

# VT-02

## Secondary Surveillance Radar Transponder Mode-S

# Installation Manual

***GARRECHT***  
***Avionik GmbH***



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## 2. Preface

### 2.1. General




This manual contains installation information and instructions for the Mode-S transponder VT-02. It shall be read before installing your VT-02 transponder.

The installation shall be carried out or supervised by a qualified person. Damage caused by installation by unqualified persons is not covered by the manufacturers warranty.

**® The product names used in this document are for identification purposes only. All trademarks and registered trademarks are the property of their respective owners.**

Safety symbols:

The following symbols and terms are used in this manual:

	<p><i>Warning</i> Warning statements identify conditions or practices that could result in injury or loss of life</p>
	<p><i>Caution</i> Caution statements identify conditions or practices that could result in damage of this product or other property.</p>
	<p><i>Important note:</i> Indicates important or usefull information. It is strongly recommended to read, understand and follow the statement.</p>

### 2.2. Warranty limitations

This product is warranted to be free from defects in material or workmanship for two years from the date of purchase. Within this period, Garrecht Avionik GmbH will at it's sole option, repair or replace any components that fail in normal use. Such repairs will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost.

**This warranty does not cover failures due to abuse, misuse, accident or unauthorized alterations, repairs or installation work by unauthorized or unqualified persons or companies.**

To obtain warranty service, an copy of the original invoice from an authorized retailer and an signed installation protocol (see chapter 10) need required.

### 3. Unpacking and part identification

The VT-02 transponder system is supplied with the following:

P/N:	VT-0201	System unit
P/N:	VT-0202-76-()-()	Adaptor kit for KT-76®
or	VT-0202-76AC-()-()	Adaptor kit for KT-76A® or KT-76C®

Document:	02.0200.10	User's guide
Document:	02.0200.11	Installation manual (this document)

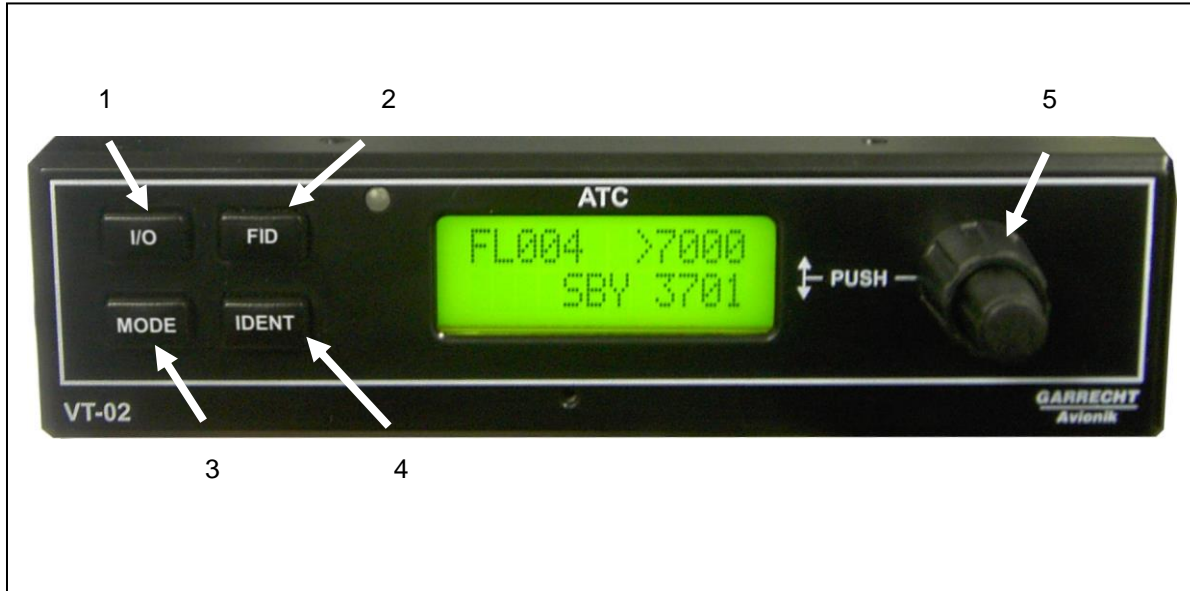
Available options:

P/N:	VT-0203-()-()	Mounting frame
Document:	02.0200.12	Maintenance and repair manual (for avionic repair shops only)

## 4. Input Devices (human machine interface)

### 4.1. VT-02

Picture of front panel with Input devices



The system will be operated using the following devices:

Nr.	Description	Function
1	On/Off key	Switches the system On or Off
2	Flight-ID Key	Invokes the menu to setup the flight ID
3	Mode – key	Selects the operating mode
4	Ident – key	Invokes the Ident Mode for 18 sec.
5	Double shaft Encoder with Push on capability	Enters or modifies values

#### 4.1.1. On/Off key

To enable the system, press key 1 shortly. After the start, the unit performs the built in test and shows the operating mode. For switching off, press key 1 for at least 3 seconds Release the key, when the LCD becomes blank.

#### 4.1.2. Flight-ID Key

Pressing the flight ID key invokes the menu to setup the flight ID. Refere to chap. 3.2 for detailed information about proper setting of the flight ID.

#### 4.1.3. Mode-key

Key 3 selects the following modes:

- SBY Standby - System is switched on, no replies or squitters will be sent.
- ON Selected reply code will be replied for Mode-A/C interrogations, altitude information is set to zero, squittering is enabled, Mode-S interrogations will be replied
- ALT Selected reply code will be replied for Mode-A/C interrogations, altitude information is set to indicated value, squittering is enabled, Mode-S interrogations will be replied

#### 4.1.4. Ident key

Pressing key 2 invokes the ident mode for 18 seconds. Use this function only when ATC requires to squawk ident.

#### 4.1.5. Double shaft rotary encoder

Main input device for setting values is the double shaft rotary encoder. Rotating the outer knob selects the position to be modified. Rotating the inner knob changes the selected value.

The edit mode will be started rotating the inner or outer knob of the double shaft encoder.

Pushing the inner knob confirms the selected value and cancels the edit mode (cursor stops blinking)

#### 4.2. VT-2000

Picture of front panel with input devices



	<p>To switch on the system, press one of the Keys <b>SBY</b>, <b>GND</b>, <b>ON</b>, <b>ALT</b>.</p> <p>To switch off, press and hold the <b>OFF</b> key.</p>
	<p>Set the desired squawk by pressing the key buttons. Edit and navigate through the menu item, use the arrow keys  or  (up/down) and  or  (left/right)</p>
	<p>To switch between the additional functions, use the <b>PGE</b> and the  key.</p> <p>The labels near the arrow keys are context sensitive. The keys will change their functions in the different pages (soft keys).</p>

## 5. Technical data and specifications

### 5.1. General

Technical characteristics	Specification
<b>Mechanical</b> Dimensions Mounting Weight	255x158x38mm (w/o. connectors) 6,25" Avionik installation bay. System unit: 0,85 kg mounting frame: 0,1 kg
<b>Environmental</b> Max. Altitude Temperature Cooling Vibration Shock	50.000 ft (internal alticoder limited to 40.000ft) -20°C - +55°C passive, no auxiliary cooling required DO160D Cat. U2 (Curve F/F1) DO160D Cat. R (Curve B/B1) Operational: 6g, crash safety: 20g
<b>Electrical</b> Voltage (nom.): Voltage (operational) Current (nom.) @ 13,8 V and 1200 A/C replies/sec. Standby (squitters active) RF-power @ antenna if cable specification of this manual are met Reply rate: Output Impedance max. VSWR	13,8 V DC 9 to 32 V DC 0,45 A 0,17 A 125 Wp min. 1200/s Mode-A/C min. 50/s Mode-S 50 Ohms 1,5:1

Technical characteristics	Specification
<b>Interfaces:</b>  Human machine interface / User input capability	<b>VT-02:</b> The system provides an LCD display, 4 push-buttons and a twinaxle rotary encoder for inputting values and selecting operational modes. <b>VT-2000:</b> The system provides a keypad with 20 buttons and a color LCD screen.
<b>Automatic input capability:</b>  On Ground interface:	The system detects the input of an "on ground" switch. If the aircraft's frame does not supply such an information, the input channel will be set to "airborne" always (ref. to chapter 5.10).  Logic = 0: on ground condition
<b>Automatic input capability:</b>  Suppression interface:	The system provides an suppression interface to prevent interference with other instruments installed in the same aircraft (such as DME):  Impedances: DC: -0,4 V to + 30 V: 7,2 kOhms DC: < -0,4 V: 1 kOhms AC: 1 kOhms  Levels: output: 10 V input: 7 V - 30 V
external standby:	An external standby interfaces is provided by the VT-02 (Ground on activate).
external ident:	An external ident interfaces is provided by the VT-02 (Ground on activate).
Alticoder interfaces:	<b>parallel:</b> 10 bit Gilham Gray Code interface, 100ft resolution (max. input capability: 62.700 ft)  <b>serial:</b> RS-232 interface for alticoders with serial output to reduce wiring harness, 100ft oder 25ft resolution.
<b>Alticoder capability</b>	The system contains an integral digital alticoder to provide data about pressure altitude for Mode C information in 100ft or 25ft steps. It's line has to be connected to the aircraft's static pressure system.  Range: -1000ft to + 40.000ft
<b>Self test routines (BIT)</b>	After powering on, the system runs several internal self test routines permanently. In case of errors, the user gets warned visible and audible and depending on the level of error, the system stops operating with a permanent error message.

## 5.2. Certification base

ETSO-2C112b  
EUROCAE ED-73B

according to ICAO Annex 10 Amendment 77, Vol. III, Attachment A to Chapter 5 and the ICAO Manual of Mode S Specific Services (Doc. 9688-AN952)

## 5.3. Equipment class

Class 1

## 5.4. Mode-S transponder level

Level 2se Mode-S transponder

## 5.5. Equivalences to FAA TSO-C112 Classes:

Equal to FAA TSO C112 Class: 2A1 120 010

## 5.6. Limitations

1. To reach the required minimum RF peak power, the use of an antenna cable with a total loss of less or equal 2,0 dB is required.
2. The range of the internal alticoder is limited to a maximum altitude of 40.000 ft.
3. The system may be operated in aircraft not exceeding a maximum speed of 250 kts, a maximum altitude of 50.000 ft and a MTOW of 5.700 kg. Faster aircraft or such with higher MTOW require antenna diversity.
4. The system does not provide connectivity to on-board ACAS/TCAS equipment.
5. Extended squitter capability will not be provided at latitudes north of 89°00'00" N and south of 89°00'00" S.

## 5.7. Environmental categories

	Section	Category	Conditions
Temperature / Altitude D1	4.0	D1	
Low ground survival temperature	4.5.1	D1	-55°C
Low operating temperature	4.5.1	D1	-20°C
High ground survival Temperature	4.5.2	D1	+85°C
High Short-time Operating Temperature	4.5.2	D1	+70°C
High Operating Temperature	4.5.3	D1	+55°C
In Flight Loss of Cooling	4.5.4	Z	No auxiliary cooling required
Altitude	4.6.1	D1	50.000 ft.*
Temperature Variation	5.0	B	5°C / minute
Humidity	6.0	A	
Shock	7.0	B	6 G operational shocks 20 G crash safety
Vibration	8.0	U2 (Helicopter) R (Fixed Wing)	Vibration curve F/F1 Vibration curve B/B1
Explosion Profness	9.0	X	
Water Profness	10.0	X	
Fluids Susceptibilities	11.0	X	
Sand and Dust	12.0	X	
Fungus Resistance	13.0	X	
Salt Spray	14.0	X	
Magnetic Effect	15.0	Z	Less than 0.3 m
Power Input (DC)	16.0	B	
Voltage Spike Conducted	17.0	B	
Audio Frequency Conducted Susceptibility	18.0	B	
Induced Signal Susceptibility	19.0	Z	
Radio Frequency Susceptibility	20.0	S T	radiated conducted
Emission of RF	21.0	B	compliant with CAT M except of harmonics of 1090 MHz
Lightning Induced Transient Susceptibility	22.0	A2XXX	
Lightning Direct Effects	23.0	X	
Icing	24.0	X	
Electrostatic Discharge (ESD)	25.0	A	
<b>* see chapter 5.6 for restrictions</b>			

## 5.8. Software level

The software level for VT-02 has been determined to be

### Level D:

Software whose anomalous behaviour, as shown by the system safety assessment process, would cause or contribute to a failure of system function resulting in a minor failure condition for the aircraft.

## 5.9. Telecommunication specifications

Emission power: 300 Watts max.

Emission class: 12M0M1D

Frequency: 1090 MHz

## 5.10. Logic of on-Ground interface

The transponder has an on-ground interface, which should be connected to your aircraft installation, if an adequate signal will be provided. The following table shows the airborne or on the ground status which the transponder will indicate to interrogators.

on ground configuration in Menu	NO / none	YES / Inst
<b>on ground switch settings</b>		
no on-ground switch present	airborne	-
on ground	-	on ground
airborne	-	airborne

on ground: system replies not to Mode-A/C and Mode-S "all-call" interrogations, squitters active  
airborne: system replies to all interrogations, squitters active



***Do not install a manual on ground switch in the cockpit of your aircraft. If no adequate on ground switch is provided in the airframe, leave the on ground input unconnected unless specific national requirements mandate usage of so called "on ground mode" while being on an airport.***

***The switch must be of an approved type, very reliable and regularly checked for proper function, as it directly affects your visibility to other TCAS Systems !!!***

## 5.11. CAN-Bus interface

The system provides a CAN-Bus interface for connecting external devices or remote control. A detailed description of the interface can be obtained by the manufacturer (for system integrators or OEMs only).

## 6. Aircraft installation

### 6.1. General

The VT-02 has been designed to fit into existing mounting frames, where a Bendix King KT-76® or KT-76A® / KT-76C® has been installed formerly. No modification in wiring harness is required for installing the VT-02.

Generally, the 24-Bit Mode-S address and the flight ID are stored in the system unit. To prevent undesired manipulation, the Mode-S address is password protected.

Refer to chapter 6.2 for installation in existing mounting frames.

If using the Mounting frame P/N VT-0203-()-(), refer to chapter 6.3.

**General: All installation work shall be performed in accordance with the acceptable methods, techniques and practices for aircraft alterations, inspections and repair, shown in FAA documents AC 43.13-1B and AC 43.13-2A (see [www.faa.gov](http://www.faa.gov) to obtain this documents free of charge in digital form).**



***Wiring electrical components shall be performed by qualified personal only to prevent damages and hazardous situations that could result in loss of life.***

### 6.2. Installation in existing mounting frame

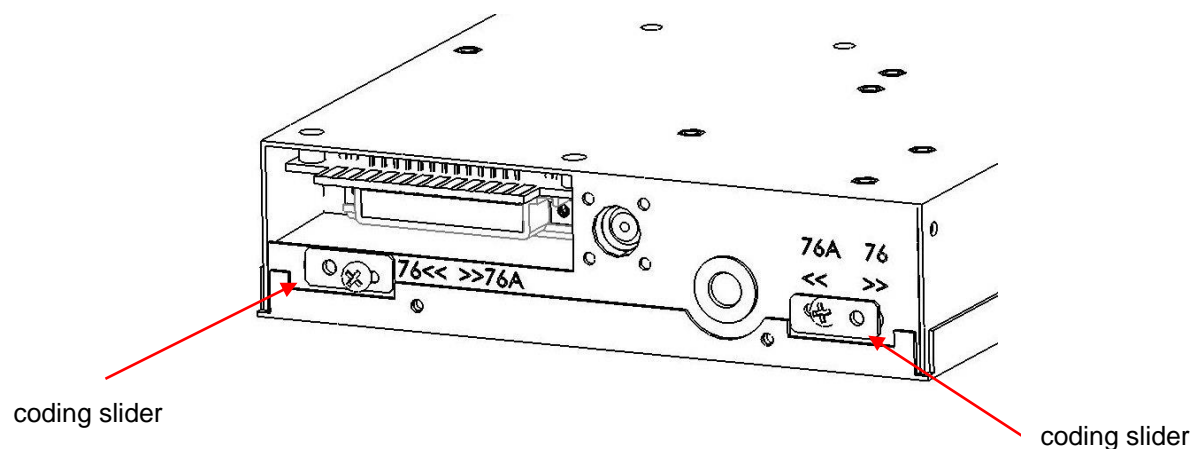
#### 6.2.1. General

To prevent wrong installation and resulting damages in the transponder or in your aircraft, please verify carefully, which Model of the KT-76 you want to replace by the VT-02.

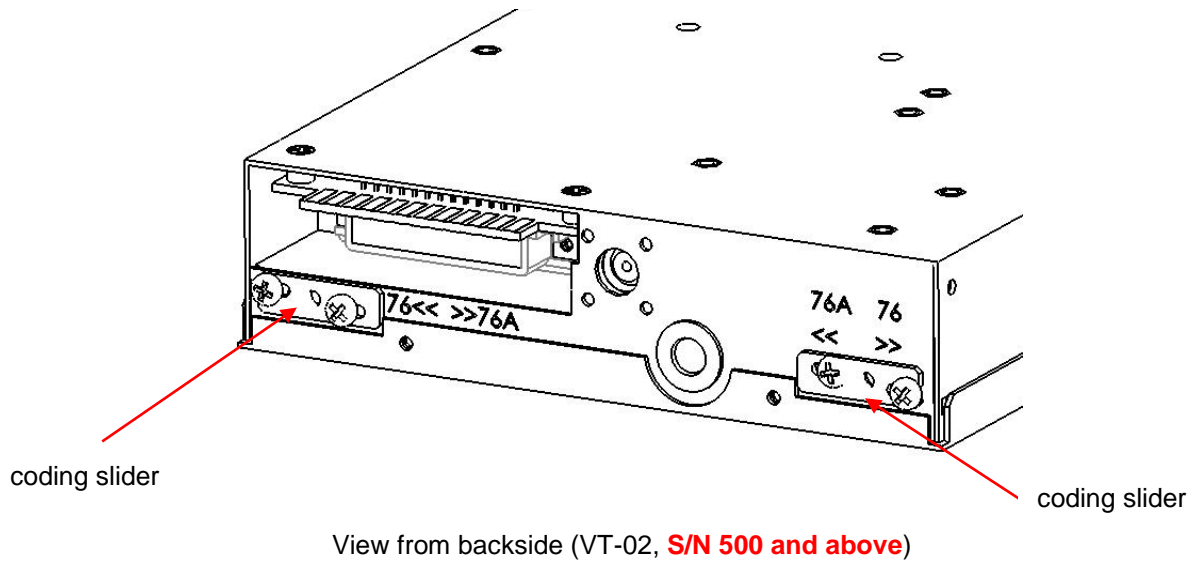
#### 6.2.2. Setting up the coding sliders

For replacing a KT-76®, set both coding sliders in the backside of the unit to KT-76 direction.

For replacing a KT-76A® or KT-76C® set both coding sliders in the backside of the unit to KT-76A direction.



View from backside (VT-02, S/N less than 500)



After setting up the coding sliders, fasten both screws (use Loctite 243 to prevent losing the screws).

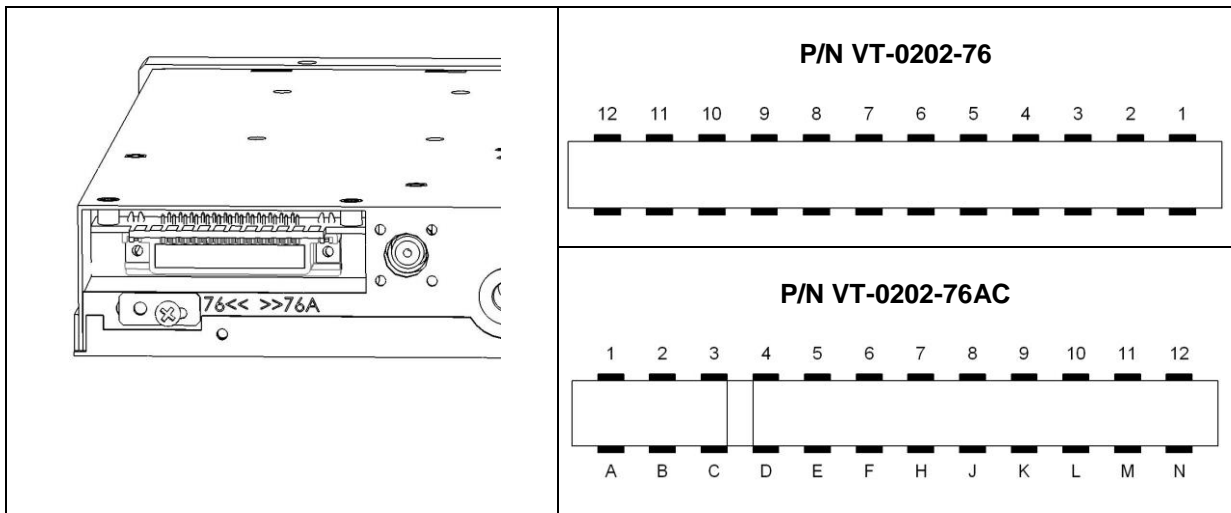
### 6.2.3. Locking and Unlocking the device in the mounting frame

The locking/unlocking mechanism works in the same manner as for the KT-76® / KT-76A® /KT-76C®. **Use a 2 mm hex wrench** key for operating the locking mechanism. To unlock the device, rotate the wrench key counter clock wise. For locking, rotate it clock wise.



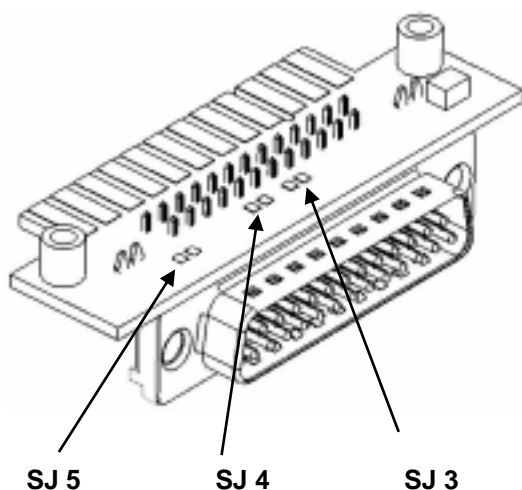
**To prevent damages to the VT-02 or your aircraft installation, be sure to switch off the avionic main switch before installing or removing the device.**

6.2.4. Setting up the Adaptors kits



Pin assignment P/N VT-0202-76		
Pin	Signal	
1	Alticoder B2	
2	Alticoder B4	
3	Alticoder C1	
4	Alticoder B1	
5	10 - 28 V DC	
6	Alticoder A1	
7	Alticoder A2	
8	Alticoder C2	
9	Alticoder A4	
10	Alticoder C4	
11	n.c.	
12	GND	

Pin assignment P/N VT-0202-76AC			
Pin	Signal	Pin	Signal
A	GND	1	GND
B	Alticoder B4	2	n.c.
C	Alticoder B2	3	n.c.
D	Alticoder C1	4	Mutual suppression
E	Alticoder B1	5	see note 1
F	external Ident	6	see note 2
H	Alticoder C4	7	n.c.
J	Alticoder A4	8	Alticoder D4
K	Alticoder A2	9	DME suppression
L	Alticoder C2	10	external standby
M	Alticoder A1	11	10 - 28 V DC
N	see note 3	12	n.c.



**for PCB-02-22-001-04:**

**Note 1:** For connecting a serial alticoder to Pin 5, close solder jumper **SJ 3**.

**Note 2:** For connecting a GPS for ADS-B purposes to Pin 6, close solder jumper **SJ 4**.

**for PCB-02-22-001-05:**

**Note 3:** For connecting a on-ground (OTG) - signal to Pin N, close solder Jumper **SJ 5**.

If using one or more of the signals shown above, add a MOLEX crimp contact in the MOLEX shell at the appropriate position for each signal. (refer also to chapter 6.4.3 of this manual)

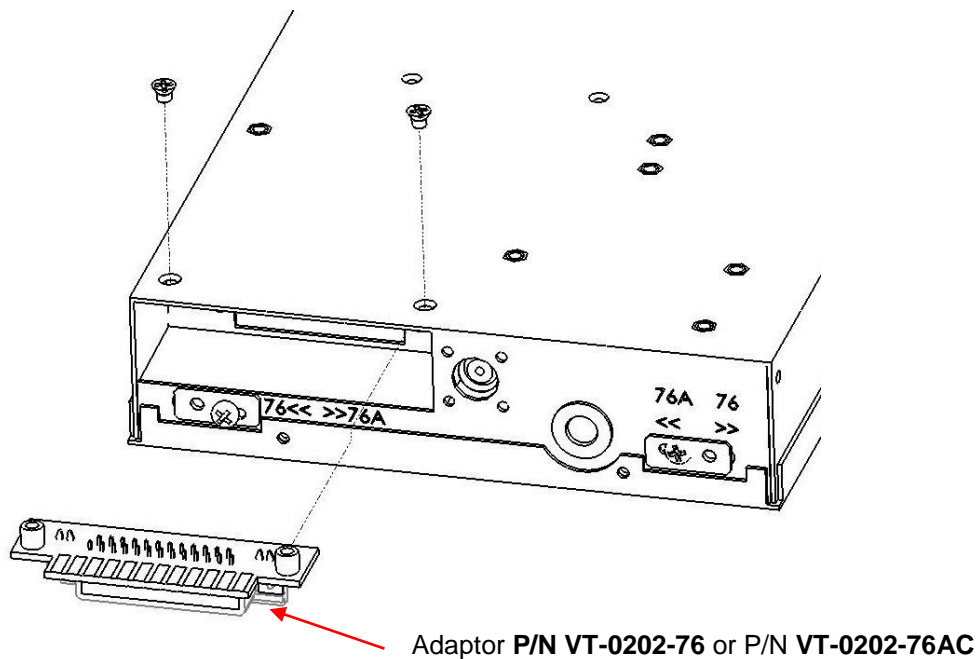
### 6.2.5. Installation of the Adaptor

Due to the different pinout of KT-76® and KT-76A® / KT-76C®, the VT-02 provides two different adaptors to make the system pin compatible to the existing frame and wiring harness in your aircraft.



For replacing a KT-76® install the adaptor **P/N VT-0202-76-()-()** as shown below.

For replacing a KT-76A® or KT-76C® install the adaptor **P/N VT-0202-76AC-()-()** as shown below.



- Plug the adaptor into the connector's bay in the back of the VT-02 as shown in the drawing above
- Use the screws provided with the adaptor to fasten the adaptor in the housing of the VT-02
- Use Loctite 243 or equivalent to prevent losing the screws.

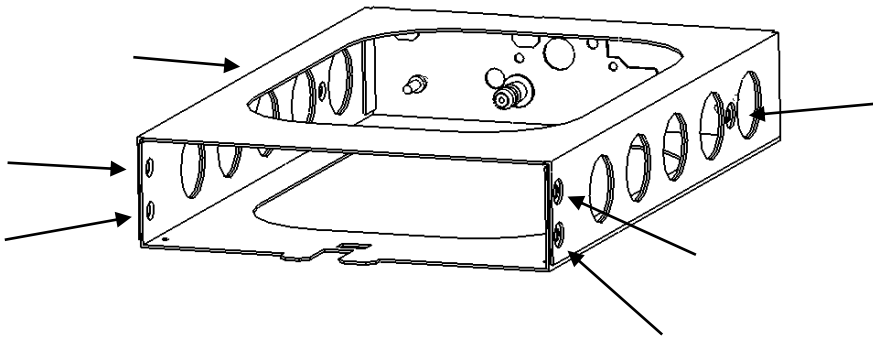
### 6.3. Installation in mounting frame P/N VT-0203-()-()

#### 6.3.1. General

For using the internal alticoder or additional interfaces of the VT-02, a dedicated mounting frame for the VT-02 is provided by the manufacturer (P/N VT-00203-()-()). It may also be used, if no KT-76® or KT-76A® / KT-76C® mounting frame is present in your aircraft. For locking and unlocking in the mounting frame, refer to chapter 6.2.4.

For installation in the mounting frame (P/N VT-0203) set the coding sliders in the backside of the unit to KT-76A direction and remove any adaptors installed in the system unit.

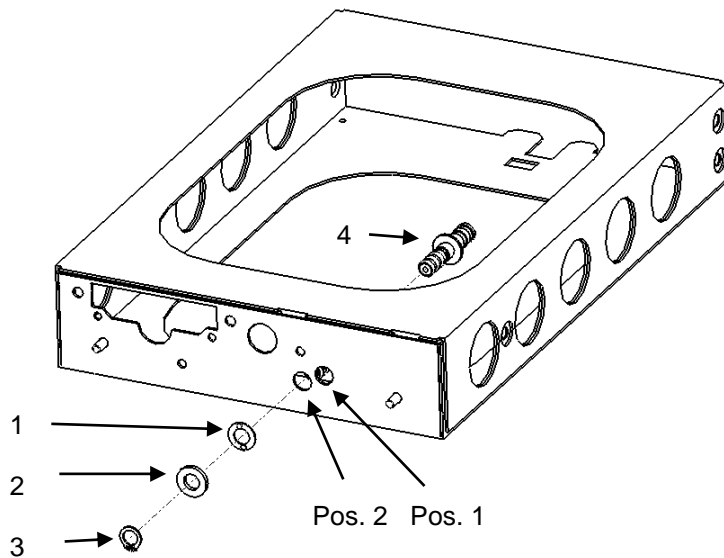
#### 6.3.2. Installation of the mouting frame in the avionic rack of your aircraft



Use **all** holes in the left and right wall of the mounting frame to fix it into the avionic bay of your aircraft.

Installations without using the rear support holes may cause problems under strong accelerations (shocks, vibrations in the z – axis).

### 6.3.3. Installation of the blind mate static pressure connector for using the internal alticoder



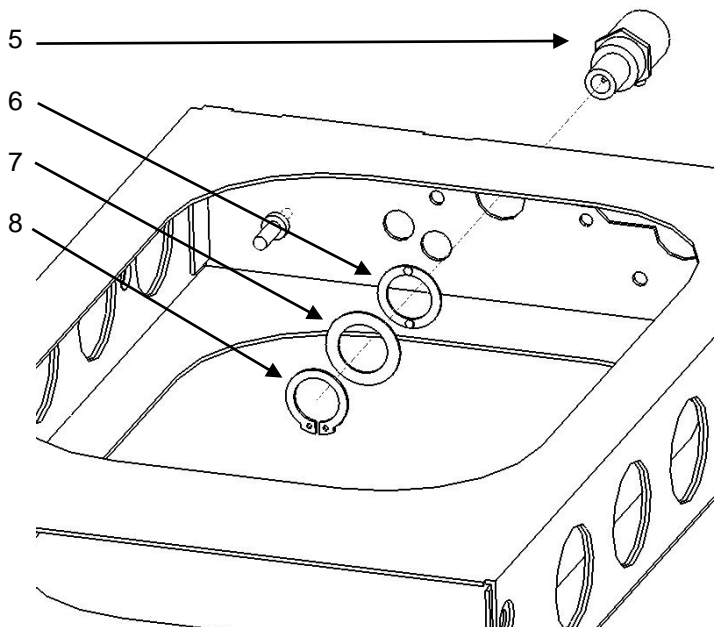
1. Wave washer  
(P/N 00.03.22.064)
2. Plain washer  
(P/N 00.03.05.061)
3. Circlip washer  
(P/N 00.D471.6)
4. Pressure connector with  
2 gaskets (3.68x1.78mm)

Apply some vaseline or similar grease to the gaskets in order to make the VT-02 slide in and out easier.

Pos 1: Installation position if  
VT-02 S/N 001 to 499

Pos. 2: Installation position if  
VT-02 S/N 500 and above

### 6.3.4. Installation of blind mate antenna connector



5. Blind mate BNC antenna connector  
(P/N 00.9-30-10)
6. Wave washer  
(P/N 00.W61380)
7. Plain washer  
(P/N 00.PS18x12x0,5)
8. Circlip washer  
(P/N 00.SH-40STPD)

For proper connection of the antenna line to the antenna connector, please refer to chapter 8 of this manual.

## 6.4. Wiring



If the installation of the unit has been performed in a present installation bay of a Bendix King KT76® or KT-76A® / KT-76C®, no modification in the wiring harness is required.



***Wiring electrical components shall be performed by qualified personal only to prevent damages and hazardous situations that could result in loss of life.***

If using the mounting frame P/N VT-0203, all wires (except the antenna line) related to the VT-02 configuration can be connected either to a 24 pin MOLEX connector or to one SUB-D 25 pin connector on the back of mounting frame. The following subchapters describe the different lines required for operating the transponder.



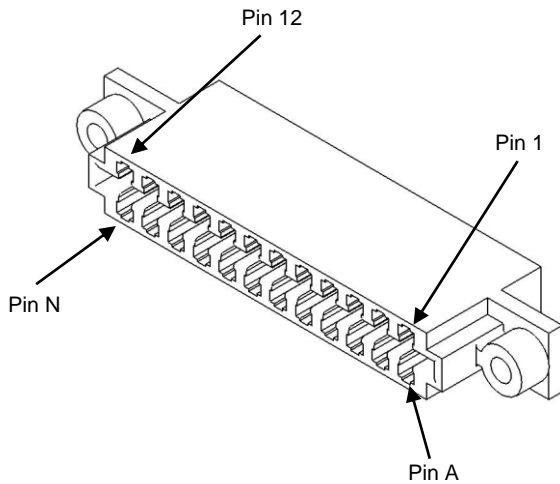
***DO NOT POWER ON THE TRANSPONDER WITH THE ANTENNA DISCONNECTED !!!***

***Damages to the unit caused by a disconnected antenna or installations performed by unqualified installers can be determined by the manufacturer and are not covered by the manufacturers warranty.***

### 6.4.1. General considerations:

- Keep all cable routing as short as practical
- Avoid sharp bendings and use tie wraps to prevent scrubbing.
- Avoid routing near power sources, hydraulic/pneumatic/fuel lines or any hot devices.
- Avoid routing near ADF antenna line
- Always use MIL-W-22759/16 or other certified wire
- Minimum cable size for interface connections: AWG 24
- Minimum cable size for power connections: AWG 18

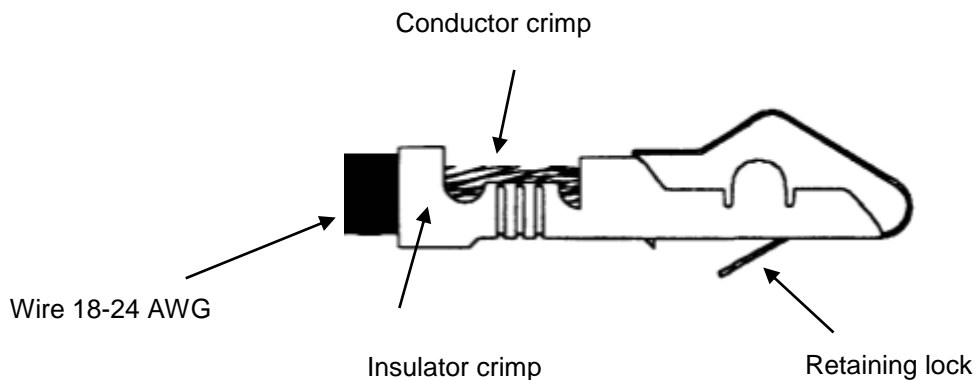
### 6.4.2. MOLEX 24 pin Connector wiring



Pin assignment MOLEX connector			
Pin	Signal	Pin	Signal
<b>A</b>	GND	<b>1</b>	GND
<b>B</b>	Alticoder B4	<b>2</b>	n.c.
<b>C</b>	Alticoder B2	<b>3</b>	n.c.
<b>D</b>	Alticoder C1	<b>4</b>	Mutual suppression
<b>E</b>	Alticoder B1	<b>5</b>	serial Alticoder in
<b>F</b>	external Ident	<b>6</b>	GPS data in (ADS-B)
<b>H</b>	Alticoder C4	<b>7</b>	n.c.
<b>J</b>	Alticoder A4	<b>8</b>	Alticoder D4
<b>K</b>	Alticoder A2	<b>9</b>	DME suppression
<b>L</b>	Alticoder C2	<b>10</b>	external standby
<b>M</b>	Alticoder A1	<b>11</b>	10 - 28 V DC
<b>N</b>	n.c.	<b>12</b>	n.c.

The orientation of the connector shown above is as it is installed in the mounting frame (P/N VT-0203).

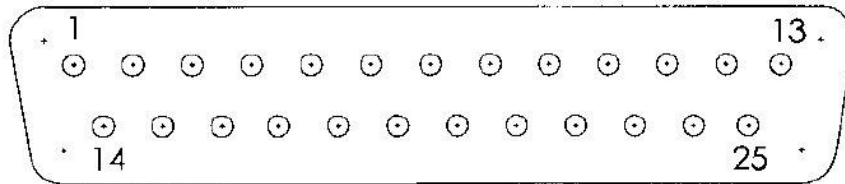
### 6.4.3. MOLEX crimp contact handling



- Strip the insulation for 4mm
- Be sure to have crimped insulator and conductor crimp
- Insert the crimped contact in the MOLEX connector housing from rear until the retaining lock clicks into the stop
- Test the self locking feature by gently pulling the cable
- If required, remove the crimp contacts using the MOLEX Removal tool

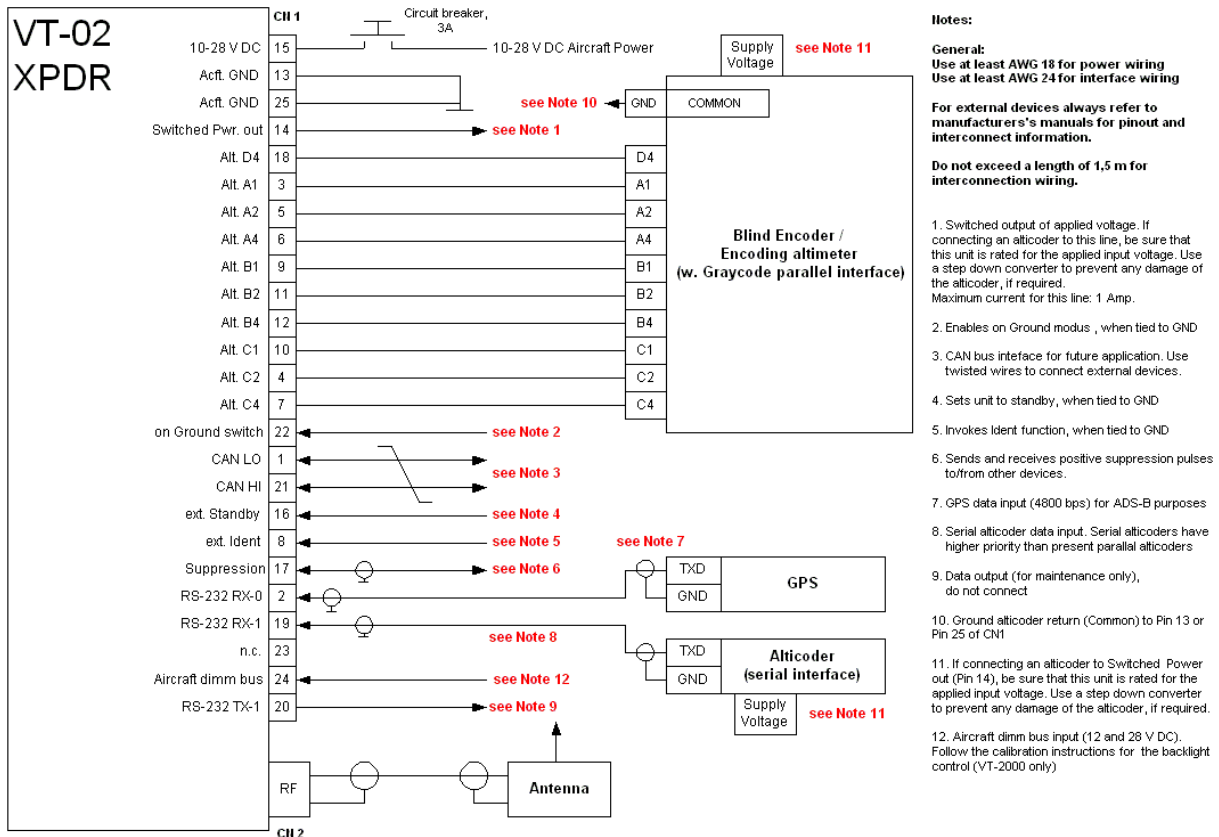
#### 6.4.4. SUB-D 25 pin Connector wiring

If using a D-SUB 25 connector instead of the MOLEX connector, wire the connector as described in the following table.



viewed from the back of the SUB-D 25 connector

Pin	Function	Additional Information
1	CAN-LO	CAN-Bus interface
2	RS-232 RX-0	Data-in 0 (future application, ADS-B)
3	Altitude A1	
4	Altitude C2	
5	Altitude A2	
6	Altitude A4	
7	Altitude C4	
8	External Ident	Ground on activate
9	Altitude B1	
10	Altitude C1	
11	Altitude B2	
12	Altitude B4	
13	GND (Power ground)	Connect to common GND of airframe
14	Switched power output	max. 1 Amp.
15	Power Input (+ 10 to + 28 V DC)	Connect to aircraft primary power source
16	External standby	Ground on activate
17	External suppression (I/O)	Connect to DME suppression bus (use shielded line)
18	Altitude D4	
19	RS-232 RX-1	Data-in 1 (serial alticoder)
20	RS-232 TX-1	Data-out 1 (maintenance only)
21	CAN-HI	CAN-Bus interface
22	on ground switch	Ground on activate, <b>Do not connect, if no on-ground signal is provided by aircraft installation</b>
23	n.c.	
24	Acft Dimm bus	Connect to aircraft dimm Bus (VT-2000 only) for external illumination control
25	GND (Power ground)	Connect to common GND of airframe



### 6.4.5. Power supply

The transponder is supplied by the aircraft's primary power source (9 V to 28 V DC).

**The system provides protection against reverse polarity only, if a fuse has been installed in the supply line.**

### 6.4.6. Switched Power output

Supplies power to the serial or parallel alticoder connected to the VT-02. Maximum current for this line: 1 Amp.

### 6.4.7. Suppression interface

The suppression line needs to be wired to other avionic components working in the 962..1213 MHz frequency band, such as DME or TACAN, to suppress any replies from the transponder that void the capability of such systems while operating.

The suppression line provides IN and OUT capability to prevent data transmission either to the transponder or other equipment.



***Wiring the suppression line requires a qualified avionic technician or engineer to prevent any kind of malfunction of the installed equipment. All equipment connected to the suppression line must be re-inspected and re-approved before operation. Refer to chapter 5 for specifications of the suppression interface.***

### 6.4.8. On-ground interface

If your aircraft installation provides an on-ground signal, it should be connected to this pin. The transponder replies only to discretely addressed Mode-S interrogations if the on-ground signal is present. The permanent emission of squitters will not be affected.

Refer to chapter 5.10 for logic table of this interface.

**6.4.9. External ident**

Momentary input for invoking the ident function of the transponder (Ground to activate).

**6.4.10. External stand-by**

Sets the unit to standby (Ground to activate). This line might be used, if two transponders are installed on board of the aircraft.

**6.4.11. RS-232 interfaces**

All RS-232 interfaces require data at RS-232 level (no TTL level).

**RS-232 RX-0 (NMEA input for ADS-B out)**

Input for connecting a GPS for ADS-B purposes.

Connecting a GPS receiver providing the data shown below makes the VT-02 broadcasting it's current position with extended squitters. Minimum recommended NMEA sentences are \$GPRMC, \$GPGGA, \$GPGSA. **The required NMEA data baud rate is 4800 bps.**

**RS-232 RX-1:**

Input for connecting serial altimeters. The system is preconfigured for the following protocol:

*UPS AT (Apollo), 1200 bps, 8N1: "#AL sdddd..."*

To setup the serial altimeter interface for another protocol, a special software can be obtained by the manufacturer on request (maintenance organisations only).

**RS-232 TX-1:**

Output (for maintenance only, do not connect)

**6.4.12. CAN-Bus interface**

The CAN-Bus interface is intended to be used in future application (such as TIS or connecting an datalink processor).

**6.4.13. Altimeter inputs**

VT-02 accepts either serial or parallel data from external altimeters.



Never connect two altimeters (serial and parallel) simultaneously in order to prevent altitude reports with the wrong resolution if one unit fails.

Data from an external altimeter will be used if and only if the altitude source has been set to **external** in the setup menu.

**6.4.13.1. Parallel gray code altimeters:**

Use the pins shown in the following table for connecting an external altimeter with gray code parallel output:

Pin	Signal
3	Altitude A1
4	Altitude C2
5	Altitude A2
6	Altitude A4
7	Altitude C4
9	Altitude B1
10	Altitude C1
11	Altitude B2
12	Altitude B4
18	Altitude D4



If using a parallel alticoder, the alticoder source setting must be set to external and the resolution must be set to 100 ft resolution (setting ext-100ft). Even though the ext-25 seems to work, it must no be used for 100 ft resolution sources.

#### 6.4.13.2. serial output alticoders:

Connect a serial alticoder to the interface RS-232 RX-1. If using a serial alticoder, the alticoder source must be set to external and the resolution must be set to the appropriate resolution of the connected device.

#### 6.4.14. Antenna connection

The antenna connector in the back of the VT-02 slides into the antenna line connector of the mounting frame. Be sure that your installation provides a proper antenna installation and wiring before switching on the system



**DO NOT POWER UP THE TRANSPONDER WITH THE ANTENNA DISCONNECTED !!!**

**Damage to the RF unit caused by a disconnected antenna can be determined by the manufacturer and is not covered by the manufacturers warranty.**

Refer to chapter 7 for details about installing a transponder antenna in your aircraft.

## 7. Antenna installation

### 7.1. General

Any type of suitable transponder antenna may be used for connection to VT-02.

Antenna installation should be done by qualified personal only. It is strongly recommend to follow the step by step instruction below:



- Generally, follow the instructions of FAA AC 43.13-2B regarding antenna installation.
- Select a suitable position for installing the antenna. The manufacturer of your aircraft should give you detailed information regarding this issue.
- Mount the transponder antenna as described by the antenna manufacturer.



- To prevent damages by moisture, seal all antenna mounts.
- When choosing a position for installation, always be sure not to damage structural devices of the airframe.
- For antenna installation in pressurized aircraft, follow the special instructions of FAA AC 42.13-2B.

### 7.2. Special instructions for antenna installation in composite aircraft

#### 7.2.1. Mounting Preparation

The electrical bonding of the antenna to the aircraft ground is extremely important. If this is not done properly, antenna performance characteristics may become distorted and nulls may appear in the antenna radiation pattern. This, in turn, may cause erratic navigational readings or signal drop out. The electrical bonding of antennas to composite aircraft is best accomplished by direct metal-to-metal contact of the antenna mounting hardware to an internal ground plane. To do this, you must have the mounting screws, washers and nuts make direct contact to the internal ground plane with the use of a backing plate. The backing plate must make direct contact to the internal ground plane. Sandwich the aircraft skin and internal ground plane between the antenna base plate and internally mounted backing plate. To test the electrical bonding of the blade to the aircraft, a reading of .003 ohms between the antenna base plate and ground should be achieved.

### 7.2.2. Ground Plane Size

UHF antennas will require a metal ground plane size of 24" by 24" OR LARGER. "As large as practical" will assure optimum antenna performance. Most other antennas may also use the 24" by 24" rule, but with ground planes, larger is always better.

After installation, double check that a reading of .003 ohms between the antenna base plate and ground has been achieved.

## 8. Antenna cable

### 8.1. General

The antenna line connects the RF connector of the transponder to the antenna. For a proper installation, it is recommended to follow the instructions below:

- Follow the instructions of the cable and plug manufacturer
- For a proper installation, avoid shorts and cable interruptions in the antenna line
- For the most type of installation, a special aircraft grade cable need to be used.

Do not exceed the maximum cable lengths specified below (assuming a loss of 0,2 dB per connector):

Max. length (m [ft])	Insertion loss (dB/100m)	Mil-C-17 Type	RG Type
2,96 [9,71']	54,0	M17/128-RG400	RG 400
5,5 [18,1']	28,9	M17/127-RG393	RG 393

Other cable types, such as RG 58, AIRCELL 7, RG 213 do not comply with the fire protection requirements of the appropriate airworthiness standards.



The table above shows several antenna cable types and it's maximum lengths for reference only.

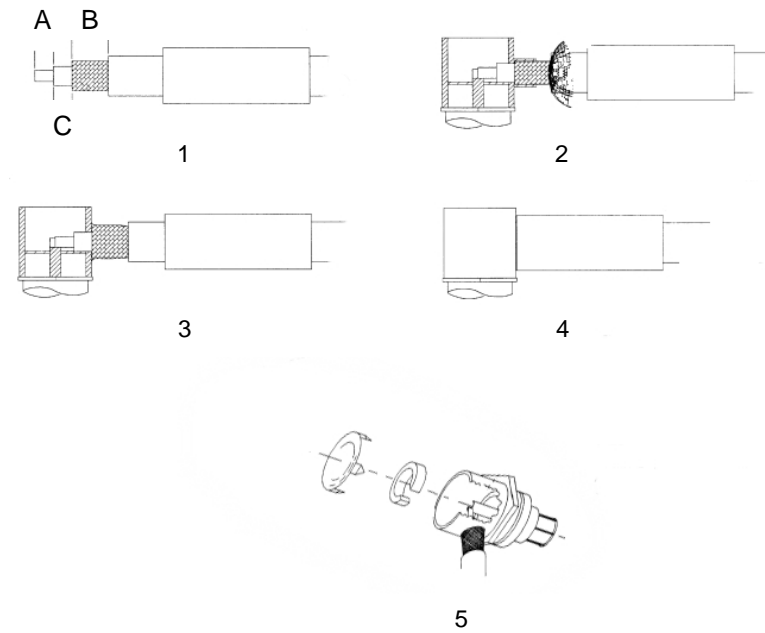
Other coaxial cable lengths and types may be used if the following requirements are met:

- maximum loss (cable + connectors) does not exceed 2.0 dB
- 50 Ohm Impedance
- Compliant with suitable airworthiness standards



Please always check, if certified cable is required for the installation in your aircraft.

8.2. Antenna cable connection to BNC blind mate connector



1. Strip back the insulation of the coaxial cable as shown in the table below and place a heat shrink tube over coax cable
2. Insert the cable into the connector as shown. Solder the inner contact and the inner shield
3. Solder the outer shield to the outside surface of the connector body
4. Slide the heat shrink tubing forward and heat to shrink the tubing
5. Complete assembly by installing the bushing and inserting the cap. Fasten the cap in place by soldering in two or three places.

Dimension	Size [mm]
A	3,2
B	6,4
C	3,1

**Caution: Avoid excess solder heat on all parts of the connector**

## 9. Post installation configuration and setup

### 9.1. VT-02



*All configuration and setup **must** be performed by qualified personnel only to prevent damages and hazardous situations that could result in loss of life. Please contact your local avionics maintenance organisation for qualified support in this issue.*

#### 9.1.1. Setting up pilot specific data

##### 9.1.1.1. Flight ID / aircraft registration

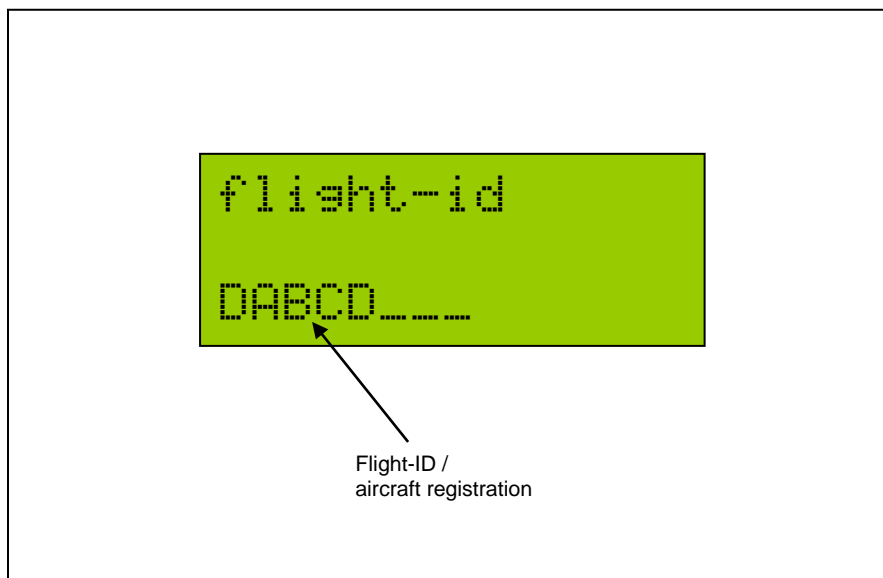
A Mode-S transponder broadcasts the flight id (company call sign for commercial aircraft or the aircraft registration for smaller private operated aircraft).



The flight id may be changed if required. Usually the FID is the call sign of your aircraft unless field 7 of the flight plan contains other data. **Always check before each flight if your flight id has been set correctly.**

Follow these steps to set the flight id / aircraft registration:

- Set the unit to standby (SBY) mode
- Press the FID key.
- The current flight id will be shown on the screen now.



- To modify the flight id, press the flight ID button of the double shaft rotary encoder. The underlined first digit of the flight id indicates the edit mode.
- Use the outer knob of the rotary encoder to select the position to be modified. Use the inner knob of the rotary encoder to modify the selected value. **Do not enter dashes or blanks even when used in your aircraft registration or company callsign. The data must be entered left aligned.**
- To finish editing the flight id press the inner knob of the rotary encoder.
- Exit the flight id page by pressing the FID key.

### 9.1.1.2. Display contrast



- Check, if the transponder antenna has been connected to the device properly
- If so, switch on the unit by pressing key 1
- If the BITE (build in self test) has been performed successfully, the system is ready for the next steps.
- Enter the installation setup by simultaneously pressing key 1 and the push button of the rotary encoder.

The screen shows as follows:

	<p>Use the outer knob of the rotary encoder to select the desired submenu.</p>
	<p>Sets the basic value for the LCD contrast.</p> <p>Additionally, the system provides an automatic temperature dependent contrast control.</p> <p>To modify the value, press the inner button of the rotary encoder and use the inner encoder to set up the desired values.</p>

If you feel that the contrast varies significantly with temperature, please contact the manufacturer for realignment instructions.

### 9.1.1.3. Display illumination

The next screen shown is the illumination set up

	<p>Possible values:</p> <p><b>on</b> LCD backlight and button illumination on, automatic brightness control by ambient light sensor</p> <p><b>off</b> LCD backlight and button illumination always off.</p> <p><b>30s</b> Illumination will be switched off automatically 30 sec. after the last user input. Pressing any button or using the rotary encoder switches on the illumination again.</p> <p>Press the inner knob of the rotary encoder and rotate it to set up the desired values.</p>
--	--

#### 9.1.1.4. Standard VFR-Code presetting

To simplify operation, the VT-02 provides a pre-programmable VFR code, which can be invoked by pressing the inner knob of the rotary encoder longer than 2sec.

For modification of the VFR code, please follow the steps shown below:

- Set unit to standby (SBY) mode
- Enter the installation set up by simultaneously pressing key 1 (power-on/off) and the push button of the rotary encoder.
- The LCD now shows password. Rotate the outer knob of the double shaft rotary encoder to select the menu **VFR-Preset** contrast
- Press the inner knob of the double shaft rotary encoder to invoke the edit mode.
- Rotate the inner knob of the double shaft rotary encoder to modify the selected value. Use the outer knob of the double shaft rotary encoder to select the desired digit position.
- Leave the menu by pressing the <Mode> key.

	<p><b>Standard VFR-Codes (as of 1. January 2008):</b></p> <p>Europe:        7000 (default setting) USA:            1200</p> <p>To obtain VFR codes for other regions, please contact your national aviation authority</p>
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### 9.1.2. Setting up password protected data

The input fields for aircraft related data (such as 24-bit Mode-S or aircraft maximum speed) address is password protected to prevent unwanted modifications by unauthorized persons.

## The password for this setup area is 10795C

Here are step by step instructions for entering the Mode-S address and other aircraft related data.



- Check, if the transponder antenna has been connected to the device properly
- If so, switch on the unit by pressing key 1 (On/Off)
- If the BITE (build in self test) has been performed successfully, the system is ready for the next steps.
- If no valid Mode-S address has been entered, skip the messages by pressing the inner knob of the rotary encoder.

**Always set the device into the <SBY> mode, if you want to modify the settings in this menu.**

- Enter the installation set up by simultaneously pressing key 1 (On/Off) and the push button of the rotary encoder.
- Enter the password shown above. If entered correctly, rotate the outer knob to navigate through the different menus as shown in this chapter.
- Press the inner knob of the rotary encoder to enter or edit the selected menu. The edit mode will be indicated by underlining the first character of the menu entry.
- An entered password remains active until switching off and on the unit.

#### 9.1.2.1. Illumination

The first submenu shown in the password protected area is the illumination set up. Refer to par. 9.1.3 to learn how to set up the illumination of the device. This setting is possible in the unprotected and password protected mode.

#### 9.1.2.2. LCD contrast


The second submenu shown in the password protected area is the LCD contrast set up. Refer to par. 9.1.2 to learn how to set up the illumination of the device. This setting is possible in the unprotected and password protected mode.

#### 9.1.2.3. Power-up Mode

The third submenu shown contains the settings for the power up mode. Here you can define, in which mode the system should start, if power will be supplied to the main of the device (i.e. by the avionic main switch).

To select the desired value, follow these steps:

- Press the inner knob of the double shaft rotary encoder to invoke the edit mode
- Rotate the inner knob of the double shaft rotary encoder to select the desired value. Entering a certain value manually is not possible. Please use the values suggested by the system.
- To finish editing the settings, press the push button of the rotary encoder.

	<p>Possible values:</p> <p><b>off:</b> System remains switched off after applying electrical power.</p> <p><b>Standby:</b> System powers up in standby mode after applying</p>
---	--


	electrical power.
--	-------------------

#### 9.1.2.4. Aircraft data

All aircraft related data of the following chapters are stored in a profile. If using the system in different aircraft (i.e. balloons), a special firmware feature provides up to five different profiles, that can be selected by the pilot before takeoff.

To enter the following submenus, press the inner knob of the rotary encoder, if the **acft data** menu item has been selected.

The screen shows

	<ul style="list-style-type: none"> <li>• To change the profile selection, press the inner knob of the encoder and rotate it then to select the desired profile.</li> <li>• If the desired profile has been selected, press the inner knob of the rotary encoder again to finish the edit mode. Now, rotate the outer knob to view and change the settings of the selected profile, as shown in the following subchapters.</li> </ul>
---	--



**NOTE:** If you have not purchased for the multiple Mode-S profile feature, only Profile-1 can be selected.

#### 9.1.2.5. Mode-S Address



***A proper installation and operation of a Mode-S transponder requires the installer to set a unique 24 bit Mode-S Address, the aircraft maximum speed as well as the flight id or aircraft registration. The 24 bit Mode-S address needs to be obtained from your national aviation authority. Contact the department, where you got the aircraft registration from.***

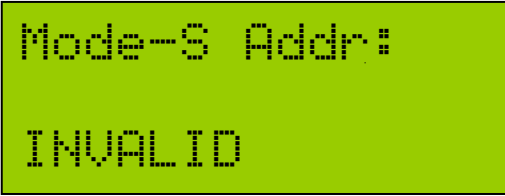

The first submenu shown contains the 24 bit address.

To modify the address, follow these steps:

- Press the inner knob of the double shaft rotary encoder. The underlined first digit of the 24-bit address indicates the edit mode.
- Use the outer knob of the rotary encoder to select the position to be modified. Use the inner knob of the rotary encoder to modify the selected value. Do not enter dashes or blanks. The data must be entered left aligned.
- To finish editing the 24-bit address, press the push button of the rotary encoder.
- Exit the flight id page by pressing the mode key.

A correct 24 bit Mode-S address is required for proper Mode-S operation. If no address has been entered, the system works as a Mode- A/C transponder.

In this case, the following messages appears in the startup screen:

	<p>confirm this message by pressing <b>&lt;Ident&gt;</b> or <b>&lt;Mode&gt;</b> or push button of rotary encoder</p>
	<p>confirm this message by pressing <b>&lt;Ident&gt;</b> or <b>&lt;Mode&gt;</b> or push button of rotary encoder</p>

### 9.1.2.6. Flight ID

Here you can enter the flight ID corresponding to the aircraft address (Mode-S address). Refer to par. 9.1.1 to learn how to set up the flight ID. The flight ID entered in this menu can be overwritten by the pilot entering the unprotected area, if required.


### 9.1.2.7. Aircraft maximum speed

The second submenu shown contains the settings for the aircraft maximum speed.

This data needs to be set for communication with the TCAS system installed in larger aircraft. Consult your aircraft's flight manual to determine the required information.

To enter the desired value, follow these steps:

- Press the inner knob of the double shaft rotary encoder. The underlined first digit of the speed range shown on the screen indicates the edit mode.
- Use the inner knob of the double shaft rotary encoder to select the appropriate range for the aircraft the unit has been installed in. Entering a certain value manually is not possible. Please use the values suggested by the system.
- To finish editing the maximum speed, press the push button of the rotary encoder.
- If you do not know the aircraft maximum speed, please select **<unknown>**.

	<p>Possible values:</p> <p><b>unknown</b> select this value, if no information is present for your aircraft</p> <p><b>&lt;= 75 kt</b></p> <p><b>76-150 kt</b></p> <p><b>151-300 kt</b></p> <p><b>301-600 kt</b></p> <p><b>601-1200kt</b></p> <p><b>&gt;1200kt</b></p> <p>Note: The maximum speed the VT-02 is allowed to use for is 250 kts. Higher values are for reference only.</p>
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### 9.1.2.8. Configuring On Ground switch (auto gnd)

The third submenu allows configuring the on ground switch input of the transponder. It needs to be configured, if the unit has been connected to an on-ground switch provided by the airframe.

- Press the inner knob of the double shaft rotary encoder. The underlined first digit on the screen indicates the edit mode.
- Use the inner knob of the double shaft rotary encoder to select the desired value. Set it to YES, if an airborne information will be provided by the aircraft and the transponder has been connected to this switch. Select NO, if no such switch is available in your aircraft. If no on ground switch is available in your airframe, the system broadcasts an "airborne" message permanently.
- To finish the edit mode press the push button of the rotary encoder.



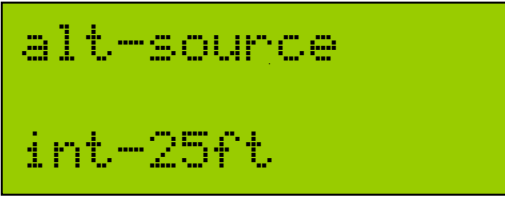
If you do not know if an external on-ground switch has been connected or works properly, please select **<no>** for the auto-gnd option.

To leave the configuration menu, press the <IDENT> button. Pressing the <MODE> button returns to the next higher menu level.

### 9.1.2.9. Altcoder setup



This menu can be activated only, if the system has been set into the <ALT> mode for at least 15 sec. after switching on and a firmware version of the main processor board unit (not the UI Firmware version) is at least rel. 1.50. For modification, set the unit to <SBY> mode.

	<p>Possible values:</p> <p><b>int-25ft</b> uses the internal pressure sensor for alticoding with 25ft resolution</p> <p><b>int-100ft</b> uses the internal pressure sensor for alticoding with 100ft resolution (not recommended anymore)</p> <p><b>ext-25ft</b> uses the data provided by an external alticoder with 25ft resolution. Never use this setting, if you don't know exactly, which resolution the alticoder connected to the VT-02 provides.</p> <p><b>ext-100ft</b> uses the data provided by an external alticoding with 100ft resolution. This is the default setting for parallel alticoders as used in former KT-76 / KT-76A/ KT-76C installations.</p> <p>Press the inner button of the rotary encoder and use the inner encoder to setup the desired values.</p>
---	--

If an external alticoder has been connected and the alticoder source has been set to internal, the external alticoder data will be ignored.

## 9.2. VT-2000

General:











**All configuration and setup must be performed by qualified personnel only to prevent damages and hazardous situations that could result in loss of life.**  
**Please contact your local avionic maintenance organisation for qualified support in this issue.**

## Fundamentals of setting up data



Fields containing modifiable values can be handled as follows:

- Navigate through a menu using the  or  key
- Activate the edit mode by pressing the **SEL** softkey, if the desired menu item has been selected
- The edit mode is indicated by an inverted item
- If the first digit of a string is inverted, use the  or  to navigate through the string.
- To modify the desired value in a string, use the the  or  key.
- If the total entry of a field is displayed inverted, no modification of a single digit is possible. in this case, only preconfigured values can be selected using the  or  key.

Pressing **ESC** quits the edit mode without saving the entered value

Pressing **SAVE** saves the entered value and quits the edit mode.

Pressing **EXIT** leaves a sub menu.

## 9.2.1. Setting up pilot specific data

Setting up pilot specific data, does not require a password as these settings are intended to set by each pilot up to his own preferences.







## 9.2.1.1. Flight ID / aircraft registration

A Mode-S transponder broadcasts the flight id (company call sign for commercial aircraft or the aircraft registration for smaller private operated aircraft).



The flight id may be changed if required. Usually the FID is the call sign of your aircraft unless field 7 of the flight plan contains other data. **Always check before each flight if your flight id has been set correctly.**


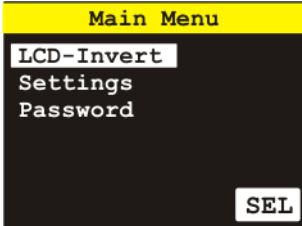
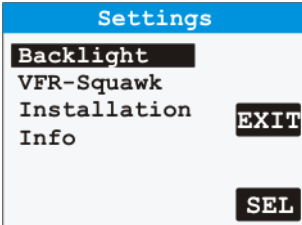
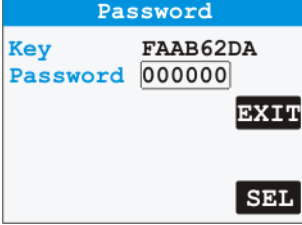
Follow these steps to set the flight id / aircraft registration:

	<ul style="list-style-type: none"> <li>• Set the unit to standby (SBY) mode</li> <li>• Press the lower softkey</li> <li>• The symbol  shown next to the Flight-ID changes to <input checked="" type="checkbox"/>.</li> <li>• Use the  or  key to navigate to the desired position. Change the selected character using the  or  key.</li> <li>• Quit editing the Flight-ID by pressing the lower softkey again. The edit symbol <input checked="" type="checkbox"/> changes to .</li> </ul>
<p style="text-align: center;">Flight-ID in edit mode</p>	

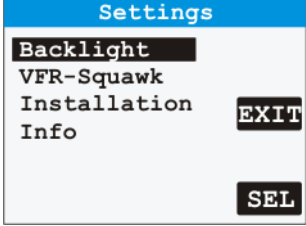





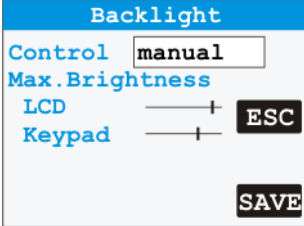
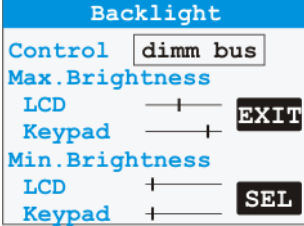
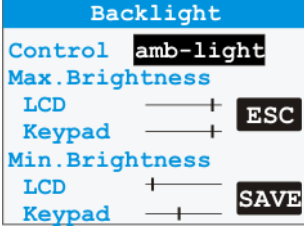
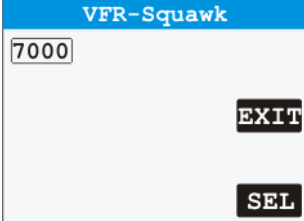
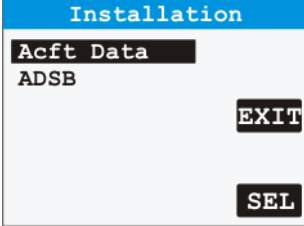
### 9.2.1.2. Main Menu


- Enter the main menu by pressing the **PGE** key twice

The screen shows as follows:

	<p>Menu item description:</p> <ul style="list-style-type: none"><li>• LCD-Invert: switches the LCD to night mode manually</li></ul>  <ul style="list-style-type: none"><li>• Settings: Invokes the settings menu</li></ul>  <ul style="list-style-type: none"><li>• Password: Invokes the password page</li></ul> 
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Settings Menu

	<p>The Setting Menu provides the following items:</p> <p>Backlight: Settings for LCD and keypad illumination  VFR-Squawk: Page for Presetting the standard VFR Squawk  Installation: Pages for extended setup (password protected, in standard mode "read-only")  Info: Info screen (firmware and FPGA version information)</p> <p>Use the  or  key to select the desired menu item. Use the  softkey to invoke the edit mode: Use the  or  key to modify the selected value.</p>
	 <p><b>Backlight brightness control:</b> manual</p> <p>Set up the LCD and keypad brightness to the desired value using the sliders.</p> <p>In this mode, the light sensor of the VT-2000 and the dimm bus of the aircraft will be ignored.</p>
	 <p>Sets the illumination control to aircrafts's dimm bus.</p> <p><b>CALIBRATION VALUES ARE READ ONLY!</b> Modifying these values is possible in the password protected setup only.</p>
	 <p>Sets the illumination control to VT-2000 ambient light sensor</p> <p><b>CALIBRATION VALUES ARE READ ONLY!</b> Modifying these values is possible in the password protected setup only.</p>
	 <p>Setup the desired squawk for the VFR key.</p>
	 <p>Branches to sub menu for</p> <ul style="list-style-type: none"> <li>• <b>Acft Data:</b> Aircraft data</li> <li>• <b>ADS-B:</b> ADS-B Settings</li> </ul> <p>Note: Both menues are in READ ONLY mode, if no installation password has been entered.</p>

	<p><b>VT-2000</b></p> <p><b>GARRECHT</b> <b>Avionik</b></p>  <p>UI: v2.06 XP: v170 FPGA: v11</p>	<p>Shows information about Firmware (UI and XPDR main unit and FPGA version ).</p> <p>Returns to Settings menu after 5 sec. automatically.</p>
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### 9.2.2. Setting up password protected data

Some input fields for aircraft related data (such as 24-bit Mode-S or aircraft maximum speed) address is password protected to prevent unwanted modifications by unauthorized persons.

## The password for this setup area is 10795C

Here are step by step instructions for entering the Mode-S address and other aircraft related data.



- Check, if the transponder antenna has been connected to the device properly
- If so, switch on the unit
- If the BITE (build in self test) has been performed successfully, the system is ready for the next steps.

**Always set the device into the <SBY> mode, if you want to modify any settings in this menu.**



The following chapters describe all menus, which are marked as read only in the previous chapter. The write protection is disabled as soon as the password shown above has been entered.

**Additionally, a maintenance menu item is added to the Main menu. All information shown in the sub menus of the maintenance menu are read only and can not be modified in this password level.**

#### 9.2.2.1. Backlight

	<p><b>VT-2000 illumination control via aircraft's dimm bus.</b></p> <p>Calibration instructions:</p> <p>Set the illumination level control of your instrument panel to maximum brightness, and thereafter set the values for LCD and keypad in the Max. Brightness fields of the menue.</p> <p>Set the illumination level control of your instrument panel to minimum brightness, and thereafter set the values for LCD and keypad in the Min. Brightness fields of the menue.</p>
	<p><b>VT-2000 illumination control via VT-2000 ambient light sensor.</b></p> <p>Calibration instructions:</p> <p>Expose the installed VT-2000 to an ambient light level at which the LCD and keypad shall have their maximum brightness, and thereafter set the desired values for LCD and keypad in the Max. Brightness fields of the menue.</p> <p>Expose the installed VT-2000 to an ambient light level at which the LCD and keypad shall have their minimum brightness, and thereafter set the desired values for LCD and keypad in the Min. Brightness fields of the menue.</p>

### 9.2.2.2. Aircraft data (Mode-S Address & more)



**A proper installation and operation of a Mode-S transponder requires the installer to set a unique 24 bit Mode-S Address, the aircraft maximum speed as well as the flight id or aircraft registration. The 24 bit Mode-S address needs to be obtained from your national aviation authority. Contact the department, where you got the aircraft registration from.**

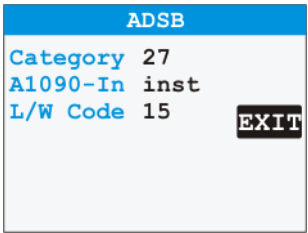
A correct 24 bit Mode-S address is required for proper Mode-S operation. If no address has been entered, the system works as a Mode- A/C transponder.

<table border="1"> <thead> <tr> <th colspan="2">Acft-data</th> </tr> </thead> <tbody> <tr> <td>Address</td> <td>3C1357</td> </tr> <tr> <td>FlightId</td> <td>DEKUL</td> </tr> <tr> <td>AltSrc</td> <td>i 25ft <b>EXIT</b></td> </tr> <tr> <td>OTG</td> <td>inst</td> </tr> <tr> <td>Maxspeed</td> <td>unknown</td> </tr> </tbody> </table>	Acft-data		Address	3C1357	FlightId	DEKUL	AltSrc	i 25ft <b>EXIT</b>	OTG	inst	Maxspeed	unknown	<p><b>Address:</b> 24 Bit aircraft address (hexadecimal format)</p> <p><b>Flight-ID:</b> Flightnumber or company call sign (left aligned, no blanks)</p> <p><b>AltSrc:</b> Altitude source  i 25ft: Internal alticoder, 25 ft resolution  e 25ft: external alticoder, 25 ft resolution  i 100ft: Internal alticoder, 100 ft resolution  e 100ft: External alticoder, 100 ft resolution</p> <p>If replacing a KT-76 / KT-76A/C, where an external alticoder has been installed before, always use the e 100ft setting.</p> <p><b>OTG:</b> on-Ground switch  Inst: OTG switch installed and connected  None: No OTG switch present</p> <p><b>If OTG switch is present, connected and configured, the VT-2000 does not allow to be set to ON or ALT, while the aircraft is on-ground.</b></p> <p><b>MaxSpeed:</b> Aircraft maximum cruising TAS, possible values:  Unknown  &gt;= 75 kts  76-150 kts  151-300 kts  301-600 kts  601-1200 kts  &gt;1200 kts</p>
Acft-data													
Address	3C1357												
FlightId	DEKUL												
AltSrc	i 25ft <b>EXIT</b>												
OTG	inst												
Maxspeed	unknown												



If you do not know if an external on-ground switch has been connected or works properly, please select **<no>** for the auto-gnd option.

### 9.2.2.3. ADS-B settings

	<p><b>Category:</b> Sets up the aircraft category. Allowed values are</p> <ul style="list-style-type: none"> <li>13 = Point obstacle (e.g. tethered balloon)</li> <li>19 = Glider</li> <li>1A = lighter than air</li> <li>1B = parachutist</li> <li>1C = Microlight and Hangglider</li> <li>1E = UAV</li> <li>20 = unknown</li> <li>21 = Aircraft with MTOW &lt; 15.000 lbs</li> </ul> <p>If entering other values than listed above, the value will be set to 20 (unknown aircraft category) automatically.</p> <p><b>A1090-In:</b></p> <p>Inst: Indicates, if an ADS-B 1090 receiver is installed on board. None: No ADS-B 1090 in cabability present</p> <p><b>L/W Code:</b></p> <p>Length / Wingspan category code (0...15)</p> <p>If the aircraft's length is &lt;= 15m and the wingspan &lt;=23m set the L/W code to 1.</p> <p>If the L/W Code is unknown, set the value to 0</p> <p>Refer to RTCA DO-260B chapter 2.2.3.2.7.2.11 for detailed information and instructions how to calculate L/W for other aircraft dimensions.</p>
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## 10. Determining installed equipment performance

In order to comply with EUROCAE ED-73B, it is required to determine equipment performance of the installed equipment.

**The complete aircraft installation must be certified by authorized personal before operation.**

### 10.1. Checking equipment installation

	passed
<b>Accessibility</b> Controls provided for in-flight operation shall be readily accessible from the operator's normal seated position. Displayed information shall be clearly viewable, without obstruction, from the normal seated position(s) of the appropriate operator/crew member(s).	<input type="checkbox"/>
<b>Aircraft Environment</b> Installed equipment shall be compatible with the environmental conditions present in the specific location in the aircraft where the equipment is installed.	<input type="checkbox"/>
<b>Display Visibility</b> Displays shall be readable from the crew members' normal position in all ambient light conditions for which the equipment is required.	<input type="checkbox"/>
<b>Workmanship</b> Check, if all installation work has been performed by qualified persons or companies in accordance with the instructions of this manual.	<input type="checkbox"/>
<b>Cables, Wiring</b> Check, if all wiring is in condition for safe operation.	<input type="checkbox"/>

### 10.2. Equipment performance

	passed
<b>Reply Frequency</b> Interrogate the installed transponder and verify that the reply frequency is 1090 MHz +- 1 MHz for both Class 1 and Class 2 equipment.	<input type="checkbox"/>
<b>Transmitter Power Output</b> a. Verify that Class 1 transponders have a peak pulse power at the antenna end of the transmission line of at least +21 dBW and not more than +27 dBW.	<input type="checkbox"/>
<b>Receiver Sensitivity</b> a. Verify that for Mode A/C interrogations the receiver sensitivity of the equipment at the antenna end of the transmission line is -73 dBm, ±4 dB.  b. Verify that for Mode S P6 type interrogations the sensitivity of the equipment at the antenna end of the transmission line is -74 dBm, ±3 dB.	<input type="checkbox"/>
<b>Pressure altitude transmissions</b> Select the mode <ON> (internal alticoder disabled) and verify that  (1) the transponder response to Mode C interrogations consists only of framing pulses F1 and F2, and  (2) the transponder response to Mode S interrogations UF=4 and UF=20 contains all ZEROs in the AC field.	<input type="checkbox"/>

<p><b>Altitude Reporting test</b> <b>General:</b> A sufficient number of test points should be checked to ensure that the altitude reporting equipment and transponder perform their intended function through their entire range while ascending or descending. Tests some altitude steps to ensure proper operation of each altitude code segment of the encoder.</p> <p>Verify that the correspondence error value of the altimeter system is 125 feet or less.</p> <p>Verify that exceeding 50.000 ft and -1.000 ft generates an out of range error message, if using the internal alticoder.</p> <p>Verify that exceeding 62.700 ft and -1.000 ft generates an out of range error message, if using external alticoders.</p> <p><b>If alticoder set to 100 ft resolution:</b> Verify in all cases that the Q bit is set to 0.</p> <p><b>If alticoder set to 25 ft resolution:</b> Verify in all cases that the Q bit is set to 1 for altitudes up to 50.170 ft. For altitudes above 50.170 ft, the Q bit must be set to 0.</p>	<p>passed</p> <p><input type="checkbox"/></p>
<p><b>Airspeed Fixed Field</b> Interrogate the equipment to confirm the maximum airspeed report.</p>	<p><input type="checkbox"/></p>
<p><b>On-the-Ground Condition</b> If a means for automatically indicating the on-the-ground condition (e.g. a weight on wheels or struct switch) <b>is available:</b>              Verify that the equipment correctly reports the "on-the-ground" condition in the CA, FS and VS fields.              Verify that the equipment correctly reports the "airborne" condition in the CA, FS, and VS fields.</p> <p>If a means for automatically indicating the on-the-ground condition (e.g. a weight on wheels or struct switch) <b>is not available:</b>              Verify that the FS and VS fields indicate that the aircraft is airborne and that the CA field indicates that the aircraft is either airborne or on the ground (CA=6).</p> <p>Also verify that when the unit is in the "inhibit replies" condition (on the ground), the transponder continues to generate Mode S squitters and replies to discretely addressed Mode S interrogations (UF=0,4,5,16,20,21,24), but does not reply to Mode A/C/S All-Call or Mode S-Only All-Call interrogations (some installations may inhibit Mode A/C).</p> <p>If the unit is not in the "inhibit replies" condition (Airborne condition), verify that the transponder continues to generate Mode S squitters and also replies to Mode A/C, Mode A/C/S All-Call or Mode S Only all Call and discretely-addressed Mode S interrogation (UF=0,4,5,16,20,21,24),</p>	<p><input type="checkbox"/></p>
<p><b>Aircraft Identification (AIS)</b> Interrogate the equipment with UF=4 or 5, and correct aircraft address with RR=18 and DI ≠ 7 or DI=7 and RRS=0. Verify that the equipment correctly reports the AIS information in the MB field of the reply.</p>	<p><input type="checkbox"/></p>

Installation performed at \_\_\_\_\_

by

\_\_\_\_\_  
Installer name

\_\_\_\_\_  
Company name

\_\_\_\_\_  
licence (type, #)

\_\_\_\_\_  
Certifying staff name

\_\_\_\_\_  
Company name

\_\_\_\_\_  
licence (type, #)

### 10.3. In Flight tests

#### 10.3.1. General

This guidance material offers examples of flight test procedures for demonstrating selected performance functions. Flight demonstration of installed performance may be required to determine the performance and characteristics of the installed antenna.

If the aircraft has been equipped with a transponder before, the flight test after installing the VT-02 might be obsolete, if the following conditions are fulfilled:

- The rated RF output power of the old device was less or equal to the RF output power of the VT-02
- The antenna used for the VT-02 is the same as used before (NOTE: Replacing the old antenna by a new antenna of the same type is also sufficient to fulfil this requirement.
- If a new antenna line need to be installed, be sure, that the maximum loss of the new line does not exceed the loss of the old antenna line.

#### 10.3.2. Flight tests instructions

For determining performance in flight, all tests on ground as shown in 10.1. need to be performed successfully.

Arrange a schedule with the area air traffic control facility so that a controller is available to observe the transponder reply and communicate with the test aircraft to confirm performance of the transponder.

- a. Select a test area such that line-of-sight signal propagation is ensured (distance: 60 nm to selected ATC facility).
- b. So that ATC can confirm valid returns through normal flight attitudes, test manoeuvres may include standard rate turns through 360 degrees, climbs and descents.
- c. Verification of Mode A codes selected, and reported altitude responses to Mode C should also be checked.
- d. Verify if ATC confirms valid replies with gear down (if applicable) and flaps set to landing configuration
- e. Verify, if interference with other electronic equipment installed in the aircraft occurs during the flight.

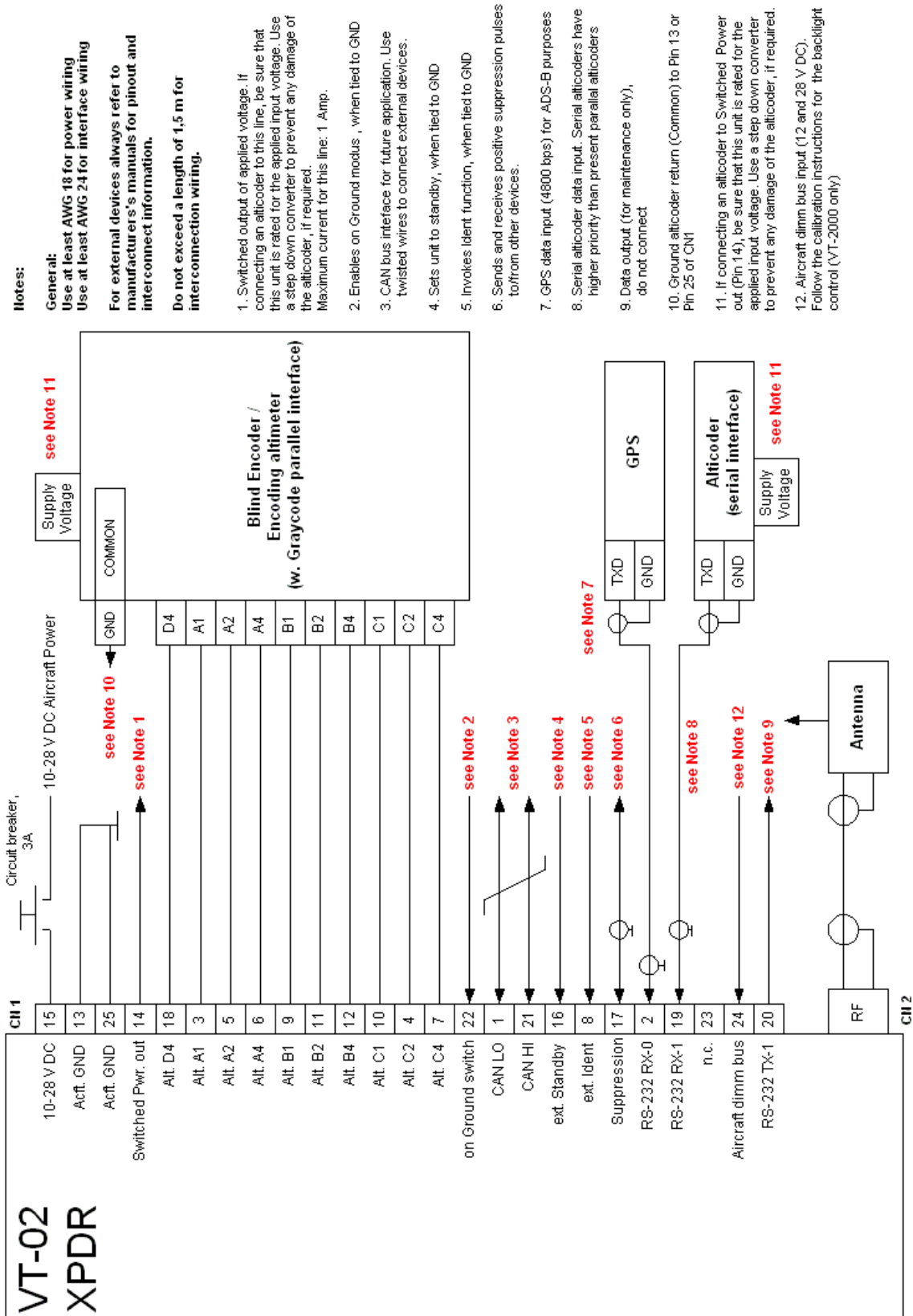
For detailed information regarding flight tests refer to document FAA AC 23-8B, Chapter 5.

## 11. Instructions for continued airworthiness

Other than for periodic functional checks required by the regulations, the VT-02 Mode S Transponder has been designed and manufactured to allow "on condition maintenance". This means that there are no periodic service requirements necessary to maintain continued airworthiness, and no maintenance is required until the equipment does not properly perform its intended function (i.e. indicated by the built-in test routines)

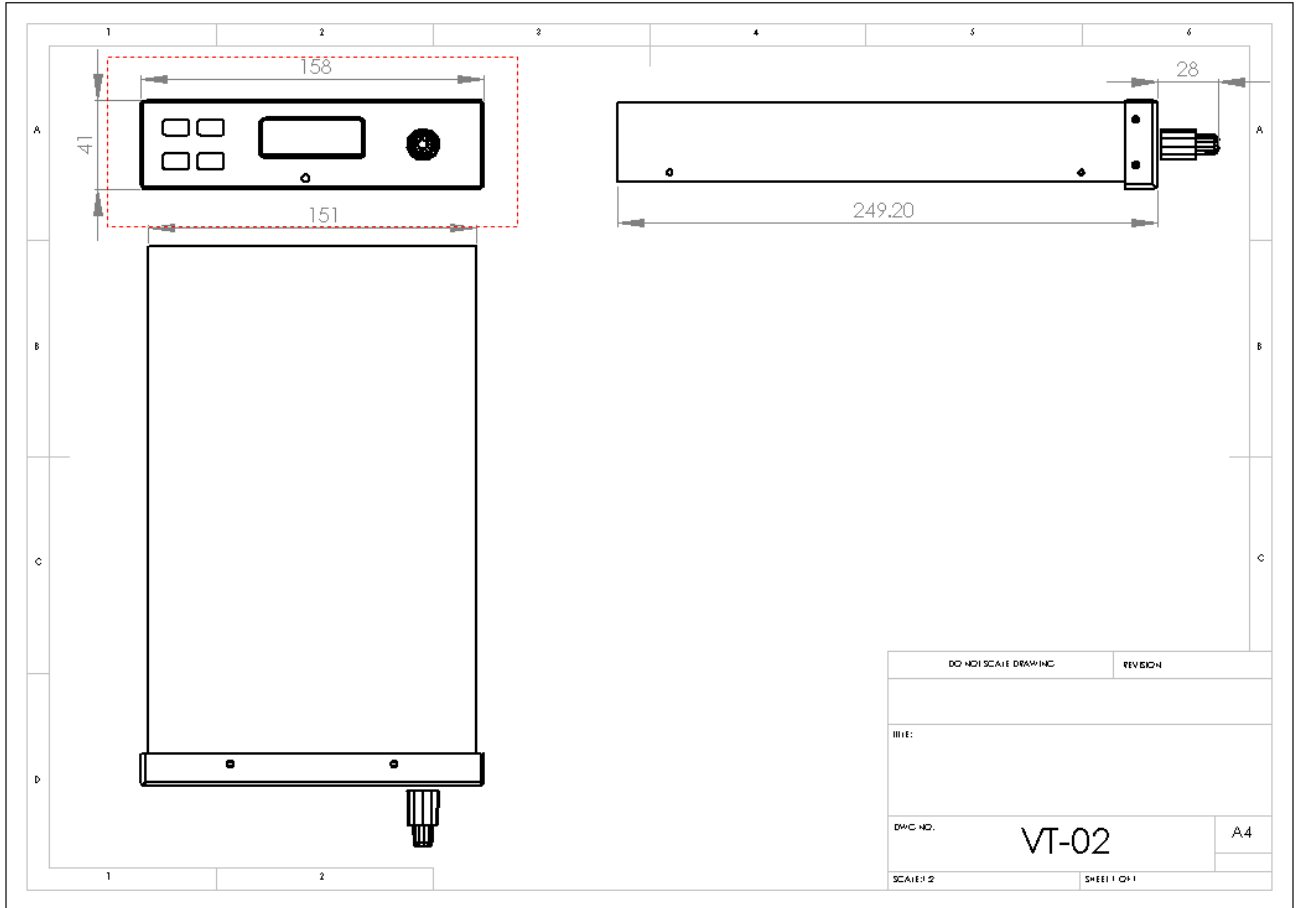
Repairs should only be carried out in accordance with Garrecht Avionik GmbH service procedures (CMM).

## Appendix A - Interconnection Drawings

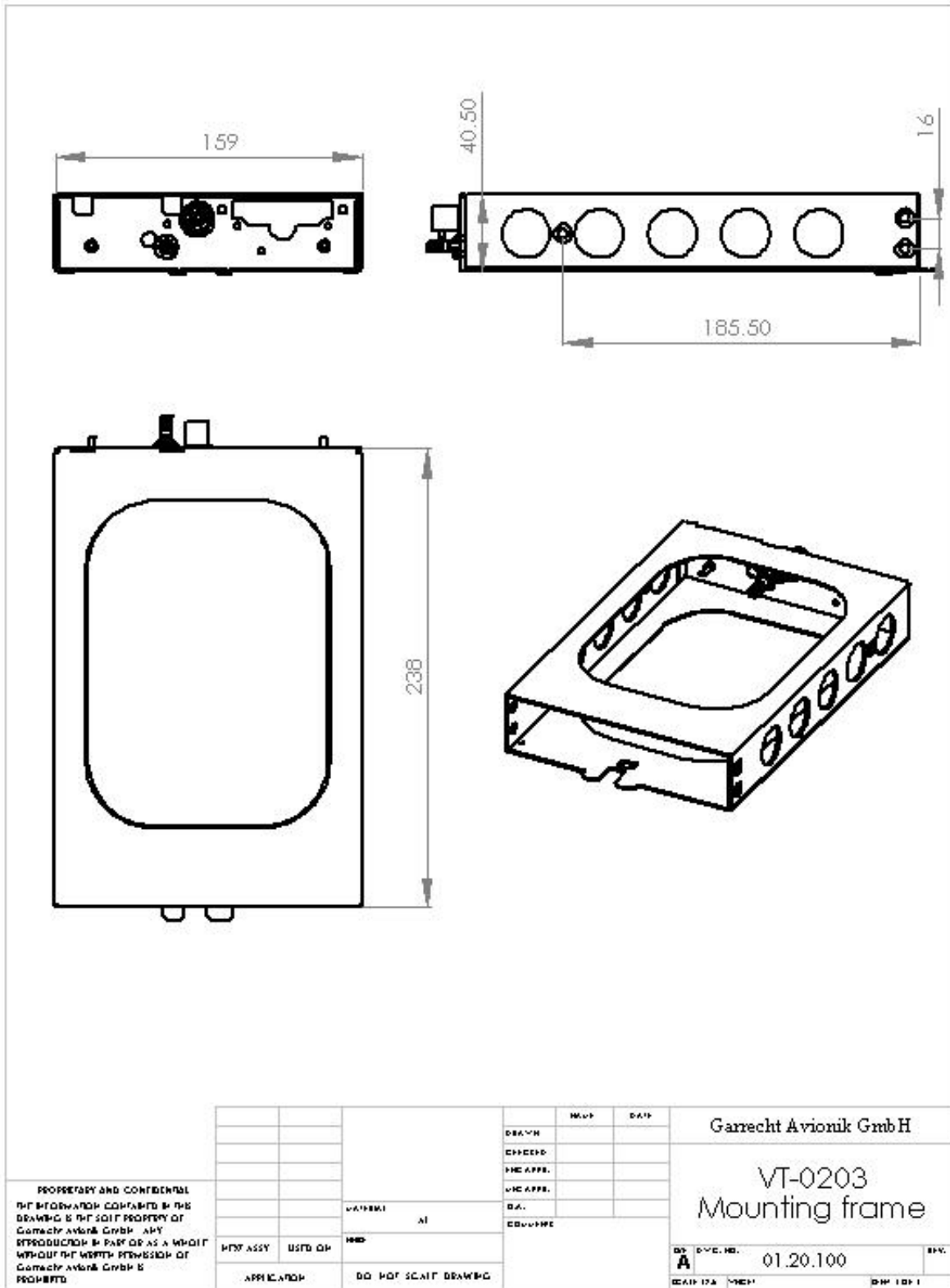


### Appendix B - Dimensions

(Unit: mm)



System unit VT-02, P/N VT-0201



Mounting frame P/N VT-0203