



KTX2-F.0001

MAN

Operation and Installation Manual

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KTX2-F

Mode-S Transponder

Flat (160mm) format

KTX2-F (flat 160mm format) with ADS-B with Part-No 295153

Operation and Installation Manual



Revision List

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Service Bulletins (SB)

Service Bulletins must be inserted in the manual and added to this table.

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Change History

Product Revision	Date	Description of Change



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1. General

1.1 Purpose

This manual contains information about the physical, mechanical and electrical characteristics, installation and operation for the KTX2-F Mode S Transponder. Additionally it describes the ADS-B functionality for a compliant ADS-B Out installation using Extended Squitter (ES).

1.2 Scope

This manual applies to the operation and installation of the KTX2-F Mode S Transponder.

At the publication date of this manual the software version is 0100 and the FPGA version is 0042. The software and FPGA versions are subject to change without further notice.

1.3 Terminology

Except where specifically noted, references made to “the Unit” or “the Installation” will apply to the transponder defined in 1.2.

Referenced Documents where the respective document is identified by document number, document title and issue.

- The word **MUST** in the text denotes a mandatory instruction. A deviation is not permissible.
- The word **SHOULD** in the text denotes a recommendation or advice. Such recommendations or advice is expected to be followed unless good reasons are stated for not doing so.
- The word **MAY** in the text denotes a permissible practice or action.

Note: Background information contained in this document is always indicated by using an italic character font.

1.4 Symbols

	DANGER: Advices whose non-observance can cause radiation damage to the human body or ignition of combustible materials.
	ATTENTION: Advices whose non-observance can cause damage to the device or other parts of the equipment or reduce the correct functionality of the device.
	INFORMATION: Supplemental information for operating the device.

1.5 Abbreviations

Abbr.	Meaning	Explanation
AA	Aircraft Address	Assigned ICAO 24 bit address
AC	Advisory Circular	Information and guidance publication
ADC	Analog Digital Converter	
ADF	Automatic Direction Finder	Navigation equipment
ADS-B	Automatic Dependent Surveillance Broadcast	
ALT	Altitude	The transponder will respond to all interrogations and transmits ABS-B messages.
ATC	Air Traffic Control	
ATCRBS	Air Traffic Control Radar Beacon System	
BAT	Battery	
BNC	Bayonet Neill-Concelman	A RF connector type.
CFR	Code of Federal Regulations	
COMM	Communication(s)	
CRC	Cyclical Redundancy Check(s)	
DME	Distance Measuring Equipment	
EASA	European Aviation Safety Agency	
ECR	Engineering Change Request	
EEPROM	Electrically Erasable Programmable Read-Only Memory	

Abbr.	Meaning	Explanation
ENV	Environment	
ES	Extended Squitter	
ETSO	European Technical Standard Order	
FAA	Federal Aviation Administration	
FAX	Facsimile	
FCC	Federal Communications Commission	
FID	Flight ID	Number of flight plan if assigned, else Registration number of aircraft
FLY	Flight	The aircraft is in "Flight Mode"
FPGA	Field-Programmable Gate Array	
GND	Ground	The transponder will respond to Mode S ground interrogations from surface movement radar. ABS-B messages are transmitted (Surface messages).
GNSS	Global Navigation Satellite System	
GPS	Global Positioning System	
ICAO	International Civil Aviation Organization	
IDT	Identify	
LSA	Light Sport Aircraft	
MAN	Manual	
MCU	Microcontroller Unit	
MIL	Military	
MTL	Minimum Triggering Level	

Abbr.	Meaning	Explanation
NMEA	National Marine Electronics Association	
ON	Transponder Mode "On"	The transponder will respond to all interrogations, but altitude reporting is suppressed. ABS-B messages are transmitted.
RMC	Recommended Minimum Sentence C	NMEA sentence
RSS	Radio Standards Specifications (Canada)	
RTCA	Radio Technical Commission for Aeronautics	
SAE	Society of Automotive Engineers	
SMA	Sub-Miniature A Connector	
SPI	Special Position Identification (ID)	If activated on request by air traffic controller („Squawk Ident“) a SPI Pulse is transmitted for 18 seconds. This highlights the respective traffic item on the radar screen of the air traffic controller.
STBY	Standby	The transponder is on, but will not reply to any interrogations or transmit any ADS-B out messages.
SUB	Subminiature	
SUPP	Suppression	
TNC	Threaded Neill-Concelman	A RF connector type.
TSO	Technical Standard Order[	
USA	United States of America	
VFR	Visual Flight Rules	



Abbr.	Meaning	Explanation
VSWR	Voltage Standing Wave Ratio	
WAAS	Wide Area Augmentation System (GPS)	



1.6 Customer Support

In order to facilitate a rapid handling of returned shipments, please send your request to the email address below. Additional information and FAX number can be found on the TQ Avionics web portal:

<https://www.tq-avionics.com/>



Any suggestions for improvement of our manuals are welcome. Contact: info@tq-avionics.com



Information on software updates are available at TQ.
<https://www.tq-avionics.com/>

1.7 Features



In order to operate the Mode-S transponder it is necessary to request an ICAO 24-Bit Aircraft Address at the responsible National Aviation Authorities. The received code must be configured within the transponder (see chapter 3.4.2.1.2).

- Class 1 Level 2els Non-Diversity Mode-S-Transponder for ground based interrogations at 1030 MHz and response at 1090 MHz
- Replies to Secondary Radar Interrogations
 - Mode-A replies with a Squawk (one of 4096 possible Codes; e.g. flight plan number, Squawk assigned by a Controller or the VFR Squawk).
 - Mode C replies, including encoded Flight Level.
 - Mode S replies, including Aircraft Address and Flight Level.
 - IDENT capability for activating the “Special Position Identification“- Pulse (SPI) for 18 seconds, which is requested by the Controller “Squawk Ident”
- ADS-B out:
 - Airborne Position
 - Identification and Category
 - Airborne Velocity
 - Operational Status
 - Extended Squitter Aircraft Status
- Maximum flight level 30 000ft; maximum airspeed 250kt
- Display information contains Squawk code, mode of operation and pressure altitude
- Temperature compensated high precision piezo-resistive pressure sensor
- RS-232 data port enabling connection with mutual suppression and On the Ground (weight on wheels) inputs. In addition, an appropriate GNSS receiver for ADS-B can be connected
- 8 storable entries for AA-/Aircraft-Code, FID
- Ground-Switch support



1.8 Safety-Conscious Utilization

For safe operation of the transponder the following notices have to be observed:

- The installation of the transponder into an aircraft should be carried out only by an authorized installation company. The country regulations always have to be observed.
- Use the transponder only within the specified conditions, see chapter 7.

Power supply:

- Do not connect the transponder to AC sources.
- Make sure that the transponder is connected to the mandatory DC source, see chapter 7.
- Do not connect the transponder with reversed polarity to the DC source.

Circuit breaker:

- The transponder should be protected from the aircraft power supply by a dedicated 3 A circuit breaker or fuse (slow-blow).

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

Do not switch ON the transponder during engine start or shutdown.

1.9 Restriction for Use

The transponder is to be used only inside the declared limits.

2. Operation

2.1 Controls and Display

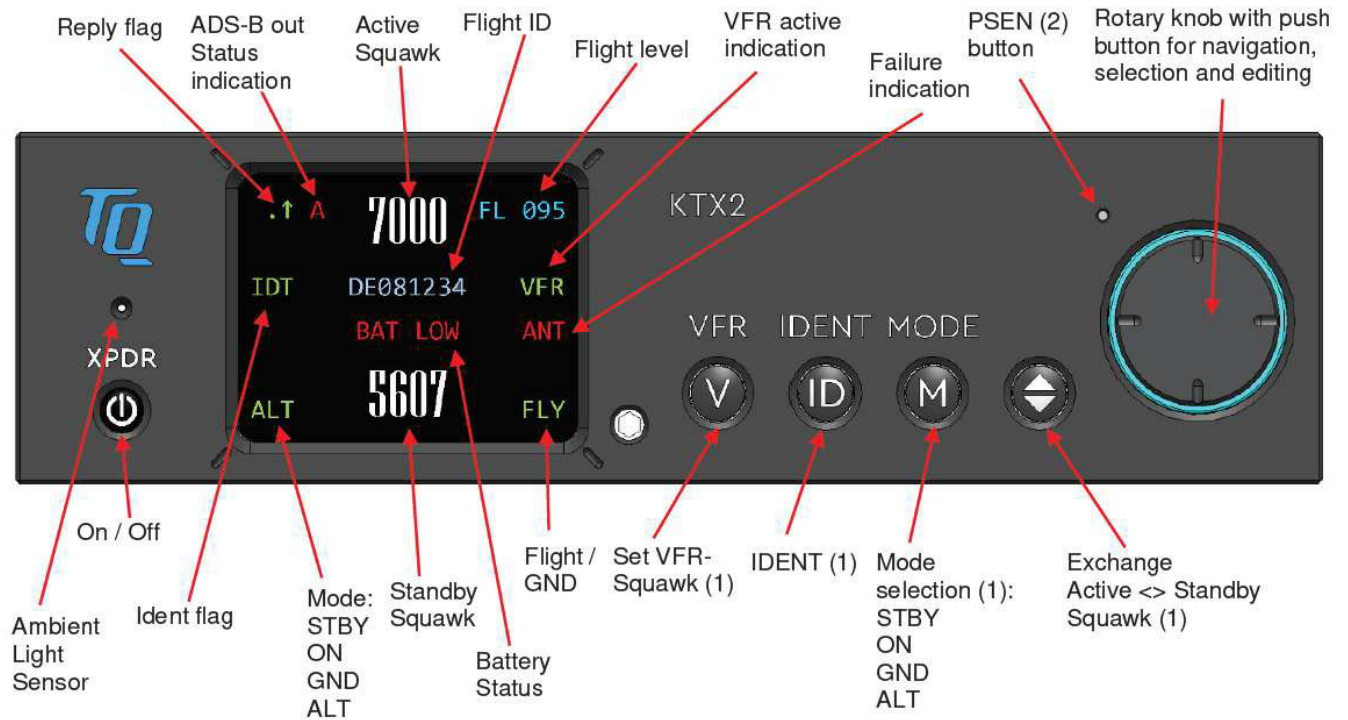


Figure 1: Display Diagram

2.1.1 Controls

This chapter describes the use of the buttons and knobs during normal operation.

The usage while in setup mode is described in chapter 3.3.

Button	Designation	Function
	ON/OFF	Press to switch the transponder on and off. This switch is mechanically locked until it is pressed a second time
	VFR	1. Activate/deactivate VFR Squawk 2. Pressing the button for more than 3 seconds will show the Brightness menu (see 2.2.8.2)
	CHANGE	1. Exchange of the active and standby-Squawk 2. Pressing the button for more than 3 seconds will show the GNSS data menu (see 2.2.9)
	IDENT	1. „Squawk Ident“, a SPI Pulse is transmitted for 18 seconds (in normal mode). 2. Pressing the button for more than 3 seconds will show the Flight-ID menu (see 2.2.8.1)
	MODE	1. Select Transponder-Mode STBY, GND, ON or ALT. 2. Pressing the button for more than 3 seconds will toggle the ADS-B mode (On/Off)
	Rotary knob	1. Enter a new Squawk (see 2.2.2) 2. Enter values and select options in submenus (see 3.3) 3. Confirm Warnings and Notifications

Figure 2: Controls

2.1.2 Display Indications

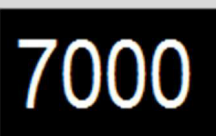
Indication	Meaning	Remark
	Transponder is transmitting Mode-A/C Replies on Interrogations	Appears per reply and persists for some time
	Transponder is transmitting Mode-S Replies on Interrogations	Appears per reply and persists for some time
	Transponder is locked by a ground station and will be directly addressed	Appears at every addressed reply and persists for some time
	ADS-B out Status	Status of ADS-B transmission
	Active Squawk	Is shown at upper position
	Battery power too low	Appears above Standby-Squawk
	Failure indication	See 4
	IDENT- Marking is transmitted	ID („Squawk Ident“) has been pressed – active for 18s
	Current Flight Level	Flight Level (in 100ft steps)
	Mode display (STBY, ON, GND, ALT)	see chapter. 2.1.6 Transponder-Modes
	Standby-Squawk	Is shown at lower position. Can be exchanged with active Squawk by pressing the UP/DOWN („Change“) button
	Flight ID	Only shown if a Flight ID is configured with a valid Aircraft Address
	VFR indication	Shown while VFR squawk is used
	Transponder is in airborne mode	Only shown if Ground Switch support is configured.
	Transponder is in ground mode	Only shown if Ground Switch support is configured.

Figure 3: Indicators

2.2 Normal Operation Menu Structure

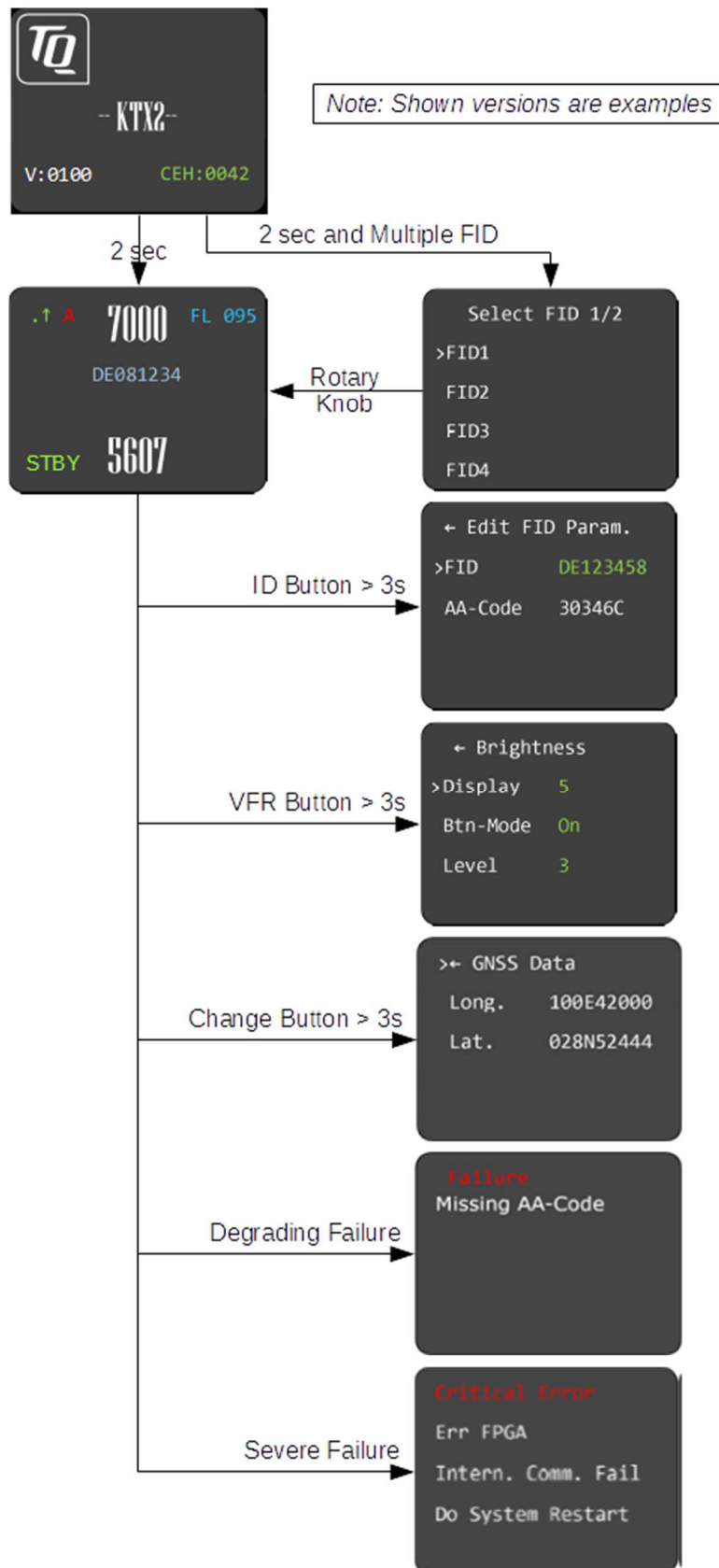


Figure 4: Operational menu structure

2.2.1 ON/OFF Switching

To switch on the transponder press the ON/OFF button once. The button will be locked in its “ON” position. Press the button again to switch it off.

The initial display is shown shortly after the transponder is switched on (see figure below).



Figure 5: Initial Display

The initial display shows the current software and FPGA version.

After approx. two (2) seconds the transponder switches either to its normal operation display or a selection menu is shown if multiple Flight IDs are configured.

	If a failure is detected during start-up a fault notification is displayed. In that case see chapter 4 for details.
---	--

2.2.1.1 Multiple Flight ID selection

If multiple Flight IDs are configured a selection menu is displayed.

2.2.1.2 Normal operation

The normal operation always starts in standby mode. The normal operation display is shown as follows:

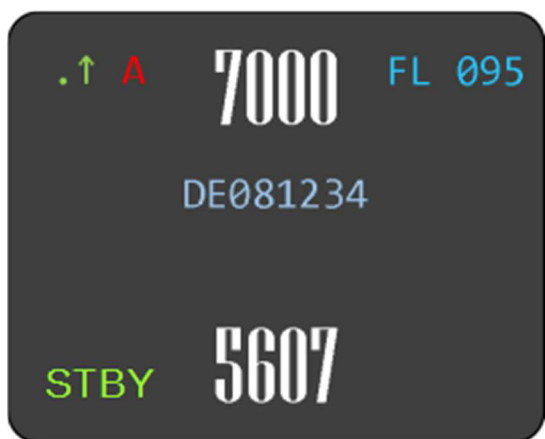


Figure 6: Normal Operation

Note:

The Flight ID is not displayed if no valid Flight ID is configured.

2.2.2 Transponder-Modes

The currently active mode is displayed at the lower left corner of the display.

Mode	Explanation
STBY	Transponder is switched on but does not respond to any interrogation. ADS-B out is disabled.
GND	Transponder responds to Mode-S interrogations. ADS-B out is enabled (Surface Squitter).
ON	Transponder responds to all interrogations, but altitude is not transmitted. ADS-B out is enabled.
ALT	Transponder responds to all interrogations. ADS-B out is enabled.

Table 1: Transponder Modes

During the flight the Mode “ALT” should always be set, unless the ATC gives other instructions.

While rolling on the ground the transponder should be set to “GND”.

If the installation includes a weight on wheels switch and it is correctly configured then the mode is changed automatically.

To change the mode press the “MODE” button until the desired mode is displayed.

The “MODE” button is also used to enable or disable the ADS-B out function. Press the “MODE” button for at least 3 seconds until the ADS-B indication changes (see 2.2.7).

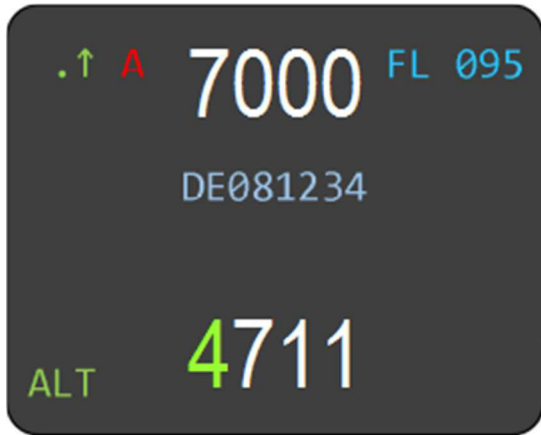
Note:

The ADS-B out function is enabled by default if a GNSS device is configured (see 3.4.2.1.3.4).

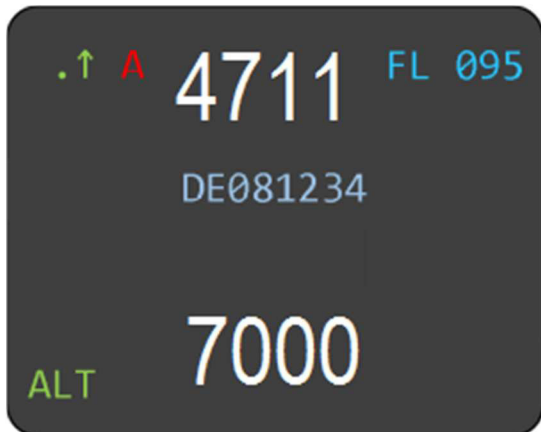
2.2.3 Squawk Code Change

To change the squawk code perform the following procedure:

1. Press the rotary knob. The first digit of the standby squawk turns green.



2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next digit turns green.
4. Repeat steps 2 and 3 until all four (4) digits are set to desired squawk code.
5. Press the "Change" button. The standby squawk code is exchanged with the currently active squawk code.



Note:

The top line shows always the active squawk.

2.2.4 VFR – Squawk

To set the active squawk to a predefined code press the “VFR” button. The VFR-squawk code is now shown as active squawk. “VFR” is indicated on the right hand side of the display and the former active squawk becomes the standby squawk.

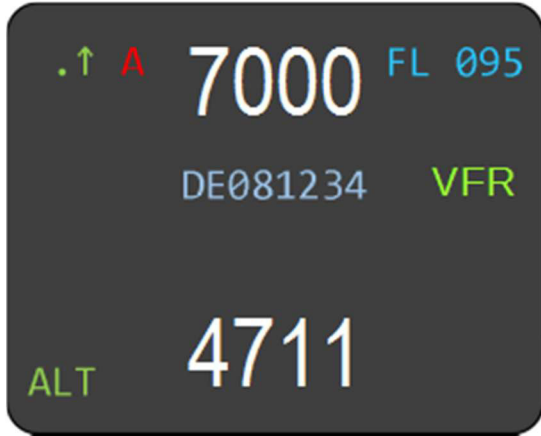


Figure 7: VFR-Squawk

Press the “VFR” button again to restore the previous squawk code as active squawk. The “VFR” indication disappears.

The factory setting of the VFR-Squawk code is 7000. The VFR-squawk code can be configured in accordance with local requirements using the setup mode (see 3.4.3).

2.2.5 Squawk Ident (ID, SPI)

Press the “IDENT” button if the ATC requests you to send “Ident” or “Squawk Ident”.

For 18 seconds the Ident Pulse is activated in the transponder replies. This is indicated by “IDT” on the left hand side of the display.

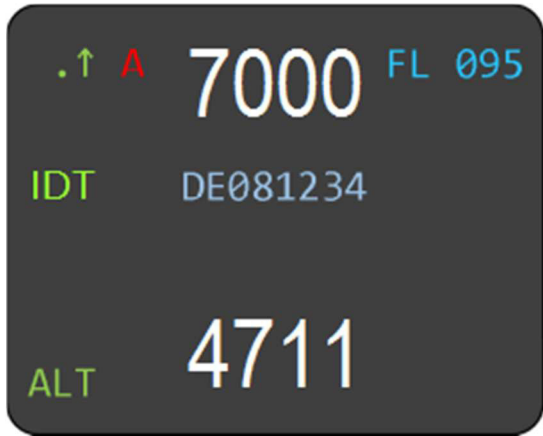


Figure 8: Squawk Ident

2.2.6 Airborne/Ground Indication

If the aircraft is equipped with a “weight on wheels” switch or has an automatic air/ground system the transponder can be configured to use it for Airborne/Ground mode switching (see 3.4.2.1.3.2).

Depending on the status either “FLY” (Flight) or “GND” (Ground) is shown on the display in the lower right corner.

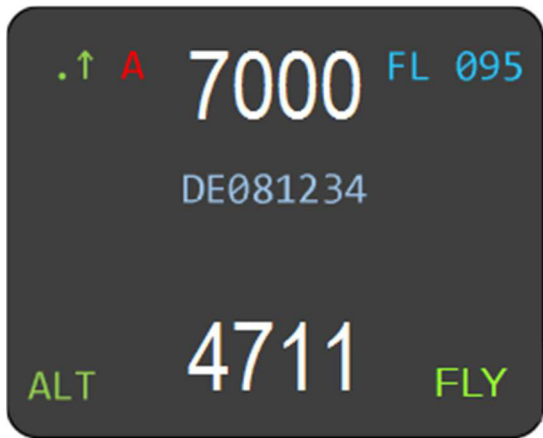


Figure 9: Airborne/Ground Indication "FLY"

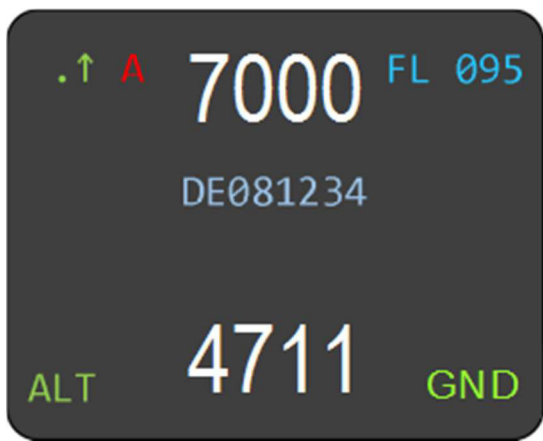


Figure 10: Airborne/Ground Indication "GND"

Note:

If this function is not activated, no indications are displayed and the mode must be manually selected (see 2.2.2).

2.2.7 ADS-B Status Indication

The current operational status of the ADS-B is shown on the display as follows:

Indication	Function	Description
	ADS-B enabled. Letter "A" appears in white color.	ADS-B out function is active and transmitting messages.
	ADS-B enabled. Letter "A" appears in yellow color.	ADS-B out function is active but not transmitting messages.
	ADS-B enabled. Letter "A" appears in red color.	ADS-B out function is active and transmitting type ZERO position messages or no position messages due to missing position data (longitude, altitude, latitude).
	ADS-B disabled. No letter "A" displayed.	No ADS-B data is transmitted.

Figure 11: ADS-B Indication

Note: Above images show the upper left section of the display only.

2.2.8 Adjustable parameters in normal operation mode

Some parameters can be changed while in normal operation mode. The changes are effective immediately after confirmation, but will remain only until the transponder is powered off.

Note:

To make changes permanently the parameters have to be changed in setup mode (see 3).

2.2.8.1 Flight ID

To modify the Flight ID press the ID button for at least 3 seconds.



Figure 12: Change Flight ID

The Flight ID can be adjusted in the same way as described in chapter 3.4.2.1.

Note:

The AA-Code is shown for information only and cannot be changed.

2.2.8.2 Brightness

To modify the display brightness and the button illumination press the VFR button for at least 3 seconds.



Figure 13: Change Brightness

To change the display brightness select “Display” and press the rotary knob.

Turn the rotary knob to change the value for brightness between 1 (lowest) to 5 (highest). Press the rotary knob to save the new value.



2.2.8.3 Button Config

To change the button illumination select “Btn-Mode” and press the rotary knob.

The button illumination has three (3) modes: Off, On and Auto.

Turning the rotary knob will change the mode. Press the rotary knob again to confirm the mode.

Depending on the selected mode further parameters can be configured.

2.2.8.3.1 Button Illumination Mode “Off”

If this mode is selected the button illumination is switched off. No further parameters can be configured.

2.2.8.3.2 Button Illumination Mode “On”

If this mode is selected the button illumination is switched on.

To change the illumination level select “Level” and press the rotary knob. Turn the rotary knob to change the value between 1 (dark) to 5 (bright). Press the rotary knob to save the new value.

2.2.8.3.3 Button Illumination Mode “Auto”

If this mode is selected the button illumination is switched between a day and night setting depending on the ambient light sensor. No further parameters can be configured.

The settings can only be configured in setup mode, see chapter 3.4.1.

2.2.9 GNSS Data

Press the “Change” button for at least 3 seconds to display the actual GNSS position data.

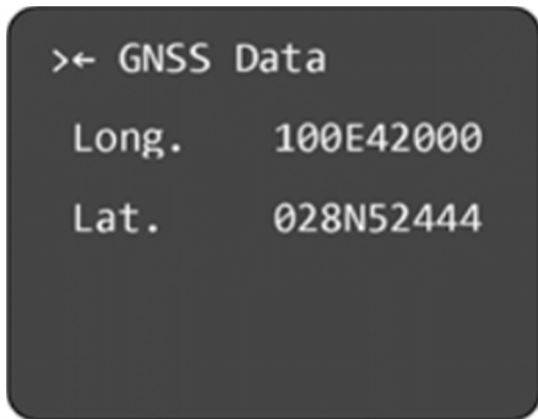


Figure 14: GNSS Data Display

Press the rotary knob to return to the normal operation display.

3. Setup Mode



**Do not use Setup Mode in flight.
Check with your avionics installer before
changing the configuration.**

3.1 Controls and Display

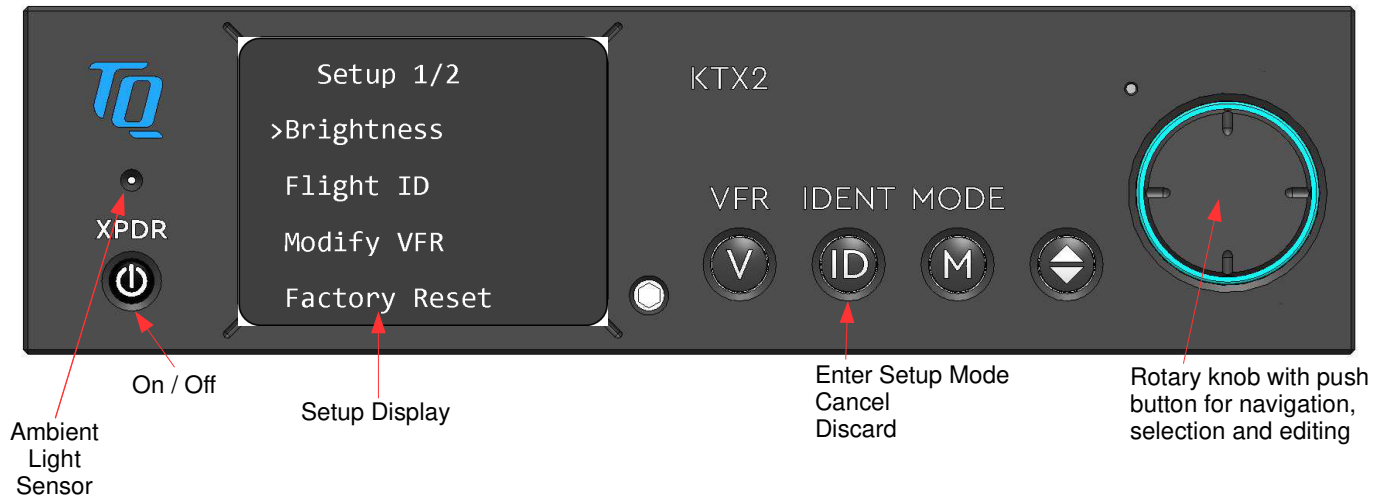


Figure 15: Button functions in Setup Mode

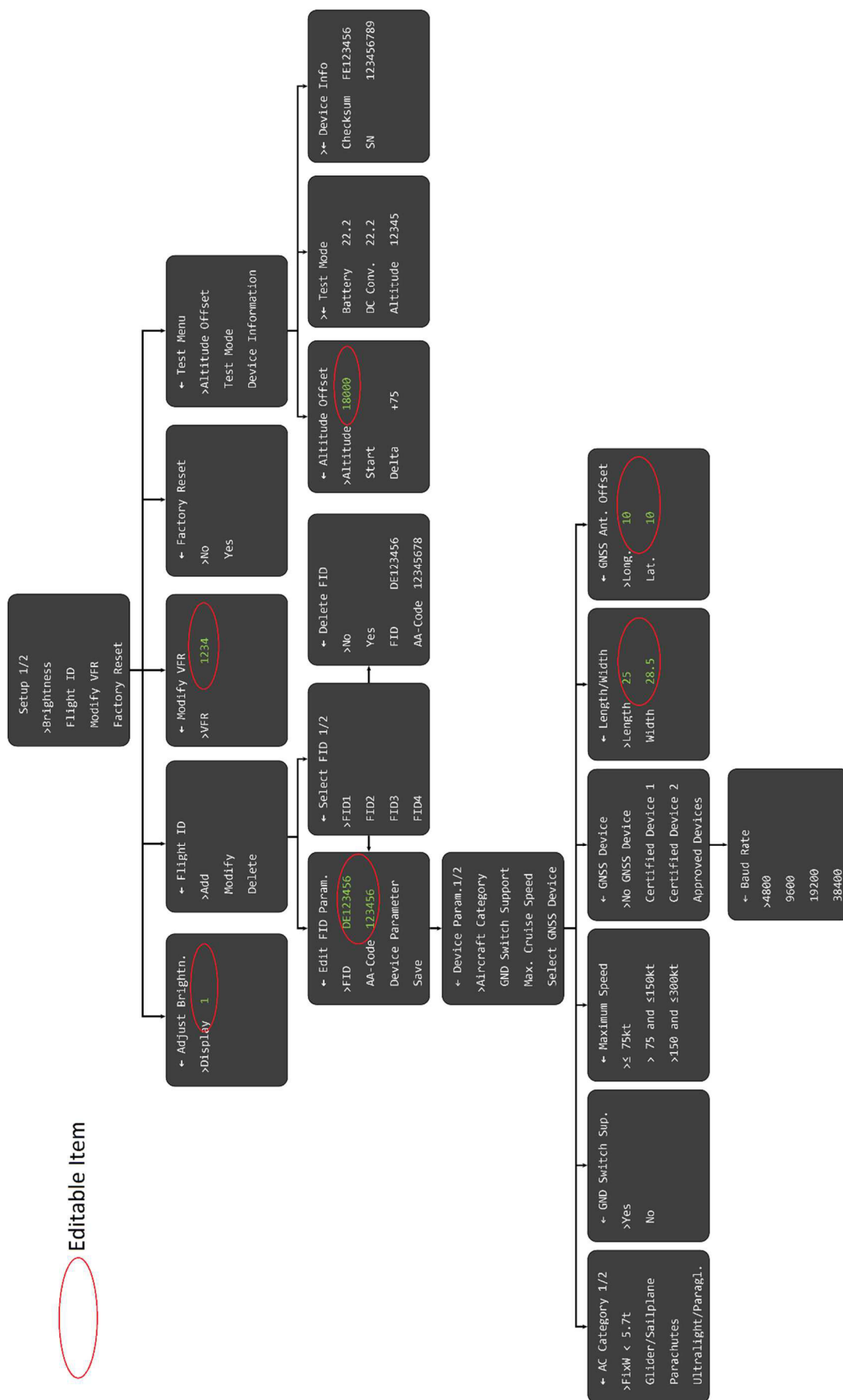


Figure 16: Setup mode menu structure

3.2 Entering Set Up

To enter the setup mode, press the “IDENT” button while switching on the transponder and the setup menu appears as shown below.

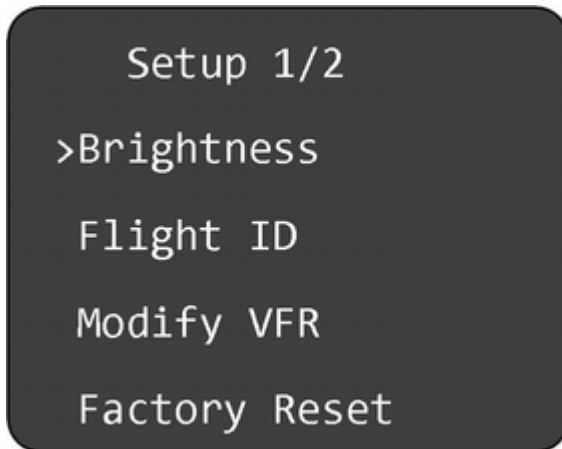


Figure 17: Setup Menu 1

3.3 Controls

3.3.1 Selection

Turning the rotary knob moves to the desired menu item.

Press the rotary knob to select the desired parameter for configuration or to enter a submenu.

If a menu consists of several pages, e.g. the setup menu, the next page can be accessed by turning the rotary knob clockwise until the next page is shown. To go back turn the rotary knob counterclockwise until the previous page is displayed.



Figure 18: Setup Menu 2

3.3.2 Return to parent menu

Any menu showing an arrow left of the headline can be left by selecting the headline and pressing the rotary knob. The previous menu will be displayed.

3.3.3 Cancel/Discard

The “IDENT” button can be used for cancelling, discarding or returning.

While editing pressing the “IDENT” button briefly will cancel the current editing. The previous configuration value is restored.

While in a submenu pressing the “IDENT” button briefly will return to the previous menu.

Pressing the “IDENT” button for at least 3 seconds will discard any unsaved changes and return to the main setup menu.

3.4 Setup Menus

3.4.1 Brightness

To change the display brightness select “Display” and press the rotary knob.

Turn the rotary knob to change the value for brightness between 1 (lowest) to 5 (highest). Press the rotary knob to save the new value.



Figure 19: Setup Brightness Menu

3.4.1.1 Button Config

To change the button illumination select “Button Config” and press the rotary knob. A menu for configuring the button illumination and its modes is displayed.

The button illumination has three (3) modes: Off, On and Auto.

To change the mode select “Mode” and press the rotary knob. Turning the rotary knob will change the mode. Press the rotary knob again to confirm the mode.

Depending on the selected mode several parameters can be configured.

3.4.1.1.1 Button Illumination Mode “Off”

If this mode is selected the button illumination is switched off. No further parameters can be configured.



Figure 20: Button Illumination Mode "Off"

3.4.1.1.2 Button Illumination Mode "On"

If this mode is selected the button illumination is switched on.

To change the illumination level select "Level" and press the rotary knob. Turn the rotary knob to change the value between 1 (dark) to 5 (bright). Press the rotary knob to save the new value.



Figure 21: Button Illumination Mode "On"

3.4.1.1.3 Button Illumination Mode "Auto"

If this mode is selected the button illumination is switched between a day and night setting depending on the ambient light sensor.

To change the illumination level for day or night select appropriate menu item ("Day", "Night") and press the rotary knob. Turn the rotary knob to change the value between 0 (off) to 5 (bright). Press the rotary knob to save the new value.

To change the threshold level for the day/night switching select "Threshold" and press the rotary knob. Turn the rotary knob to change the value between 1 (high light sensitivity) to 5 (low light sensitivity). Press the rotary knob to save the new value.

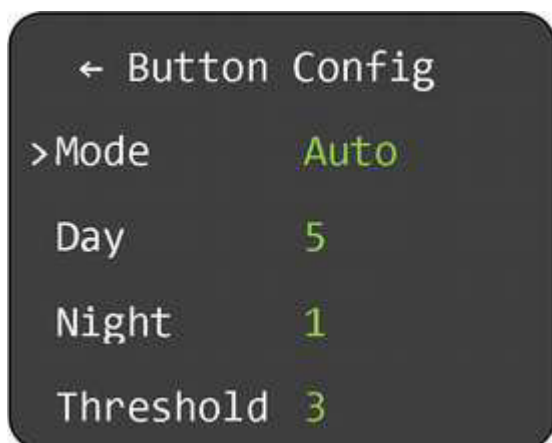


Figure 22: Button Illumination Mode "Auto"

3.4.2 Flight-Identifier (Flight ID)

The transponder can store up to eight flight IDs for multiple aircraft configurations (e.g. in a portable station as used in hot-air/gas filled balloons).

For multiple flight IDs, an appropriate Aircraft Address must be assigned to each of the flight IDs.

See 3.4.2.4 for details.

Note:

ICAO regulations require Mode-S data to contain a valid flight identification (FID), to ensure automatic exchange of flight plan and radar data. Commercial flights usually have their own FIDs. General aviation FIDs should be the registration letters or numbers of the aircraft. The FID must not be confused with the 24-bit Aircraft Address. The FID is left aligned and shown in green characters. The FID may not contain any blanks.

To configure a Flight ID configuration select “Flight ID” and press the rotary knob. A menu for adding, modifying and deleting a Flight ID configuration is displayed.

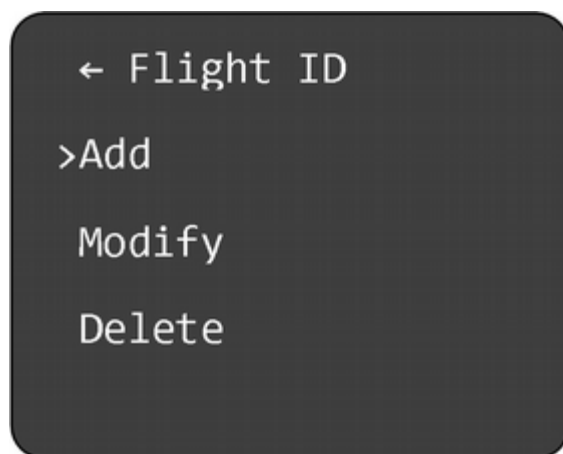


Figure 23: Flight ID configuration

Select “Add” to add a Flight ID, “Modify” to modify a Flight ID or “Delete” to delete a Flight ID and press the rotary knob.

3.4.2.1 Add/Edit Flight ID

To add a Flight ID select “Add” and press the rotary knob.

If all eight possible IDs are already configured the following notification is displayed.

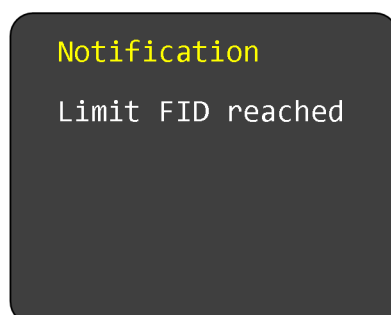


Figure 24: FID Limitation Notification

If this message appears you can either modify an existing entry (see 3.4.2.2) or delete an existing entry (see 3.4.2.3) and add a new one as shown below.

If a new Flight ID can be added a submenu “Edit FID Param.” is displayed.

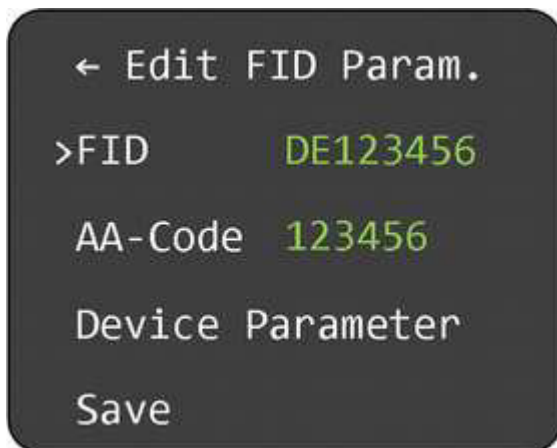


Figure 25: Flight ID Edit Menu

Note:

All configuration settings of a new Flight ID are set to their default values.

3.4.2.1.1 Flight ID Value

To configure the Flight ID perform the following procedure:

1. Select “FID” and press the rotary knob to start editing a Flight ID. The first character turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected character. The next character turns yellow.
4. Repeat steps 2 and 3 until all characters (max. 8) are set to desired value.
5. Saving the 8th character will end the editing. If the Flight ID contains less than 8 characters then enter a space as last character to end the editing.

Note:

After editing the changed value is not saved automatically! You have to select “Save” once all data have been configured (see 3.4.2.1.4).

	Enter the FID left-aligned, without any blanks or dashes (!), e.g. DENWS for the marking D-ENWS.
---	---

	A missing FID disables mode-S operation and A/C-mode only will be engaged. See chapter “4 Self-Test, Errors and Warnings”
---	--

3.4.2.1.2 Aircraft Address (AA) Value

To configure the Aircraft Address (AA) perform the following procedure:

1. Select “AA” and press the rotary knob to start editing the AA. The first digit turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next character turns yellow.
4. Repeat steps 2 and 3 until all digits are set to desired value.

Note:

After editing the changed value is not saved automatically! You have to select “Save” once all data have been configured (see 3.4.2.1.4).

Note:

Before you can enter the Aircraft Address, the Flight ID needs to be defined.

Note:

All values except “000000” and “FFFFFFF” are valid. The transponder accepts all values but if an invalid value is used as Aircraft Address the transponder will show a failure and the transponder switches to AC-only mode.

3.4.2.1.3 Device Parameter

To configure the parameters associated to a Flight ID select “Device Parameter” and press the rotary knob. A submenu “Device Param.” is displayed.

Note:

The submenu “Device Parameter” consists of two (2) pages.

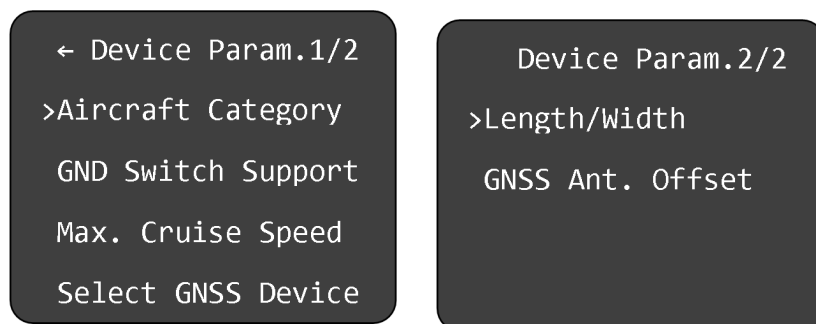


Figure 26: Device Parameter Configuration Menu

Note:

After changing any parameter the new value is not saved automatically! You have to select “Save” once all data have been configured (see 3.4.2.1.4).

3.4.2.1.3.1 Aircraft Category

To configure the aircraft category select “Aircraft Category” and press the rotary knob. A submenu “AC Category” is displayed.

Note:

The submenu “Device Parameter” consists of two (2) pages.

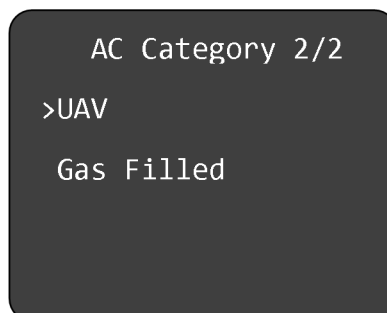
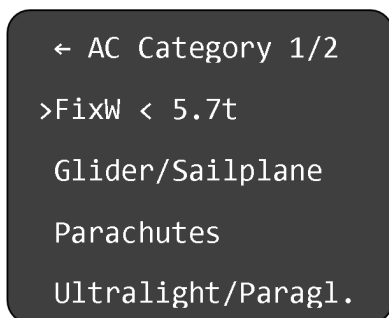


Figure 27: Aircraft Category Selection Menu

Turn the rotary switch to select the desired aircraft category and press the rotary knob to confirm.

Note:

The transponder is not yet certified for A/C FixW>5.7t, speed >250kts and helicopters (RotorCr). Therefore, these items are not yet selectable.

3.4.2.1.3.2 Ground Switch

To activate or deactivate the Airborne/Ground switch function select “GND Switch Support” and press the rotary knob. A submenu “GND Switch Sup.” is displayed.

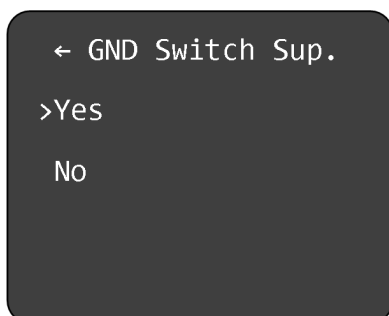


Figure 28: Ground Switch Setup Menu

Turn the rotary knob to select Yes or No and press the rotary knob to confirm.

GND Switch Support	Explanation
Yes	The Airborne/Ground switch function is enabled. The transponder switches the Airborne/Ground mode automatically depending on the status of the Ground Switch input (see 5.1.3).
No	The Airborne/Ground switch function is disabled. Airborne/Ground mode has to be switched manually using the mode button (see 2.2.2).

Table 2: GND Switch Support

3.4.2.1.3.3 Speed Category

To configure the maximum speed category select “Max. Cruise Speed” and press the rotary knob. A submenu “Maximum Speed” is displayed.

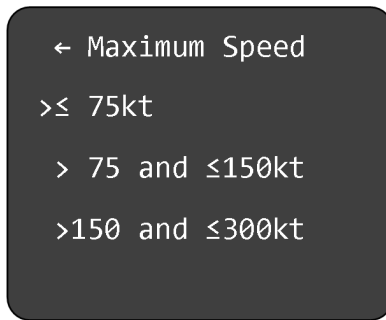


Figure 29: Maximum Speed Category Selection Menu

Turn the rotary switch to select the desired speed category and press the rotary knob to confirm.

3.4.2.1.3.4 Select GNSS Device

If the ADS-B function is used, an appropriate WAAS GNSS source needs to be connected (see 5.1.5).

This transponder is certified to TSO-C166b and meets the requirements of AC 20-165B when directly connected to one of the certified or approved GNSS units listed below. This will form the basis of a 14 CFR 91.227 compliant ADS-B installation.

Certified GNSS Unit	Remarks
---------------------	---------

NexNav Mini WAAS GPS
Receiver
Part Number 21000

Table 3: Certified GNSS Units

Other aircraft voluntarily equipped with ADS-B like experimental aircrafts, gliders, ultralights etc. may be equipped with an appropriate low-cost WAAS GNSS source. It is encouraged to use only GNSS receivers recommended by TQ.

Approved GNSS Unit	Remarks
--------------------	---------

Holux GPS Receiver
Model: M-215+

Table 4: Approved GNSS Units

	If other than a recommended GNSS receiver is used the following shall be observed: • Standard NMEA0183 protocol (\$GPRMC message required) • Update Rate from 5 to 0.5 Hz (0.2 to 2 seconds)
---	--

To configure the GNSS Device select "Select GNSS Device" and press the rotary knob. A submenu "GNSS Device" is displayed.



Figure 30: GNSS Device Selection Menu

Turn the rotary switch to select the desired GNSS device and press the rotary knob to confirm.

GNSS Device	Explanation
No GNSS Device	No WAAS GNSS device is used. The ADS-B function is disabled.
NexNav mini	A NexNav mini device is used. The ADS-B function is enabled.
Approved Device	A recommended NMEA WAAS GNSS device is used. The device must support at least the \$GxRMC-sentence (as defined in the NMEA 0183 protocol). The ADS-B function is enabled.

Table 5: List of supported GNSS Devices

If an “Approved Device” is selected a submenu is displayed for configuring the baud rate.

Turn the rotary switch to select the appropriate baud rate and press the rotary knob to confirm.

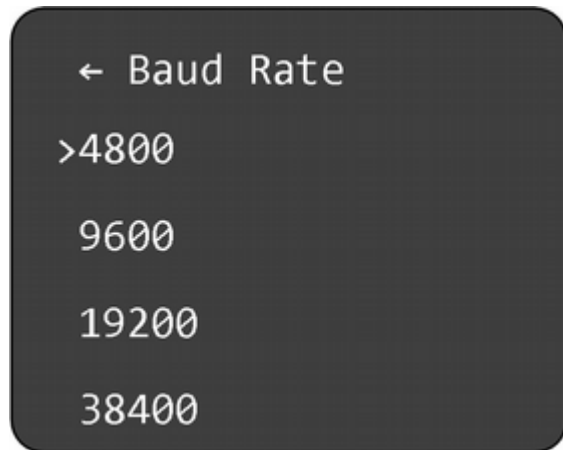


Figure 31: Baud Rate Selection Menu

3.4.2.1.3.5 Select Length/Width

On the ground, ADS-B transmits encoded aircraft size information which is used by ATC to identify taxiing routes and potential conflicts.

To configure the length and width of the aircraft select "Length/Width" and press the rotary knob. A submenu "Length/Width" is displayed.

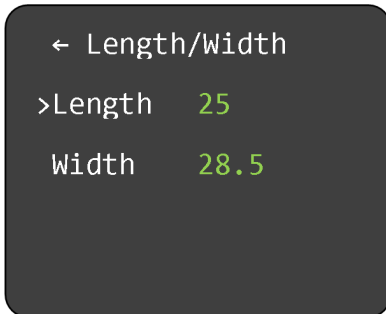


Figure 32: Aircraft Length/Width Configuration Menu

To configure the length of the aircraft perform the following procedure:

1. Select "Length" and press the rotary knob. The first digit of the length value turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next digit turns yellow.
4. Turn the rotary knob to change the value.
5. Press the rotary knob again to save the selected digit. The length value turns green.

Note:

The aircraft length has to be entered in meters rounded to next full meter.
E.g.: If the length is 7.2 m, the value must be 08.

To configure the width of the aircraft (wingspan) perform the following procedure:

1. Select "Width" and press the rotary knob. The first digit of the width value turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next digit turns yellow.
4. Turn the rotary knob to change the value.
5. Press the rotary knob again to save the selected digit. The next digit turns yellow.
6. Turn the rotary knob to change the value.
7. Press the rotary knob again to save the selected digit. The width value turns green.

Note:

The aircraft width has to be entered in meters rounded to the next 1/10 meter.
E.g.: If the width is 9.31 m, the value must be 09.4

3.4.2.1.3.6 GNSS Antenna Offset

The GNSS antenna offset is used together with the aircraft length and width to manage taxiway conflicts. Within the GNSS antenna offset menu, the longitudinal and lateral position offset of the GNSS antenna can be entered. While mainly important for large aircraft, the values can be entered for small aircraft as well.

To configure the GNSS antenna offset select “GNSS Ant. Offset” and press the rotary knob. A submenu “GNSS Ant. Offset” is displayed.

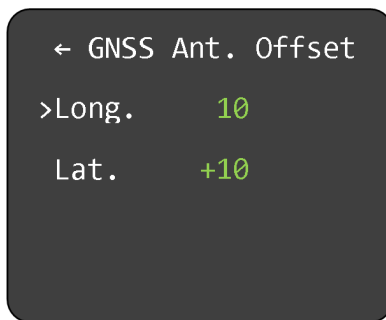


Figure 33: GNSS Antenna Offset Configuration Menu

To configure the longitudinal offset of the GNSS antenna perform the following procedure:

1. Select “Long.” and press the rotary knob. The first digit of the offset value turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next digit turns yellow.
4. Turn the rotary knob to change the value.
5. Press the rotary knob again to save the selected digit. The offset value turns green.

Note:

The longitudinal offset has to be entered in meters measured from the nose of the aircraft.
E.g.: If the offset is 3.2 m, the value must be 04.

To configure the lateral offset of the GNSS antenna perform the following procedure:

1. Select “Lat.” and press the rotary knob. The “+/-” sign of the offset value turns yellow.
2. Turn the rotary knob to change the sign.
3. Press the rotary knob again to save sign value. The first digit of the offset value turns yellow.
4. Turn the rotary knob to change the value.
5. Press the rotary knob again to save the selected digit. The next digit turns yellow.
6. Turn the rotary knob to change the value.
7. Press the rotary knob again to save the selected digit. The offset value turns green.

Note:

For most small aircraft a value of “00” is adequate. In case an antenna offset is applicable, the position to the left side of the aircraft will require a negative sign, to the right a positive sign. The lateral offset has to be entered in meters measured from longitudinal (Roll) axis of the aircraft.
E.g.: If the offset is 1.3 m to left side, the value must be -02.

3.4.2.1.4 Save Flight ID

To save a Flight ID configuration select “Save” and press the rotary knob. The “Flight ID” menu for adding, modifying and deleting a Flight ID configuration will be displayed after the configuration is saved.

3.4.2.2 Modify Flight IDs

To modify a Flight ID select “Modify” and press the rotary knob. A submenu “Select FID” is displayed. See 3.4.2.4 for details.

After the desired Flight ID is selected the submenu “Edit FID Param.” is displayed and the parameters of the Flight ID can be modified (see 3.4.2.1).

3.4.2.3 Delete Flight IDs

To delete a Flight ID select “Delete” and press the rotary knob. A submenu “Select FID” is displayed. See 3.4.2.4 for details.

After the desired Flight ID is selected the submenu “Delete FID” is displayed.

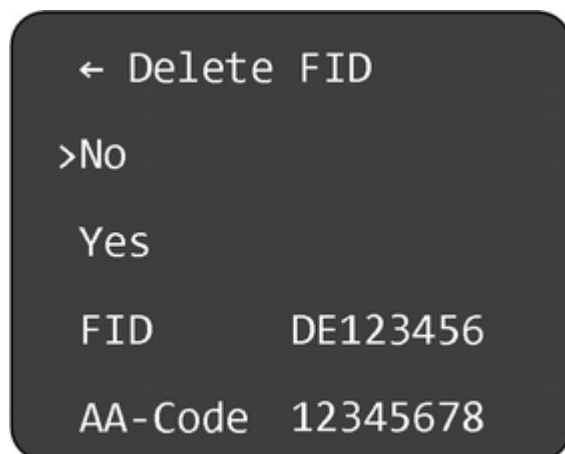


Figure 34: Delete Flight ID Menu

To delete the Flight ID turn the rotary knob to select “Yes” and press the rotary knob. The Flight ID is deleted and the “Flight ID” menu is displayed.

If you select “No” and press the rotary knob the Flight ID is not deleted and the “Flight ID” menu is displayed.

The “FID” and “AA-Code” are only displayed for information purposes.

3.4.2.4 Multiple Flight IDs

In case multiple Flight IDs are configured a selection menu is displayed where necessary.

The selection menu for multiple Flight IDs allows the selection of an already configured Flight ID (see 3.4.2.1) for the operation or configuration of the transponder. The selection menu may consist of two pages (see note below).

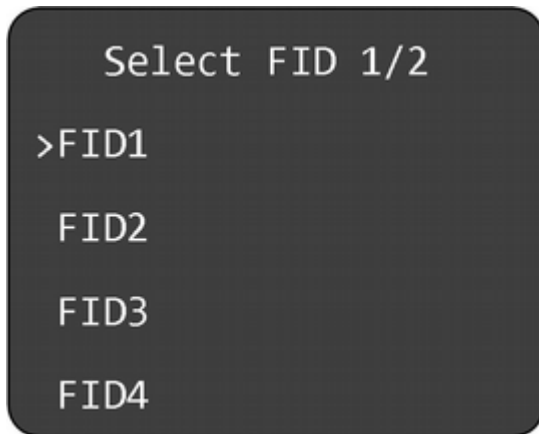


Figure 35: Multiple Flight ID Selection Menu

Turn the rotary knob to select the desired Flight ID. Press the rotary knob to confirm the selection. The transponder will then use the selected configuration.

Note:

If more than four Flight IDs are configured turn the rotary knob clockwise until the next page is shown. To go back to the previous page turn the rotary knob counterclockwise.

3.4.3 Modify VFR

To configure the VFR squawk code "Modify VFR" and press the rotary knob. A submenu "Modify VFR" is displayed.



Figure 36: Modify VFR Code Menu

To change the VFR squawk code perform the following procedure:

1. Press the rotary knob. The first digit of the standby squawk turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next digit turns yellow.
4. Repeat steps 2 and 3 until all four (4) digits are set to desired VFR squawk code.



Note:

Make sure, that you enter the correct VFR squawk code for the particular country where your aircraft is operated.

Examples:

Germany: VFR Squawk = 7000

USA: VFR Squawk = 1200

3.4.4 Factory Reset

In certain cases it may be necessary to perform a factory reset. Performing a factory reset will reset all settings to their factory defaults.

To perform a factory reset select “Factory Reset” and press the rotary knob. A submenu “Factory Reset” is displayed.

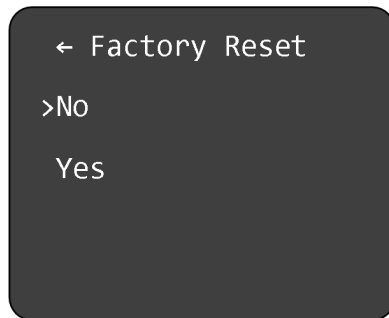


Figure 37: Factory Reset Menu

To perform a factory reset turn the rotary knob to select “Yes” and press the rotary knob. A notification is displayed which requests a restart of the transponder.

3.4.5 Test Menu

The second page of the setup menu contains only the test menu.

To enter the test menu select “Test Menu” and press the rotary knob. A submenu “Test Menu” is displayed.

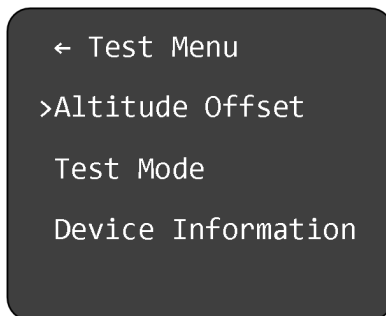


Figure 38: Test Menu

To calibrate the altitude offset select “Altitude Offset” and press the rotary knob. A submenu “Altitude Offset” is displayed (see 3.4.5.1).

To enter the test mode select “Test Mode” and press the rotary knob. A submenu “Test Mode” is displayed (see 3.4.5.2).

To show some device information select “Device Information” and press the rotary knob. A submenu “Device Info” is displayed (see 3.4.5.3).

3.4.5.1 Altitude Offset Calibration

The Altitude Offset Calibration allows you to adjust the built-in altitude encoder to ensure that the flight level transmitted by the transponder complies with all relevant standards.

This process is normally carried out every 24 months, as part of the altimeter checks on the aircraft. The maximum allowed difference between the primary altimeter and the altitude encoder is 125 feet according to ETSO C88a.

The altitude encoder in the transponder is extremely accurate, has an excellent long-term stability and is accurately calibrated during manufacture. But it is possible that a combination of allowed accuracy deviations in the altitude encoder and the primary altimeter may show an altitude difference exceeding 125 feet. In that case it is recommended to perform an altitude offset calibration.

3.4.5.1.1 Calibration Equipment

To perform the altitude offset calibration the transponder needs to be powered up. Additionally a pitot static test set is needed together with the appropriate adapters to connect to the static port on the aircraft. The pitot static test set should be able to drive the altitude from sea level to above the service ceiling of the aircraft.

Note:

For the calibration procedure no transponder test set is required. During the calibration procedure all necessary information is displayed. Nevertheless a transponder test set can be used to verify the transmissions of the transponder.

3.4.5.1.2 Calibration Procedure

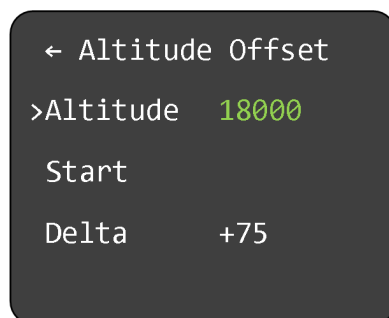


Figure 39: Altitude Offset Calibration Menu

To perform the altitude offset calibration perform the following procedure:

1. Select "Altitude" and press the rotary knob. The first digit of the altitude set point turns yellow.
2. Turn the rotary knob to change the value.
3. Press the rotary knob again to save the selected digit. The next digit turns yellow.
4. Repeat steps 2 and 3 until all digits are set to desired altitude set point.

Note: It is recommended to use 18000 ft as altitude set point.

5. On the pitot static test set drive the altitude to the set point value as entered before and wait until the pressure has stabilized.
6. Select "Start" and press the rotary knob. The calibration procedure is started. During the "Delta" value shows three dashes ("---").

7. After a few seconds either the “Delta” value is showing the altitude offset value or a notification is displayed.

In a normal case the calibration procedure was successfully performed and the new altitude offset value is stored.

In a rare case the offset value determined by the calibration procedure is beyond the limits. Possible reasons can be:

- Altitude set point values of transponder and static test set do not match.
=> Check the settings.
- Failure in the static port connection from the static test set to the transponder.
=> Check the installation.
- Failure of the altitude encoder.
=> Send the unit for servicing.

To verify the altitude measurement the following procedure must be performed:

1. Switch off the transponder.
2. Switch on the transponder in “Setup Mode” and enter the “Test Mode” (see 3.4.5.2).
3. On the pitot static test set drive the altitude to -1000 feet.
4. Verify that the altitude displayed on the transponder correspond within the 125 foot tolerance. Additionally verify the altitude value transmitter by the transponder.
5. Repeat this procedure for all altitudes to the service ceiling of the aircraft in steps of 1000 feet.

3.4.5.2 Test Mode

The submenu “Test Mode” displays the following internal measurements:

- Operating voltage (Battery)
- DC Converter voltage (power supply for the transmitter)
- Altitude (in feet)

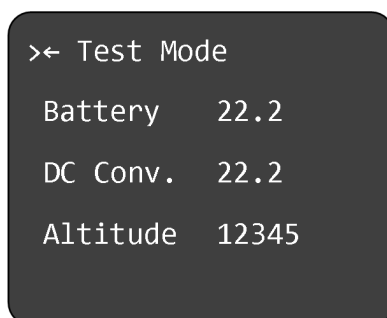


Figure 40: Test Mode Menu

3.4.5.3 Device Info

The submenu “Device Info” displays the checksum of the software and the serial number of the device.

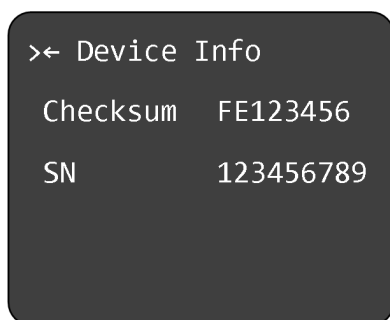


Figure 41: Device Info Menu

4. Errors, Warnings and Notifications

The transponder distinguishes 3 types of faults:

- Degrading failures
- Limiting failures
- Severe failures

Additionally notifications are displayed where appropriate.

In order to be serviced, a defective transponder needs to be shipped to the nearest service station. For addresses see the TQ General Aviation website:

<https://www.tq-general-aviation.com/en/Service>

4.1 Degrading failures

If a degrading failure is detected the transponder continues to operate. But its performance may be reduced. Once detected a warning message is displayed. This message can be confirmed by pressing the rotary knob. The normal operation display will be shown again with the failure indication.



To handle a nonrecurring cause the transponder can be switched off and on again. If the error reoccurs the transponder can be operated as usual but with reduced performance.

Note:

Only the last failure is shown except for the battery voltage warning.

The following table shows a list of all degrading failures of the transponder.

Failure	Explanation	Degradation	Action / Remark
DC converter	TX supply voltage is low	TX output power is reduced.	Send unit for servicing.
Bad antenna	Antenna VSWR is bad (very high)	TX output power is reduced.	Check antenna installation (cable, connectors etc.) to resolve the problem before next flight. If no root cause can be discovered, send unit for servicing.
Transmitter weak	TX output power is too low	TX output power is reduced.	Check antenna installation (cable, connectors etc.) to resolve the problem before next flight. If no root cause can be discovered, send unit for servicing.
Flight Level	The altimeter reports a failure	No barometric altitude information is sent.	Check connection and function of static air port to resolve the problem before next flight. If no root cause can be discovered, send unit for servicing.
Low battery voltage	Battery voltage is below 11 Volts	See below.	See below.
Very low battery voltage	Battery voltage is below 7.5 Volts	See below.	See below.

Table 6: Degrading Failures

4.1.1 Low Battery Voltage

If the supply voltage of the transponder falls below 11 V DC, a yellow indication “BAT LOW” is shown in the center of the display. The indication is shown as long as the voltage is too low.

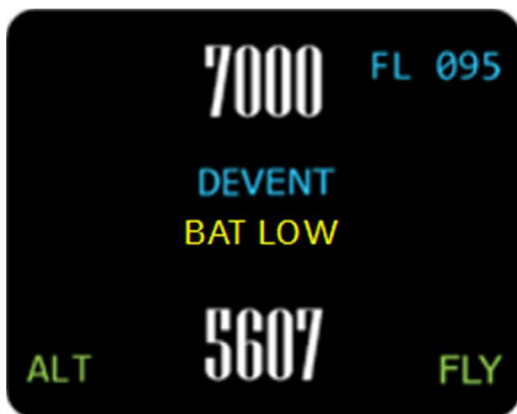


Figure 42: Low Battery Voltage

Note:

The transponder is designed to operate above 9 V DC. Do not operate the unit below 9 volts.

Degradation:

TX output power may be reduced.

Possible Reasons:

1. Battery exhausted.
2. Voltage of electric generator is low.

Actions:

1. Exchange or charge the battery.
2. Check electric generator.

4.1.2 Very Low Battery Voltage

If the supply voltage of the transponder falls below 7.5 V DC, a red indication “BAT LOW” is shown in the center of the display. The indication is shown as long as the voltage is too low.



Figure 43: Very Low Battery Voltage

Degradation:

Transponder is switched into “STBY” mode. No further operation possible.

Possible Reasons:

1. Battery exhausted.
2. Voltage of electric generator is very low.

Actions:

1. Exchange or charge the battery.
2. Check electric generator.

4.2 Limiting failures

If no FID-Code (Flight ID) is entered or if the corresponding Aircraft Address (AA-Code) is missing or incomplete, the following failure is displayed after switching on the transponder:

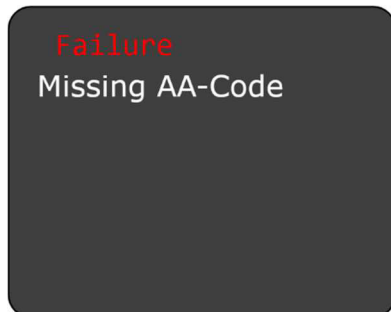


Figure 44: Missing AA-Code

To fix this error an appropriate FID and AA-Code has to be configured as described in chapter 3.4.2.

Note:

This message can be cleared by pressing the rotary knob. The transponder will then operate in A/C mode only.

4.3 Severe failures

In case a severe failure is detected, a message (example) as shown below is displayed. No further operation of the transponder is possible. No replies will be made to interrogations and ADS-B out is switched off.

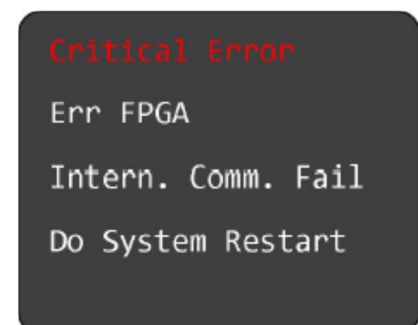


Figure 45: Critical Error (Example)



To handle a nonrecurring cause the transponder can be switched off and on again. But if the error reoccurs the transponder must be switched off.



The following table shows a list of all degrading failures of the transponder.

Displayed Error	Explanation	Remarks
EEPROM access	Severe operation error. No access to EEPROM.	Send unit for servicing.
FPGA communication	Severe operation error. No access to FPGA.	Send unit for servicing.
FPGA internal	Severe operation error. FPGA internal failure.	Send unit for servicing.
ADC	Severe operation error. No access to ADC.	Send unit for servicing.
Trans. out. power	Severe operation error. No or very low TX output power.	Check installation (power cable, antenna cable, etc.). If no root cause can be discovered, send unit for servicing.
Antenna failure	Severe operation error. Antenna not connected or Antenna VSWR is very high.	Check installation (power cable, antenna cable, etc.). If no root cause can be discovered, send unit for servicing.
MCU	Severe operation error. MCU internal failure.	Send unit for servicing.
Unknown Error	Severe operation error.	Check installation (power cable, antenna cable, etc.). If no root cause can be discovered, send unit for servicing.

Table 7: Severe Failures

4.4 Notifications

4.4.1 GNSS Data CRC Failure

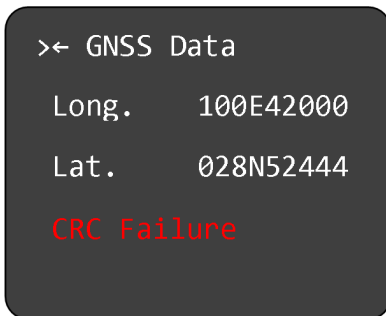


Figure 46: GNSS CRC Failure

Possible Reasons:

Invalid data from GNSS source.

Actions:

Check installation, cable, connections and configuration of the installed GNSS source.

4.4.2 Do System Restart

The following message is displayed if a restart of transponder is necessary.



Figure 47: System Restart

Actions:

Switch the transponder off and on again

5. Installation

5.1 Equipment Connections

5.1.1 Electrical Connections

The 15pin D-SUB connector at the rear side of the unit includes all electrical connections, except for the antenna, see chapter 5.2.2 for details.



The positive supply line needs to be protected by a 3A slow blow fuse!



The transponder should be connected to an uninterruptible power supply as short power interrupts may cause the transponder to restart in “STBY” Mode or in Multiple Flight ID selection.

5.1.2 Mutual Suppression

Other equipment on board (e.g. DME) may transmit in the same frequency band as the transponder. If such a device is installed a single wire bus (Suppression = active at +12V) must be installed in order to protect the receiving parts of the different devices from in-band transmissions.

Mutual suppression is a pulse that is sent to the other equipment to suppress transmission of a competing transmitter for the duration of the pulse train transmission. The transponder transmission may be suppressed by an external source and vice versa.

To activate mutual suppression the SUPP_I/O requires a +12V source from the other equipment, see chapter 5.2.2.



All equipment connected to the suppression line must be re-inspected and reapproved from a qualified avionic technician before operation. Use only shielded lines.

5.1.3 Ground Switch

If a Ground Switch is connected (and activated in the Setup), the transponder is enabled to distinguish between weight-on-wheel (On the Ground) and no-weight-on-wheel (In-Flight) conditions. In the weight-on-wheel condition the transponder automatically enters the Standby mode.

In order to complete this installation the input “FLY-GND” must be connected to a switch, which connects the input with “GND” in case there is weight on wheels, or remains open during flight, see chapter 5.2.2.



This option must additionally be activated in the Setup. For details on configuration please refer to chapter 3.4.2.1.3.2.

5.1.4 Static Air Port

The transponder has a built-in altitude encoder which must be connected to the same source of static pressure as the primary altimeter on the aircraft.

For this purpose the transponder has a hose connection at its rear side for nominal 5mm or 3/16 inch tubing (inside diameter).

Connect the static air connection to the static pressure port and ensure a tight connection with a suitable hose clamp.

5.1.5 GNSS Interface

A GNSS source can be connected to the serial interface (RS232) providing GNSS position data for use of ADS-B out.

Requirements:

- Required GNSS hardware:
 - NexNav Mini (Part-No. 21.000) which turns the transponder into a 14 CFR 91.227 compliant device as required for TC'd aircraft (FAA 2020 mandate).
 - or
 - Standard NMEA0183 RMC data stream including the RMC-sub-format (4800/9600/19200/38400 Baud) for aircrafts which do not require the ADS-B requirements defined in 14 CFR 91.227.
- GNSS hardware needs to be connected to pin 13 (RX-RS232) and optionally pin 2 (TX-RS232) of the D-SUB connector (see chapter 5.2.2). Power supply needs to be provided separately considering the required operating voltage for the GNSS hardware.

The WAAS GNSS device needs to be selected in the setup menu (see chapter 3.1.4.4).

Note:

For connection to the NexNav Mini device, a proprietary cable is available from TQ. Please contact your dealer for more information.

If a standard NMEA0183 WAAS GNSS source is sufficient for your aircraft (LSA, Experimental, Ultralight etc.) you should consider brands recommended by TQ to avoid incompatibilities or malfunctions.

Note:

For correct function of the movement detection an update rate of 5 Hz is recommended for NMEA devices.

5.1.6 Antenna Connector

The antenna is connected to a single coaxial connector (SMA) at the rear side of the transponder.

5.1.6.1 L-Band ADS-B Antennas

The L-Band antenna used with the KTX2 must fulfil to the following specifications:



- Standard 50 Ω , vertically polarized antenna with a VSWR < 1.7:1 at 1090 MHz.
- TSO-C66(), TSO-C74(), TSO-C112(), or TSO-154c antennas that also meet the VSWR specification.

Only the L-Band antennas listed in the table below have been tested for compatibility with transponder installations.

Manufacturer	Part Number	Connector Type	Remarks
RAMI	AV-74	BNC	
Comant	CI-105	BNC	
Comant	CI-105-11	TNC	

Table 8: L-Band Antennas

5.1.6.2 Antenna Installation

The antenna should be installed according to the manufacturer's instructions.

The following considerations should be taken into account for the antenna installation:

- The antenna should be placed not directly near any projections, the engine(s) and propeller(s). It should also be placed not directly near landing gear doors, access doors or others openings which will break the ground plane for the antenna.
- The antenna should be mounted on the bottom surface of the aircraft and in a vertical position when the aircraft is in level flight.
- The antenna should not be mounted within 3 feet of the ADF sense antenna or any COMM antenna and 6 feet from the transponder to the DME antenna.
- Where practical, the antenna location should be chosen to keep the cable lengths as short as possible and to avoid sharp bends in the cable to minimize the VSWR.
- To prevent RF interference, the antenna must be physically mounted at a minimum distance of 3 feet from the transponder.

Electrical connection to the antenna should be dust and water proof to avoid loss of efficiency as a result of the presence of liquids or moisture. All antenna feeders must be installed in such a way that a minimum of RF energy is radiated inside the aircraft.

5.1.6.3 Antenna Cable

The transponder is designed to fulfil the ADS-B Class 1 requirements allowing a maximum loss of 2 dB in the connectors and cable used to connect it to the antenna. Exceeding this loss will degrade the transmitter output power and receiver sensitivity.

A typical installation needs two (2) connectors at each end of the antenna cable.

Calculating a loss of 0.25dB for each connector allows a loss of 1.5dB for the cable itself.

An acceptable cable must have the following characteristics:

- Less than 1.5dB loss for the cable length needed.
- Characteristic impedance of 50 Ohms.



- Double braid screens or a foil and braid screen.

Once the cable length from the transponder to the antenna is known, a cable type can be chosen which has a loss per meter low enough to meet the above requirements (see table below).

Note:

Low loss cable typically uses foamed or cellular dielectrics and foil screens. These make such cables especially prone to damage from too-tight bends or from momentary kinking during installation. Once kinked, these cables do not return to full performance when straightened.

The following table shows a list of some common cable types and the maximum usable lengths.

Cable Type	Max Length in meters (feet)	Insertion Loss dB/meter (db/100ft) ¹	Remarks
RG-400 M17/128-RG400	2.5 (8' 2")	0.6 (18.5)	
RG-304 M17/112-RG304	4.2 (13' 9")	0.36 (11.1)	
RG-393 M17/127-RG393	5 (16' 5")	0.3 (9.2)	
Carlisle IT Type 3C142B	3.1 (10' 2")	0.48 (14.5)	
Carlisle IT Type 311601	5.2 (17' 1")	0.29 (8.7)	
Carlisle IT Type 311501	6.5 (21' 4")	0.23 (7.1)	
Carlisle IT Type 311201	8.3 (27' 4")	0.18 (5.6)	
Carlisle IT Type 310801	12.5 (41')	0.12 (3.6)	

Table 9: Common Antenna Cables

When routing the cable, ensure that you:

- Keep the cable length as short as possible.
- Avoid routing the cable round tight bends.
- Avoid kinking the cable, even temporarily during installation.
- Secure the cable so that it cannot interfere with other systems.
- Route the cable away from any heat sources.

¹ RG type coaxial cable insertion loss can vary significantly between manufacturers. The insertion loss for RG type cables shown in this column is considered 'worst case'. Refer to the cable manufacturer's specification sheet for actual attenuation (insertion loss) for the cable being used.



- Route the cable away from potential interference sources such as ignition wiring, 400Hz generators, fluorescent lighting and electric motors.
- Allow a minimum separation of 300mm (12 inches) from an ADF antenna cable.

Note:

In case an already installed antenna can be further used (old transponder is replaced) and the existing connector does not fit, it is recommended to replace the connector. Alternatively, an adapter from the existing connector to a SMA male type connector can be used. But this will add an additional loss of typical 0.1 – 0.2 dB to the installation which must be considered. If the total loss of 2 dB is exceeded the cable must be replaced.

Note:

An SMA<->TNC adapter is available from TQ.

5.2 Wiring

5.2.1 Conductor Cross Section

Power Supply (Batt. Plus, GND): AWG20 (0.62 mm²)
Signals: AWG22 (0.38 mm²)

The conductors must be approved for aircraft use. Recommended Quality:

MIL-Spec 22759/34, (Spec 55) 20AWG / 22AWG

Crimped D-Sub connector is always preferred against soldered connectors. Original TQ harness comply with common aviation wiring standards. Consult your approved aviation shop for installation details.

5.2.2 Wiring Scheme

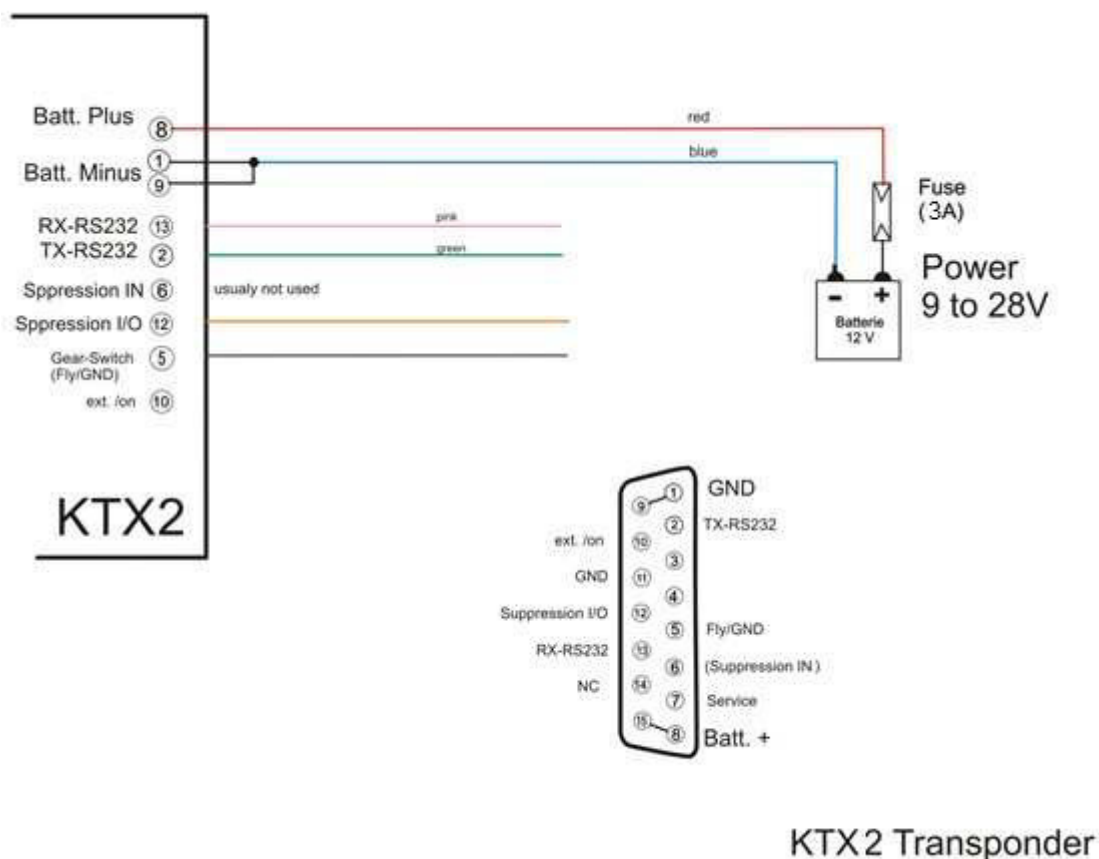


Figure 48: Wiring

6. Drawings

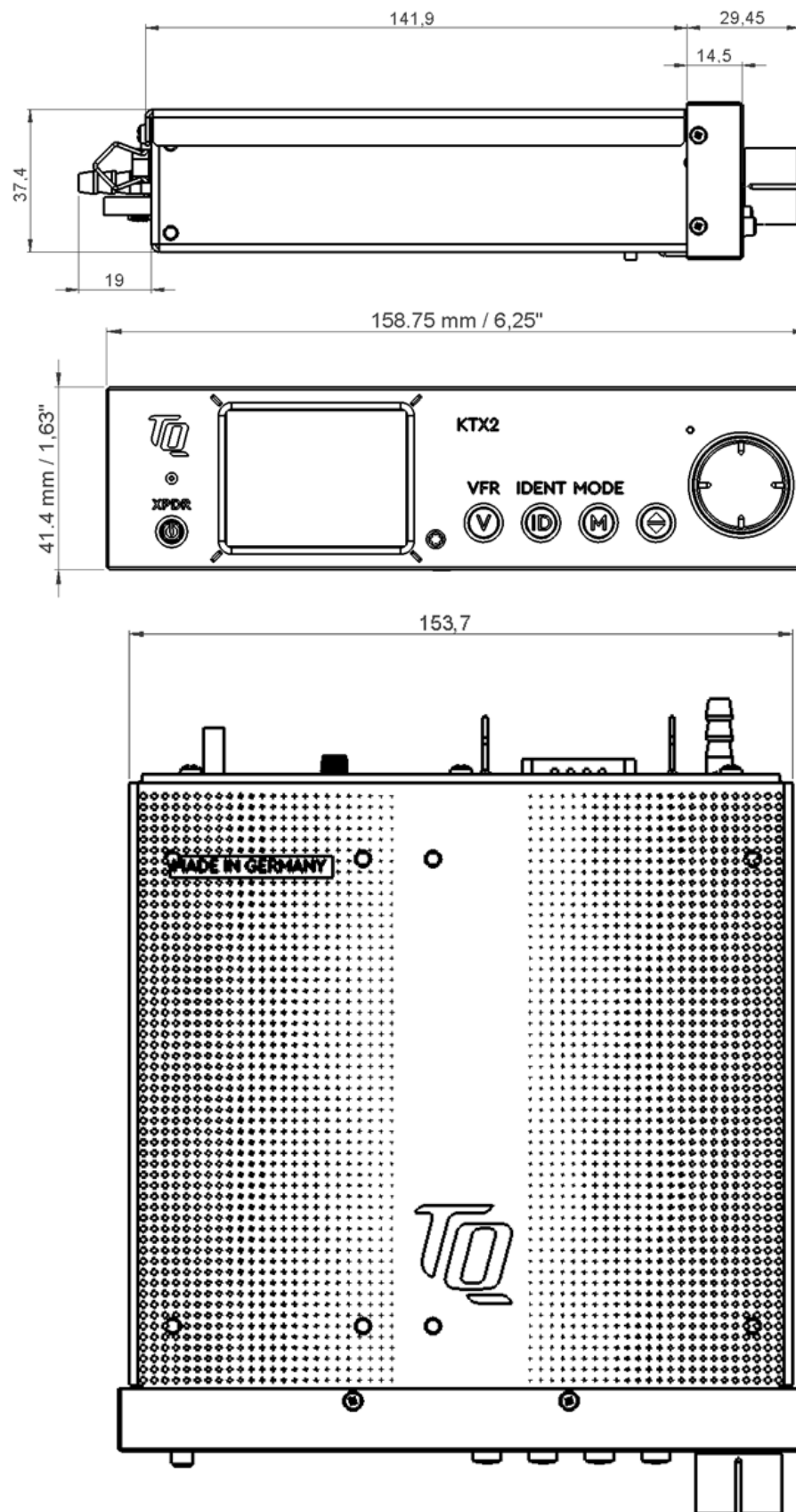


Figure 49: Dimensions of KTX2-F Standard round format

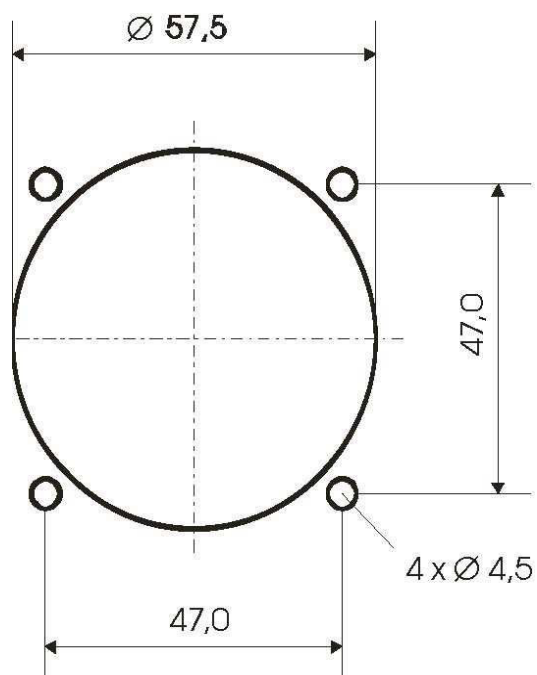


Figure 50: Panel Cut-Out

7. Technical Data

7.1 General

Designation	
Authorization	EASA.21O.10070633
Certification	ETSO-C112e / TSO-C112e ETSO-C88b / TSO-C88b ETSO-C166b_A3 / TSO-C166b
Compliance	RTCA DO-181E / ED-73E / Level 2els, Class 1 RTCA DO-178C/ ED-12C Level D RTCA DO-254 / ED80 Level C RTCA DO-160G / ED-14G RTCA DO-260B / ED102A Class B1S SAE AS8003 FCC ID: 2ANFF-KTX2F
Dimensions KTX2-F	158.75 x 41.4 x 190.35 +/- 1 mm (6.25" x 1.63" x 7.5") pure housing
Weight	KTX2-F 0.600 kg
Mounting	KTX2-F: cut-out dimensions 155 x 38 +/- 0.2 mm (6.1" x 1.5") installation depth short frame: 140 +/- 0.2 mm (5.5") long frame: 236.4 +/- 0.2 mm (9.3")
Temperature ranges: Operation Storage	-20 °C to +55 °C -55 °C to +85 °C
Maximum flight level	30 000ft
Vibration	DO-160G, Cat. S, Vibration Curve M
Humidity	RTCA DO-160G, Cat. A
Shock	6G operation 20G crash safety
RTCA DO-160F ENV. Category	[C4Z]CAB[SM]XXXXXXZ[BBB][AC]TB[B2F2]XXAX
Software Category	ED-12C (RTCA DO-178C) Level C
Hardware Category	DO-254 Level C
Power supply	9 V DC to 33V DC



Designation	
Power consumption	- depending on the number of requests = 0.2 to 1.0A (@ 12V DC) - Illumination 0.02A (@ 12V DC)
Fuse	External fuse required: 3A, slow-blow
Compass security distance	300 mm (12")

Table 10: Technical Data

7.2 Transmitter – Receiver

TRANSMITTER	
Reply transmission frequency	1090 ± 1MHz
RF Peak Power Output	≥ 54dBm (250 W) nominal at antenna connector, ≥ 51dBm (125 W) minimum at antenna base (allowing 0.5dB connector loss and 1.5dB cable loss)
Squitter	Transmitted periodically at random intervals, full self-verification of data and occurrence

Table 11: Transmitter Data

RECEIVER	
Receiving frequency	1030 ± 1MHz
Receiver Characteristics: Sensitivity	RF input power level resulting in a 90 % reply rate: ■ MTL for ATCRBS and ATCRBS/Mode S All-Call interrogations: -74dBm ±3dB. ■ MTL for Mode S interrogations: -74dBm ± 3dB.

Table 12: Receiver Data

General	
ICAO 24-bit Aircraft Address (Hex-Code)	Aircraft Address as assigned by National Aviation Authority
FID	Flight ID: Flight Plan call sign or aircraft registration marking
Pressure Altitude	Up to 30 000ft in 25ft increments in-flight / on-ground
Flight Status	Reports the available data and means by which the transponder can report.

Table 13: General Data



8. FCC related issues

8.1 Radiofrequency radiation exposure Information:

This transponder complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transponder should be installed and operated with minimum distance of 200 mm between the radiator and your body.

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

Notice: This transponder has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This transponder generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

8.2 Compliance

Notice: This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) this transponder may not cause harmful interference, and
- (2) this transponder must accept any interference received, including interference that may cause undesired operation.

8.3 Modifications

Note:

Changes or modifications made to this transponder not expressly approved by TQ-Systems GmbH may void the FCC authorization to operate this equipment.



9. Maintenance

9.1 Periodic Maintenance

This 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 as long as it does properly perform its intended function. When service is required, a complete performance test must be accomplished following any repair action. Repairs must only be carried out in accordance with TQ-Systems GmbH service procedures.

9.2 Repair

Only exchange and flat repair of the equipment is permitted. In case of equipment malfunction, the unit must be sent to the manufacturer. Refer to section “1.2 Customer Service”.

9.3 Cleaning

Clean the display only with, lint-free cloth and an eyeglass lens cleaner that is specified as safe for anti-reflective coatings.



10. EXCLUSIVE LIMITED WARRANTY and LIMITATIONS ON LIABILITY

1. Our warranty and liability is based on legal provisions, provided nothing else has been agreed.
2. Delivery items may differ from product illustrations, especially in regard with color and weight. Such differences do not constitute a defect of quality which is relevant for warranty claims.
3. The Customer's warranty rights are subject to the fact that the Customer has properly fulfilled its obligations of examination and notification of defects under § 377 HGB (Commercial Code).

Inasmuch as the Customer is a consumer, the delivery will be considered as approved if written notice of defects is not received within a period of ten (10) working days after arrival of the goods. If the defect was not noticeable in an ordinary inspection the period is extended to four (4) weeks.

If the claim for defects is not files in good times, warranty shall be excluded.

4. Our warranty obligation to the Customer ends 36 months after delivery to the Customer or 24 months after delivery to the end customer, whichever period expires first. The warranty obligation for claims for subsequent performance, replacement deliveries or replacement performance after a substitute performance, replacement delivery or replacement performance exist within the scope of the remaining period of the warranty term as stated above.
5. The warranty period expires prematurely, however, if repair attempts or other modifications are made to the contractual objects by the Customer or agents it has commissioned without the prior agreement.
6. Our liability for damages attributable to it or its agents is, in cases of gross negligence or damage with negligence, an obligation that is significant for achieving the purpose of the contract and is financially and materially limited to the business and product liability insurance cover concluded. Any further liability is excluded.



11. Software License Conformity

OpenSource-Software has been developed with the collaboration of many different developers under differing conditions. Thus, any liability for consequential damages arising out of the use of OpenSource-Software shall, if not compulsory regulated by law, be excluded or limited to modifications or alterations of OpenSource-Software which can clearly and definably be assigned to TQ or its auxiliary persons.

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