and Operation RT5202-(0X), English	Article-No. 0566.731-071

General Description

Order Code

Blank

2. Installation

This manual must be available close to the device during the performance of all tasks.

Careful planning should be applied to achieve the desired performance and reliability from the product. Any deviations from the installation instructions prescribed in this document are under own responsibility.

The installation of the RT5202 depends on the type of aircraft and its equipment. Therefore only general information can be given in this chapter.

In this chapter you can read about:

2.1. Packaging, Transport, Storage	23
2.1.1. Packaging Material and Transport.....	23
2.2. Device Assignment	24
2.2.1. Scope of Delivery.....	24
2.2.2. Additional Required Equipment	24
2.2.3. Type Plate.....	25
2.3. Mounting Requirements	26
2.3.1. Order of Installation.....	26
2.4. Dimensions.....	27
2.4.1. RT5202	27
2.4.2. Mounting Frame.....	28
2.5. Electrical Installation	29
2.5.1. Connector Pin Assignments	29
2.5.2. Microphone Connection	30
2.5.3. Audio Input.....	30
2.5.4. Audio Output	30
2.5.5. Sidetone.....	31
2.5.6. Control Inputs.....	31
2.5.7. Status and Control Outputs	31
2.5.8. SQL_EVAL.....	31
2.5.9. RX_AGC (AGC Voltage of the RX-RF-AGC)	32
2.6. Interfaces.....	32

2.1. Packaging, Transport, Storage

Visually inspect the package contents for signs of transport damage.

2.1.1. Packaging Material and Transport



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

The packaging material can be kept and reused 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 place the device on. The electric connections may not be damaged when placing the device.

First Device Checkup

- Check the device for signs of transport damages.
- Please verify if the indications on the type plate correspond to your purchase order.
- Check if the equipment is complete ("Scope of Delivery", page 24).

Storage

If you do not wish to mount and 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.

2.2. Device Assignment

This manual is valid for the following devices:

- RT5202-(01)
- RT5202-(02)

2.2.1. Scope of Delivery

- Manuals
 - Installation and Operation manual.
- Transceiver
 - RT5202 (corresponding to your ordered version)

2.2.2. Additional Required Equipment

- Mounting kit
- Connector kit
- Antenna

Details see "Accessories", page 21.

2.2.3. Type Plate

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

Example:



Figure 1: Type plate (example)

Explanation:

PN:	Example Type designation: RT5202-(01) RT5202 = Remote VHF Transceiver Options: 01: 118.000-136.975 MHz 02: 118.000-155.975 MHz
SN:	Unique number of the particular device
AN:	Article number

2.3. Mounting Requirements

SAFETY INSTRUCTIONS

The device must not be opened.

When installing the device, make sure the heat dissipators of the device receive sufficient air. Keep an efficient distance of the devices with integrated ventilator fans in order to ensure free circulation of the cooling air.

Make sure that the mounting frame is not exposed to external temperature influences.

2.3.1. Order of Installation

The RT5202 is designed for installation in an avionics compartment.

- First the mounting equipment must be secured to an appropriate point in the avionics compartment using 6 screws.
- Slide the RT5202 into the mounting frame.
- Lock it in place and fasten it with the screw cap.

Dimensions see page 27, 28.

2.4. Dimensions

2.4.1. RT5202

Dimensions mm (inch)

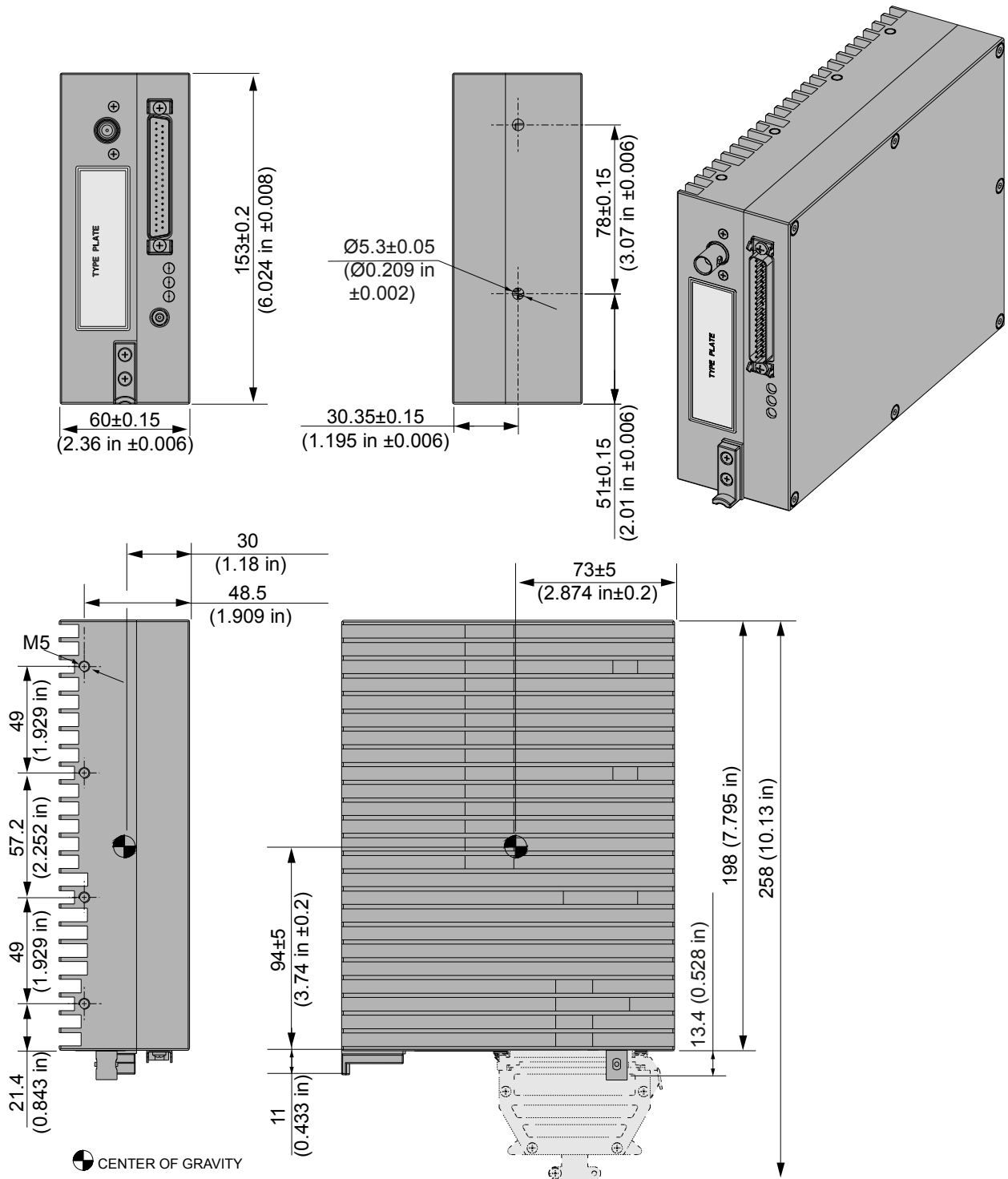


Figure 2: Dimensions RT5202-(XX)

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

2.4.2. Mounting Frame

Dimensions mm (inch)

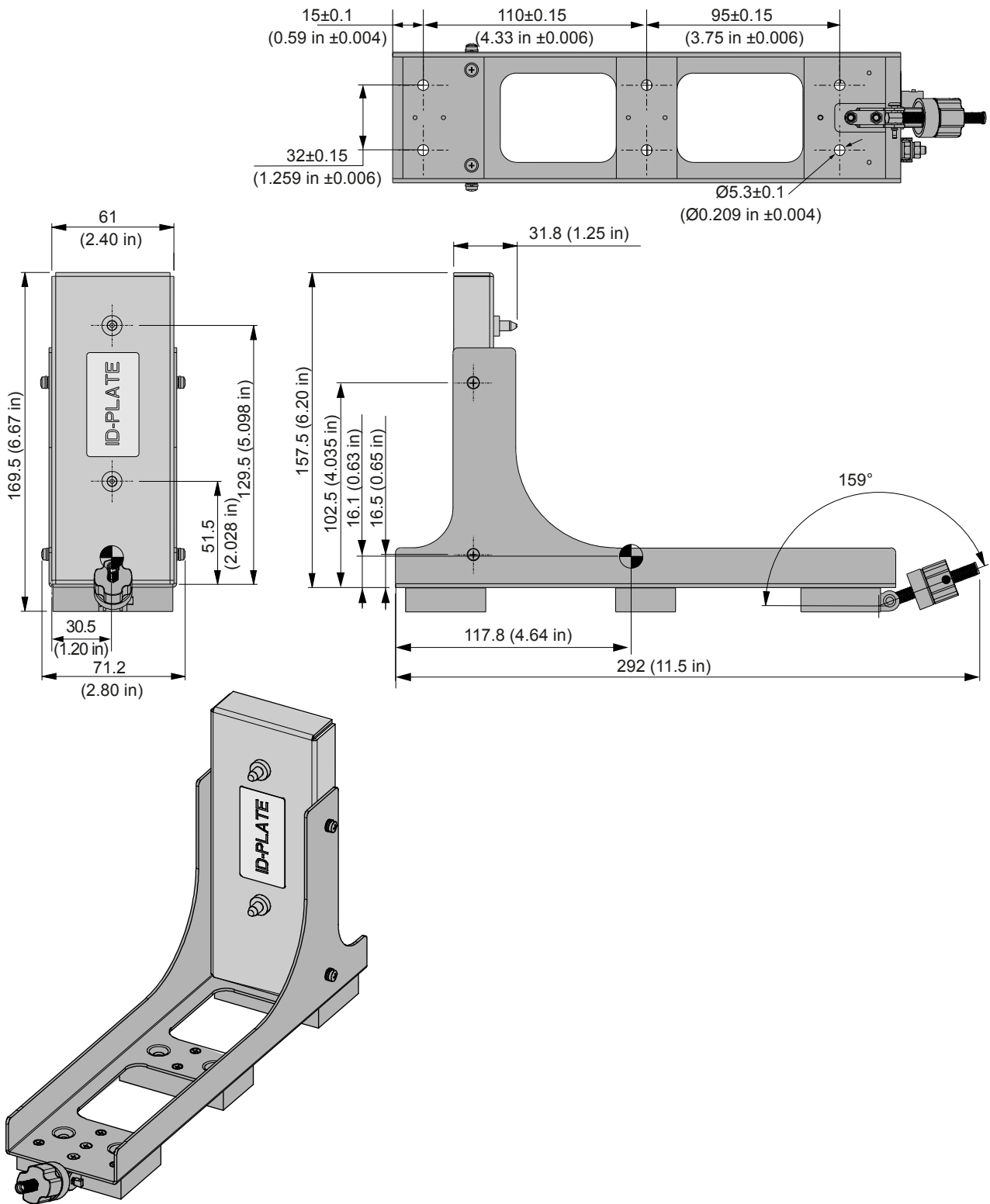


Figure 3: Dimensions mounting frame MT5202-01

2.5. Electrical Installation

Installation wirings see "Wiring Diagrams", page 47.

- Use only cable which is fit for use in aircraft (self extinguishing). AWG20 for power supply and AWG22 for other cables.
- Fit rubber sleeves over the solder joints on the equipment connector.
- Protect the power supply with a 10 A fuse or circuit breaker.
- No HF cables should be included in the cable harnesses of the system and the routing of connecting cables along cables which carry audio power or pulses should also be avoided.
- Carefully check the wiring before switching on the unit and check particularly that (+) and (-) have not been reversed.

2.5.1. Connector Pin Assignments

2.5.1.1. Connector P1

Connector P1 (37-pole)		
Pin	Name	Function
1	AF_GND	Audio Ground
2	AF_GND	Audio Ground
3	Line_IN_HI	Audio Input
4	STD_MIKE HI	Standard Mike Audio Input
5	LINE_OUT_HI	Audio Output
6	Sidetone	Audio Output Sidetone
7	/PTT	Input Transmit Key
8	RX_AGC	AGC-Voltage Output
9	/Failure	Red LED = a failure has occurred
10	/Test_OK	Green LED = the transceiver is operable
11	ARI429_RX_A	ARINC 429 Interface
12	ARI429_RX_B	ARINC 429 Interface
13	RS232_RX	RS232 Interface
14	RS422_RX_+	RS422 Interface
15	RS422_RX_-	RS422 Interface
16	/A0	Device Address Line Bit 0
17	SUPP_28V	+Power Supply
18	SUPP_28V	+Power Supply
19	SUPP_GND	GND Power Supply
20	AF_GND	Audio Ground

Connector P1 (37-pole)		
Pin	Name	Function
21	AF_GND	Audio Ground
22	Line_IN_LO	Audio Input
23	STD_MIKE LO	Standard Mike Audio Input
24	LINE_OUT_LO	Audio Output
25	/TX_ENABLE	
26	/RX_ATT	
27	SQL_EVAL	Output of the Squelch Evaluation
28	/SERV_EN	
29	N/A	
30	ARI429_TX_A	ARINC 429 Interface
31	ARI429_TX_B	ARINC 429 Interface
32	RS232_TX	RS232 Interface
33	RS422_TX+	RS422 Interface
34	RS422_TX-	RS422 Interface
35	/A1	Device Address Line Bit 1
36	/ON	Signal to switch ON/OFF
37	SUPP_GND	GND Power Supply

2.5.2. Microphone Connection

Standard microphone unbalanced

The STD_MIKE_HI input sensitivity has an AC input impedance of $150 \Omega \pm 20\%$ from 300...3400 Hz. The maximum input level without clipping is 3 V.

Pin connection: Pin4 STD_MIKE_HI and Pin23 STD_MIKE_LO.

2.5.3. Audio Input

LINE_IN

The LINE_IN input is asymmetric (balanced) input which has no DC connection to ground (symmetrical line input Pin3 LIN_IN_HI and Pin22 LIN_IN_LO).

The LINE_IN input impedance is $600 \Omega \pm 20\%$ from 300...3400 Hz. The maximum input level without clipping is 6 V.

2.5.4. Audio Output

The power output of the symmetrical line output is 100 mW in to 600Ω and at least 200 mW into 150Ω with the maximum audio power setting (volume) (Pin5 Line_OUT_LO and Pin24 Line_OUT_HI).

The audio level is adjustable from $<1 \text{ mW}$ to $>100 \text{ mW}$ via a serial interface. This output provides the received signal in RX mode or the sidetone signal in the TX mode.

2.5.5. Sidetone

This additional sidetone output is a direct DC coupled output, which is linear to the transmitted forward wave amplitude (square root of the forward power).

The output resistance is less than 5000 Ω (Pin6 sidetone and Pin20 audio ground).

2.5.6. Control Inputs

/ON/OFF line (device ON/OFF input)

The /ON/OFF line is active, if the level on the ON-input is less than 4.0 V or a resistance less than 1000 Ω is connected to ground.

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

/PTT line (push to talk input)

The /PTT line is active, if the level on the PTT-input is less than 4.0 V or a resistance less than 1000 Ω is connected to ground.

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 is connected to ground.

/RX_ATT (external RX attenuation control)

The /RX_ATT line is active, if the level on the RX_ATT-input is less than 4.0 V or a resistance less than 1000 Ω is connected 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 is connected to ground.

/TX_ENABLE (enabling the TX)

The transceiver is detected a low state on the /TX_ENABLE input when a external resistance of lower than 1000 Ω is connected to ground.

The transceiver is detected a high state on the /TX_ENABLE input when a external resistance of higher than 50 k Ω is connected to ground.

/SERV_EN (enabling the setup modes)

The transceiver is detected a low state on the /SERV_EN input when a external resistance of lower than 1000 Ω is connected to ground.

The transceiver is detected a high state on the /SERV_EN input when a external resistance of higher than 50 k Ω is connected to ground.

2.5.7. Status and Control Outputs

/TEST_OK, /FAILURE line (status outputs)

These outputs are directly coupled with the status shown at the status LEDs mounted at the connector side of the device.

The output is an open collector type with capability to:

- ≥ 100 mA current to ground with a voltage loss of less than 2 V (corresponding LED is on)
- ≤ 100 mA current to ground for output voltage 28.0 V when in "inactive" state (LED off).

NOTICE

The output is protected against spikes produced from a relay which could be connected to this output.

The output should also be protected against a short circuit to the positive power supply.

2.5.8. SQL_EVAL

This digital output indicates that the audio from the RX is available on the LINE_OUT

The output is an open collector type with capability to:

- ≥ 100 mA current to ground with a voltage loss of less than 2 V (corresponding LED is on)
- ≤ 100 mA current to ground for output voltage 28.0 V when in "inactive" state (LED off).

NOTICE

The output is protected against spikes produced from a relay which could be connected to this output.

The output should also be protected against a short circuit to the positive power supply.

2.5.9. 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 (Pin8 RX_AGC).

The output voltage changes over the range of 0...5 V, when the input level at the antenna input is varied from -105...+13 dBm. For all antenna 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. The output resistance is less than 5000 Ω .

2.6. Interfaces

The RT5202 provides communication via the following interface standards:

- RS422
- ARINC 429
- RS232

NOTICE

Only one kind of interface may be used at the same time.

If the RS422 interface is used for communication the RT5202 is able to receive commands and to transmit information in accordance with "RS422 - Serial Interface to the Control Unit", page 32.

If the ARINC 429 interface is used for communication the RT5202 is able to receive commands in accordance with "ARINC 429 - Serial Interface to the Control Unit", page 45.

If the RS232 interface is used for communication the RT5202 is able to receive commands and to transmit information in accordance with "RS232 - Serial Interface to the Control Unit", page 46.

NOTICE

Received data which are out of range are ignored. This means they are handled from the device as not received.

2.6.1. RS422 - Serial Interface to the Control Unit

Name	Function / Remarks
RS422_RX+	RS422 Interface RX Line A
RS422_RX-	RS422 Interface RX Line B
RS422_TX+	RS422 Interface TX Line A
RS422_TX-	RS422 Interface TX Line B

The physical behaviour of the RS422 interface (level definition, rise time, fall time ...) is according to the requirements of DIN 66259. The RS422 control lines have internal a 120 Ω terminating impedance.

The basic working principle is as follows: The control unit initiates the communication, RT5202 acts only as a slave, it only responds to control unit interrogations. The control unit requests periodically the RT5202 status. RT5202 has to check if the received data have changed and if this happened it has to initiate an action (in case of frequency changing, to reprogram the synthesizers).

The RT5202 never initiates any transmission if there was no request from the control unit. Except the header all data are coded in BCD.

2.6.1.1. **Link Parameters**

The following link parameters shall be used:

Bitrate: 9600 Bits/s
 Start bits: 1
 Data bits: 8
 Stop bits: 1
 Parity: none

2.6.1.2. **Frame Definition**

Overview

Header	Device ID	Protocol Version	Frame ID	1 st data byte	...	Last data byte	Checksum

The data bytes are optional.

Header & General Synchronisation Rules

When RT5202 is answering of an interrogation it shall always use the header 0xAA.

The start of a new received frame is only be detected when the received header is 0xAA. If RT5202 receives a frame which has, except of the header, a further value which not corresponds to a BCD code it ignores the complete frame. No further action is happen (no error message back to the control unit).

Device ID

The RT5202-ID is defined as 00.

When RT5202 is answering an interrogation the RT5202-ID is used.

When the device ID of a received frame does not correspond to the RT5202-ID, the complete frame is ignored.

Protocol Version

The used RT5202-protocol-version is 16.

When the RT5202 is answering an interrogation the RT5202-protocol-version is used.

When the device protocol version of a received frame does not correspond to the RT5202-protocol-version the complete frame is be ignored.

Frame Identification

When the frame identification of a received frame does not fit to the following table, then the whole frame is ignored.

Frame	ID	Frame	ID
GET_STATE	01	CU	Request
SET_STATE	11	CU	Set
ANS_STATE	21	RT	Report
GET_SERVICE_SETUP	03	CU	Request
SET_SERVICE_SETUP	13	CU	Set
ANS_SERVICE_SETUP	23	RT	Report
GET_FACTORY_SETUP	04	CU	Request
SET_FACTORY_SETUP	14	CU	Set
ANS_FACTORY_SETUP	24	RT	Report
GET_CALIBRATION_SETUP	05	CU	Request
SET_CALIBRATION_SETUP	15	CU	Set
ANS_CALIBRATION_SETUP	25	RT	Report

Check Sum

If RT5202 is answering an interrogation it calculates its checksum as follows:

The checksum is the modulo sum of the bcd-digits (per column) from the 1st byte after header up to the byte before the checksum. The modulo sum is calculated separately for each most significant digit and less significant digit. Value of modulo is 10.

Example: (Command of CU: GET_CALIBRATION_SETUP of COM 1)

Datastream:

Name	Data sent	First digit	Second digit
Header	AA	Ignored	
Dev. ID	00	0	0
Prot. Ver	16	1	6
Frame ID	06	0	6
sum		1	12
modulo 10		1	2
Check sum	12	1	2

If RT5202 receives a frame which has a wrong checksum it ignores the complete frame. No further action is happen (no error message back to the CU).

Data Block Description

The normal data in the data block table are split into nibbles.

The nibble which is standing in the table at the upper position is the high nibble of a byte (bit 7...bit 3). The nibble which is standing in the lower position is the low nibble of a byte (bit 3 ... bit 0).

The error information data in the tables below are split into bits (within the nibbles).

The bit which is standing in the table at the upper position is the MSB. Then the LSB follows in the same logical direction.

The bytes are transferred in the direction from table top to table down.

Signed BCD: A signed BCD is coded as follow:

- First digit is sign: 0 - positive, 1 - negative
- Next three digits: absolute value coded in standard BCD

BCD Character: For the information fields which includes a alpha numerical information (character) the assignment of the following table.

NOTICE

Code assignment to character is based on ASCII table.
From ASCII code value of 32 is subtracted, to put values within range from 0...99. Characters with ASCII code below 32 are not needed.

Data Block Table

		LSD									
		0	1	2	3	4	5	6	7	8	9
	0	00 SP	01 !	02 "	03 #	04 \$	05 %	06 &	07 '	08 (09)
	1	10 *	11 +	12 ,	13 -	14 .	15 /	16 0	17 1	18 2	19 3
	2	20 4	21 5	22 6	23 7	24 8	25 9	26 :	27 ;	28 <	29 =
	3	30 >	31 ?	32 @	33 A	34 B	35 C	36 D	37 E	38 F	39 G
MSD	4	40 H	41 I	42 J	43 K	44 L	45 M	46 N	47 O	48 P	49 Q
	5	50 R	51 S	52 T	53 U	54 V	55 W	56 X	57 Y	58 Z	59 [
	6	60 \	61]`	62 ^	63 _	64 ,	65 a	66 b	67 c	68 d	69 e
	7	70 f	71 g	72 h	73 i	74 j	75 k	76 l	77 m	78 n	79 o
	8	80 p	81 q	82 r	83 s	84 t	85 u	86 v	87 w	88 x	89 y
	9	90 z	91 {	92 	93 }	94 ~	95 SP	96 SP	97 SP	98 SP	99 SP

LSD: less significant digit of the code
MSD: most significant digit of the code
SP: SPACE character

SET_STATE

The data in the SET_STATE frame is interpreted as defined in the following table.

SET_STATE Name	Size	Valid values (in BCD)	Data Interpretation	see also
-	1n	X	Reserved	-
dev_super_mode_w	1n	0...4	Wanted Device Super Mode 0 = Reserved 1 = Normal Operation 2 = Service Setup 3 = Factory Setup 4 = DSP Calibration Setup	R026...R030
channel_name_w	3B	Normal: 118000...136980 Extended: 118000...155980	Wanted channel name (coded without dot) ABCDEF - channel ABC.DEF 1st nibble: A 6th nibble: F i.e.: 127500 represents channel name 127.500	R011 R034
volume_level_w	3n	000...430	Wanted volume at LINE_OUT 000 = Maximum Volume 430 = Minimum Volume Range: 43 dB Resolution: 0.1 dB	R091
	1n	X	Reserved	
squelch_level_w	3n	060...230	Wanted threshold level of the noise squelch 060 = threshold at 6.0 dB 230 = threshold level at 23.0 dB	R110
	1n	X	Reserved	
squelch_control_w	1n	0/1	Wanted state of the CU squelch disable switch: 0 = auto squelch 1 = audio from RX enabled all the time	R114
self_test_req_w	1n	0/1	Selftest request 0 = no selftest request 1 = selftest request	R184
-	2B	XX XX	Reserved	-

ANS_STATE

The data in the ANS_STATE frame is coded as defined in the following table.

ANS_STATE Name	Size	Valid values (in BCD)	Data Interpretation	see also
-	1n	0	Reserved	-
dev_super_mode_r	1n	0...4	Active Device Super Mode 0 = Reserved 1 = Normal Operation	R026...R030

ANS_STATE Name	Size	Valid values (in BCD)	Data Interpretation	see also
			2 = Service Setup 3 = Factory Setup 4 = DSP Calibration Setup	
channel_name_r	3B	Normal: 118000...136980 Extended: 118000...155980	Active channel name (coded without dot) ABCDEF - channel ABC.DEF 1st nibble: A 6th nibble: F i.e.: 127500 represents channel name 127.500	R011 R034
volume_level_r	3n	000...430	Active volume at LINE_OUT 000 = Maximum Volume 430 = Minimum Volume Range: 43 dB Resolution: 0.1 dB	R091
	1n	0	Reserved	
squelch_level_r	3n	060...230	Active threshold level of the noise squelch 060 = threshold at 6.0 dB 230 = threshold level at 23.0 dB	R110
	1n	0	Reserved	
squelch_control_r	1n	0/1	Active state of the squelch disable switch: 0 = auto squelch 1 = audio from RX enabled all the time	R293
self_test_grant_r	1n	0/1	Selftest grant. 0 = ready for selftest 1 = selftest in progress or done	R184
-	2B	00 000	Reserved	-
dev_mode_r	1n	0 ... 4	Mode of the device: 0 = RX Mode 1 = TX Mode 2 = Channel Change Mode 3 = Calibration Mode 4 = TEST Mode	R031...R036
service_smode_allowed_r	1n	0/1	0 = Service modes forbidden 1 = Service modes permitted	R285
reserved	1n	0	Reserved	
squelch_eval_r	1n	0/1	State of squelch evaluation: 0 = audio muted 1 = audio enabled due to SNR squelch 2 = a. enabled due to carrier	R286

ANS_STATE Name	Size	Valid values (in BCD)	Data Interpretation	see also
			override squelch 3 = a. enabled due to both squelch evaluations 4 = audio enabled due to disabled squelch function	
rssr_r	2B	- 120 ... +20	Received signal strength indication -120 = -120 dBm +20 = +20 dBm Coding in signed BCD!	R287
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	-
err_antenna_r	1b	0/1	Antenna Error 0 = No antenna error 1 = Antenna error	R165
err_txoff_temp	1b	0/1	TX Off Overtemp. Error 0 = No error 1 = TX Off Overtemp. Error	R168
err_txhot	1b	0/1	TX Hot Error 0 = No error 1 = TX Hot Error	R369
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	-
err_stuck_ptt_r	1b	0/1	Stuck PTT Error 0 = No PTT stuck 1 = PTT stuck	R372
err_rx_synth_r	1b	0/1	RX Synthesiser Error 0 - Loop locked 1 . Error: Out of lock	R118
err_rx_agc_r	1b	0/1	RX AGC Test Error 0 = Test passed 1 = Test failed	R189
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	-
err_tx_synth_r	1b	0/1	TX Synthesizer Error 0 = Loop locked 1 = Error: Out of lock	R367
err_tx_prl_r	1b	0/1	TX power regulation loop Error 0 = Loop locked 1 = Error: Out of lock	R174
err_internal_r	1b	0/1	Internal Data Error 0 = No error	-

ANS_STATE Name	Size	Valid values (in BCD)	Data Interpretation	see also
			1 = Error	
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	-
err_psb	1b	0/1	PSB Error 0 = No PSB error 1 = PSB Error	R361
err_channel	1b	0/1	Channel Error 0 = No user error 1 = Channel error	R380
-	1b	0	Reserved	
-	2B	00 00	Reserved	-

SET SERVICE_SETUP

The data in the SET_SERVICE_SETUP frame is interpreted as defined in following table.

SET SERVICE_SETUP Name	Size	Valid values (in BCD)	Data Interpretation	see also
modulation_lth	3n	050...310	Limiting threshold for the modulation inputs 050 = Max. LTH at 5.0 dB below clipping point 310 = Minimum LTH (max. Gain) Resolution: 0.1 dB	R138 R139
	1n	X	Reserved	
rx_af_agc_enable	1n	0/1	RX AF AGC 0 = AGC disabled 1 = AGC enabled	R089 R090
sidetone_enable	1n	0/1	0 = Sidetone signal at LINE_OUT disabled 1 = Sidetone signal at LINE_OUT enabled	R288
sidetone_level	3n	000...400	Attenuation of the sidetone level relative to the RX-level 000 - 00.0 dB relative attenuation 400 - 40.0 dB relative attenuation	R177
	1n	X	Reserved	
volume_change_allowed	1n	0/1	0 = volume change is prohibited 1 = volume change is allowed	R279

SET SERVICE_SETUP Name	Size	Valid values (in BCD)	Data Interpretation	see also
squelch_level_change_allowed	1n	0/1	0 = squelch level change is prohibited 1 = squelch level change is allowed	R116
	1n	X	Reserved	n/a
	1n	X	Reserved	n/a
squelch_mode	1n	0/1/2	Squelch Switch Control Selector 0 = Fixed Auto squelch 1 = Fixed squelch disable (audio enabled) 2 = Squelch controlled via CU	R115
-	1n	X	Reserved	-
ocxo_data	3n	000...126	Ocxo Calibration Factor	R292
mod_off	1n	0/1	0 = Modulation on 1 = Modulation off	R332
set_txpwr	1B	...05 ...20	Nominal Tx carrier power setting 05 = 5 W carrier power 20 = 20 W carrier power	R342
-	1n	X	Reserved	-
ari_install_no	1n	0...3	Installation No. by using the ARINC 429 interface 0 = all call capability 1 = installation no. 1 2 = installation no. 2 3 = installation no. 3	R405
-	3B	XX XX XX	Reserved	-
inspec_date	3B	00 00 00... 99 12 31	Last Inspection Date coded in YYMMDD	R343
clear_err_flag_req	1n	0/1	ored error history flags 0 = no clear, 1 = clear all error flags Clear all st	R345
recall_service_req	1n	0/1	Request for Recall the Service Setup 0 = no request 1 = request to recall	R347

ANS_SERVICE_SETUP

The data in the ANS_SERVICE_SETUP frame is coded as defined in following table.

ANS_SERVICE_SETUP Name	Size	Valid values (in BCD)	Data Interpretation	see also
modulation_lth	3n	050...310	Limiting threshold for the modulation inputs 050 = Max. LTH at 5.0 dB below clipping point 310 = Minimum LTH (max. Gain) Resolution: 0.1 dB	R138 R139
	1n	0	Reserved	
rx_af_agc_enable	1n	0/1	RX AF AGC 0 = AGC disabled 1 = AGC enabled	R089 R090
sidetone_enable	1n	0/1	0 = sidetone disabled 1 = sidetone enabled	R288
sidetone_level	3n	000...400	Attenuation of the sidetone relative to the rx-level 000 - 0.0 dB relative attenuation 400 - 40.0 dB relative attenuation	R177
	1n	0	Reserved	
volume_change_allowed	1n	0/1	0 = volume change is prohibited 1 = volume change is allowed	R279
squelch_level_change_allowed	1n	0/1	0 = squelch level change is prohibited 1 = squelch level change is allowed	R116
-	1n	0	Reserved	n/a
-	1n	0	Reserved	n/a
squelch_mode	1n	0/1/2	Squelch Switch Control Selector 0 = Fixed Auto squelch 1 = Fixed squelch disable (audio enabled) 2 = squelch controlled via CU	R115
	1n	0	Reserved for disable the 8.33 channels	
ocxo_data	3n	000...126	OCXO Calibration Factor	R292
mod_off	1n	0/1	0 = Modulation on, 1 = Modulation off	R332

ANS_SERVICE_SETUP Name	Size	Valid values (in BCD)	Data Interpretation	see also
set_txpwr	1B	...05 ...20	Nominal Tx carrier power setting 05 = 5 W carrier power 20 = 20 W carrier power	R342
-	1n	0	Reserved	-
ari_install_no	1n	0...3	Installation number by using the ARINC 429 interface 0 = all call capability 1 = installation no. 1 2 = installation no. 2 3 = installation no. 3	R405
reflection	1B	00...99	Antenna reflection factor: 00 -> r = 0.00 99 -> r = 0.99 <i>Note: This field is used for development reasons and is out of scope of this document</i>	-
int_err_code	1B	00...99	Error code of internal data error <i>Note: This field is used for development reasons and is out of scope of this document</i>	-
-	1B	00	Reserved	-
inspec_date	3B	00 00 00... 99 12 31	Last Inspection Date coded in YYMMDD	R343
clear_err_flag_grant	1n	0/1	Grant for clear all stored error flags 0 = ready to clear, 1 = error flags cleared	R345
recall_service_grant	1n	0/1	Grant for Recall the Service Setup 0 = ready to recall, 1 = recall done	R347
mike_peak	1B	00 ... 90	Modulation input peak level 00 = input level at clipping point 90 = minimum detectable input level (90 dB below clipping point)	R276
device_temp	2B	-60...+110	Temperature internal to the device -60 = -60°C +110 = +110°C Coding in signed BCD!	R294
hsink_temp	2B	-60...+110	Temperature of the heatsink	R333

ANS_SERVICE_SETUP Name	Size	Valid values (in BCD)	Data Interpretation	see also
			-60 = -60°C +110 = +110°C Coding in signed BCD!	
supply_volt	3n000400	Internal supply voltage of the transmitter 000 = 0.0 V 400 = 40.0 V <i>Note: This field is used for development reasons and is out of scope of this document</i>	-
-	1n	0	Reserved	-
operating_time	4B	00000000... 99999999	Operating time of the device in minutes	R283
band_limit	1n	0/1	Channel name limits: 0 = 136.980 normal frequency range 1 = 155.990 extended frequency range	R008...R010
-	1n	0	Reserved	-
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	-
eflag_rx_synth	1b	0/1	Error-Flag RX synthesizer 0 = Loop locked 1 = Error: Out of lock	R118
eflag_rx_agc	1b	0/1	RX AGC Test 0 = Test passed 1 = Test failed	R189
eflag_tx_synth	1b	0/1	Error Flag TX synthesizer 0 = Loop locked 1 = Error: Out of lock	R171
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	-
eflag_tx_prl	1b	0/1	Error Flag TX power regulation loop 0 = Loop locked 1 = Error: Out of lock	R174
eflag_internal	1b	0/1	Error Flag Internal Data Error 0 = No error 1 = Error	-
eflag_psb	1b	0/1	Error Flag PSB Error Detection 0 = No PSB error 1 = PSB Error	R362

ANS_SERVICE_SETUP Name	Size	Valid values (in BCD)	Data Interpretation	see also
-	1b	0	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	
eflag_cu_lost	1b	0/1	Error Flag CU Lost Connection Error 0 = No error 1 = Error	R036
eflag_channel	1b	0/1	Error Flag Channel Error 0 = No error 1 = Channel Error	R380
eflag_antenna	1b	0/1	Error Flag Antenna VSWR Error 0 = No error 1 = Antenna VSWR Error	R371
-	1b	0/1	Highest bit of this error indication nibble shall be 0 (BCD-Code!)	
eflag_txoff_temp	1b	0/1	Error Flag TX Off Overtemp. Error 0 = No error 1 = TX Off Overtemp. Error	R168
eflag_txhot	1b	0/1	Error Flag TX Hot Error 0 = No error 1 = TX Hot Error	R369
eflag_stuck_ptt	1b	0/1	Error Flag Stuck PTT Error 0 = No error 1 = Stuck PTT Error	R372
hsink_temp_max	2B	- 60...+110	Maximum hold temperature of the heatsink -60 = -60 °C +110 = +110 °C Coding in signed BCD!	R393
device_sn	2B	0000...9999	Serial number of the device (Copy of factory setup)	R360
device_mod	3B	00 00 00... 99 99 99	Device Hardware Modification State. Coded in a 3 digit bcd character (Copy of factory setup)	R360
dsp_soft	2B	00 00.99 99	Version of DSP Software	R295
bib_soft	2B	00 00.99 99	Version of BIB Software	R295
cpld_ver	2B	00 00 99 99	Version of DSP-CPLD	R398
bib_cpld_ver	2B	00 00 99 99	Version of BIB-CPLD	R398

Data Processing

In the received frames the nibbles, which are designated with an .X. have a valid range from 0...9. Independent what value they have within this range it has no influence to the device behavior. If they have a value higher than 9 it is not any more a BCD value.

The maximum time between the beginning of an .get frame. and the beginning of an "answer frame" doesn't exceed 100 ms.

The maximum time for updating device status is 700 ms. This time is measured from receiving the last byte till the updated information is accessible via the serial interface.

The device is be ready to accept a new frame at a latest time of 10 ms after starting to send a response to the previous frame. In the case that the device is not responding to a frame (It has received a .set frame): The device is ready to accept a new frame at the latest time of 100 ms after the beginning of the previous frame.

2.6.2. ARINC 429 - Serial Interface to the Control Unit

Name	Function / Remarks
ARI429_RX_A	ARINC 429 Interface RX Line A
ARI429_RX_B	ARINC 429 Interface RX Line B

NOTICE

Via this interface only a simplex communication from the control unit to the RT5202 is available.

The physical behaviour of the RS422 interface (level definition, rise time, fall time ...) is according to the requirements of ARINC 429.

2.6.2.1. Scope and General Requirements

The following Information shall only be taken as an overview:

	PARITY		SIGN/STATUS MATRIX		10 MHz		1 MHz		100 kHz		10 kHz		1 kHz		SDI		LABEL (VHF COM)																
BIT No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Example:	1	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
	Norm		(2)		(8)		(5)		(3)		(0)		all call		(0)		(3)		(0)														
	.Oper																																

NOTICE

The 100 MHz character is always 1 and therefore a not transferred information.

2.6.2.2. BIT RATE

The device is able to receive the information when the bitrate is within the specified limits below:
LOW SPEED OPERATION: 12.0 ... 14.5 kilobits per second.

2.6.2.3. Labels

When the label of a received frame is not equal to (030 or 047) then the complete frame is ignored.

2.6.2.4. Source / Destination Identifier (SDI)

A received frame is ignored if the SDI does not fulfil at least one of the following conditions:

- The received SDI is equal to 00 (all-call code).
- The received SDI correspond to the installation number chosen in the service setup (parameter: ari_install_no).

2.6.2.5. **Frequency Characters**

In a valid frame the information in the characters 10 MHz to 1 kHz is handled from the device as a channel name. The 100 MHz character is not transferred and is internally be interpreted as 1.

NOTICE

The information in the frequency characters of the received frame represents the channel name NOT the frequency. In the example above the transferred channel name would be 128.530. This is a 8.33 kHz channel name. The device is tuned to a frequency of 128.525 MHz

2.6.2.6. **Sign / Status Matrix**

A received frame is ignored if in the sign / status matrix the received information is a "Minus" or "Not Computed Data".

If in a valid received frame the contents of the sign / status matrix is changing from "Plus" to "Functional Test" it is handled as a selftest request.

2.6.2.7. **Parity BIT**

The parity bit of a received frame have such a value, that the number of received ones (including the parity bit) is odd. If this condition is not fulfilled the frame is ignored.

2.6.3. **RS232 - Serial Interface to the Control Unit**

The same protocol definition as described in RS422 is used.

Name	Function / Remarks
RS232_RX	RS232 Interface RX Line
RS232_TX	RS232 Interface TX Line

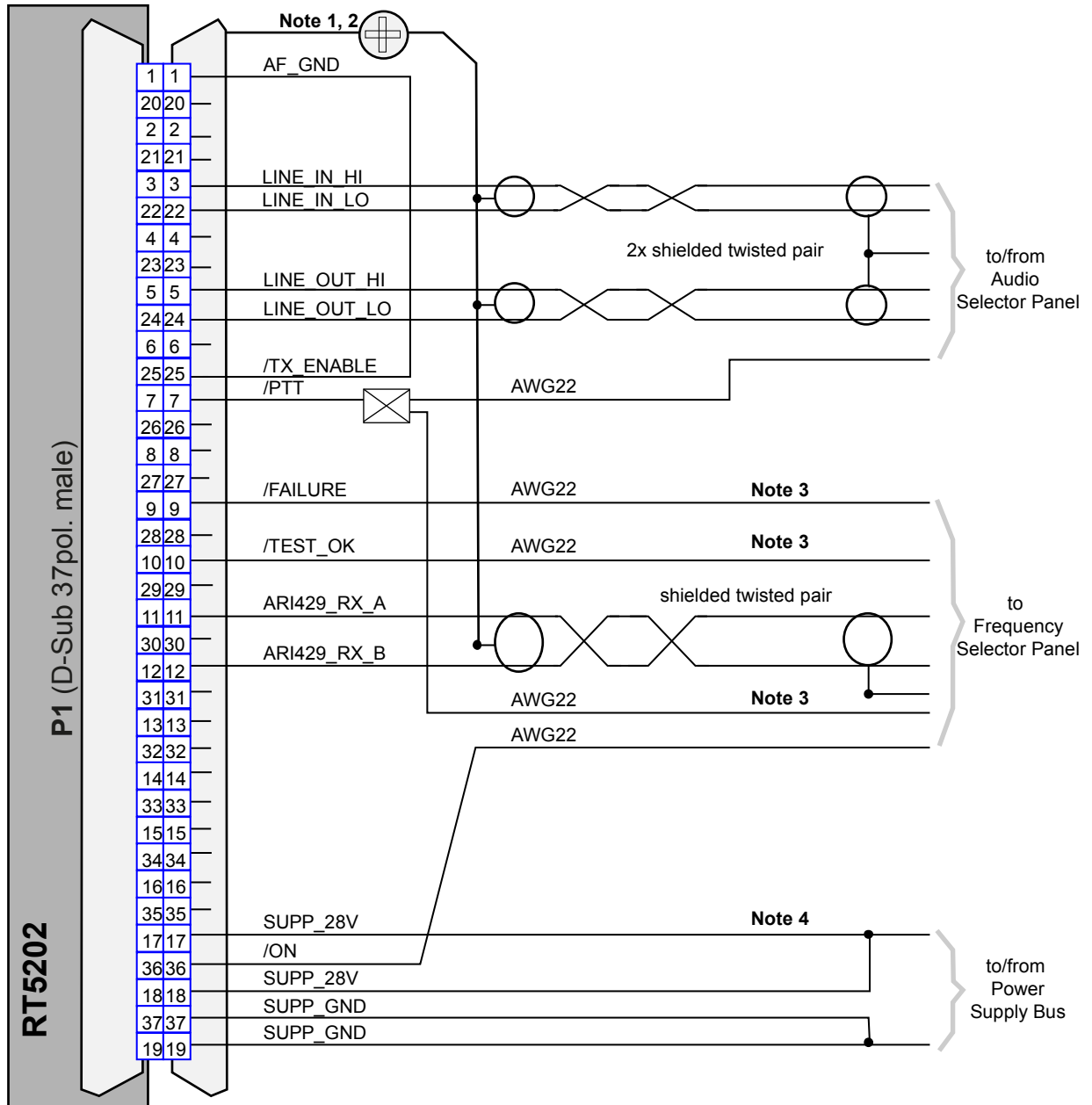
The physical behaviour of the RS232 interface (level definition, rise time, fall time ...) is according to the standard [TIA/EIA-232-F].

2.7. Wiring Diagrams

SAFETY INSTRUCTIONS

Installation of the unit varies according to aircraft and equipment design. It is therefore only possible to provide general guidelines in this section.

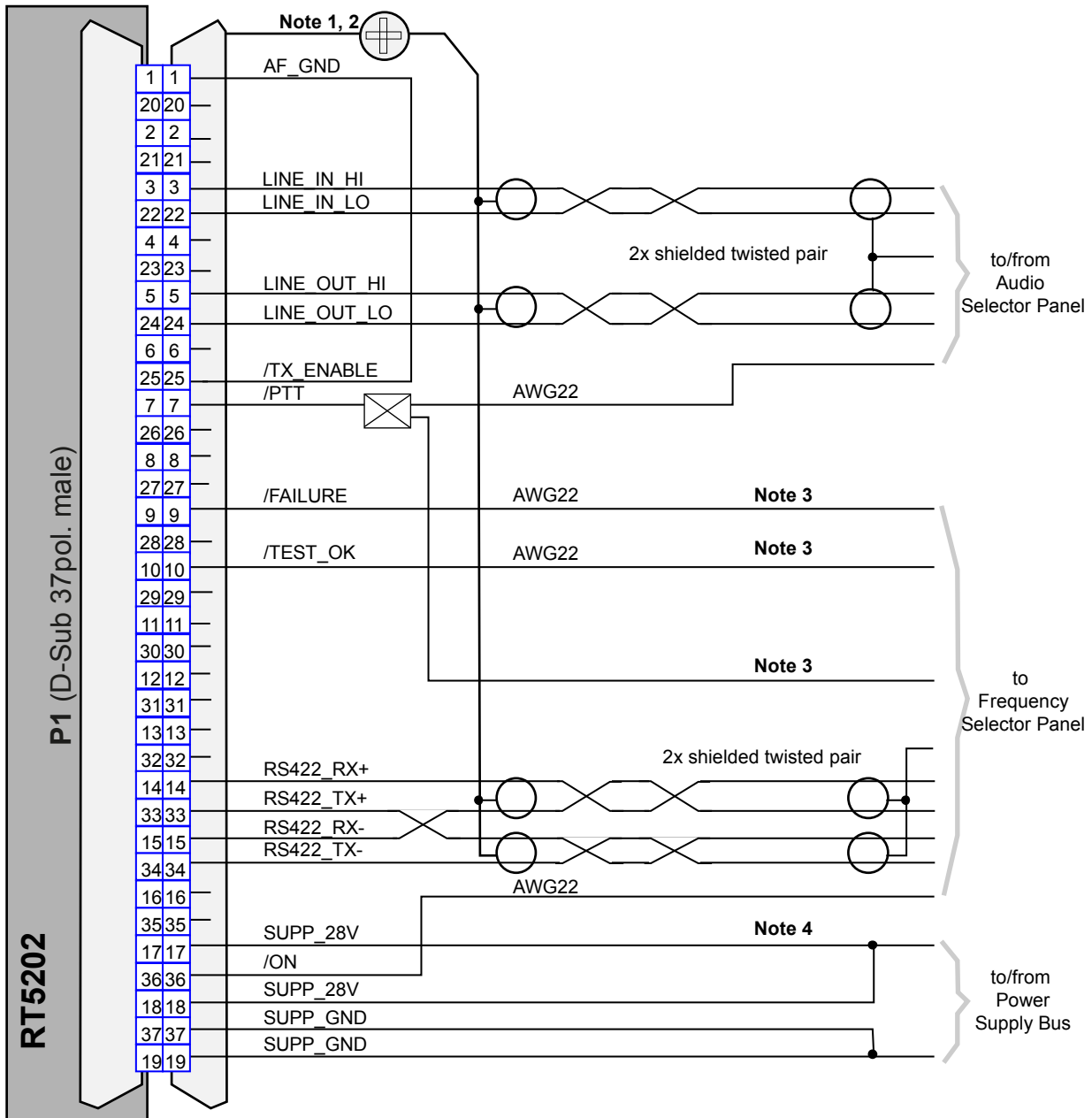
2.7.1. Interface ARINC 429 Sym. Audio Output



- Note1: Shield connected to grounding screw of the connector.
 Note2: 37pol D-Sub connector with metal housing and grounding screw.
 Note3: May be not used depending on capability of CU.
 Note4: Cross section has to be chosen to ensure voltage loss is <5 V.
 Don't apply reverse voltage.

Figure 4: Wiring - ARINC 429 sym. audio output

2.7.2. Interface RS422 Sym. Audio Output



- Note1: Shield connected to grounding screw of the connector.
 Note2: 37pol D-Sub connector with metal housing and grounding screw.
 Note3: May be not used depending on capability of CU.
 Note4: Cross section has to be chosen to ensure voltage loss is <5 V.
 Don't apply reverse voltage.

Figure 5: Wiring - RS422 sym. audio output

2.7.3. Interface ARINC 429 Asym. Audio Output

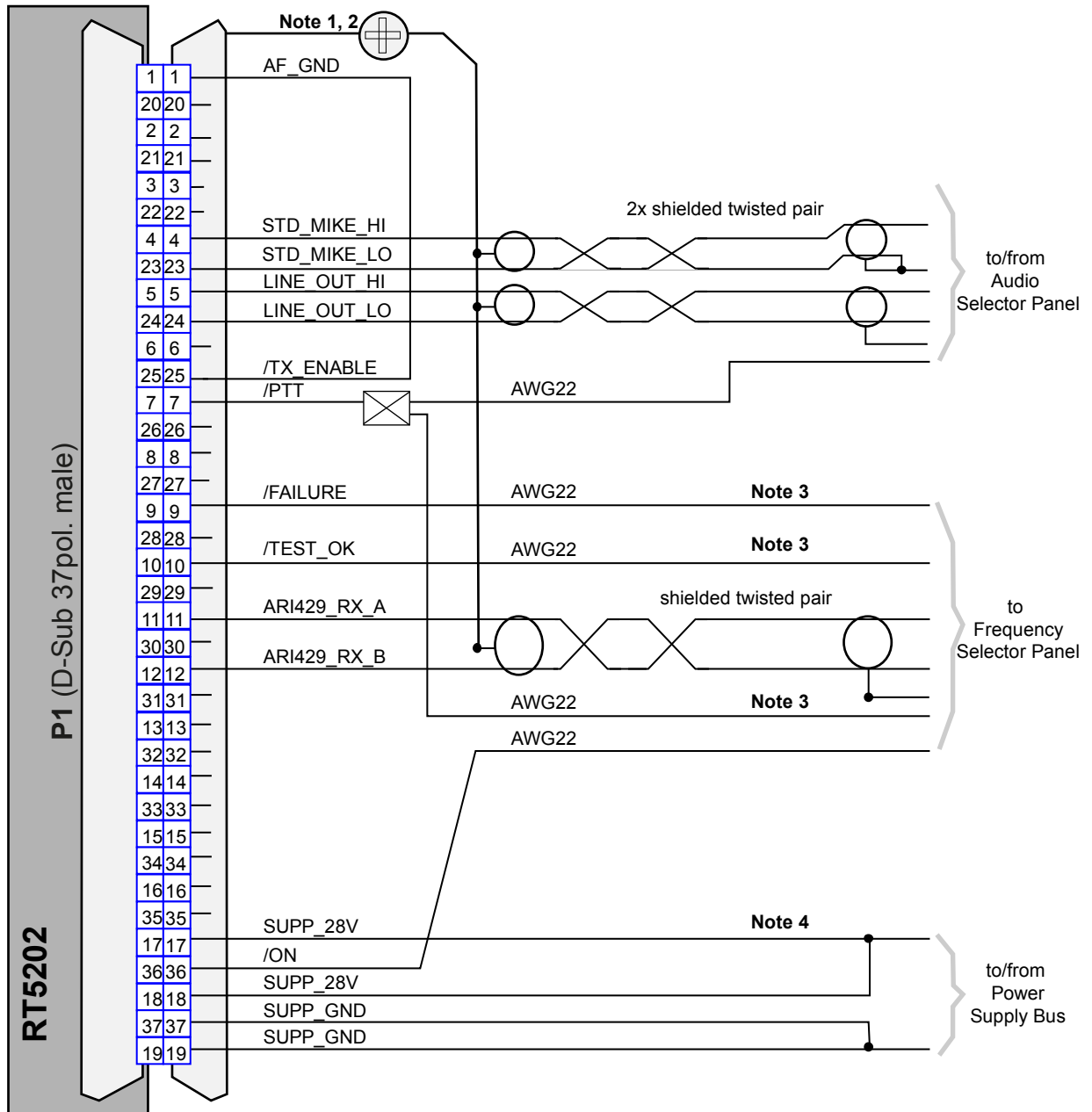
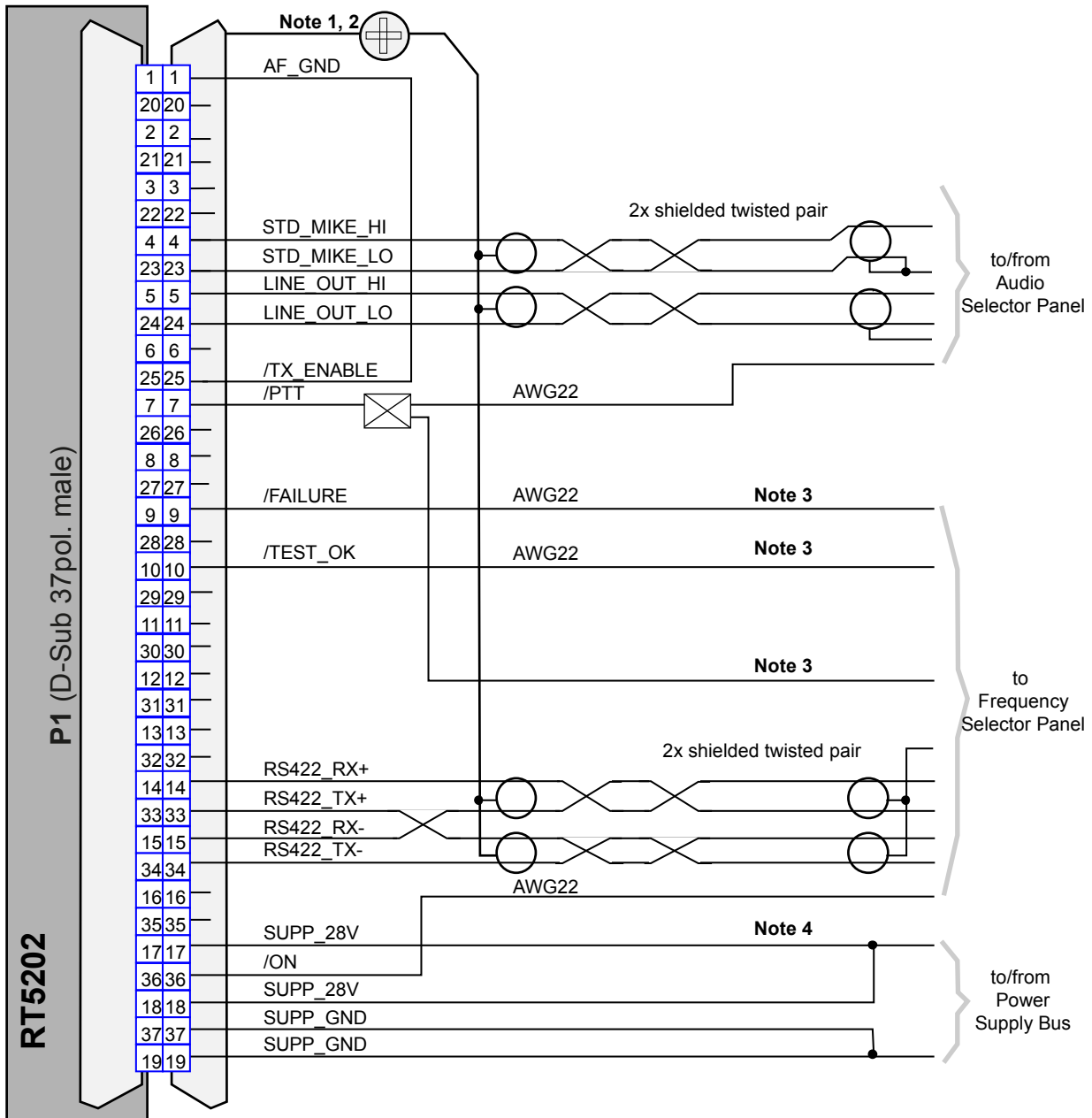


Figure 6: Wiring - ARINC 429 asym. audio output

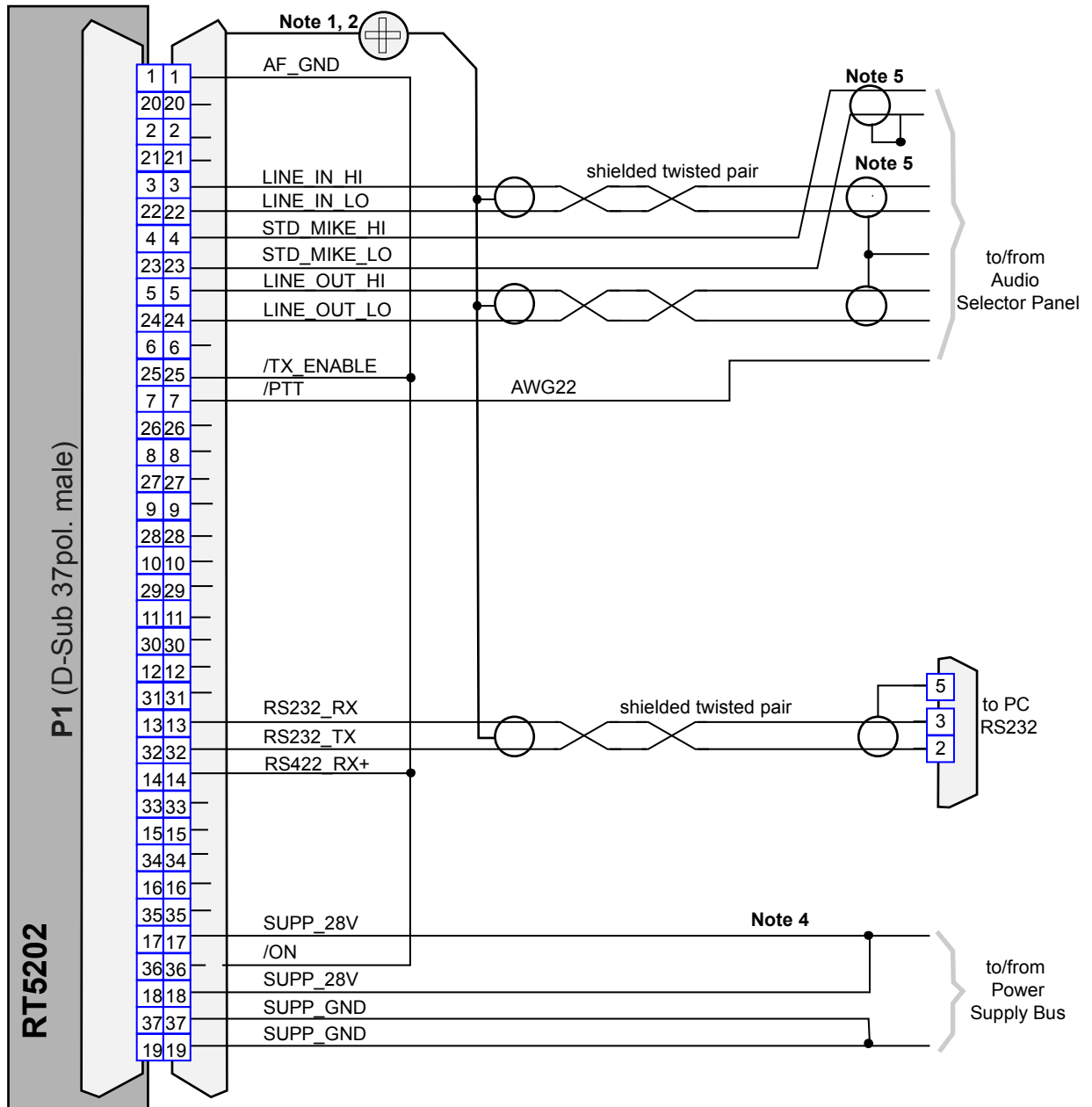
2.7.4. Interface RS422 Asym. Audio Output



- Note1: Shield connected to grounding screw of the connector.
 - Note2: 37pol D-Sub connector with metal housing and grounding screw.
 - Note3: May be not used depending on capability of CU.
 - Note4: Cross section has to be chosen to ensure voltage loss is <5 V.
- Don't apply reverse voltage.

Figure 7: Wiring - RS422 asym. audio output

2.7.5. Interface RS232 Control via Personal Computer



- Note1: Shield connected to grounding screw of the connector.
 - Note2: 37pol D-Sub connector with metal housing and grounding screw.
 - Note3: May be not used depending on capability of CU.
 - Note4: Cross section has to be chosen to ensure voltage loss is <5 V.
 - Note5: LINE_IN or STD_MIKE input can be used.
- Don't apply reverse voltage.

Figure 8: Wiring - RS232 control via personal computer

Blank

3. Operating Instructions

In this chapter you can read about:

3.1. Device Description	53
3.1.1. Device Assignment	53
3.1.2. Packing, Transport, Storage	53
3.1.3. Scope of Delivery	53
3.1.4. Type Plate	53
3.1.5. Controls and Indications	54
3.2. Operating.....	54
3.2.1. Optical Indication	54
3.2.2. Channel name to Frequency and Channel Spacing Assignment	55
3.2.3. Antenna Input / Output	55
3.2.4. Warning or Failure Indication Test Routine IBIT	55
3.2.5. NOGO-Signal at the LINE_OUT	57
3.2.6. Serial Interface	57
3.2.6.1. Applicable Interfaces	57
3.2.6.2. Common Behaviour Independent from the Interface Standard	58

3.1. Device Description

The remote-controlled VHF-transceiver RT5202 is for half duplex voice communication in the VHF frequency range 118.000 MHz...155.975 MHz.

RT5202-(01) = 118.000-136.975 MHz.

RT5202-(02) = 118.000-155.975 MHz.

The RX and the TX operate at the same frequency. The RT5202 has the capability to work with the 25 kHz channel spacing and with the 8.33 kHz channel spacing.

The RT5202 is remote controlled by a control unit via an interface RS232, RS422 or via an interface ARINC 429. The RT5202 can cooperate with an Audio Selector Panel.

3.1.1. Device Assignment

This manual is valid for the following devices:

- See page 24

3.1.2. Packing, Transport, Storage

- See page 23

3.1.3. Scope of Delivery

- See page 24

3.1.4. Type Plate

- See page 25

3.1.5. Controls and Indications

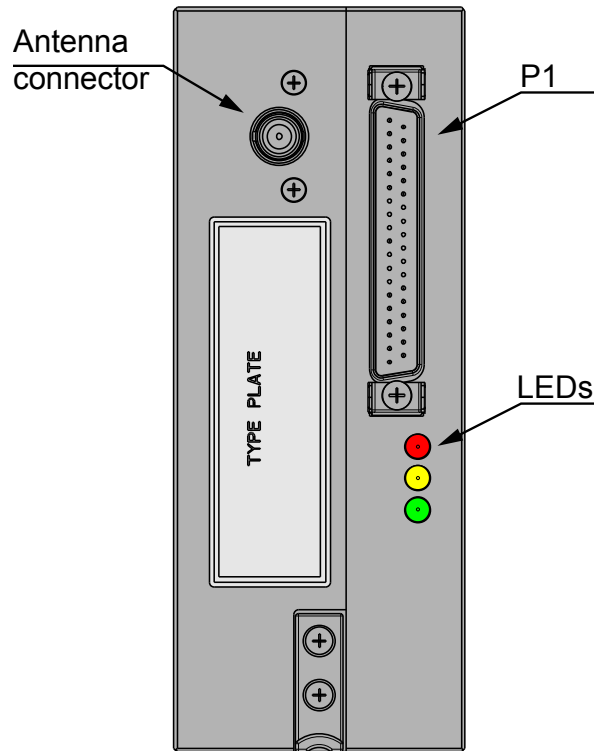


Figure 9: RT5202-(XX) controls and indications

3.2. Operating

3.2.1. Optical Indication

LED	Function/Remarks
Green	System is operable
Red	Internal failure indication
Yellow	External failure indication

3.2.2. Channel name to Frequency and Channel Spacing Assignment

The channel frequency and the channel spacing is chosen automatically depending from the received channel name (over the serial interface) in accordance to the table below:

Channel Name	Channel Frequency	Channel Spacing
118.000	118.0000 MHz	25 kHz
118.005	118.0000 MHz	8.33 kHz
118.010	118.0083 MHz	8.33 kHz
118.015	118.0166 MHz	8.33 kHz
118.025	118.0250 MHz	25 kHz
118.030	118.0250 MHz	8.33 kHz
118.035	118.0333 MHz	8.33 kHz
118.040	118.0416 MHz	8.33 kHz
118.050	118.0500 MHz	25 kHz
118.055	118.0500 MHz	8.33 kHz
118.060	118.0583 MHz	8.33 kHz
118.065	118.0666 MHz	8.33 kHz
118.075	118.0750 MHz	25 kHz
118.080	118.0750 MHz	8.33 kHz
118.085	118.0833 MHz	8.33 kHz
118.090	118.0916 MHz	8.33 kHz
118.100	118.1000 MHz	25 kHz
...
155.975	155.9750 MHz	25 kHz
155.980	155.9750 MHz	8.33 kHz

3.2.3. Antenna Input / Output

Name	Function/Remarks
Antenna	Antenna connec tor: <ul style="list-style-type: none"> • Input in RX mode • Output in TX mode

3.2.4. Warning or Failure Indication Test Routine IBIT

- The test routine IBIT is activated by pressing the test button on the control unit.
 - During the automatic test (ca. 2 s) the green LED is flashing at the rear.

NOTICE

It is not possible to interrupt a started selftest by an active PTT or a new received channel name.

When the test result is positive

- Green LED is on (front)
- Yellow LED is off (front)
- Red LED is off (front)
- All errors accessible via the serial RS422 interface are zero
- Status output /TEST_OK is active
- Status output /FAILURE is inactive

In the test phase of the selftest:

- Green LED is blinking (front)
The blinking period is 0.125 s on/0.125 s off
- Yellow LED is off (front)
- Red LED is off (front)
- All errors accessible via the serial RS422 interface are zero
- Status output /TEST_OK is blinking (like the green LED)
- Status output /FAILURE is inactive

Internal failure indication

- Green LED is off (front)
- Yellow LED is off, except when an "external error has been indicated" (front)
- Red LED is on (front)
- Error is be accessible via the serial RS422 interface
- Status output /TEST_OK is inactive
- Status output /FAILURE is active

External failure indication

- Green LED is off (front)
- Yellow LED is on (front)
- Red LED is off, except when an "internal error has been indicated" (front)
- Error is accessible via the serial RS422 interface
- Status output /TEST_OK is inactive
- Status output /FAILURE is active

Failure indication in the case that an "internal failure" and an "external failure" is indicated

- Green LED is off (front)
- Yellow LED is on (front)
- Red LED is on (front)
- Error is accessible via the serial RS422 interface
- Status output /TEST_OK is inactive
- Status output /FAILURE is active

When the the test is finished the transceiver goes to receive mode.

The test routine IBIT checks the following functions:

- Test-channels
- PSB error
- Control unit lost connection error
- Channel error
- RX synthesizer error
- RX AGC error
- TX output power error
- TX synthesizer error
- TX OFF-over temp. error
- TX hot error
- Antenna VSWR error
- Stuck PTT error
- TX-test-signal
- Error-history flags in the service setup

All errors which occur one or more time(s) set the corresponding error-history-flag.

The error-history-flag stays set for a time of 10 operating hours after the error has disappeared. The state of all error-history flags is stored at power off. The error-history-flags are readable in the service setup. The error history-flag can be cleared immediately at service setup.

3.2.5. **NOGO-Signal at the LINE_OUT**

The RT5202 immediately produces a NOGO-audio signal at the LINE_OUT if a failure is detected. The NOGO-signal has the following characteristics:

Pulse modulated sine wave:	800 Hz
Interrupt duration before first burst:	70 ms
Pulse duration:	60 ms (3 times)
Interrupt duration:	60 ms (3 times)
Interrupt duration after last burst:	70 ms
Overall indication time:	500 ms

3.2.6. **Serial Interface**

The RT5202 is a remote controlled device. It receives most commands via a serial interface from a control unit (CU). Depending on functionality of the used interface standard it is also possible that the control unit can read the device status.

3.2.6.1. **Applicable Interfaces**

The RT5202 provides communication via the following interface standards:

- RS422
- ARINC 429
- RS232

NOTICE

Only one kind of interface may be used at the same time.

3.2.6.2. ***Common Behaviour Independent from the Interface Standard***

Data out of range:

Received data which is out of range is ignored. This means it shall be handled as not received.

Blank

4. Index

Abbreviations	5	General Description	9
Accessories	21	Header & General Synchronisation	33
Additional Required Equipment	24	Installation	23
ANS_SERVICE_SETUP.....	41	List of Abbreviations.....	5
ANS_STATE.....	36	Mounting	26
Check Sum	34	Non Warranty Clause.....	8
Conditions of Utilization	7	Operation Instructions.....	53
Connector P1	29	Packaging, transport, storage	23
Connector Pin Assignments	29	Protocol Version.....	33
Controls and Indications	54	Purpose of Equipment	10
Data Block Description	34	Safety Definitions	7
Data out of range.....	58	SET_SERVICE_SETUP	39
Device Assignment.....	24, 53	SET_STATE.....	36
Device ID	33	Type Plate	25
Environmental Condition.....	20	Units	6
First Issue and Changes.....	3	Variants Overview	10
Frame Identification	33	Warranty Conditions	7

We reserve the right to make technical changes.
The data correspond to the current status at the time of printing.

***** End of the Document *****