Moving Terrain

Installation Manual MT-VisionAir X

Revision 7

Note on this manual

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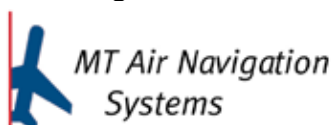
REVISION

Date	Changes / Additions / Corrections	Revision	Valid Pages
2012/04/02	1st edition	0	92
2012/10/24	RG58C/U 50 Ohm corrected (p. 48) Chapter 5 added (p. 36-39) New COM Port logic for TCAS added (p. 71-88) COM Port assignment corrected (p. 95)	1	96
2016/02/10	Complete revision	2	134
2016/03/02	MT Camera: mtpro.ini parameters	3	134
2017/02/02	Insertion of MT MMS: Rescue Track via ITAS Insertion of MT-VGA-Input Device Completion of mtpro.ini parameter	4	166
2018/12/05	Completion of Thuraya XTpro installation	5	168
2019/06/19	Revision ITAS connection diagram	6	170
2021/06/07	MT DVI Output Device	7	174

Contents

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General Safety Precautions

⚠️	**CAUTION:** • The two central connectors (50-pin MDR) of the MT-VisionAir X are connected identically; **strictly avoid** using both at the same time! This could cause severe damage of the device. Always connect ONLY ONE of these connectors. • Never disconnect the conducting connector during operation. This could cause severe damage of the device. • Never store the device into the transport case when equipped with battery packs. This could cause overheating. • Always take care to allow sufficient ventilation of the device when mounted. Otherwise overheating could occur.

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1. General information for Operating a MT-VisionAir X

MT-VisionAir X was designed to be installed and operated as a panel mounted device, but can easily be removed for flight planning.

MT-VisionAir X is equally suited as a hand-held device **(not suitable for MT-Terrain EFIS function).**

Fig. 1.1: MT-VisionAir X Panel mount installation in Piper JetProp

The Easy mount is permanently installed in the panel. The MT-VisionAir X slides into the Easy mount, but can easily be removed for flight planning, updates of the navigation data or charts, etc.

Installation of the the MT-VisionAir X has virtually no influence on the weight and balance calculation.

Following installation, an EMI test has to be performed in the aircraft. Prior to the first flight it is mandatory to turn on the system and check cockpit instruments for deviations from normal performance.

2. Introduction of MT-VisionAir X

2.1 Views of device

Bottom view

157 mm

126 mm

Right side view

Front view

Top view
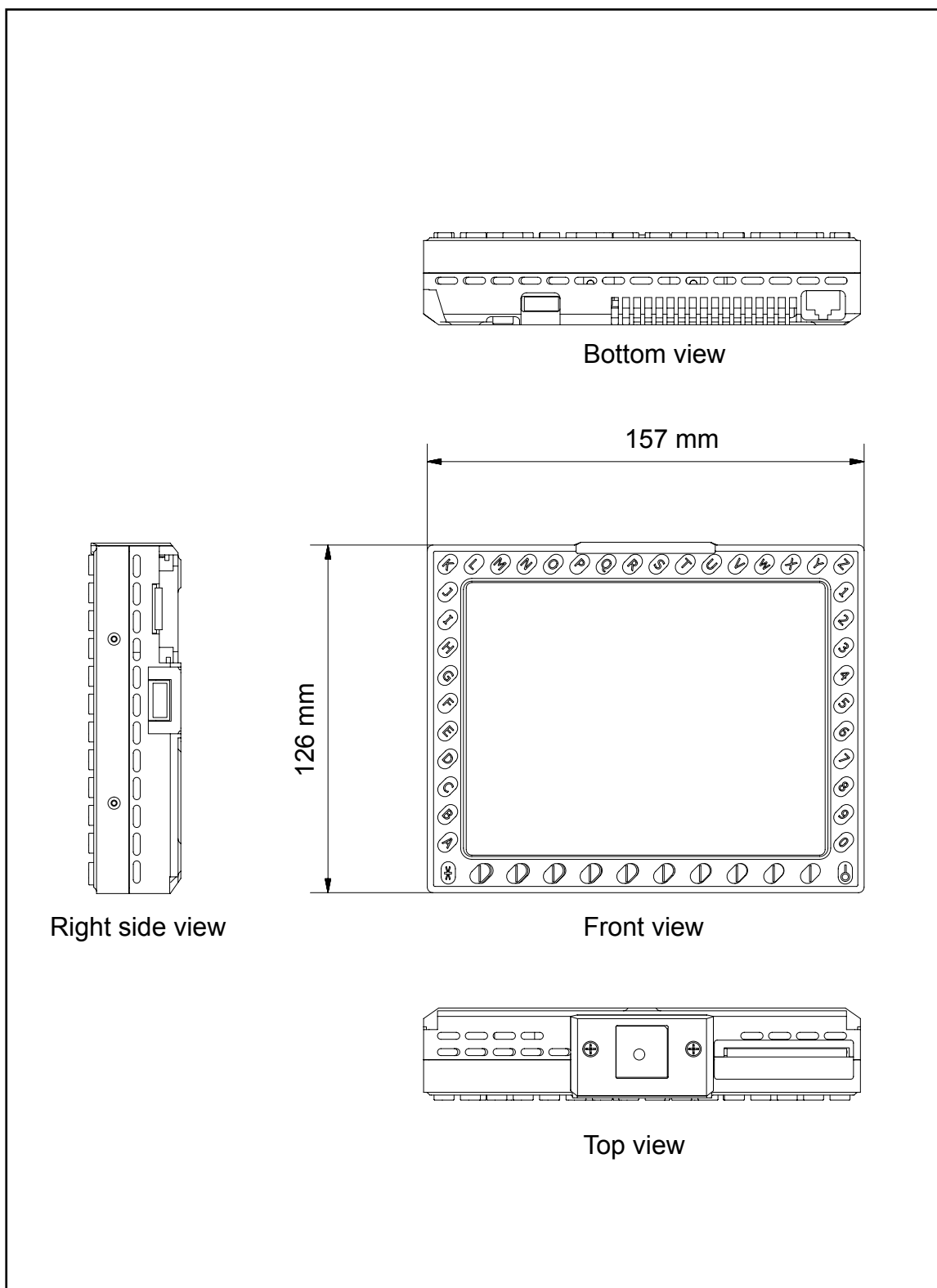
Fig. 2: Views of MT-VisionAir X (1)

33.1 mm

Left side view
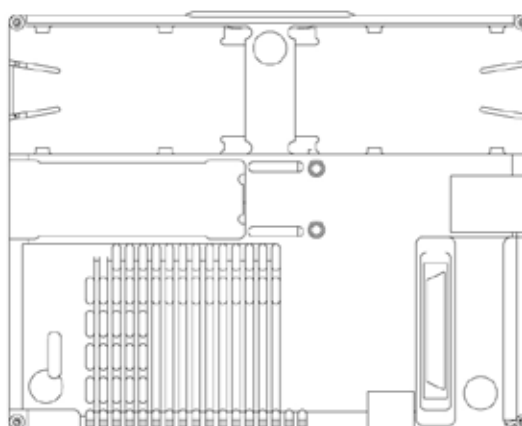
Rear view
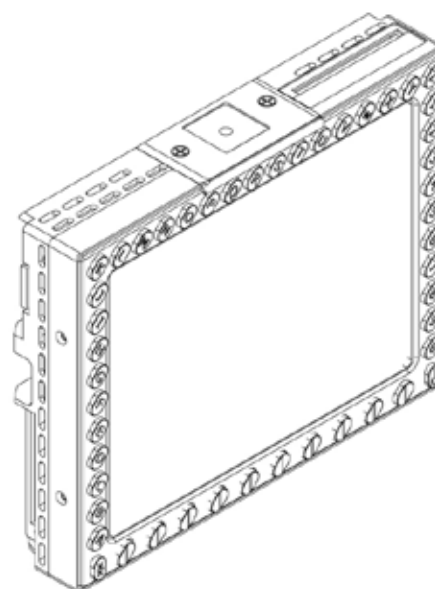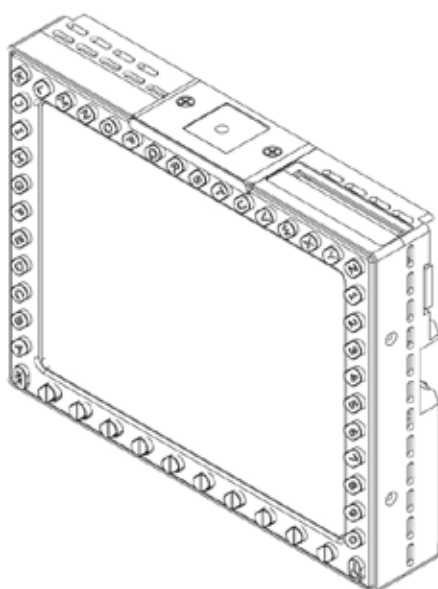
Fig. 2: Views of MT-VisionAir X (2)

3. Installation of MT-VisionAir X

3.1 Requirements for MT-Terrain EFIS

To find the optimum place for installation in the cockpit technical requirements have to be taken into account if MT-Terrain EFIS is part of the system.

The combination of internal position sensors with the positioning on the Fast Integral GPS enables an indication of the attitude directly on the unit in real time.
The presentation is in full- or split-screen, with or without terrain representation (3D Terrain or Horizon).
The calibration of the internal sensors is part of the MT-Terrain EFIS and already done in the factory.

3.1.1 Requirements for mounting with respect to aircraft axes

- The MT-VisionAir X / Easy mount must be firmly attached to the aircraft.

- An installation on the controls is not possible.

- The MT-VisionAir X must be mounted aligned to the aircraft axes.
- **No deviation angles** to   latitude axis = y axis   = roll
  and   yaw axis   = z axis   = heading.
- **A deviation angle** to the   lateral axis = x axis   = pitch
  can be compensated.
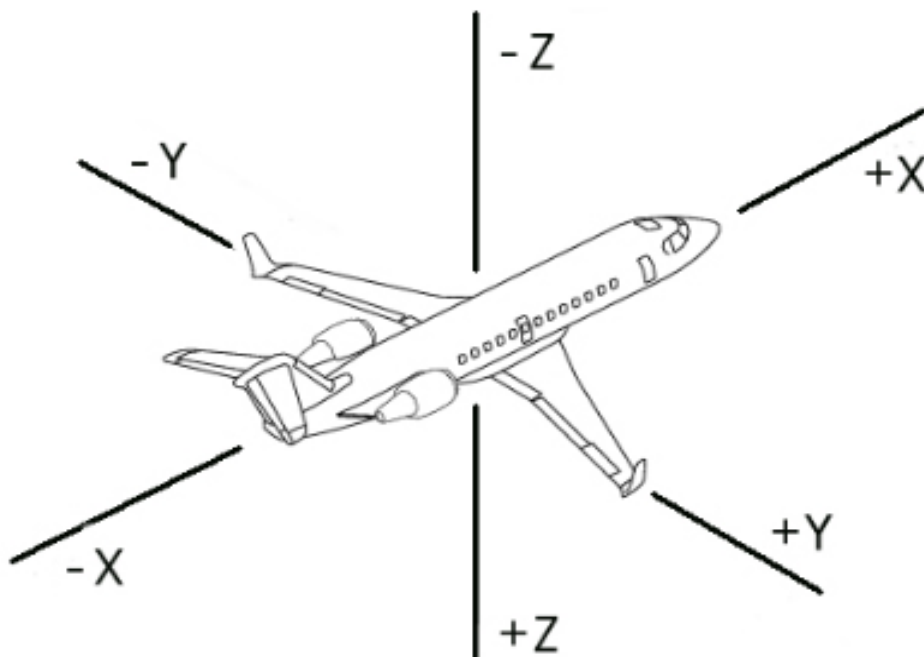
Fig. 3.1: Aircraft axes)

3.1.2 Calibrating of Deviation Angle to Pitch Axis (Button A)

It is possible to display the aircraft attitude (not that of the MT-VisionAir!) on MT VisionAir X systems that are not mounted completely vertically.

After installation of the MT-VisionAir the „Mounting angle" must be determined:
    Select → EFIS → HORIZ → Press the button „A".
    The MT-VisionAir will confirm the measurement with a message.

IMPORTANT: The aircraft must be on a level surface and must not be moved.

„A" in → EFIS → HORIZ is deactivated as soon as the GPS Speed > 5 kts in order to avoid unwanted calibration in flight.

Should it become necessary due to compensate an unusual situation on the ground (eg tail dragger ...), give us a call.

The calculated mounting angle is stored. To adjust this setting is only necessary again if the installation situation changes or the MT-VisionAir X will be installed in another aircraft.

3.1.3 Overview of MT-Terrain EFIS as AHRS operation

- The AHRS maintains an internal representation of the aircraft attitude expressed as heading, pitch, bank. The aircraft is initially assumed to be level and pointing north (all angles = 0). During an initial transitory state the system will gradually align itself with the actual starting attitude using the „slaving" mechanism described below.

- Three solid state gyroscopes („rate-gyros") provide a continuous stream of angular rates measured around the X, Y and Z axes. These angular rates are integrated over time to produce an estimated attitude. Each integration step starts from the previously-estimated attitude and produces a new estimated attitude.

- Due to many reasons (primarily the imperfection of gyros) the estimated attitude will drift over time compared to the real attitude. Thus one or more reference signals (assumed to be reliable on the long term) are used to "slave" the estimated attitude.

- The slaving signal is the GPS-derived attitude (slaves Heading, Pitch, Bank).

- Thus the AHRS has the following characteristics:
   Reacts promptly to any attitude change due to the rate-gyros
   Maintains itself coupled to the actual aircraft attitude due to the slaving signal.

3.1.4 Settings for MT-Terrain EFIS

To get a reliable result, it is important to define appropriate speeds and angles of attack:
→ EFIS → HORIZ → SET

Refer to User Manual, chapter MT-EFIS for correct settings and an example of a test flight for calibration.

This values are preset and need to be adjusted:

Name	Description	Default	Setting / Reaction
Vminc	Minimum speed clean	85 Kts	Set in EFIS config.
Vminf	Minimum speed w/flaps	70 Kts	Set in EFIS config.
Vmaxc	Maximum speed clean	160 Kts	Set in EFIS config.
Vmaxf	Maximum speed w/flaps	130 Kts	Set in EFIS config.
Ksg	Konst. slaving GPS	.005 rad/s (~ .3 deg/s)	
MINSPEED	Minimum GPS speed	5 knots	The GPS speed and ground track outputs are considered „alive" only at or above this GS
EFISGPS_ CUTOFF	Minimum speed for EFIS/GPS calculation	20 m/s => 39 kts	

Table 3.1.4: Calibration parameters for MT-EFIS / MT-Terrain EFIS

The grey section shows fixed parameters.

3.1.5 Speeds and Coordinated Actions

Track	0	Instantaneous GPS track	Integrated track (GPS + sensors)				
Pitch	0	0	Integrated pitch + ramp angle + settings				
			flaps		clean	flaps		clean
Bank	0	0	Integrated bank				
Math		No usage of rate gyros	EFIS/GPS math „ON" All EFIS slavings „ON"				
Speed	0	MINSPEED 5 kts	EFISGPS_ CUTOFF 0> 39 kts	Vminf *70 kts*	Vminc *85 kts*	Vmaxf *130 kts*	Vmaxc *160 kts*

Table 3.1.5: MT-Terrain EFIS: speeds and coordinated actions

MINSPEED is a ground speed while other speeds are CAS (calibrated airspeed).

Below 39 kts the MT-VisionAir X Display is marked with a red cross and a level attitude is shown.

3.1.6 Adjust Flight Attitude Display with GPS Attitude (Button R)

"R" adjusts the displayed flight attitude with the flight attitude from the Fast Integral GPS.,

3.2 Installation of Easy mount in the cockpit panel

For installation of the MT-VisionAir X an Easy mount is used.
Choose the installation location according to requirement of application or preferences:

- in the cockpit panel

- in other locations, e.g. the yoke.

3.2.1 Choosing the best location

- The MT-VisionAir X should be easily visible during flight.

- Choose the optimum readability angle.

- Refer to the following figures showing the dimensions of the Easy mount (without and with MT-VisionAir X) before specifying the location of the panel cutout.

- For correct working of MT-Terrain EFIS consider:

  - The MT-VisionAir X must be mounted aligned to the aircraft axes.
  - **No deviation angles** to   latitude axis = y axis   = roll
    and   yaw axis   = z axis   = heading.
  - **A deviation angle** to the lateral axis = x axis   = pitch
    can be compensated.

3.2.2 Easy mount sketch
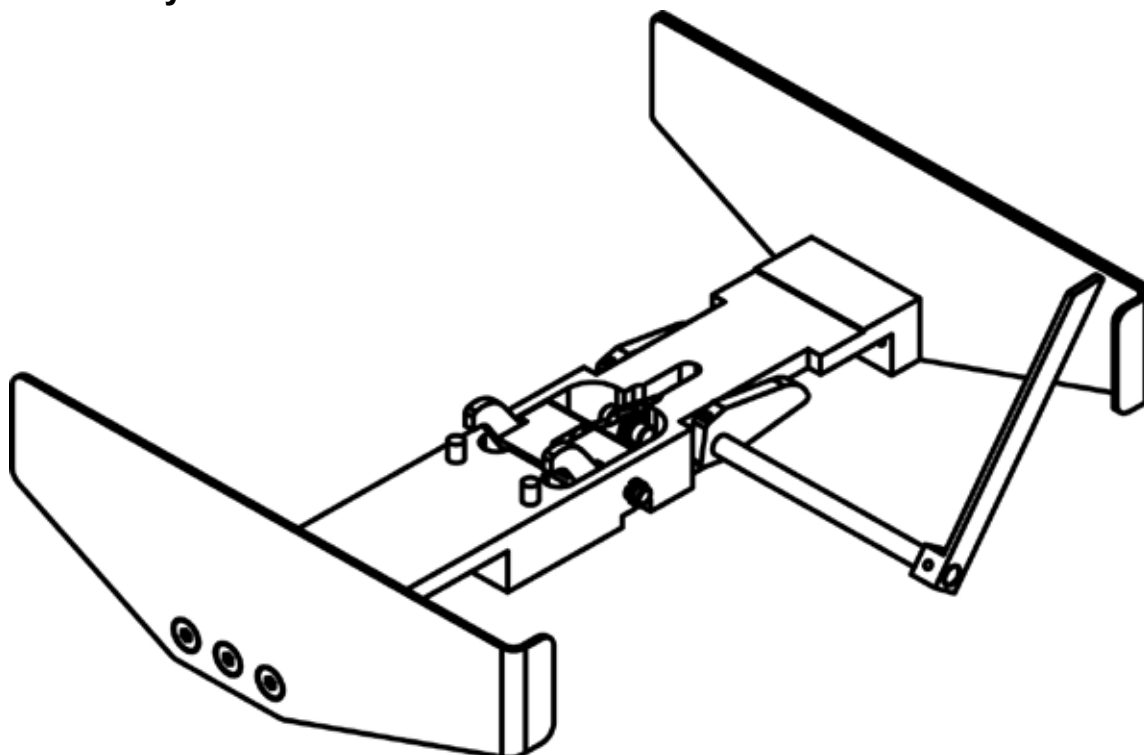
Fig. 3.2.2: Easy mount sketch

3.2.3 Panel cutout

The Easy mount must be firmly attached to the cockpit panel with screws.

Please use countersunk screws or rivets for installation in the instrument panel (or onto the angled rail) as space of 158 mm including any protruding screwheads must remain available for the device.

Panel cutout dimensions:
Width: 157.5 mm minimum (with latches in the rack), 160.5 mm optimum
Height: 128 mm
Depth: 46 mm
(all dimensions incl. 0.5 mm tolerance)

1. Installation for panel clearance of 160.5 mm
Mounting flush with cockpit panel or tilted mounting due to improved readability angle (e.g. for mounting at co-pilots side).
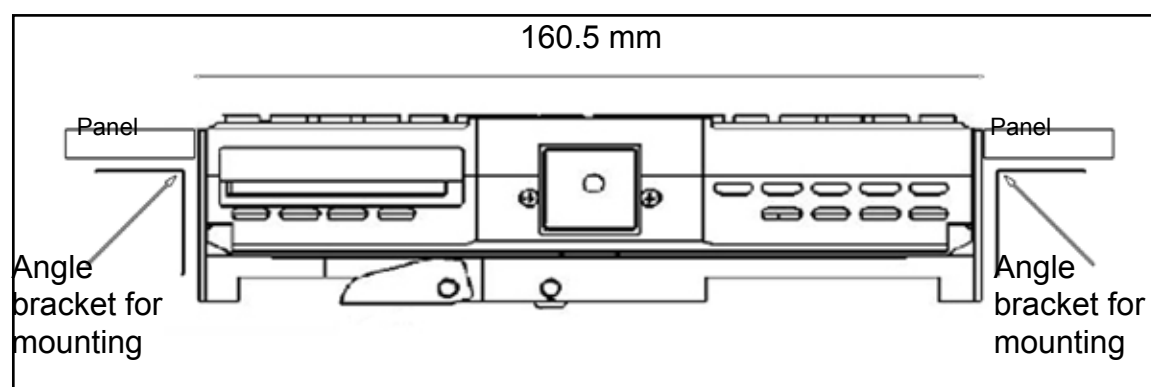
Fig. 3.2.3 (1): Panel clearance 160.5 mm

2. Installation for panel clearance of 158 mm
Mounting at the rear side of the panel: to flush the unit with the panel relocate the screws in the side mounting brackets.
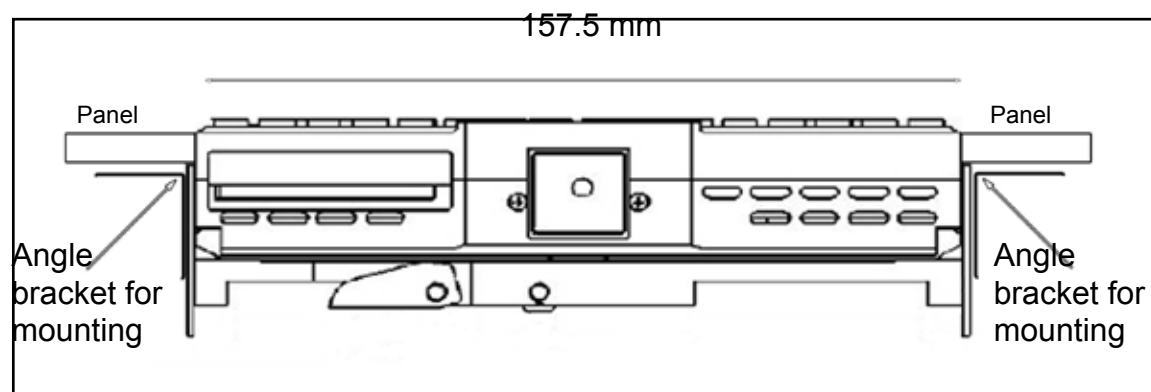
Fig. 3.2.3.(2): Panel clearance 158 mm

3.2.4 Dimensions of Easy mount
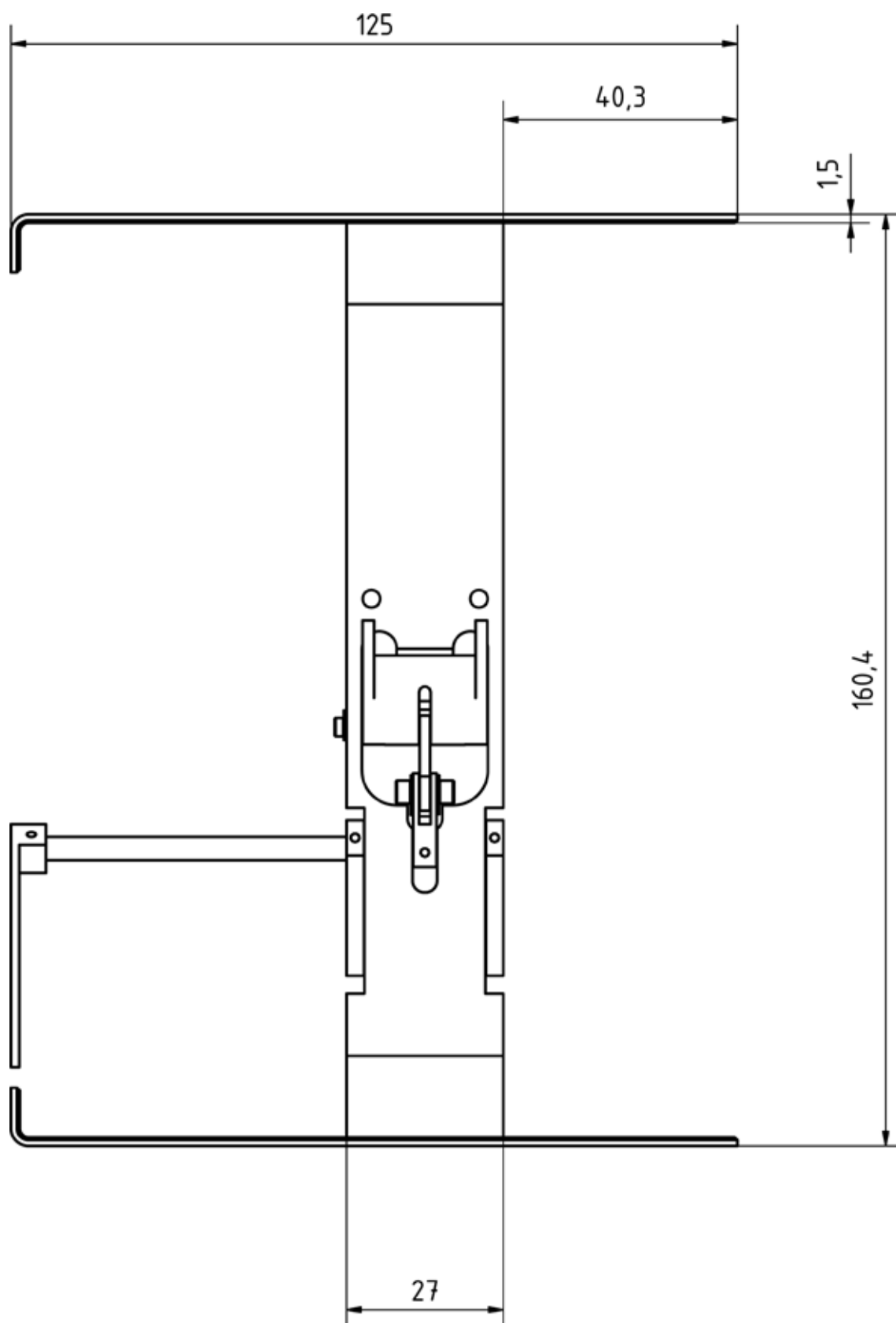
Fig. 3.2.4 (1): Front view of Easy mount / dimensions in mm
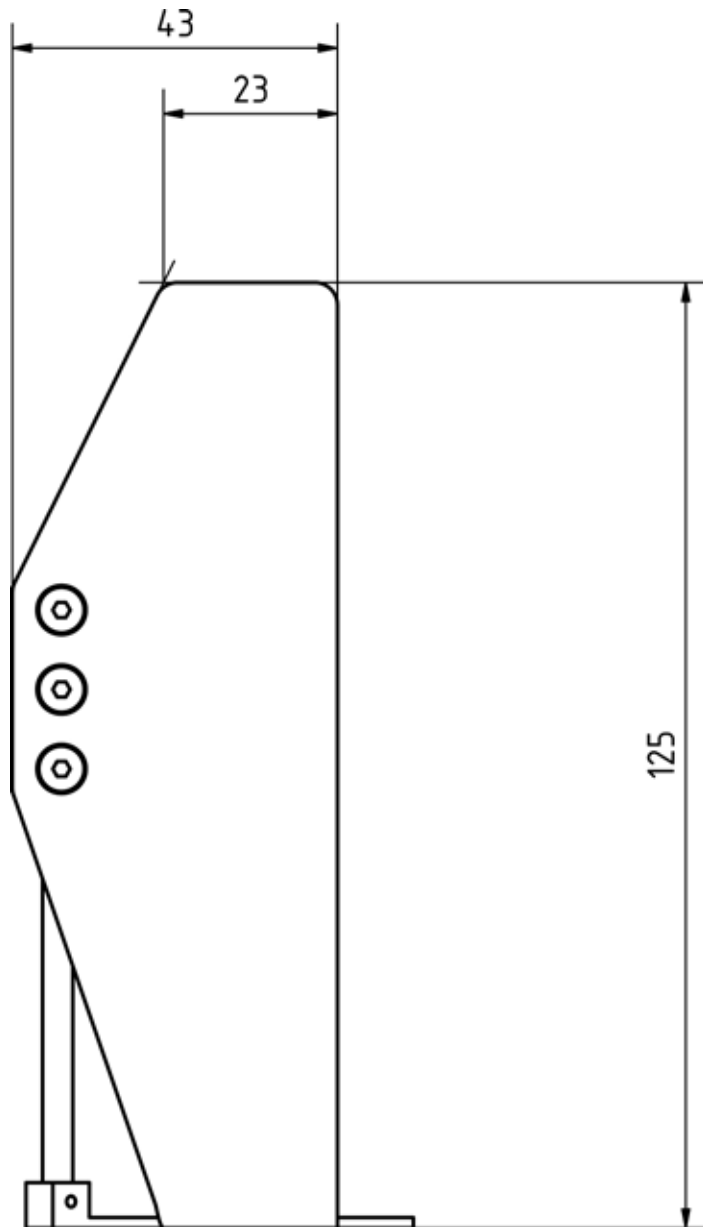
Fig. 3.2.4 (2): Side view of Easy mount / dimensions in mm
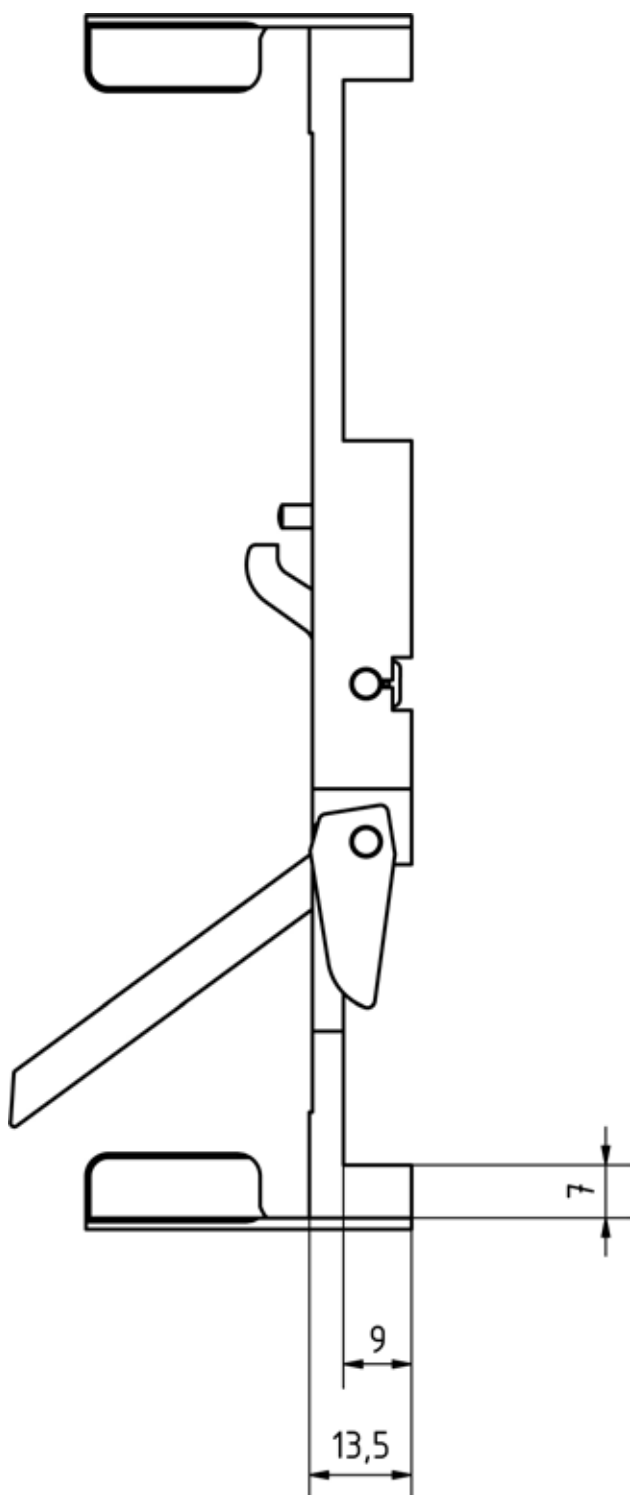
Fig. 3.2.4. (3): Top view of Easy mount / dimensions in mm

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3.2.5 Dimensions of MT-VisionAir X <u>with</u> Easy mount
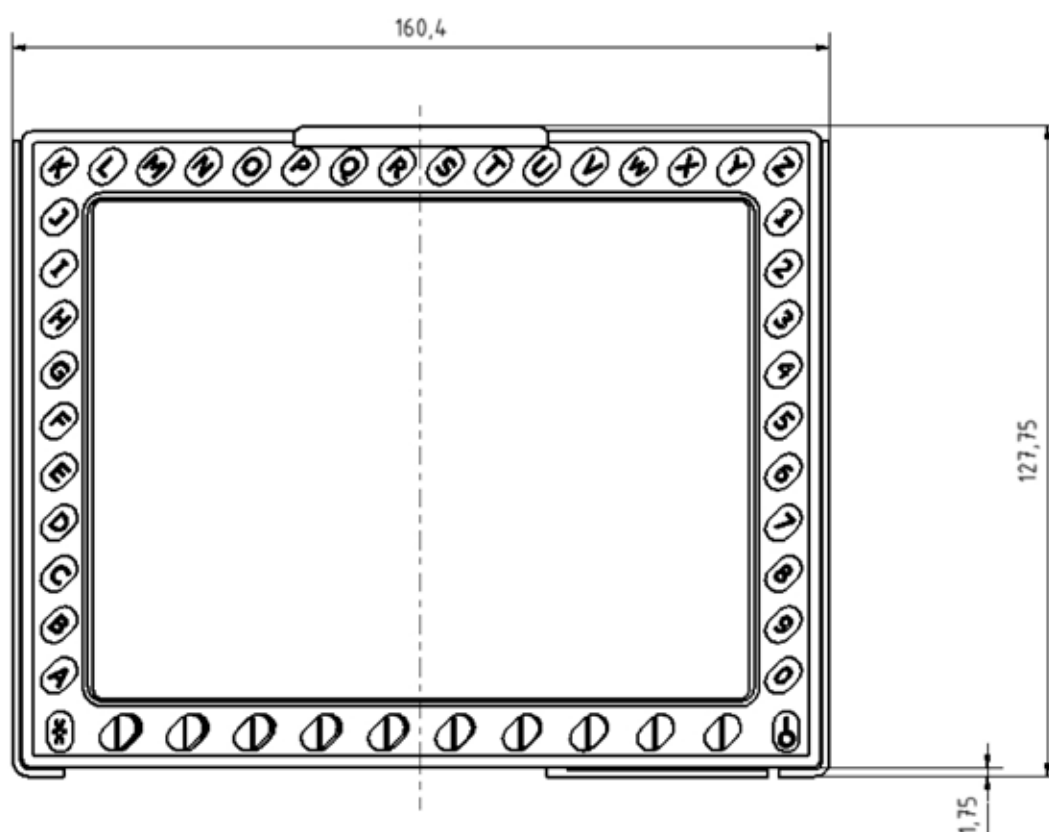
Fig. 3.2.5 (1): Front view of MT-VisionAir X **with Easy moun** / dimensions in mm
t
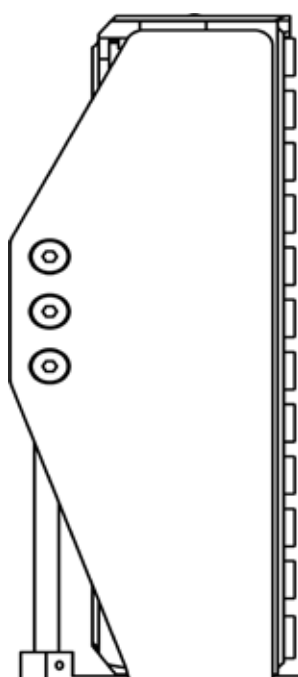
Fig. 3.2.5. (2): Side view of MT-VisionAir X **with Easy mount**
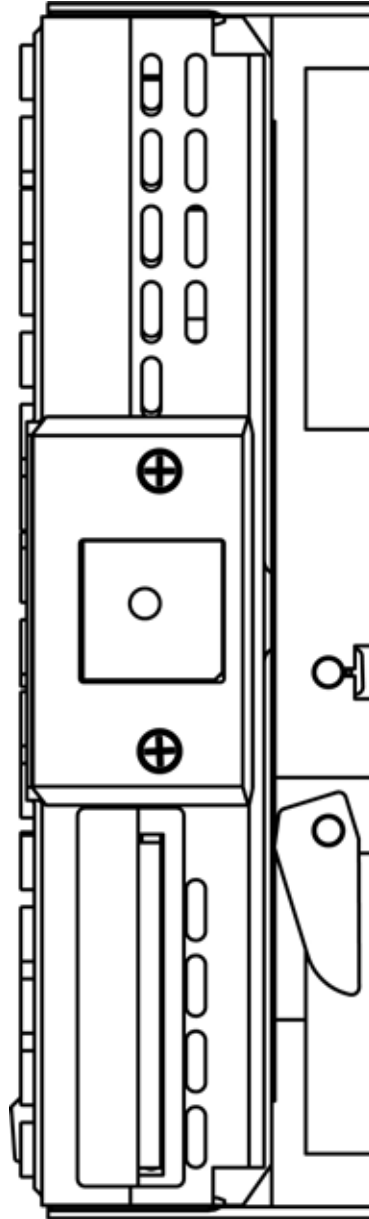
Fig. 3.2.5. (3): Top view of MT-VisionAir X **with Easy mount**

3.2.6 Remarks regarding installation

The device can be adversely affected if it is allowed to vibrate against fixed parts of the aircraft - see the symbolic sketch below.

spring action: very adverse effect
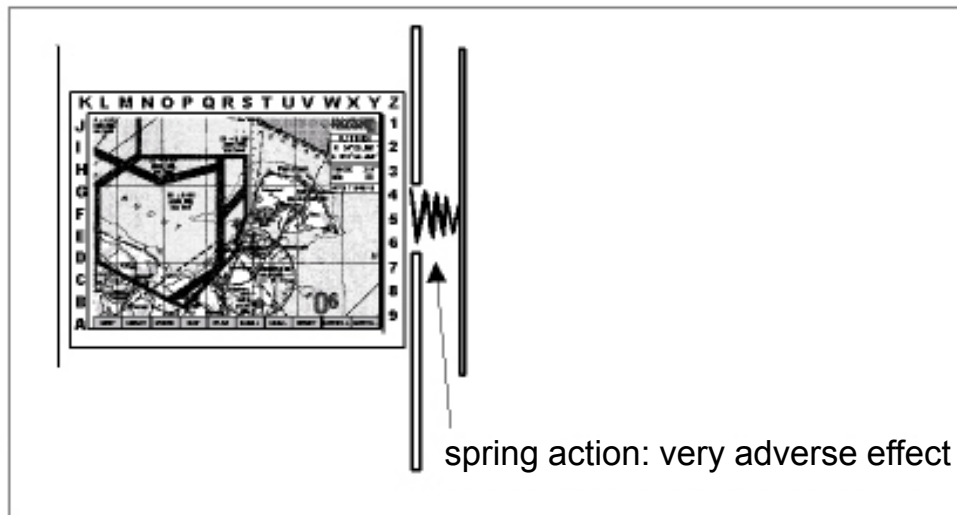
Fig. 3.2.6: Observe to avoid adverse effects

The locking mechanism of the Easy mount must be easy to operate.

Leave a loop of the cable and bundle the cables so that the device can be easily removed again.

3.2.7 View of an installation in a cockpit

Fig. 3.2.7: Installation in a cockpit EC 120

3.2.8 Removal and insertion of the device

Removal is required for several reasons:

• Changing/charging of battery packs

• Flight preparation can be performed outside of the cockpit.

• Updates via USB device.

The manufacturer recommends that pilots make themselves familiar with the removal and insertion of the device together with the facility providing installation service and to pay attention to the correct installation method of the Easy mount.

Please refer to the video instruction on the website of Moving Terrain (www. moving-terrain.de) for a demonstration of how to insert and to remove the MT-VisionAir X into/from the Easy mount.

3.3 Installation of the Easy mount in other locations

For installation of the Easy mount in other locations (e.g. the yoke) special mounting devices of other manufacturers may be suitable or required.

Please contact the customer's service at Moving Terrain for detailed information.

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4. Installation of GPS

MT-VisionAir X is by default equipped with a Fast Integral GPS (with integrated antenna). Optionally, the internal GPS with SiRF IV technique or other types of GPS can be used.

For the configuration of the correct GPS in the software refer to chapter "5. Connections" on page .

The MT-VisionAir X can be operated with the internal GPS and an external GPS in parallel. Switching between GPS must be done in the software (refer to section "5.7.2 Configuration of the correct GPS in the software", table 5).

4.1   Installation of Fast Integral GPS

4.1.1 Recommended installation location of the Fast Integral GPS

The manufacturer recommends installation of the Fast Integral GPS on the glare shield.

- A windshield heater usually attenuates the incoming signal to such an extent that placing the antenna under it does not make sense.

- A segment of the sky as large as possible must be visible for the antenna (integrated in the GPS!). The cable length is limited to 20 m.

- Because of the high peaks of the digital signal a well shielded cable is recommended to prevent interference with other units.

- For the installation a ground plate (min 20x20 cm) made of conducting material is recommended. Provide ground connection to aircraft structure. On this ground plate the antenna is mounted **with upward vision**. Conducting material (e.g. galvanized sheet metal) improves the reception.

Top View

Integral-GPS

Flugzeug
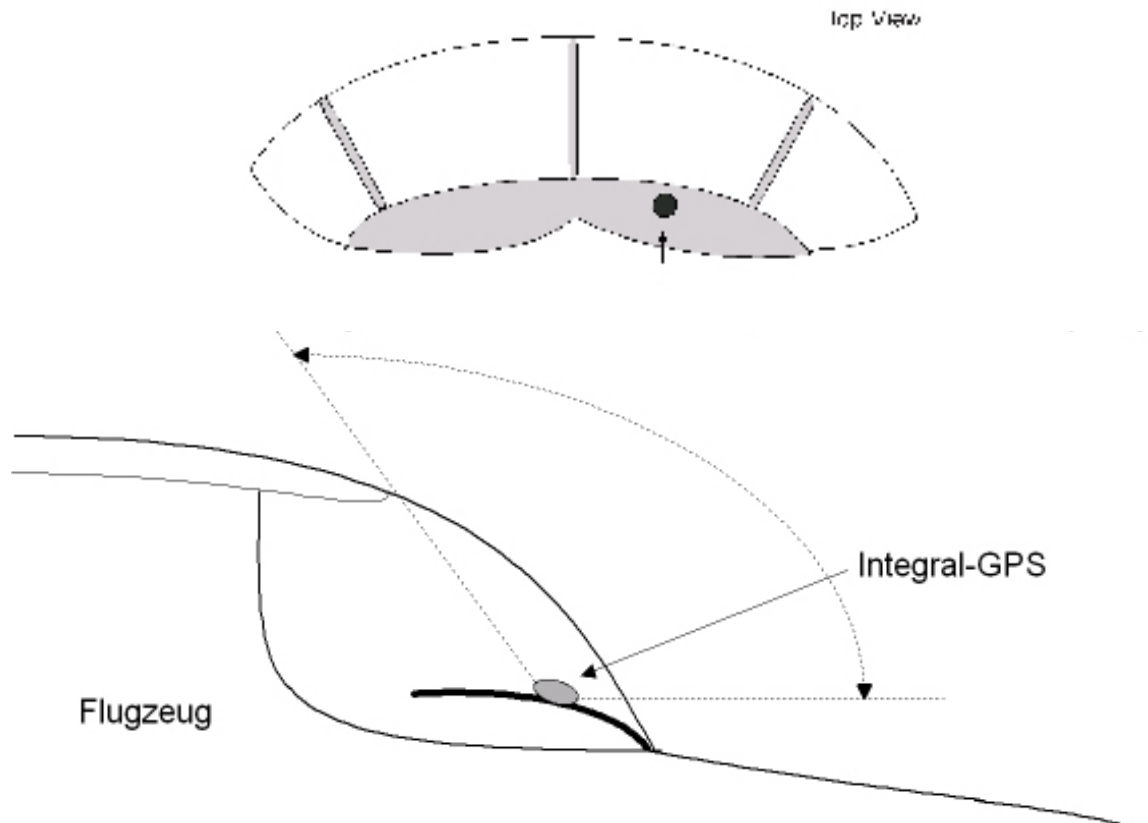
Fig. 4.1.1: Installation of the Fast Integral GPS on the glare shield

NOTES   For a glare shield made of plastics, installation beneath the glare shield is also possible.
In this case observe to install the Fast Integral GPS top side up.

The Fast Integral GPS can also be mounted on the outside of the aircraft. In general a temperature limit of –20 °C must be observed.

4.1.2 View of Fast Integral GPS

Fig. 4.1.2 (1): Top view of Fast Integral GPS

Fig. 4.1.2.(2): Side view of Fast Integral GPS
- screws can be used, but we recommend fastening with velcro

4.1.3 External dimensions of Fast Integral GPS
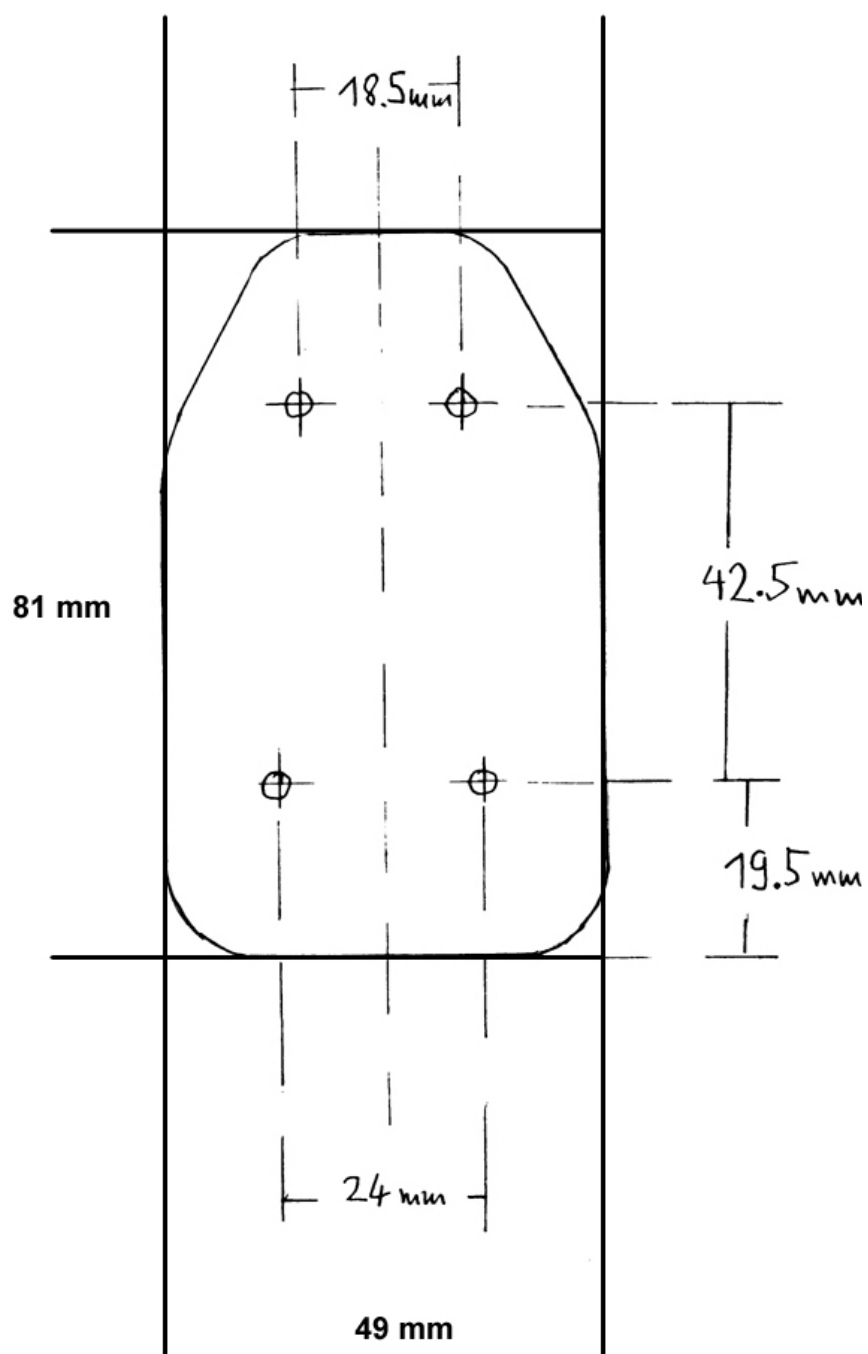
Fig. 4.1.3: Dimensions of Fast Integral GPS

4.1.4 Remarks regarding installation

The manufacturer recommends a velcro strap to fix the Fast Integral GPS to the desired location. This facilitates a change of location.

Alternatively mounting screws can be used:

- Use 4 mounting screws 16x2.2 mm (tapping screw, DIN 7981 or the like).
- It's absolutely necessary to remove the short screws in the mounting holes before the 4 mounting screws can be used.

4.2 Internal GPS with SiRF IV technique (option)

The MT-VisionAir X is optionally equipped with an internal GPS with SiRF IV technique.
Remark: No longer available from 2014 on.

Internal
GPS

Fig. 4.2: View of MT-VisionAirX with internal GPS

4.3 Restrictions for Location of Fast Integral GPS and iridium antenna

NOTE	In order to avoid interference **any** iridium / satellite antenna must be located at least 1.30 m away from the Fast Integral GPS.
	This applies for any type of Iridium antenna, as well as ITAS modules with integrated antenna situation.

Refer to chapter "MT Satellite Radar and MT BLITZPLAN" for details.

5. Connections

5.1 Power supply

The manufacturer recommends attaching MT-VisionAir X devices to a power supply whose fuse is directly connected to the aircraft battery and does not include any other substantial power loads.

Recommended: Ground Clearance Switch
                          Hot Bus

<u>Not</u> recommended: General Avionics Bus

Only under these conditions is the pilot able to perform his preflight work with MT-VisionAir X without draining the battery.

For the aircraft side required fuses and power consumption:

Aircraft side required fuses	Operating voltage 12 V -> min. 5 A, slow Operating voltage 24 V -> min. 2 A, slow

Shielded wires are to be used for cabling and the shield must be connected to aircraft ground to avoid interference of other avionics units.

NOTE	The power supply coming from the central connector is not switched by the unit, i.e. a Fast Integral GPS connected to the central connector draws 50 to 70 mA even when the unit is switched off. If no master switch is used this can drain the aircraft battery in a couple of weeks, therefore always connect the unit with a master switch.

5.2 Power supply via battery pack

Batteries are are provided as a 2 piece for MT-VisionAir X. A charger is supplied.

The batteries are intended for mobile use or in emergency cases. Ideal in combination with use of the internal GPS (SiRF IV technique).

Fig. 5.2 (1): View of battery packs for left/right slot (figure shows slim packs for example)

Fig. 5.2.(2): Loading station = charger

NOTE | Batteries are not charged while installed on the MT-VisionAir X, charging is only possible with the loading station.
Mind taking the loading station with you when using batteries.

5.3   General connection of MT-VisionAir X

Slots for battery packs

USB port

USB port

USB port

Ethernet

USB port

Central connectors
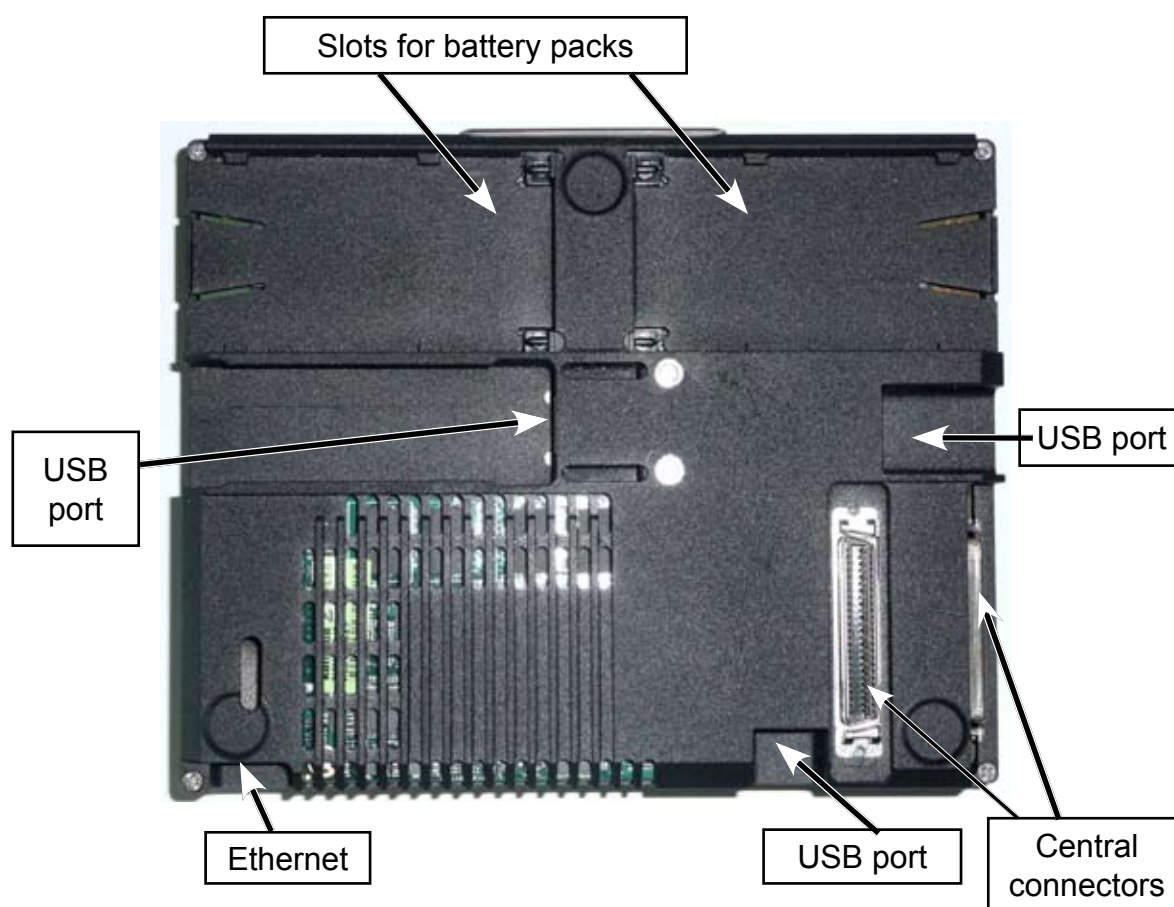
Fig. 5.3 (1): General connection of MT-VisionAir X (rear view)
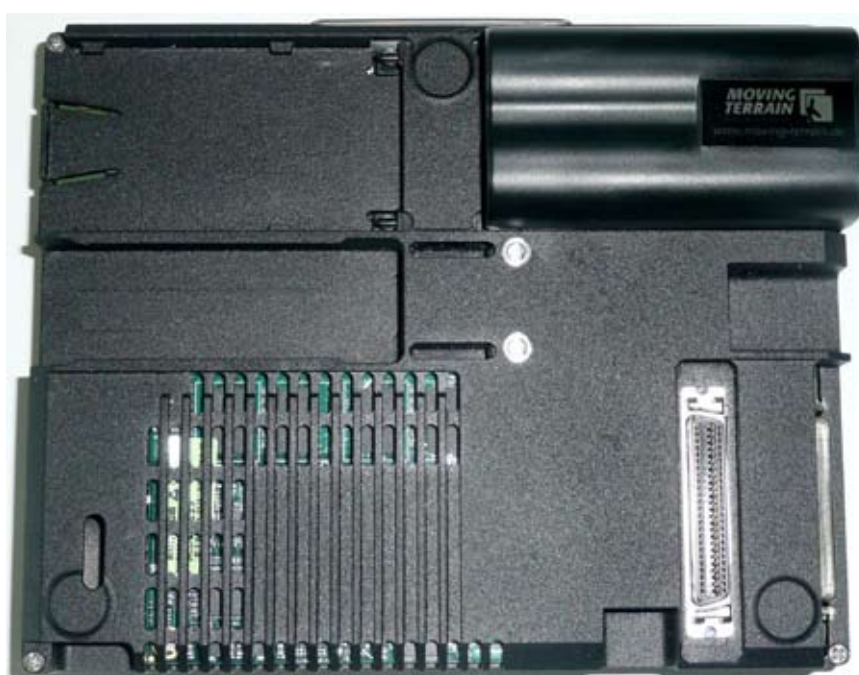
Fig. 5.3 (2): Rear view of MT-VisionAir X connectors (equipped with 1 battery)

5.4 Central connector (50-pin MDR)

| USB | COM 1–4 | | | Audio I/O | Autopilot Analog Out | Power DC |
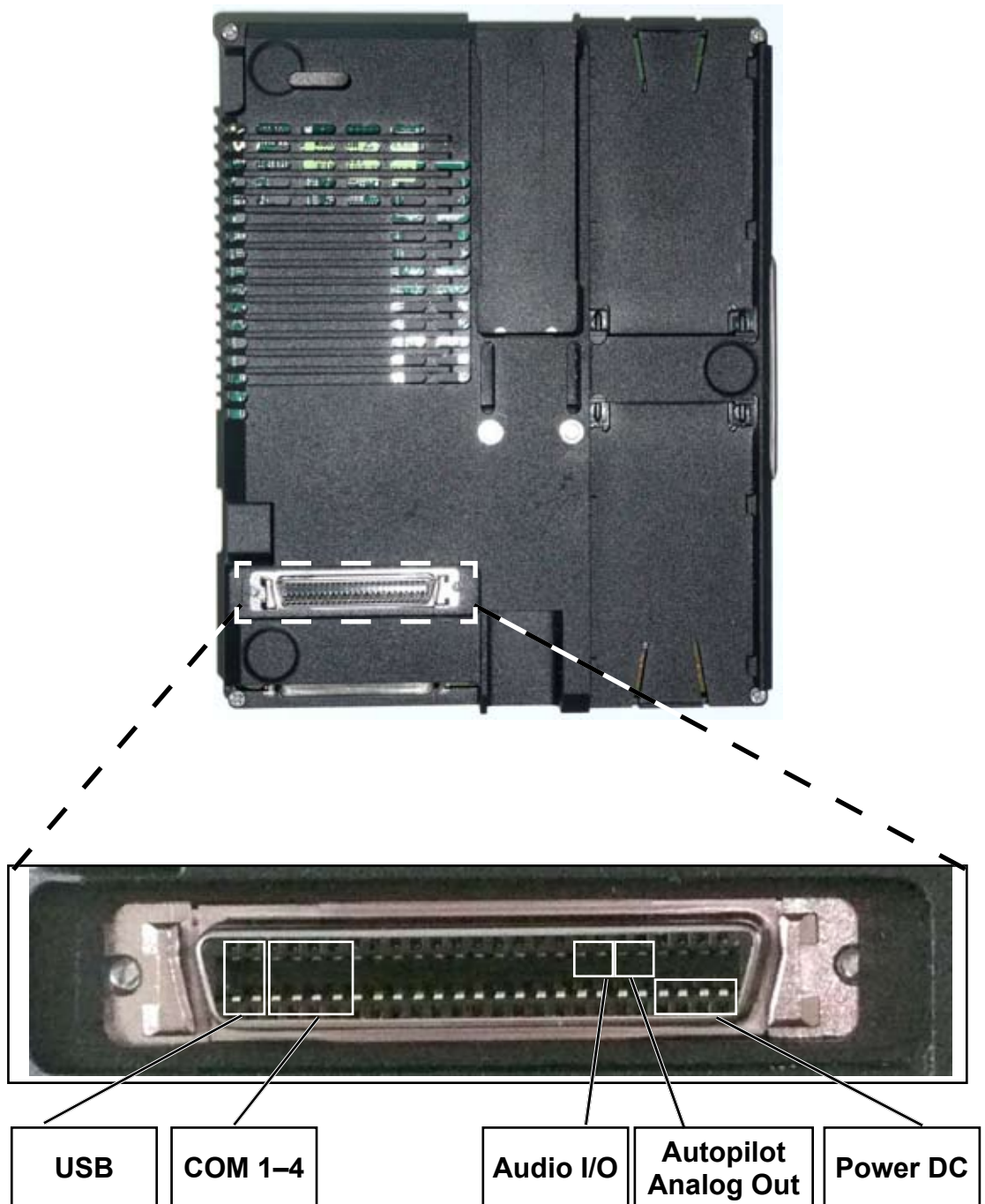
Fig. 5.4 (1): MT-VisionAir X central connector (50-pin MDR) / view on unit

CAUTION:
The two central connectors (50-pin MDR) are connected identically; **strictly avoid** using both at the same time!
This could cause severe damage of the device.
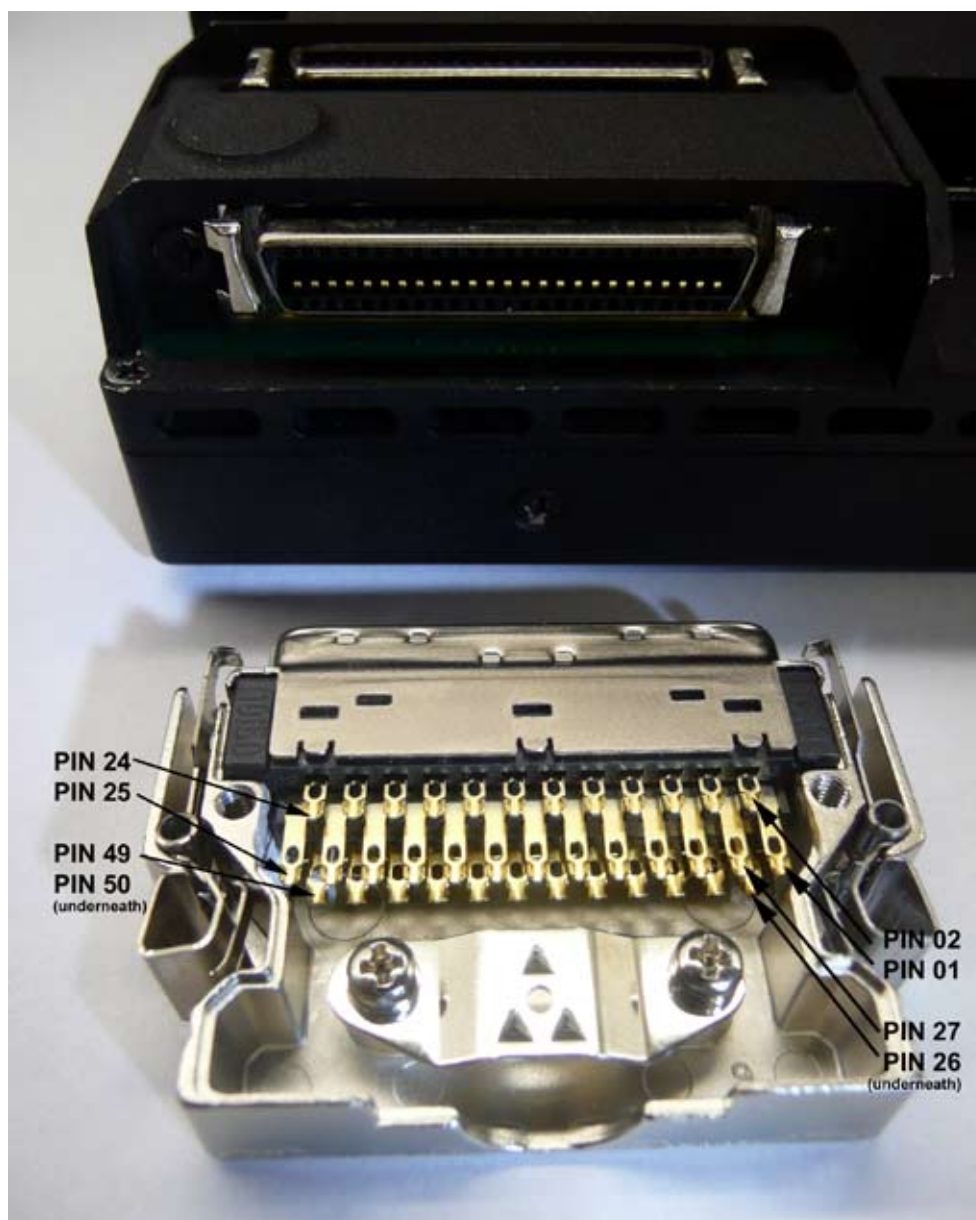
Fig. 5.4 (2): Detailed view of connector solder layout

PIN 24
PIN 25

PIN 49
PIN 50
(underneath)

PIN 02
PIN 01

PIN 27
PIN 26
(underneath)

	24		22		20		18	16	14	12	10	8	6	4	2
25		23		21		19		17	15	13	11	9	7	5	3	1
	49		47		45		43	41	39	37	35	33	31	29	27
50		48		46		44		42	40	38	36	34	32	30	28	26

USB	COM 1–4	COM Gnd		Audio I/O	Autopilot Analog Out	DIM	Power GPS	Power DC

Power Gnd
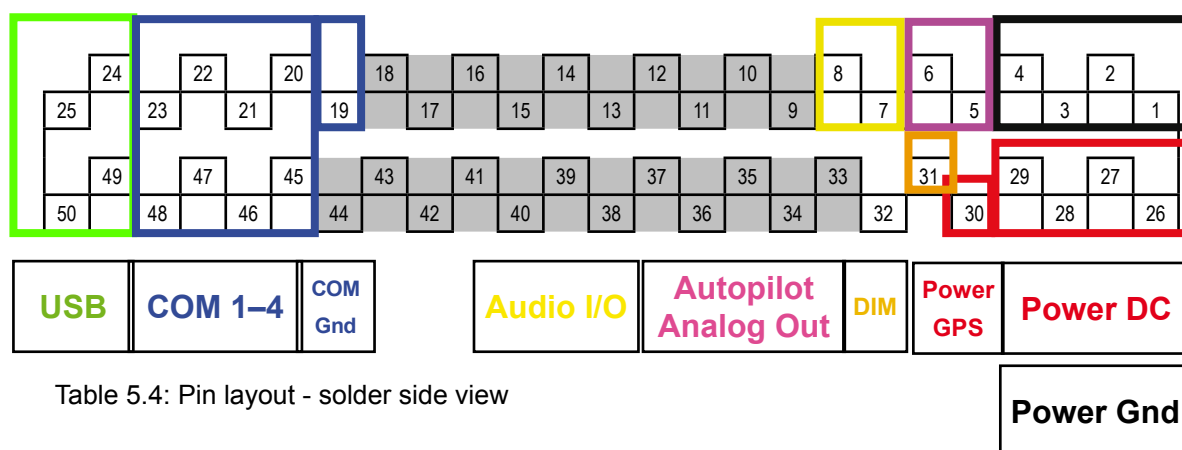
Table 5.4: Pin layout - solder side view

NOTE	Do not connect the pins highlighted in grey: 9 to 18 and 33 to 44.

5.5 Pin layout of the central connector (50-pin MDR)

Standard Pin Assignment				
Signal	**Central connector pin**	**Pin at Common Connector**	**Common Connector**	**Common Wire Color**
Power DC 12–36 V	26	2	2 pin socket	red
Power DC 12–36 V	27	2		red
Power DC 12–36 V	28	2		red
Power DC 12–36 V	29	2		red
PWR GND	1	1		blue/black
PWR GND	2	1		blue/black
PWR GND	3	1		blue/black
PWR GND	4	1		blue/black
DC Power out	30	3	4 pin socket	red
COM 1 RxD	45	2	9 pin Sub-D	*
COM 1 TxD	46	3		*
COM 2 RxD	47	2	9 pin Sub-D	*
COM 2 TxD	48	3		*
COM 3 RxD	20	2	9 pin Sub-D	*
COM 3 TxD	21	3		*
COM 4 RxD	22	2	9 pin Sub-D	*
COM 4 TxD	23	3		*
GND COM 1–4	19	5	9 pin Sub-D	*
USB +5V	24	1		red
USB data –	25	2	USB	white
USB data +	50	3		green
USB GND	49	4		black
Audio out	7			
Audio in	8			
Audio GND	4			
DIM analog in	31			
Autopilot analog out 1	5			
Autopilot analog out 2	6			
Autopilot GND	4			

Table 5.5: Pin layout of central connector (continued on next page)

* the colors for COM test cables are not standardized - can not be specified.

Standard Pin Assignment	Optional Pin Assignment			
Description	Signal Optional	Pin at Common Connector	Common Connector	Common Wire Color
necessarily use all pins connected for power GND (pin 51&52 if available to plug housing also connect to GND)				
Voltage from the board or battery 500 mA max. for Fast Integral GPS				
Line level				
Line level				
0–28 V DC for backlight dimming in respect to GND				
Autopilot heading				
Autopilot altitude				
GND for Autopilot output 1 & 2				

5.6 The central plug cable assembly for MT VisionAir X

5.6.1. Recommended tools and materials

- Temperature-controlled soldering iron (soldering max.2mm width (better: 1.5 mm) set to about 350 °C
- Solder with integrated solder flux, 0.5 mm (no lead-free solder)
- Stripper with fixed cable diameters
- Tweezers
- Hot air gun
- Shrink on tubing various sizes (2mm diameter)
- Kapton tape
- Range of reasonable diameter cable sleeves
- Various sizes small Phillips screwdriver
- Scalpel or penknife
- Cutters (for example: Knipex)
- A small vice with alligator clip.
- Sufficient light in the workplace, torch

5.6.2. The strain relief

A cable sleeve with a diameter fitting to the complete cable bunch ensures a proper strain relief. This sleeve protects single cables from slipping out of the complete cable bunch and also from the sharp edges of the strain relief clamp. The strain relief should be fixed with the screws as firm as possible so that they can't be loosend by vibration.

The position of the cables in the strain relief should be in a way that the outer shells of all cables are clamped into the cable clamp and that the individual strands are distributed loosely in the connector housing. There should be no mechanical stress between the solder and the cable network. This should be determined prior to stripping the individual strands quite accurately. The external connector pins need longer wires because they are further from the strain relief as the inner pins.

| NOTE | Pulling the cable into the cable sleeve is easier if you use silicone spray |
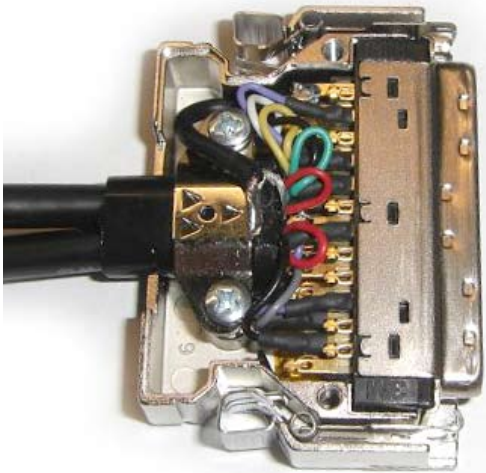
Fig. 5.6.2 (1): Strain relief in metallized connector housing
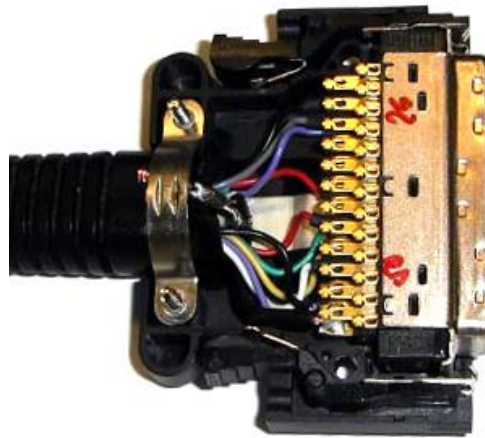
Fig. 5.6.2 (2): Strain relief in non-metallized connector housing

5.6.3. Strip the cable and solder to the connector pins

When stripping the cables make sure that no single strand is accidentally cut and taken off with the isolation. This reduces the diameter and weakens the strand mechanically. A stripper with fixed diameters is recommended. The correct dameter should be determaned with a non essential part of the cable. The stripped cable should be as long as necessary and as short as possible.

To support the solder joints it is recommended to use a shrink tubing for each connection. This not only increases the mechanical stability of the critical transition strand / tinned strand, but prevents short circuits between connector pins. After soldering all wires the shrinkable tubing is slipped over the solder buckets. Hold the connector in a way that they don't slip back and shrink them only shortly with the hot air gun (max. 2 seconds).
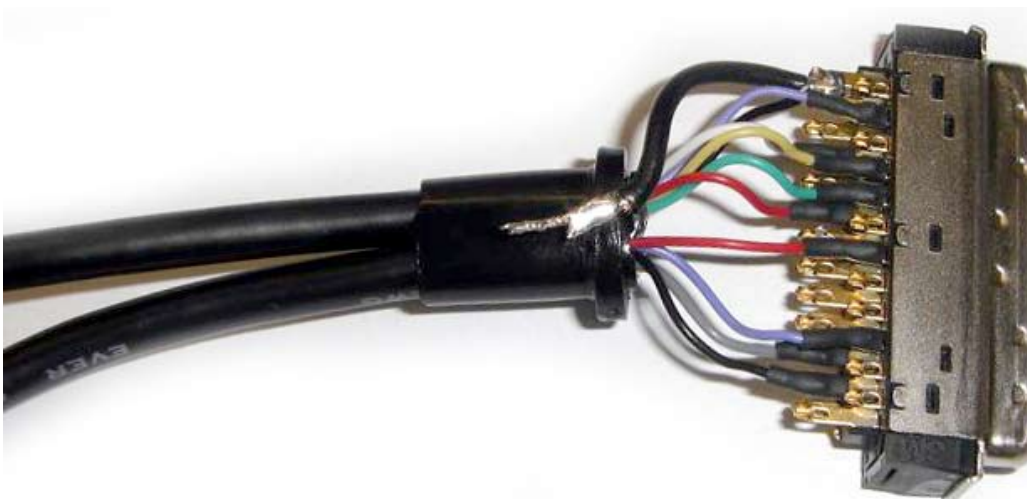
Fig. 5.6.3: Single Cables solded to connector pins

5.6.4. The grounding

The correct grounding of all attached peripheral devices should be considered in addition to the strain relief as the second important condition for the proper operation of the units. They cause not only total failures, but mostly sporadic disorders. This may not be reproduced without further ado and can cause an infinitely time-consuming search.

All peripheral grounds are radially merged within the central connector and placed on the reference ground, the power supply ground (ground of the aircraft). This ground is the point of reference for all signals, which are either single ended (GPS or USB) or double-ended as the serial interface which is connected to ground via peripheral device itself.

Different ground potentials of the devices can cause interference in the best case – due to strong transients in the worst case permanent damage to the units.

In addition to individual ground strands (mostly signal grounds, part of cables) the electric shieldings have to be grounded to the aircraft mass due to the most stable oscillation-free potential.

Fig. 5.6.4 (1) Soldering ground strand to unit ground

For metallized connector housings the shielding is placed above the cable sleeve and on the strain relief. Make sure that the shielding cannot get into contact with unused connector pins, which can be current-carrying from the unit. Isolation of the connector pins using a so-called special "Kapton" tape is recommended. The frame of the connecting plug board itself is connected to ground in the metallized housing. So the optimum connection to the frame is given. This guarantees optimal shielding and protection against external interferences.
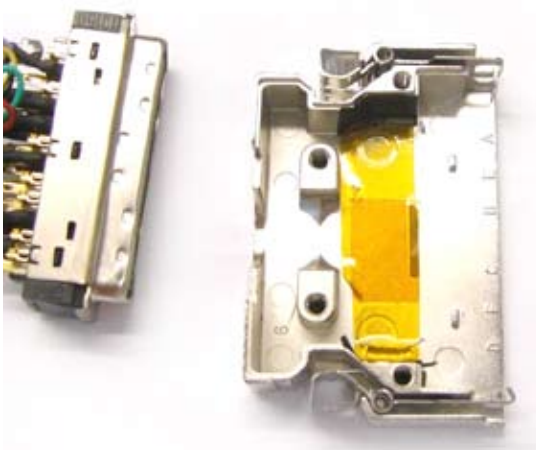
Fig. 5.6.4 (2) Kapton tape in the base   Fig. 5.6.4 (3) Kapton tape in the lid

Within the not metallized connector housing (due to mechanical reasons) the shielding as well as the frame of the connector itself must be grounded. This must be done with additional (in cross section wider) strands. They have to be soldered directly to the device ground (GND pin = power supply (ie negative) in the plug and to the shielding / the frame.

Fig. 5.6.4 (4): Soldered shieldings and connector to device ground

5.7 Standard/test connection with MDR50 central connector

5.7.1 Standard/test cabling when system is delivered w/o COM / USB connections

Fig. 5.7.1: Central connector plug

No. in fig.	Description
1	Fast Integral GPS with central connector (to MT-VisionAir X)
2	220 V power supply with clutch for direct connection to Fast Integral GPS, e.g. for trial connection before installation of the Fast Integral GPS on the aircraft or for mobile use/flight preparation.
3	Connection cable to on-board power supply/Fast Integral GPS installed on aircraft.

Table 5.7.1: Connections of Fast Integral GPS

5.7.2 Connection of further COM / USB devices to central connector

If further connections are desired the manufacturer provides a test cabling. For final installation it is recommended to merge the shielded wires.

5.7.3 Optional 220 V power supply with central connector

Optionally a second 220 V power supply equipped with a central connector is available.

This might be convenient for mobile use of MT-VisionAir X in different locations, e.g. for flight preparation without GPS.

NOTE	In this case **strictly avoid** using both central connectors of the MT-VisionAir X at the same time.

5.7.4 Using connections of previously installed versions

Connections of previously installed versions of MT-VisionAir (e.g. MT-VisionAir EP3, MT-VisionAir EP TSO) can be used. An adapter cable can be produced to be connected to the central connector of MT-VisionAir X (suitable for connection to Fast Integral GPS, Power and COM port connections.)

Fig. 5.7.4: View of adapter cable

NOTE	When using the adapter cable, observe to install it strain-relieved.

5.8 MT-VisionAir X starts automatically as soon as power is connected

Once the MT-VisionAir X is powered via central connector it will automatically start.

5.9 Adjust the brightness of the screen

Use the star button down left to adjust the brightness. 5 squares (cyan) indicate the dimming level. Repeated pressing of the star button will be stepwise dim down to the lowest level and further pressing will set the brightness back to the the highest level.

5.10 Connecting GPS to the system

5.10.1 Fast Integral GPS

Fast Integral GPS connects to the 50-pin MDR central connector on COM2 according to following table:

Function	Central Connector Pin	Fast Integral GPS Wire
RXD	47	Green
TXD	48	White
VCC = +12 to 36 V DC	30	Red
GND	19	Black

Table 5.10.1: Connecting the Fast Integral GPS to central connector (50-pin MDR)

NOTE	For installation of the Fast Integral GPS in the proper location, refer to section "4.1 Installation of Fast Integral GPS" of this installation manual.

5.10.2 Connecting another type of GPS

Any GPS must be connected to COM 2.

Function	Central Connector Pin	
RXD	47	
TXD	48	
GND	19	

Table 5.10.2: Connecting another type of GPS to central connector (50-pin MDR)

NOTE	**Fast Integral GPS is mandatory if MT-Terrain EFIS or MT-EFIS is installed!** Do not connect "Integral GPS" - it is not longer reliable due to a software bug on the GPS itself. For crossfill use of GARMIN 430/530 refer to chap. 6.

5.10.3 Configuration of the correct GPS in the software

GPS must be configured by pressing the following keys in the main menu: <AUX> → <SETUP> → <GPS>

Select the correct GPS in the list of the available GPS receiver types:

AVAILABLE GPS RECEIVER TYPES		
Extern		
	FAST INTEGRAL GPS	(9600 , NMEA)
	TRIMBLE	(9600 , AVIATION)
	KING KLN90	(9600 , AVIATION)
	GARMIN 430/530	(9600 , AVIATION)
	UNIVERSAL FMS	(9600 , AVIATION)
	FLARM	(38400 , NMEA) (ONLY FOR COMBINED TCAS DISPLAY)
Intern	BUILT-IN GPS	(4800 , NMEA)

Table 5.10.3: GPS drivers in software

NOTE | A restart of the unit is necessary when changing from extern to intern GPS receiver type or vice versa.

6. Crossfill options

6.1 Crossfill from Garmin 430 / 530

6.1.1 System description

The VisionAir X accepts route information (in Aviation protocol) from an external GPS connected via serial port, for example a Garmin 430.

6.1.2 Prerequisites

• XFILL must be ordered and enabled

• The external GPS / equipment must send data in Aviation protocol, including the loaded route.

6.1.3 Configurations and usage

Further configuration may be needed by editing the „mtpro.ini" configuration file. The procedure is as follows:

• Connect an USB keyboard

• Press SHIFT + 1 to call the configuration text editor

- Edit the desired parameters

- When finished press CTRL + X, then ,Y' to confirm and save the changes (,N' will discard all changes)

- Restart the system for the changes to take effect.

There are 2 possible configurations:

6.1.3.1 Configuration 1: Single GPS used both for Crossfill-IN and position data

Route data = Crossfill IN
+ GPS position

COM 2

Fig. 6.1.3.1 Single GPS for Crossfill-IN and position data

The VisionAir X must be configured with one of these GPS types: Trimble, KLN90, Garmin 430/530 or Universal FMS

Only „Crossfill IN" is possible, no „Crossfill OUT".

No further setup is necessary in mtpro.ini.

Usage

1) Program a route in the Garmin 430
2) On the VisionAir X press navRTE - ROUTES - X-FILL
3) The latest route data received from the Garmin 430 will be copied into the MT VisionAir X.

NOTE	**Fast Integral GPS is mandatory if MT-Terrain EFIS or MT-EFIS is installed!** Use configuration 2 in this case!

6.1.3.2 Configuration 2: Separate GPS devices used for Crossfill-IN and position data

```
┌─────────────────┐
│  GPS used for   │   Position data                Route data
│   navigation:   │                                = Crossfill-IN
│ Fast Integral GPS│                         ◄─────────────────
└─────────────────┘   COM2                          COM3
```
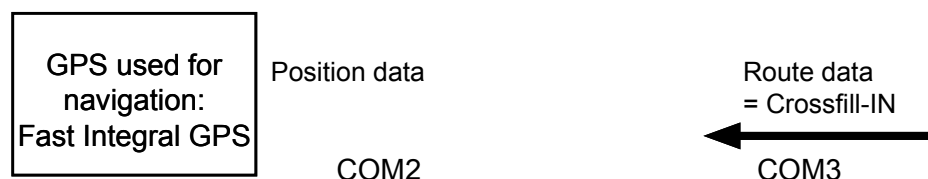
Fig. 6.1.3.2 2 separate GPS for Crossfill-IN and position data

The position data is received by Fast-integral GPS connected to COM2.

Garmin 430 (or other Aviation protocol GPS) feeds route data into COM3. Position data sent into COM3 is discarded.

The following settings have to be entered in configuration file mtpro.ini:

[XFILL]
Port = 3

Usage

1) Program a route in the Garmin 430
2) On the VisionAir X press navRTE - ROUTES - X-FILL
3) The latest route data received from the Garmin 430 will be copied into the MT VisionAir X

6.1.4. Limitations

• Whenever an Aviation/TNL GPS is selected as position input (-> AUX -> SETUP -> GPS) the COM3 port is freed and the system will NOT listen for flight plan data over it. It is NOT supported to have two GPS sending Aviation/TNL protocol at the same time to the VisionAir X.

• Only the first 31 waypoints of the route will be transferred via Crossfill, due to the structure of the Aviation protocol.

6.2. Transmission and Displaying of a User Route from an External Flightplanning Program

6.2.1 System description

VisionAir X accepts routes from external Flightplanning program in GPX format, transmission of the flightplan via USB stick.

6.2.2 Installation advice for USB port

Recommended is the usage of the USB via central connector, so the USBport can be provided at a suitable remote position and the MT-VisionAir X remains in place.

6.2.3 Prerequisites

- XFILL must be ordered and enabled
- the USB stick has to be be formatted FAT32

6.2.4 Usage (see User manual)

→ navRTE → ROUTES → IMPORT

6.2.5 Error Messages using IMPORT Function

When giving the IMPORT command and no USB stick has been inserted, or if the USB memory cannot be read, the unit shows the following message:


```
⚠️  Please plug an USB memory stick containing the route files
    to import, then retry the command.
                                                    BACK
```

In case no route files (in known format) are found:

```
⚠️     No routes found on the USB memory
                                                    BACK
```
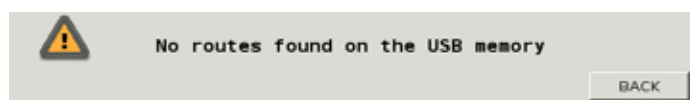
When route files are found but cannot be interpreted:

```
-- Route import from USB memory --

EDNLLOWI.gpx                         -> FORMAT ERROR

0 routes imported
                                                    BACK
```

7. Software Updates, OS Upgrade, Backup of User Data

7.1 Information about the system

→ AUX → SETUP→ VERSION
the current version number is displayed

<div style="text-align:center">1 x press: SW version</div>

<div style="text-align:center">
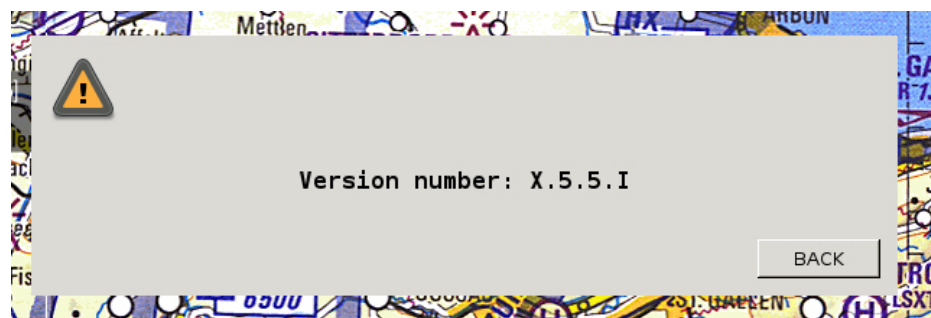
2 x press: version of operating systems
OS (operating system) version
Details for data storage
Hardware ID + (type of CPU)

</div>

7.2 Software Update / Update of Charts and Data

7.2.1 Prerequisites

For the updates you need:
• Power supply

• USB stick = update stick

The USB stick contains the file firmware.img.
Either the data have been downloaded from our website and saved on the stick or we send the prepared USB stick.

7.2.2 Procedure

Make sure a uninterrupted power supply is provided.

• Power off MT-VisionAir

• Insert USB stick into the slot on the left bottom side of the MT unit with the logo showing upwards.

• Switch on MT-VisionAir X

• Update starts automatically

• Update was successful when the following message is shown: "Installation complete. Please remove update device and restart."

• Switch off MT-VisionAir X

• Remove the USB stick carefully and parallel to the slot.

• Switch on the unit again: starting the program might take some time. Once the keys are shining blue, background processes are running and MT program will be started soon.

NOTE	For a long update process, the screen may turn dark (enter the sleeping mode). To get the message of the successful update, please press the * button on the bottom left, so that the panel again „wakes up". Wait for the message, do not pull out the stick before.

7.3   Upgrade of the Operating System

7.3.1 Prerequisites

You will need:
- Power supply

- USB Stick, which is prepared as upgrade stick, marked as OS Upgrade

- USB keyboard: please use a commercial keyboard and conntect to one of the 2 USB slots on the back of the unit.

7.3.2 Info CPU Type

There are different types of CPU in the devices in use - and they have to be prompted with different commands to boot from the USB stick.
Inform about the built-in MT-X VisionAir Processor Type:

→ AUX → SETUP → VERSION   Displays the current version
                              press 1 x: SW version
                              press 2 x: version of the operating system (OS)
                              processor type TT or SP

7.3.3 Procedure

- Plug in USB keyboard

- Make sure a uninterrupted power supply is provided

- Plug in USB stick "OS Upgrade" into the slot on the left bottom side of the MT unit

- Start the unit

- As soon as the BIOS boot logo appears (space picture),

-       press and hold F11 for SP board

-       press and hold F7 for TT board till a selection menu for boot device is shown.

- Select the USB stick in the boot device menu (mostly the 3rd option) (cursor down), and confirm with ENTER.

- Unit will boot from USB stick. Follow the onscreen instructions

- Restart the unit without USB stick and keyboard.

7.4   Backup of User Data

7.4.1 Prerequisites

For the backup you need:
• Power supply

• USB stick (FAT32 formatted)

7.4.2 Procedure

Make sure a uninterrupted power supply is provided.

• Insert USB stick into the slot on the left bottom side of the MT unit with
  the logo showing upwards.

• Press   → AUX → SYS → BACKUP

• This triggers a current backup of:

    -       USER waypoints / routes / tracks
    -       Logbook
    -       Blitzplan   FPL list and log in data
    -       saved PDFs
    -       current settings for display and system

⚠️

Backing up user data to USB memory . . .
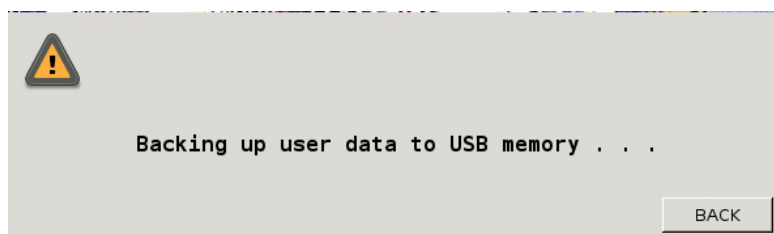
BACK

• Wait till the status changes to:

⚠️

Backup of user data completed on the USB memory
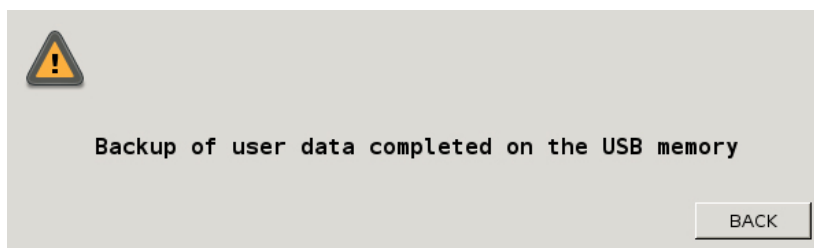
BACK

• Press → BACK

• Remove the USB stick

The data backup is now completed and can be transferred to
    other MT-VisionAir X
    Backup workstation

7.4.3 Error Message

If the USB stick cannot be detected the following error massage shows up:


```
⚠  Please plug a USB memory stick and retry the command
   (Must be formatted with FAT32 filesystem, e.g. Windows)

                                              BACK
```
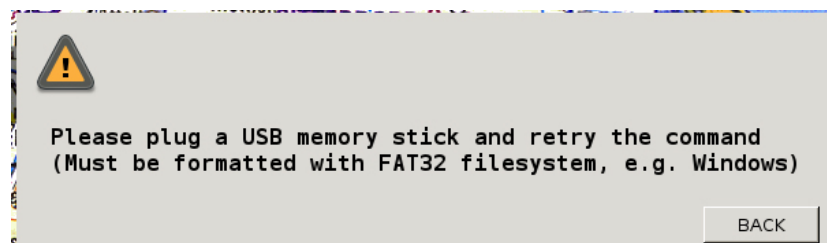
7.5   Restore of User Data

→ RESTORE   restores the data from the backup USB stick,
                 e.g. to synchronize several MT-VisionAir X systems

7.5.1 Procedure

NOTE	All data on the unit will be overwritten!

Make sure a uninterrupted power supply is provided.

- Insert USB stick (FAT32 formatted) with user data you want to restore into the USB slot.
- Press   → AUX → SYS → RESTORE
- Data which are restored (= overwritten):

     -     USER waypoints / routes / tracks
     -     Logbook
     -     Blitzplan   FPL list and log in data
     -     saved PDFs
     -     current settings for display and system

8.   Entries in mtpro.ini - general info

To edit the mtpro.ini follow these instructions:

- Connect an USB keyboard
- Press SHIFT + 1 to call the configuration text editor
- Edit the desired parameters
- When finished press CTRL + X, then ‚Y' to confirm and save the changes (‚N' will discard all changes)
- Restart the system for the changes to take effect.

Note: -
- Lines with ";" do not take effect (comments)
- "["   "]" are square bracke
- upper- and lowercase notation is relevant

9. MT Satellite Radar and MT BLITZPLAN
9.1 System components for data transfer (Hardware/Software)

MT Satellite Radar and MT BLITZPLAN require the following components (hardware/software):

Hardware

• MT-VisionAir X with 50-pin MDR central connector for data transfer

plus
• a telephone connection

plus
• a GPS receiver.

Software

• For MT Satellite Radar: MT Satellite Radar Display software and access to DWD weather data (PCMET access) are required.
  You need to be a customer of PCMET.

• For MT BLITZPLAN: MT BLITZPLAN software needs to be installed.

9.1.1 Telephone connection

The telephone connection can be established via satellite telephone (Motorola Iridium 9555 or Thuraya XT-PRO) with data transfer cable and antenna and/or via UMTS-Modem.

| NOTE | Satellite telephone connection and UMTS-Modem can be used in parallel. Switching must be done in the software (refer to section "8.5 Selection of the telephone connection (in the software)"). |

When using the satellite telephone

• A special SIM-card is required for satellite telephones.

• Deactivation of Captains PIN (Iridium):
  The Captains PIN must be deactivated. When shipped from Moving Terrain, the PIN is deactivated by default.

• Optional: Suppression of the security PIN code:
  Standard satellite telephones (e.g. Iridium) allow the deactivation of the security PIN code, so that the telephone needs only be turned on. Further input is not required.

Using a UMTS-Modem

- The SIM-card of the UMTS-Modem must be international data roaming enabled. Contact the provider in your home country (or in the roaming country if you are on roaming) for detailed information.

- Following figure shows the insertion direction of the SIM-card:

-

Fig. 9.1.1: SIM-card insertion direction (UMTS-Modem)

- The security PIN of the SIM-card of the UMTS-Modem must be deactivated with your telephone beforehand.

9.1.2 GPS receiver

The GPS receiver can either be
- a Fast Integral GPS,

- the Internal GPS with SiRF IV technique (MT-VisionAir X option) or

- another type of GPS.

NOTE	The GPS has to transmit current time, because radar data download is not possible otherwise. Currently known GPS models that are not suitable and do not transmit the time: Garmin GNS430, GNS530.
	If the GPS is not connected or has no access to the satellites, the time given by BIOS will be read in as UTC. A popup window will inform about this.

9.2 Connection of system components for data transfer

9.2.1 Block diagram of system components

MT-VisionAir X
+ Satellite Radar Module / MT BLITZPLAN

Central connector

USB cable

Power

Antenna

Power

Fast Integral GPS/
GPS antenna
or BIOS time

Satellite phone or UMTS Modem
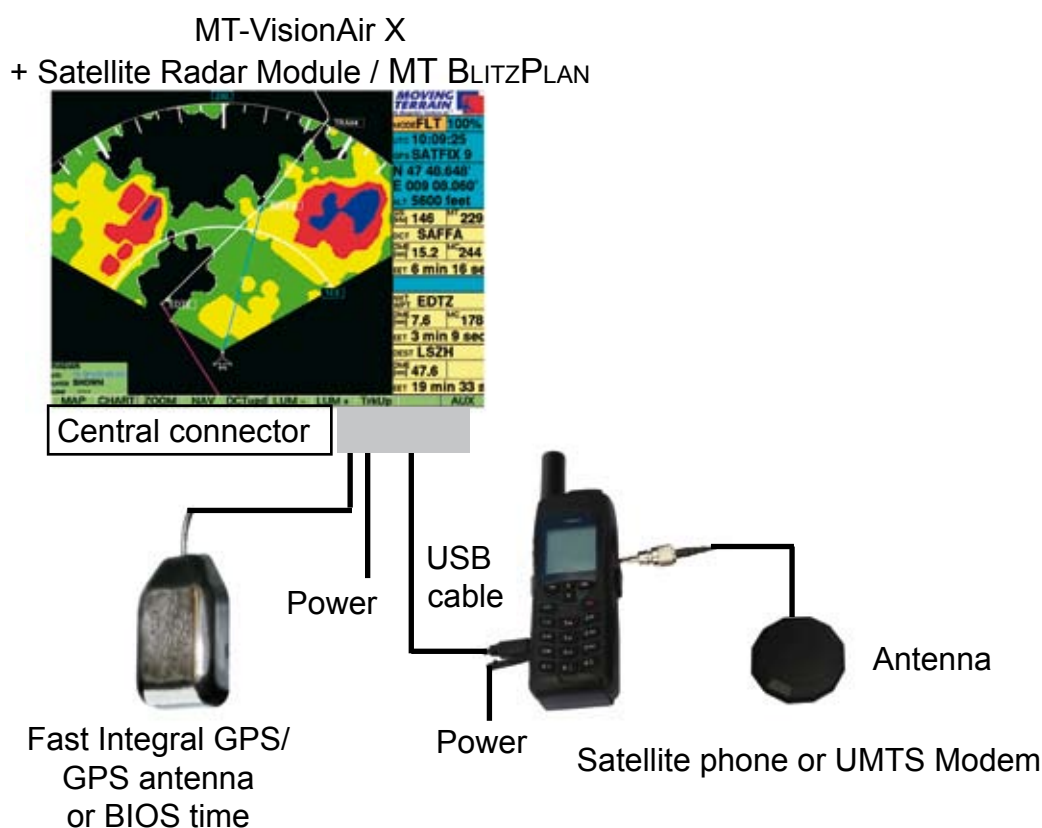
Fig. 9.2.1: Block diagram connections

NOTE	The components of the system must be correctly connected: For pin assignment of the central connector please refer to section "5.5 Pin layout of the central connector (50-pin MDR)".

9.2.2 Connection options and Limitations

Depending on location of the unit there are different connection options:

- When the unit is mounted on the Easy mount in the cockpit: use the USB port of the central connector and the provided USB cable with central connector to connect the satellite telephone or the UMTS-Modem. Make sure to provide reliable power supply for the telephone (on board power).

- When connecting the satellite telephone via USB port of the central connector, it is necessary to install a satellite telephone holder for Iridium 9555 (for units with SP type of CPU) with a hub, see following section "6.3 Installation of the satellite telephone holder".

- For mobile use: USB ports can be used directly to insert the UMTS-Modem stick.

NOTE	**Signal Reception (UMTS stick installation)**
	If the UMTS stick is placed in the slot **and** the unit is mounted in the Easy mount the reception may not be sufficiant. This must be considered and tested. Alternativ solution is the connection via central connector in a suitable remote position.

NOTE	**2 telephone sources via central connector**
	In case both telephone sources - the satellite phone and the UMTS stick - will be used and must be installed via central connector it is necessary to install a HUB to provide 2 connection the installation of a HUB is mandatory.

9.3   Datalink Overview
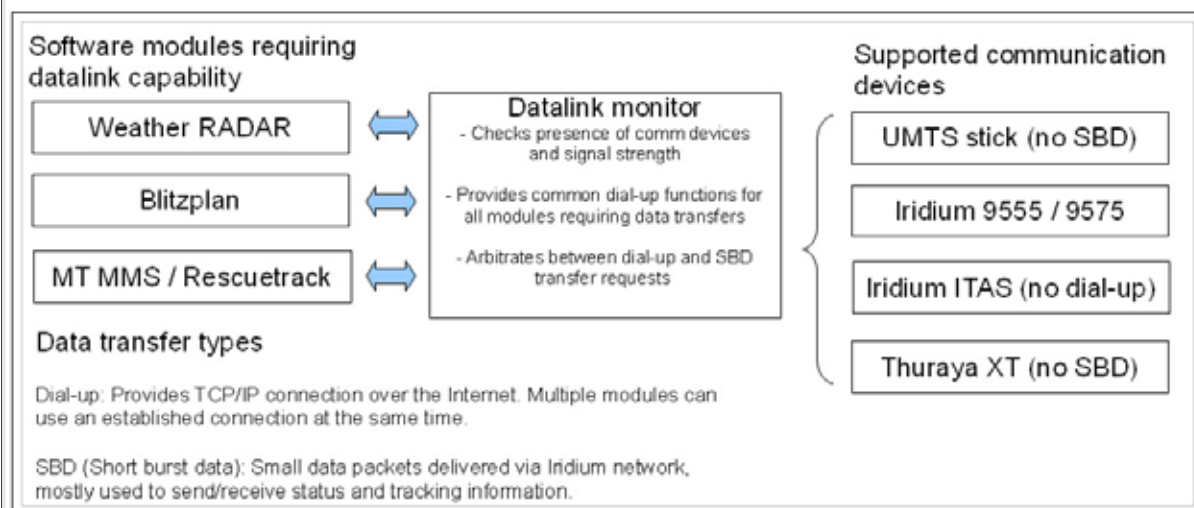
9.3.1 Datalink status infoblock

This infoblock appears on the left side of the 2D map screen whenever a data transfer is in progress or the RADAR menu is entered.
Graphic examples:

Datalink: Idle	Dial-up in progress	Online

Signal strength bars — Status message — Status and icon

UMTS / Selected comm device

1 DIAL UP... / UMTS — Activity indicator (spinning)

5 ONLINE / THURAYA — Satellite finder (specific for Thuraya satphone)
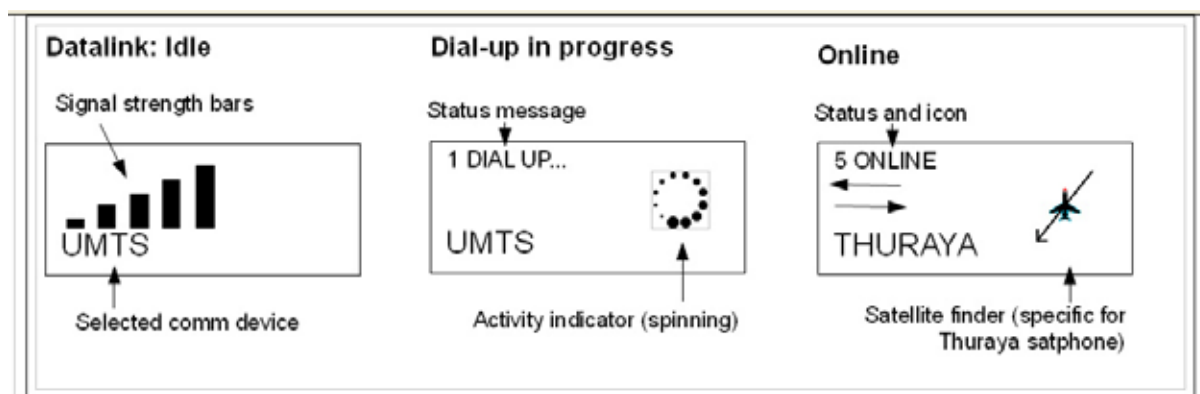
Corresponding screenshots with Download information:

UMTS
RAD MAN / SHOWN
14:10(12.08.16)

4 SEARCHING FOR ISP
UMTS
RAD MAN / SHOWN
14:10(12.08.16)
LIVE UPDATE...

5 ONLINE
UMTS
RAD MAN / SHOWN
14:10(12.08.16)
1 REQ RADAR (6/90s)

9.3.2 Loss of communication with phone or modem

All communication devices are connected to the USB bus of the VisionAir X.
In case of electromagnetic interference or bad cable connection the USB link may fail.
In this case the VisionAir X reacts as follows:
IF: 1) a dial-up connection is requested (FPL or RADAR)
   2) .. and the modem / phone is not detected

THEN a prompt is shown and flashes periodically (~ 4 sec interval):


```
   Modem not responding, check cabling/power. Retrying ...

 Force USB reset (Y = Yes, perform USB reset; BACK = Cancel)
```

IF:
1) The communication device becomes available   --> Prompt disappears and dial-up resumes automatically
2) The user presses ‚Y'   --> The VisionAir X resets the USB bus
3) The user presses any other key or button (e.g. BACK)--> Dial-up attempt is cancelled, RADAR goes to OFF

9.3.3 RADAR usage: Manual download / Live update

In DWD mode: press RADAR - M.LOAD to trigger a single RADAR download.

In Enhanced mode: the same button RADAR - LiveRad will behave differently depending on the current minute within the hour, as described in the following schema

Time of request	Result
Minutes: 04 - 05, 19 - 20, 34 - 35, 49 - 50	Downloads the latest 15-minute RADAR picture (during the first 2 minutes).
Minutes: 06 - 18, 21 - 33, 36 - 48, 51 - 03	Requests a „Live update" The RADAR server will recreate a composite RADAR image from the latest data available from each station. Some areas of the coverage may then show a more recent RADAR situation compared to the usual 15-minute picture. Live update needs 80 - 90 seconds more than a „normal" download due to additional processing time on the weather server.

Table 9.3.3: Time Sheet for Radar Update Requests

9.4 Satellite Phones

9.4.1 Thuraya XT-PRO

Usage

The Thuraya XT-PRO needs to get visual contact to the satellite which is in position 140°.

To get the connection it is needed to point towards 140° with the rod antenna.

Due to this restriction it is not possible to fix the Thuraya XT-PRO, because it is needed to point out of the window any time the download is needed.

Download time is very fast - a few seconds for the complete European coverage.
During this time the visual contact with the satellite must be provided.
Once it gets connection to the Thuraya net it remains online.
Costs: Only real data loading will be charged for.

Connection directly via USB via MDR50 central connector.

9.4.1.1 Installation / Mounting and Antenna Connection

Following components are tested:

SATTRANS: Sat Docker Thuraya Docking Adaptor for Thuraya XTPro (Bury Technologies)
GPS Antenna for Thuraya Telephone

Scan Antenna: Thuraya Passive Omnidirectional Mobile SATCOM Antenna P/N 60 410

Or alternatively an external antenna.
Antcom
P/N: 5GL1RxTxT-AP-XST-1

GPS Antenna

Scan Antenna

female SMA

male SMA

male SMA

female SMA

female SMA

GSM

SATTRANS Docking

11-16 V

12V / 24V converter

24V in
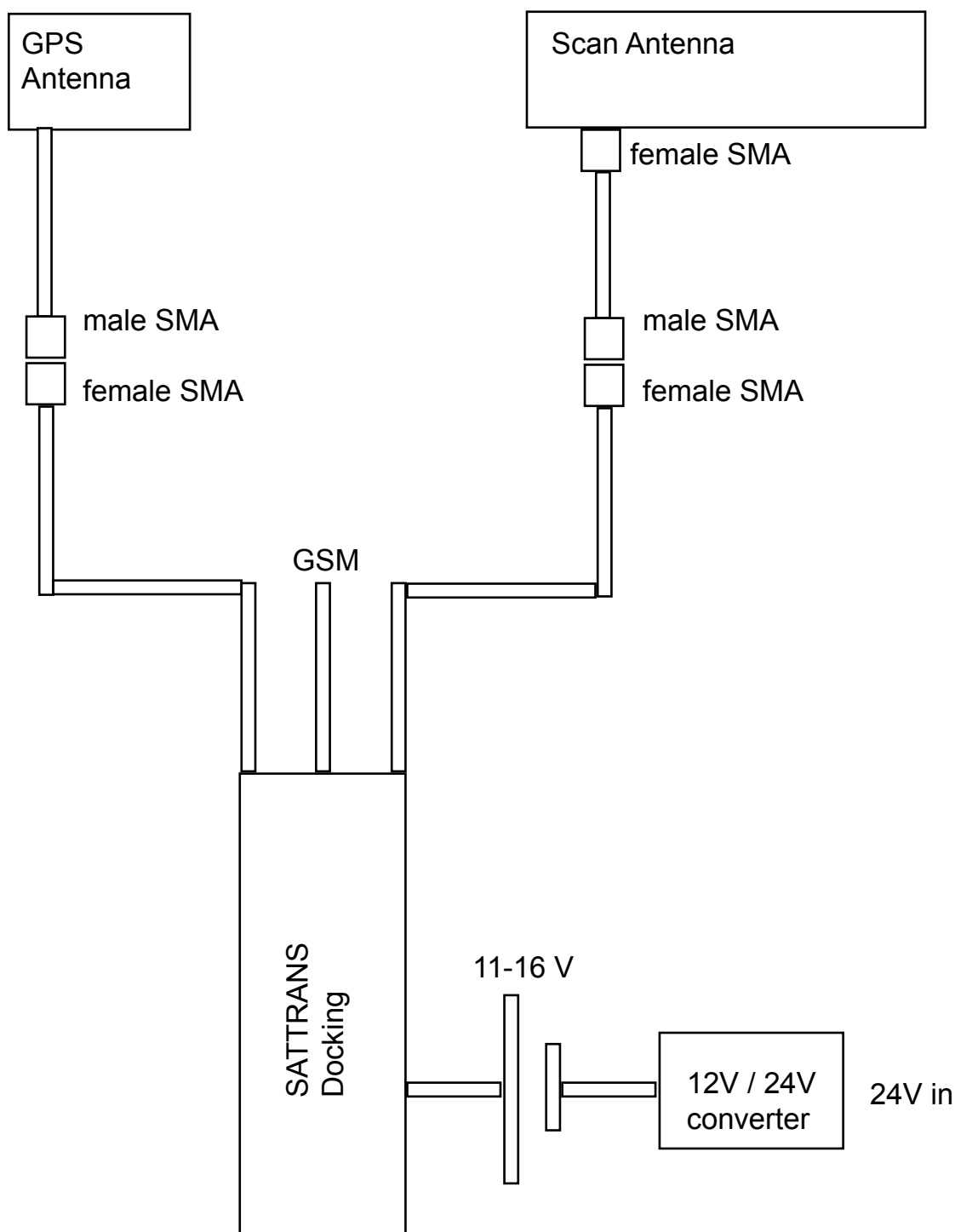
Notes:
Use appropriate adapters to BNC or TNC for the connection of already established antenna situation.

Use TNC connectors outside of the bulkhead.

9.4.1.2 Scan Antenna Diagram /Specifications

Black = Satellite

Red = GSM

Blue = GPS
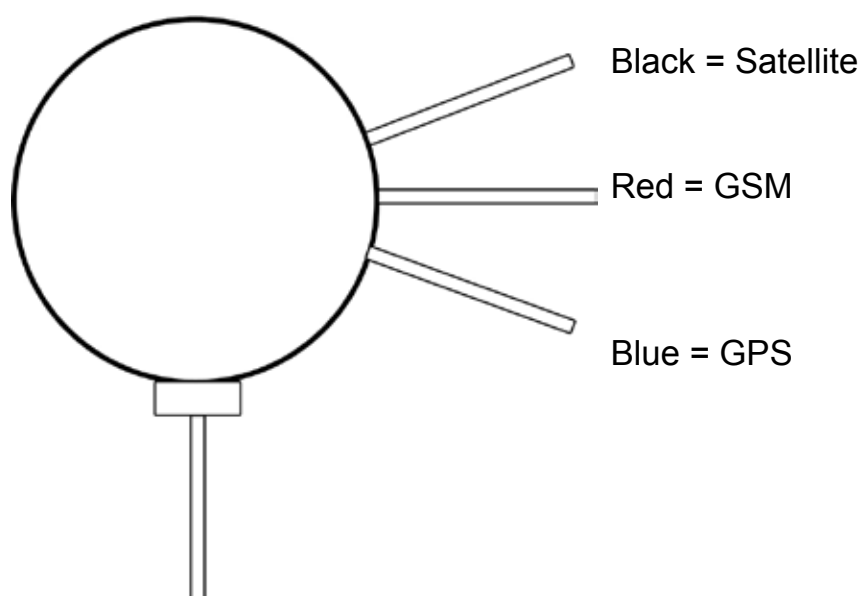
The SCAN Antenna 60410 is a passive antenna for Thuraya Docking stations.

Electrical Specifications:

Frequency	1525 - 1660.5 MHz, 824 - 960 MHz, 1710 - 2170 MHz
Impedance	50 ohm
Satellite System	Thuraya, GPS
Polarisation	LHCP (SAT)
Axial ratio	< 6 dB
Gain	4 dBic
LNA Gain	25 dB (GPS)
Noise Figure	1.2 dB (GPS)
Supply voltage	3.0 - 5.5 V DC (GPS)
Current consumption, average	20 mA (GPS)

Mechanical Specifications:

Color	White
Weight	170 g
Diameter	Ø 111 mm
Mounting	Magnetic or with supplied adhesive tape
Mounting place	On steel roof etc.
Mounting instruction	Included
Height above roof	36.5 mm
Materials	ASA, PCB, brass and PTFE
Operating temperature	-40°C to +70°C
Connector	SAT: SMA-female (Black coding)
Connector 2	GSM: SMA-female (Red coding)
Connector 3	GPS: SMA-female (Blue coding)
Cable	No cables supplied
Ingress Protection	IP66

9.4.2 Iridium 9555

Usage

MT-VisionAir X unit with **SP** board:
Demands the mounting of the satellite telephone holder which provides a HUB to transform from USB 1 standard to USB 2 standard.

MT-VisionAir X unit with **TT** board:
No hub needed, direct connection to USB via central connector ok.

How to check the board type?
Use <AUX> <SETUP> <VERSION> <VERSION>

9.4.3 Installation of modified antenna adapter for Iridium 9555

9.4.3.1 Mounting / cable routing

(G) Cradle
(B) USB from VisionAir X
(K) Audio cable
(E) Front plate
(C) Reserve cable from USB Hub
(D) Back plate
(F) Connecting screws
(A) Power supply cable
(J) Mini USB plug
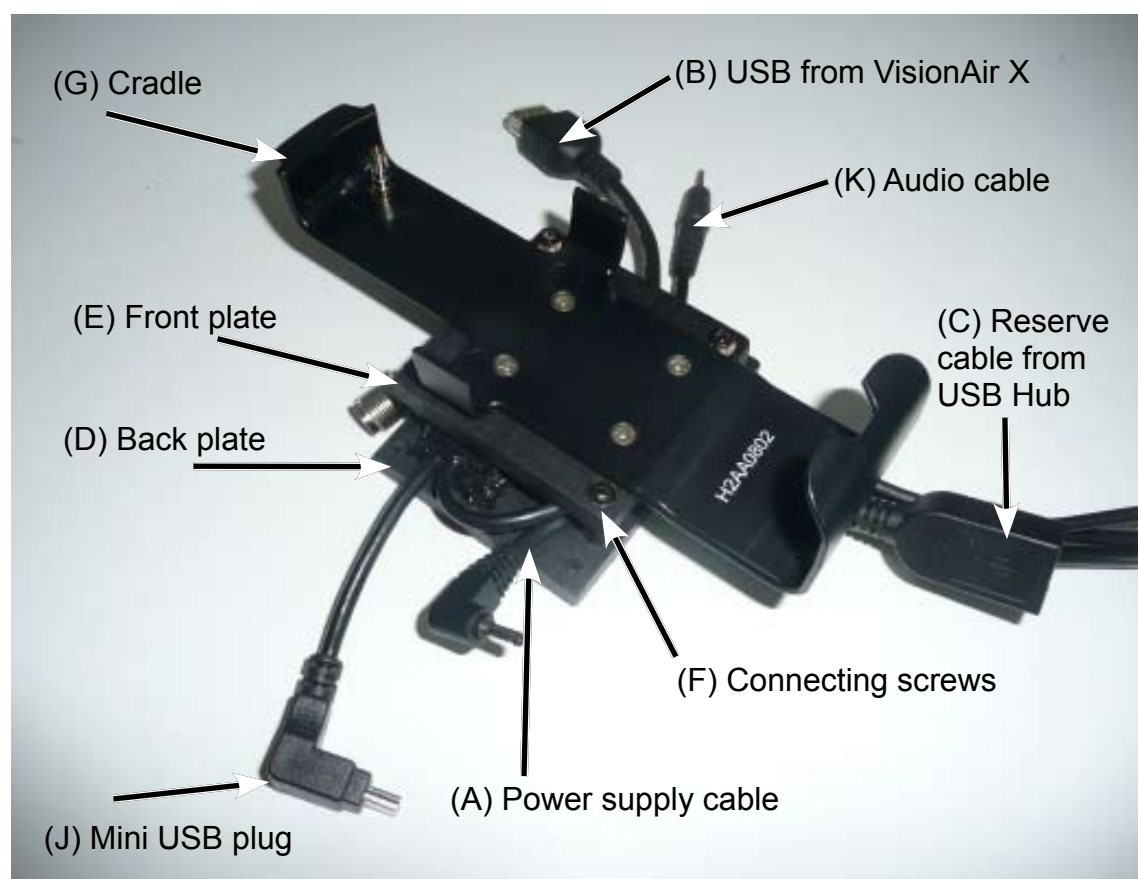
Fig. 9.4.3.1: Parts / Cable routing of satellite telephone holder

1. Mounting of the back plate
Mount the back plate (D) of the holder in the cockpit according to your specification.

2. Cable routing to the satellite telephone
Lead the power supply cable (A) for the satellite telephone from below to the left hand side of the holder. Lead the USB cable from MT-Vision-

Air X (B) and the audio cable of the SafetyCell (K) from below to the right hand side of the holder.

3. Cable routing from satphone
Lead the reserve cable from the USB hub (C) (for the optional 3G UMTS USB Stick), coming from the left hand side of the integrated USB hub, to the bottom of the satellite telephone holder.

9.4.3.2   Connections

(B) USB from VisionAir X

(K) Audio cable

(H) Power plug

(J) Mini USB plug

Fig. 9.4.3.2.: Connections of satellite telephone holder

1. USB connection
Connect the USB cable from MT-VisionAir X (B) with the USB Hub of the satellite phone holder. Ensure that the plug is located straightly.

2. Secure screws with the holder / Strain relief
Now secure the front plate (E) to the back plate (D) with the connecting screws (F). The USB cable from MT-VisionAir X (B) must be clamped straightly.

3. Connection of the satellite telephone
Insert the satellite telephone into the cradle (G) of the holder. Connect the plugs (H), (J), (K) with the respective connector sockets.

9.4.4 Iridium 9575

Usage similar to Iridium 9555.

9.5 Installation of the iridium antenna

9.5.1 Recommended installation location of the iridium antenna

Like with the Fast Integral GPS or the Internal GPS with SiRF IV technique the visible segment of the sky must be as big as possible (see "Installation of Fast Integral GPS").

Position of the antenna:

The satellite antenna needs ideally about 180° free vision. The positioning on the glare shield is not ideal as it offers only vision of 2/3 of the sky.

Solutions: - Installation in the rear roof window (Cessna)
              - Installation directly under the plastic fuselage
              - External antenna (mounted on the roof).

NOTE	The external antenna is the best and recommended solution. Contact your avionics installer.

9.5.2 Extension of the antenna cable

The antenna provided by Motorola can be extended using the RG58 cable (ideally shielded against interference).

Fig. 9.5.2: Extension cable of Motorola antenna

Material: RG58C/U 50 Ohm cable with foil- and braided shield
TCN male connector for RG58
SMA female connector for RG58
SMA male connector for RG174 resp. RGS316

NOTE	Trim the thin antenna cable as close as possible to the antenna.

9.5.3 Recommended solution of external antenna for Thuraya communication

Same instructions are to be maintained.

9.5.4 Solutions for improving reception

Mounting antenna on a ground plane
For the installation a ground plate (min 20x20 cm) made of conducting material is recommended. On this ground plate the antenna is mounted **with upward vision**. Conducting material (e.g. galvanized sheet metal) improves the reception. Make sure the plate is grounded to metalic part of the structure.

Avoiding interference of the antenna
- Distance (GPS to Iridium antenna) for optimal GPS reception must be 1.3 m or more.

- A distance of less than 40 cm between the antennas results in complete failure of GPS => SATACQ.

NOTE	Interference often only shows up on the GPS (SATACQ or other error messages), but the satellite telephone has no reception in spite of showing a good signal quality. A good signal doesn't mean a good reception.
	Non-MT GPS receivers sometimes show no error message in spite of a failure, because they still send data from the cache.

NOTE	An ideal SatRadar download with Iridium takes approx. 3 min.
	The iridium reception is generally unstable, sometimes weak. The iridium antenna should be installed with an optimal vision of the sky (horizon to horizon). At testing keep enough distance to hangar etc. While installing the iridium antenna watch out for other GPS antennas (non-MT)!

9.5.5 Example for an internal installation

Installation of the GPS antenna on the glare shield, the antenna of the satellite telephone in the rear window - if available - facing up, such as in a Cessna. Such an installation is well suited as long as the minimum distance to the GPS antenna is 1.3 m.

9.5.6 ITAS module for MT-Mission Management System

All advises regarding the antenna position and the minimum distances between GPS and GPS antenna apply for ITAS module.

9.5.7 Advice for certification tests

Please be aware that interference of GPS reception by use of a satellite telephone cannot be totally ruled out (see also AC-20-138B, Advisory Circular - Airworthiness Approval of Positioning and Navigation Systems). It is therefore recommended to check the critical avionic devices when the satellite telephone is turned on during a ground test and during a test flight.

9.6   To adjust of the telephone connection(s) (in the software)

9.6.1 Authorization for download of radar data

Before radar data can be downloaded from Deutscher Wetterdienst (DWD) prior authorization is required once.

NOTE	Normally the authorization data (when known) are preset by Moving Terrain before shipping.

(1) Turn on the unit.
(2) Press the keys <AUX> <SETUP> <DIALUP> <RadAuth>.

This leads to the **DWD AUTHORIZATION page:**
Enter   **FTP USERNAME** (beginning with Lf)
            FTP PASSWORD
            online username
            online password.
These are communicated by DWD on request.
Upper and lower case must be observed.
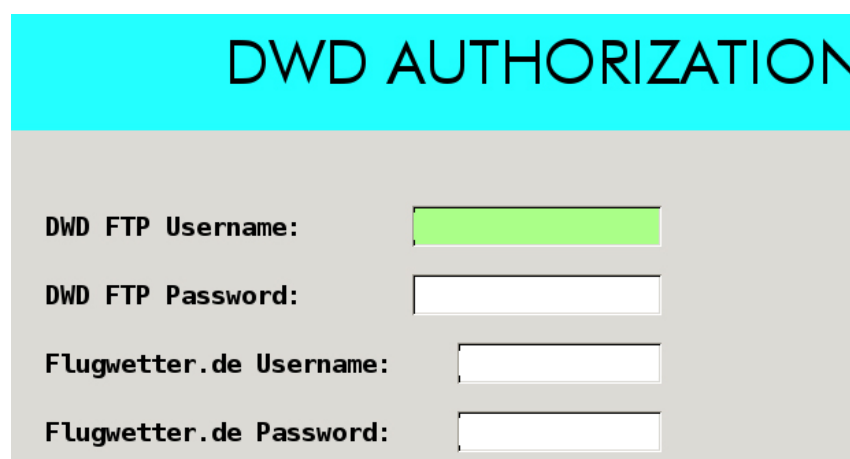
Key	Function
SAVE	To save the input
DEL	To delete a single character, if hold the whole input will be deleted
CAPS	To enter an uppercase letter: First press CAPS key, followed by the appropriate letter key.
NEXT	Tabs between the fields USERNAME and PASSWORD
BACK	Confirmation of entries. Both entries will be automatically stored. These need not to be re-entered.

Table 9.6.1: Description of keys and functions on PCMET FTP USER AUTHORIZATION screen

(3) Confirm the entries by pressing the key <BACK>.

The RADAR screen is displayed.

9.6.2 Selection of the telephone connection (in the software)

**First connect the satellite phone / UMTS Modem,
then turn on the MT-VisionAir X unit.**

(1) Press the keys <AUX> → <SETUP> → <DIAL-UP>.
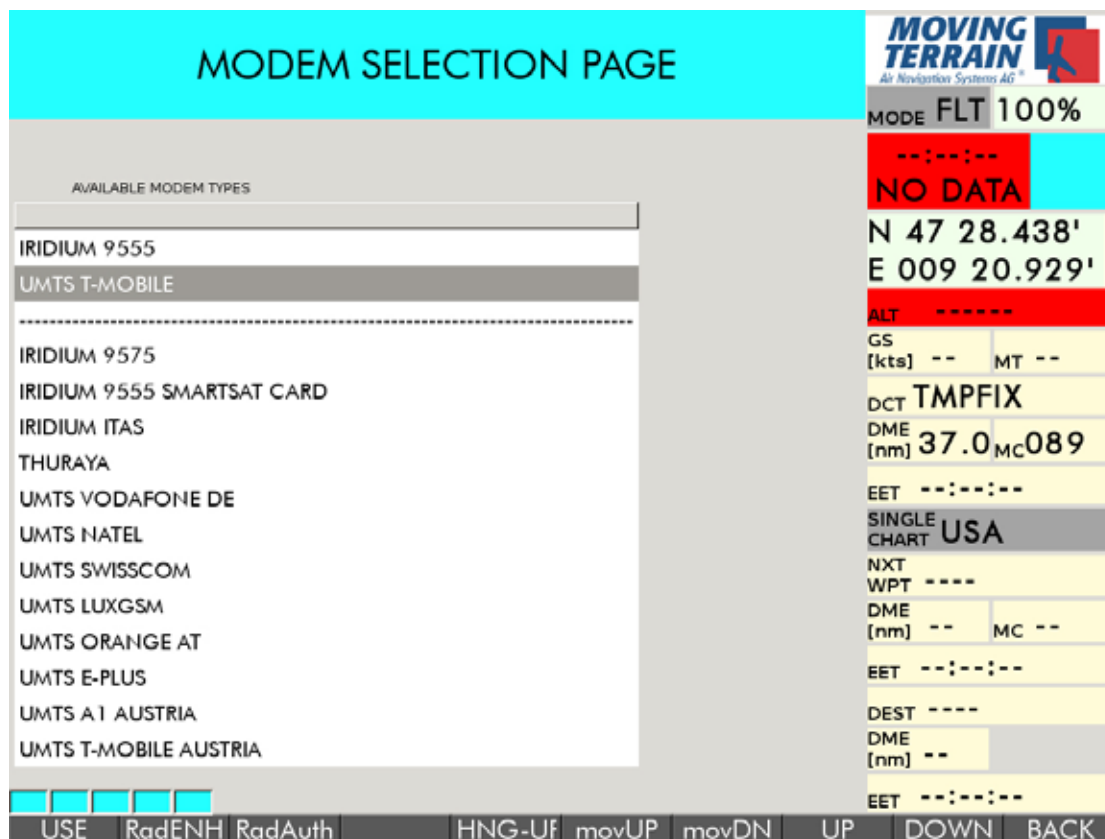
Fig. 9.6.2: MODEM SELECTION PAGE (Example)

Key	Function
USE	Confirmation of the selected choice of modem type
RadDWD / RadENH	Toggle between Sat Radar DWD (central European coverage) and Sat Radar Enhanced (European Coverage)
RadAuth	Authorization page
HNG-UP	Hang up, manual termination of modem connection. The connection is active for 3 minutes and ends automatically afterwards. During the countdown from 180 to 0 seconds the connection can be interrupted by pressing <HNG-UP>, e.g. for starting a new request.
movUP	To move a telephone source upwards within the list
movDN	To move a telephone source downwards within the list
DOWN / UP	Selection of items in the list. The key labels change depending on position.
BACK	Return to previous screen

Table 9.6.2: Description of keys and functions on MODEM SELECTION PAGE

(2) Sort the modem selection page according to the telephone sources which are in use:

Move the 2 telephone types you will use above the line by pressing <movUP> and <movDN>

(3) Select desired item in the list with the key <DOWN> resp. <UP>.

(4) Confirm with <USE>.

(5) Return to previous screen by pressing <BACK>.

The selected modem type is valid for both MT Satellite Radar and MT BLITZPLAN.

NOTES	If you want to make Data Call, then select the VODAFONE option as default. If an error message occurs (protocol error) then try using the TMOBILE option.
	Use "Iridium 9555 smartsat card" when you have a contract with Smart Sat COM. If you have a contract with another provider use "Iridium 9555 satellite phone".

9.7 Test of radar data download: MT Satellite Radar (Enhanced)

Following installation of the telephone connection a test of radar data download should be performed to ensure that installation has been successful.

9.7.1 Download of radar data for MT Satellite Radar (standard)

Prerequesites

- Telephone connection is provided
- Fast Integral GPS is connected -> UTC will be delivered

Procedure

(1) Turn unit on.

(2) Press key <RADAR> (MT Satellite Radar).

The RADAR screen is displayed.

Fig. 8.7.1: RADAR screen (initial)

Key	Function
M.LOAD	Manual Mode: Manual download of radar data. Allows an immediate one time download of radar data, e.g. at the beginning of the weather briefing.
SHOW / HIDE	Display of radar data previously downloaded / Suppress radar layer for better legibility of the chart. The key labels change depending on available function.

Key	Function
RAD ON / RAD OFF	Starts / terminates the automated download of radar images every 15 min. Complete automated handling of the full procedure without any further inputs. In the case the telephone is busy due to a voice call, the procedure will start as soon as the line is available again.
ZOOM+	Zooming in of the chart / decrease the scale factor for the displayed range of data. In steps of 500 / 400 / 300 / 200 / 150 / 100 / 50 % depending on the map scale.
ZOOM-	Zooming out of the chart / increase the scale factor for the displayed range of data. In steps of 50 / 100 / 150 / 200 / 300 / 400 / 500 % depending on the map scale.
DIAL-UP	Switches to MODEM SELECTION PAGE
<<	Scroll back in the download history of radar data
>>	Scroll forward in the download history of radar data
BACK	Return to previous screen

Table 9.7.1: Description of keys and functions on RADAR screen

NOTE	The keys are labelled with the appropriate function that can be executed.

The status window

The **status window** is displayed in the left part of the map display.

... information about connection status
and type

... Status SHOWN or HIDDEN
/ type MAN or AUTO

... UTC time of data of displayed download
.... Download message
(see below for detailed description)

NOTE	The download messages provide information concerning the current download (success, progress and error messages). The progress messages are displayed quickly, so not all of them are readable.

(3) Press key <M.LOAD> to start the manual download of radar data. No further entries are required.

(4) Check the download message.

  • If the latest file was already downloaded into unit, LATEST AVAILABLE is displayed. Press key <SHOW> to display.

  • Otherwise the download proceeds with the following steps:

  - Dialing
  - Establish a connection
  - File transfer via FTP (Starting FTP, searching file, downloading file)
  - Termination of connection.

9.7.2 Download of radar data for MT Satellite Radar Enhanced

Prerequesites

- Telephone connection is provided

- Fast Integral GPS is connected -> UTC will be delivered

- System is set to MT Satellite Radar Enhanced and prepared for downloads of the full European coverage <AUX> <SETUP> <DIALUP> <RadENH> (now the button shows <RadDWD> !)

- The subscription for the data downloads is valid

Procedure

(1) Turn unit on.

(2) Press key <RADAR> (MT Satellite Radar Enhanced).

The RADAR screen is displayed.

Fig. 8.7.2: MT Satellite Radar Enhanced screen (initial)

Key	Function
Live	Download of radar pictures inbetween the 15 minutes download cycles: Provided by some countries in Europe

Key	Function
SHOW / HIDE	Display of radar data previously downloaded / Suppress radar layer for better legibility of the chart. The key labels change depending on available function.
RAD ON / RAD OFF	Starts / terminates the automated download of radar images every 15 min. Complete automated handling of the full procedure without any further inputs. In the case the telephone is busy due to a voice call, the procedure will start as soon as the line is available again.
ZOOM+	Zooming in of the chart / decrease the scale factor for the displayed range of data. In steps of 500 / 400 / 300 / 200 / 150 / 100 / 50 % depending on the map scale.
ZOOM-	Zooming out of the chart / increase the scale factor for the displayed range of data. In steps of 50 / 100 / 150 / 200 / 300 / 400 / 500 % depending on the map scale.
DIAL-UP	Switches to MODEM SELECTION PAGE
<<	Scroll back in the download history of radar data
>>	Scroll forward in the download history of radar data
BACK	Return to previous screen

Table 8.7.2: Description of keys and functions on RADAR screen

NOTE | The keys are labelled with the appropriate function that can be executed.

The status window is analog to MT Satellite Radar.

plus information of satellite finder.
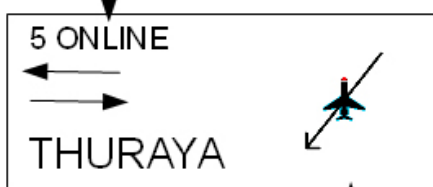
The table below shows the process-step related progress, success and error messages and the necessary actions in case of an error.

9.7.3 Download messages in detail

Process	Possible error message	Meaning / Error cause	User action
DIALING		Dialing to the network to make a connection.	
	GPS CLOCK ERROR	GPS clock has no valid UTC for downloading the weather file.	Connect GPS and get UTC from GPS.
	SIM PIN ISSUE	PIN not disabled for SIM card	Deactivate PIN (via telephone).
	SIM NO SIGNAL	No signal detected to carry out the call (Voice / Data)	Allow reception or wait for getting the signal.
	SIM NOT REGISTERED	SIM is not registered for network access.	Contact provider.
	SIM DATA TRANSFER DISABLED	SIM card has no data download option.	Contact provider.
	SIM FAILED AUTHENTICATION	Authentication for SIM card failed to enter the network.	Contact provider.
	SIM NOT DETECTED	SIM card not inserted correctly.s	• Insert SIM card correctly. • Check SIM card.
	IRIDIUM NOT CONNECTED or STICK NOT CONNECTED	Selected modem type is IRIDIUM SAT RADAR or UMTS STICK, but no appropriate hardware connection was found.	• Connect telephone (when selected modem type is IRIDIUM SAT RADAR). • Connect UMTS Modem stick (when selected modem type is UMTS STICK).
	IRIDIUM ALREADY IN USE or STICK ALREADY IN USE	There is already an active call going on using the Iridium phone resp. UMTS Modem.	Terminate the connection by pressing the keys <AUX>, <SET-UP>, <DIAL-UP>, <HNG-UP> and start again.

Process	Possible error message	Meaning / Error cause	User action
	WRONG MODEM SELECTION	The selected modem option is not a valid / supported option.	Select correct modem in Modem Selection page (refer to section 6.5).
WAITING FOR CARRIER			
CARRIER DE-TECTED		Successful authenti-cation searching for ISP or searching for the server	
	NO CARRIER DETECTED	Signal problem	Allow reception. Retry the action if signal is back after sometime.
	SEARCHING FOR ISP (for UMTS) or-SEARCHING FOR SERVER (for Iridium)		
	ISP CONN PROBLEM	SIM card problem with the connection to the ISP (Internet Service Provider).	Check your APN (Access Point Net-work) settings. The MT software will retry, but in case it fails call your provider to get the APN information.
	PPP STARTED		
CONN ESTAB-LISHED		Connection to server (Internet Service Provider ISP or RA-DAR/BLITZPLAN) established.	
	LOGGED IN BLITZPLAN		
	SERVER DOWN OR BUSY		Retry after sometime
STARTING FTP		Starting FTP (File Transfer Protocol) to download the latest radar file	
	WEATHER SERVER DOWN	RADAR server down or currently too busy to process the down-load request.	Try again later (e.g. in 1 minute)

Process	Possible error message	Meaning / Error cause	User action
	SERVER UNREACH-ABLE	RADAR server unreachable for the moment.	Try again later (e.g. in 1 minute)
	SERVER LOGIN PROB-LEM	DWD login information is incorrect.	• Contact MT support. • Change DWD login data.
	RETRYING FTP	Problem in carrying out the download.	Wait. Software will retry.
SEARCHING FILE		Searching the RADAR file on server.	
	FTP TIMEOUT	Network speed too slow / file too big (at 1st occurrence).	Wait. Software will retry.
	SERVER RESPONSE ERROR	Unable to get a response from RADAR server (during retry).	Wait. Software will retry.
	FATAL ERROR	Probably the connection was lost during download.	Try again later.
DOWNLOAD-ING FILE		Download in progress.	
	Wrong UTC	UTC is invalid.	Verify GPS time and reception.
	WRONG BIOS UTC	BIOS time is wrong.	Report to MT.
100% DOWN-LOADED		RADAR file fully downloaded.	
HANGING UP		Hanging up an active call.	
DISCON-NECTED		The active call has been disconnected.	

Table 8.7.3: Description of download messages in detail (status window)

9.7.4 Overview: RADAR download statuses, messages and timings

Note: Reported timigs are typical for Thuraya
R = Radar download step - message appears in RAD infoblock: D = Datalink step - message appears in Datalink infoblock

Step		Message DWD	Message Enhanced	Thuraya / Iridium / UMTS Timings for Thuraya alt: Error Message
R0		0 AUTO UPDATE 0 MAN UPDATE	0 AUTO UPDATE 0 MAN UPDATE 0 LIVE UPDATE	26 seconds to establish net-working connection
D1		1 DIAL-UP...	1 DIAL-UP...	< 1 sec
				RETRYING (MODEM NOT READY)
				THURAYA NOT CONNECT-ED [RAD ON]
D2		2 WAITING FOR CARRIER	2 WAITING FOR CARRIER	< 1 sec
				RETRYING (NO CARRIER)
D3		3 PPP STARTED	3 PPP STARTED	3 sec
				RETRYING (PPP ERROR).
D4		4 SEARCHING FOR ISP	4 SEARCHING FOR ISP	21 sec
				RETRYING (PPP ERROR)..
D5		5 ONLINE	5 ONLINE	--
	R1	1 CONTACTING SERVER	1 REQ RADAR or 1 REQ RADAR (xx/90 s)	8 sec (~90 sec for live upd.)
				FTP LOGIN ERROR Error: Check DWD Login
				[RAD ON]
				NO NEWER IMAGE

Description
RADAR download has been triggered, either manually (M.LOAD) or by the automatic timer (RAD ON) The message stays until the system has achieved a network connection
Modem Initialisation, Sending Modem Commands
The modem is not responding to commands --> Back to D1
The satphone appears to be unplugged --> The connection is aborted --> Radar is switched off]
Wait for Modem Response
Modem reports it cannot connect ->(probably not enough signal strength or ->no satellite in view)   --> Back to D1
Negotiation of networking protocol is in progress
The networking protocol negotiation failed In this case the dial-up call also drops   --> Back to D1
Negotiation of networking protocol is in progress
The networking protocol negotiation failed In this case the dial-up call also drops   --> Back to D1
Networking established
VisionAir X has sent the request to the server to start the weather download, and it is waiting for an answer xx = counting up (seconds)
DWD Username and/or Password are not valid --> Download attempt is aborted
--> Radar is switched off
The server has no newer image than the VisionAir X, download skipped --> Go to R6

Step		Message DWD	Message Enhanced	Thuraya / Iridium / UMTS Timings for Thuraya alt: Error Message
				RETRYING (SERVER DOWN)
				RETRYING (SERVER UN-REACHABLE)
				RETRYING (TIMEOUT)
				RETRYING (PROTOCOL ERROR)
				HTTP SERVER ERROR [RAD ON]
				HTTP BAD REQUEST [RAD ON]
				Unable to connect to weather server [RAD ON]
				Unable to read weather data [RAD ON]
				Try again in xx seconds.
	R2	2 SEARCHING FILE		
	R3	3 DOWNLOAD-ING FILE		
	R4	4 DOWNLOAD-ING: xx%	4 DOWNLOADING: xx%	3 sec
				RETRYING (TIMEOUT)
	R5		DECODING IMAGE	7 sec
				DECODE ERROR (x) x = diagnostic code
	R6	LATEST AVAIL-ABLE	LATEST AVAILABLE	
				TOTAL 18 sec for Rad Download only
				TOTAL 44 sec incl DialUp

Description
The server refused the connection --> Back to R1
The network reports that the server cannot be reached --> Back to R1
Timeout is 25 sec (or 120 sec for live update) without receiving any data
(DWD) error in FTP protocol --> Back to R1
There was a fatal error on the server --> Download attempt is aborted   --> Radar is switched off
The server did not understand the request (VisionAir X may need a firmware upgrade) --> Download attempt is aborted   --> Radar is switched off
MT server cannot connect to weather server --> Download attempt is aborted --> Radar is switched off
MT server could not receive the whole image from the weather server --> Download attempt is aborted   --> Radar is switched off
The MT server does not request another update from the weather server before 2 minutes have passed since the previous request.
File size: 14505 bytes
Timeout is 25 sec (or 120 sec for live update) without receiving any data

9.7.5 Download test completed

After successful download radar data are shown on the screen.
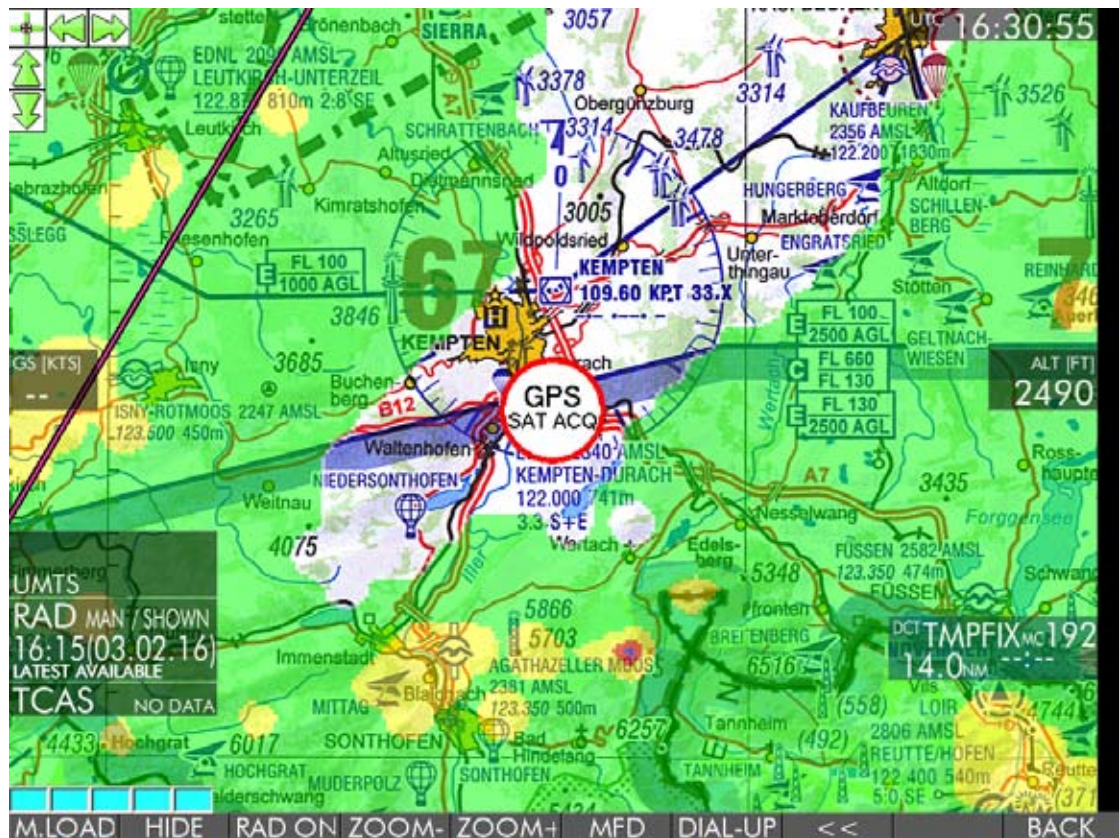
Fig. 9.7.4 (1): RADAR screen with radar data on ICAO chart

If precipitation information is not displayed there are two possible causes:
- Layer is still suppressed (status HIDDEN).
  Solution: press <SHOW>.

- No precipitation was recorded for the area of the chart displayed.
  Check status display, layer status is SHOWN

- Check in MFD Mode by using <ZOOM-> to
  adjust the range to European overview
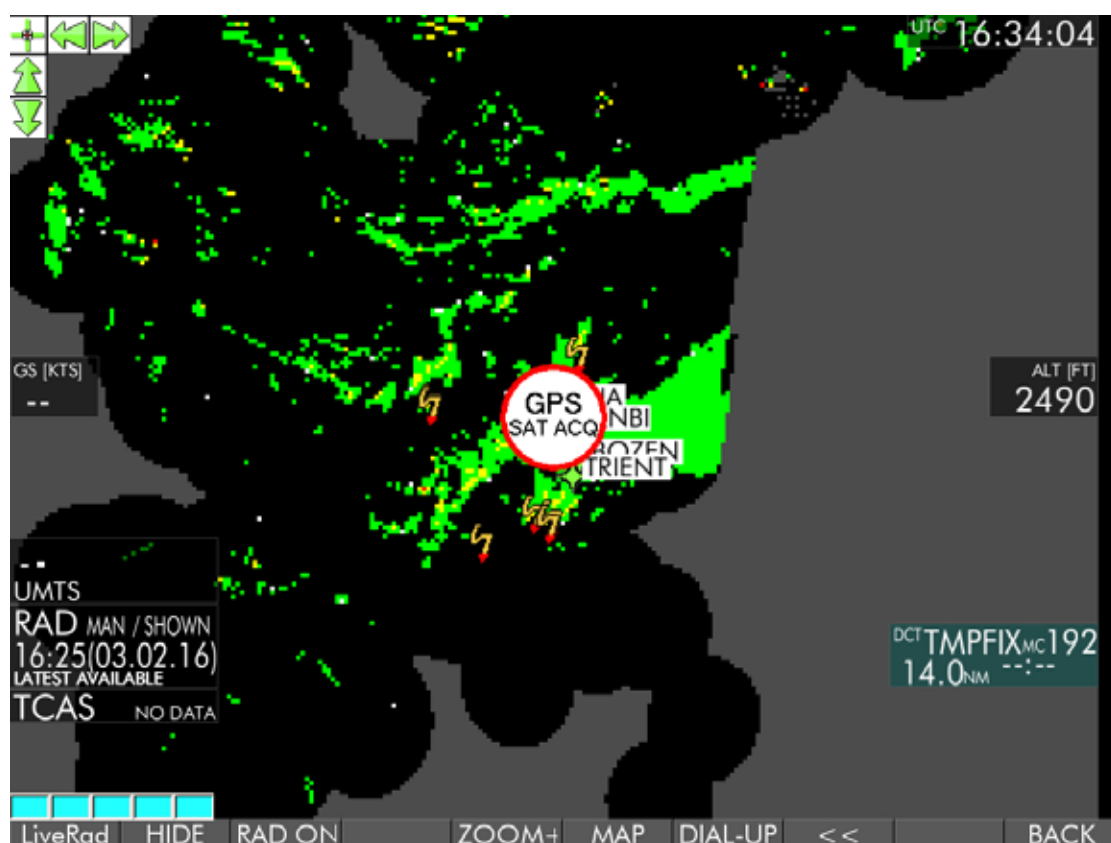
Fig. Fig. 9.7.4 (2) RADAR in MFD mode

After sucessful completion of the download, it may be assumed that installation is correct.

9.8 Test of MT BLITZPLAN connection

NOTE	Before testing MT BlitzPlan connection make sure that the correct telephone modem has been selected. Refer to section "6.5 Selection of the telephone connection (in the software)".

Starting MT BLITZPLAN

(1) Turn unit on.

(2) Press key <FPL> (Flightplan).

Either the MT BLITZPLAN Login screen (A) or Flightplan Archive screen (B) is displayed.

(A) Account information / LOGIN

When using MT BLITZPLAN for the first time with your MT-VisionAIR X unit, Username and Password are required.

NOTE	Normally the authorisation data (when known) are preset by Moving Terrain before shipping.

(1) Type in your Username (or ACT ID without "-") and Password.

(2) Confirm with <Login>.

LOGIN data must be entered once and are then permanently stored.

Fig. 8.8 (1): MT BlitzPlan Login

Key	Function
PREV / NEXT	Tabs between the fields USERNAME and PASSWORD
Login	Confirm data and log in
DEL	Deletes character last entered
Char	Enter special characters like SPACE, ., -, /
Archive	Shows the list of previously downloaded flights
Exit	Leave the LOGIN screen

Table 8.8: Description of keys and functions on MT BLITZPLAN Login screen

(B) Flightplan Archive screen (when LOGIN data are correct)

Status messages are displayed in the upper right corner of the Flightplan Archive screen.

NOTE	With every request to the MT Server a modem connection is established. Connection time is 3 minutes and ends automatically afterwards. You can interrupt the connection during the countdown from 180 to 0 seconds by pressing <DIAL-UP >, then <HNG-UP>.

A list of stored flightplans is displayed on the Flightplan Archive screen.
In case there are no flightplans in the archive, only the entry NEW IFR FLIGHTPLAN appears.

Flightplan Archive							OFFLINE DATA UMTS TMobile
DOF	DEP Time DEP		DEST	Acft Ident	Status	Date routed	Date uploaded
111031	1546	EDDH →	EDDM	DEMOZ	Not Valid	2011-10-31 14:51:02	2011-11-08 16:15:50
111029	1546	EDDH →	EDDM	DEMOZ	Route OK	2011-10-27 16:36:58	2011-11-08 16:15:50
111027	1000	EDDH →	EDNL	DEMGG2	Route OK	2011-10-25 11:28:57	2011-11-08 16:15:51
111026	1546	EDDH →	EDDM	DEMOZ	Activating	2011-10-25 14:31:00	2011-11-08 16:15:51
111025	1000	EDDH →	EDNL	DEMGG2	Route OK	2011-10-24 17:02:53	--
111024	1746	EDDH →	EDDM	DEMGG2	Cancelled	2011-10-19 20:18:20	--
111024	1546	EDNL →	EDDM	DEMGG2	Route OK	2011-10-19 20:20:20	2011-11-08 16:15:50
111024	1000	EDDB →	EDNL	DEMGG2	Route OK	2011-10-20 07:54:52	--
111023	1900	EDDH →	EDNL	DEMGG2	Route OK	2011-10-19 20:25:44	--
111023	1546	EDDH →	EDDM	DEMOZ	Route OK	2011-10-21 14:01:44	--
111023	1546	EDMK →	EDDM	DEMOZ	Route OK	2011-10-19 15:48:05	--
111022	1546	EDDH →	EDDM	DEMOZ	Route OK	2011-10-19 17:37:21	2011-11-08 16:15:51
111022	1000	EDDH →	EDNL	DEMOZ	Route OK	2011-10-19 20:23:38	--
111022	1000	LESB →	EDDF	DEMGG2	Route OK	2011-10-21 16:38:56	--
111022	1000	LESB →	EDFZ	DEMGG2	Not Valid	2011-10-21 16:25:37	--
111021	1900	EDDH →	EDDM	DEMGG2	Cancelled	2011-10-19 14:27:27	--
111020	1746	EDDH →	EDDM	DEMGG2	Cancelled	2011-10-17 07:08:18	--
111018	1546	EDDH →	EDDM	DEMGG2	Route OK	2011-10-17 07:04:02	--
111018	1546	EDDH →	EDNL	DEMGG2	Route OK	2011-10-17 07:10:24	--
ChgUsr	Edit	FPLList	UPLFPL	NewFPL		INS	Up	Down	Exit

Fig. 8.8. (2): Flightplan Archive

Choose a flight plan which is marked "Route OK" but not uploaded yet ("Date uploaded" empty) and press "UPLFPL" to start the process. If the plan gets loaded the connection test was performed successfully.

If there are no plans available enter a new flightplan and get the routing by pressing ROUTE (only visible if all fields for the flightplanning are filled in correctly). Be aware that every query for routing will cause costs for the customer. Please call customer's service at Moving Terrain for further help.

For detailed information about MT BLITZPLAN refer to the MT BLITZPLAN manual.

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10. MT Autopilot guidance output

10.1 Technical Description

10.1.1 Operating modes

Operating mode	Protocol
Analog	No protocol - analog voltage output -10V to +10V Lateral steering goes to Analog Out 1 *Vertical signal goes to Analog Out 2*
Serial - text	AVIATION - Simulates Aviation GPS protocol output for compatible autopilots (e.g. Trutrak DigiFlight) 9600 Baud
Serial - text	NMEA (sentences: $GPRMB, $GPRMC) also suitable for DigiFlight AP and EZ Pilot AP 4800 Baud

Table 10.1.1: Autopilot guidance operation modes

10.1.2 Summary of mtpro.ini parameters
The following parameters must be configured under the [AUTOPILOT] section in mtpro.ini.

Entry	Description
Port	*Specifies the output type (serial/analog) and port number (only for serial output):* *Port = 0* --> *Analog output* *Port = 1 .. 16* --> *physical serial ports*
Protocol	Specifies the serial protocol to be used (if appropriate) Protocol = ATP-AVIATION --> Aviation GPS protocol Protocol = ATP-NMEA-MIN --> NMEA0183 protocol (minimal) When "Port = 0" (analog voltage output) the "Protocol" setting can be any value OR missing altogether (not used)
Sensitivity	Adjusts how the autopilot responds to the track error, it is expressed as a percentage Sensitivity = 250 --> Neutral value (see "autopilot steering algorithm" below) Values above 250 make the autopilot more responsive / aggressive.
LookAhead	Number of seconds to "look ahead" (see "autopilot steering algorithm" below) Neutral value: 30

Entry	Description
Polarity	Changes the sign of the correction signal, can be L or R Polarity = L --> Default: positive Voltage = right turn Polarity = R --> Inverted output: negative Voltage = right turn Same Convention acts on the Protocols
ServoMode	Determines whether the VisionAir X drivers directly the aileron servo (default 0) ServoMode = 0 --> Output signal represents a turn rate (emulates the HDG bug error signal) ServoMode = 1 --> Output signal is meant to drive the aileron servo position directly IMPORTANT: ServoMode 1 requires EFIS module and calibrated sensors
StdBank	Target bank angle [deg] which is assumed to generate the target turn rate (StdTurnRate) Default: StdBank = 22 NOTE: ignored when ServoMode = 0

Table 9.1.2 (1): Summary of mtpro.ini parameters for horizontal navigation

Additional parameters for vertical navigation (n/a)

Entry	Description
VertEnable	*Default: VertEnable = 0* *Enables (1) or disables (0) the vertical autopilot*
FlightPathAngle	Default: FlightPathAngle = 3.0 Defines the target flight path angle (in degrees) for climb/descent
ThetaDotScale	Default: ThetaDotScale = 0.25 Scaling of autopilot reaction to pitch perturbations
AltHoldBand	Default: AltHoldBand = 100 The autopilot switches from CLB/DES mode to HOLD mode when the projected altitude (at „LookAhead" seconds) is within the selected altitude +/- AltHoldBand
SensitivityElev	Default: SensitivityElev = 1.0 Tuning for the sensitivity of the vertical autopilot to the altitude deviation. The altitude deviation is calculated as projected in the future at „LookAhead" seconds.

Entry	Description
ThetaDotMax	Default: ThetaDotMax = 1.0 Defines the maximum pitch rate that the autopilot will try to maintain when changing pitch

Table 10.1.2 (2): Summary of mtpro.ini parameters for vertical navigation

10.1.3 Examples for mtpro.ini entries

Example 1: activate analog output (recommended)

```
[AUTOPILOT]
Port = 0
LookAhead = 30.0
Sensitivity = 100
Polarity = R
```

Example 2: activate NMEA0183 protocol output on COM port 3

```
[AUTOPILOT]
Port = 3
Protocol = ATP-NMEA-MIN
LookAhead = 30.0
Sensitivity = 100
Polarity = R
```

IMPORTANT: all [AUTOPILOT] parameters must be explicitly set (the software will display an error otherwise) unless the autopilot module is disabled in "mtrights.ini"

Additional parameters in [GENERAL] section

The following parameters, configured under the [GENERAL] section, affect the sequencing of route legs and as such have an influence on how the autopilot intercepts the next segment:

Entry	Description
LegFinishedSecs-VFR	Threshold (in seconds, estimated to end of current flight plan leg) under which the system switches to the next leg (when dealing with a "VFR" flight plan leg – not for IFR procedure legs) Neutral value: 25
LegFinishedSecs-IFR	Threshold (in seconds, estimated to end of current flight plan leg) under which the system switches to the next leg (when dealing with an IFR procedure leg) Neutral value: 10
LegFinishedSecs-FlyOver	Threshold (in seconds, estimated to end of current flight plan leg) under which the system switches to the next leg – but ONLY when deaing with an IFR procedure leg AND a Fly-Over waypoint Neutral value: 5

10.1.4 Modifying mtpro.ini for Autopilot configuration

- Connect USB keyboard (no need to connect the mouse)
- Press SHIFT + 1 (or the equivalent keyboard combination to print an exclamation mark, "!")
- The configuration editor will appear full screen
- After making the desired changes to the configuration, press:
  - CTRL + X, then Y and finally ENTER to exit the editor and confirm the changes
- The editor closes and Moving Terrain program resumes full screen
- It is now necessary either to restart the unit to reread the new configuration

OR
- use the following key combination:
- SHIFT + 2 (or the equivalent of the double quotes symbol , " ,) (this will restart the Moving Terrain program without the need to restart the whole unit).

10.1.5 Autopilot steering algorithm (lateral navigation)

The following algorithm is implemented in MTATOPLT/mtatpclc.c, function SteerAutopilot

Realtime input parameters:
- Speed (current aircraft speed in kts)
- Track (current aircraft true course in degrees)
- PFrom (starting point of current route segment or direct vector)
- PTo (ending point of current route segment or direct vector)
- PAct (Current aircraft position)

Parameters from configuration:
- Sensitivity (percentage, 100 = neutral value)
- Polarity (L = Left, R = Right)
- DeltaTime (look-ahead time in seconds)

Constants (defined in program source)
- AP_CORR_SIGNAL_ABS_MAX is the maximum absolute value of the autopilot correction signal when at full deflection (depends on the configuration of the digital-analog converter). Current value is 100.0 which will output an absolute voltage of 10V.
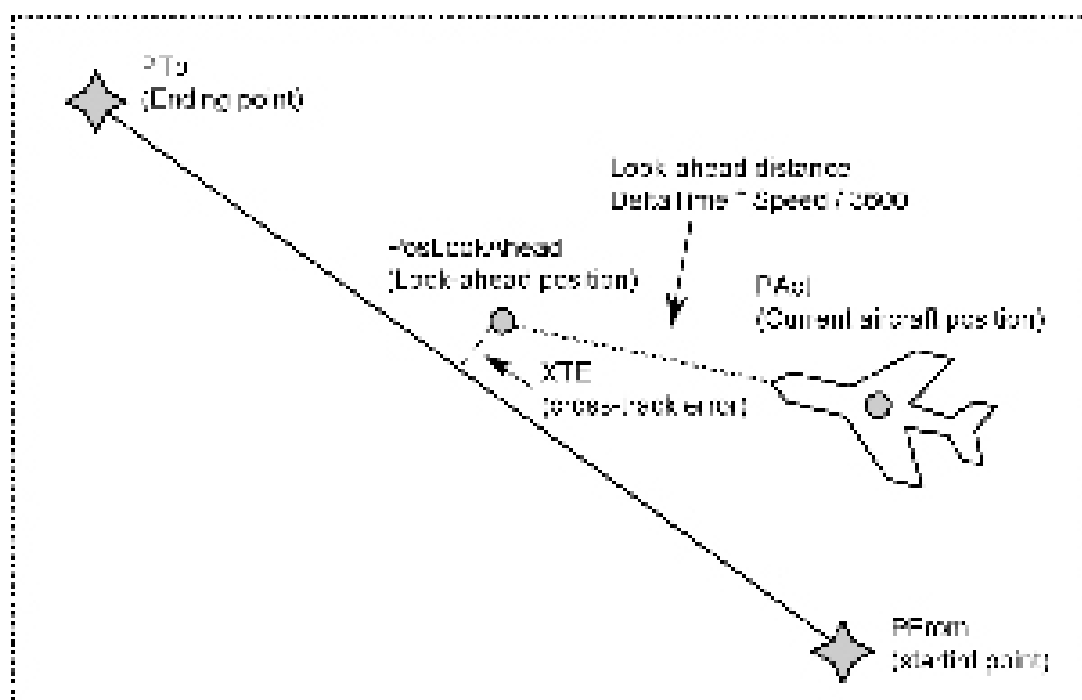
10.1.6 General autopilot logic

The autopilot code runs about 10 times per second (together with main loop software loop)

At any given moment the autopilot status can only be:
- AP DCT when following the direct vector
- AP RTE when following the route
- AP TRK when maintaining a ground track
- AP OFF when the autopilot has been disconnected

When the autopilot is OFF, a neutral correction segnal (0 V) is sent to the digital-analog converter (which should result in a „wings level" attitude)

Depending on the way the autopilot is activated, it will either:
- Follow a direct vector (APDCT button)
- Follow the route (APRTE button)
- Follow a specific track, from „current position" (APHDG button)

When the destination has been reached (either at the end of the direct vector or at the end of the last route segment) the autopilot switches to AP OFF status, thus sending the „wings level" neutral signal.
The AP TRK status is kept indefinitely as there is no terminating condition.
Interface with internal GPS simulator
For demonstration purposes the autopilot (when active) feeds the correction signal to the internal GPS simulator, by adjusting the rate of turn. The full amplitude of the correction signal corresponds to a turn rate of 3 degrees per second.

10.1.7 Protocols

10.1.7.1   NMEA protocol

Baud rate is set at 4800 bps.
The following sentences are sent when NMEA autopilot output is selected:

```
$GPRMB,A,0.66,L,003,004,4917.24,N,12309.57,W,001.3,052.5,000.5,V*20
```
Where:
```
    RMB            Recommended minimum navigation information
    A                  Data status A = OK, V = Void (warning)
    0.66,L             Cross-track error (nautical miles, 9.99 max),
                   steer Left to correct (or R = right)    (NOTE 1)
    003            Origin waypoint ID
    004            Destination waypoint ID
    4917.24,N      Destination waypoint latitude 49 deg. 17.24 min. N
    12309.57,W     Destination waypoint longitude 123 deg. 09.57 min. W
    001.3          Range to destination, nautical miles (999.9 max)
    052.5          True bearing to destination (NOTE 2)
    000.5          Velocity towards destination, knots
    V                  Arrival alarm  A = arrived, V = not ar-
rived
    *20            checksum
$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A
```

```
Where:
    RMC            Recommended Minimum sentence C
    123519         Fix taken at 12:35:19 UTC
    A              Status A=active or V=Void.
    4807.038,N     Latitude 48 deg 07.038' N
    01131.000,E    Longitude 11 deg 31.000' E
    022.4          Speed over the ground in knots
    084.4          Track angle in degrees True
    230394         Date - 23rd of March 1994
    003.1,W        Magnetic Variation
    *6A            The checksum data, always begins with *
```

NOTE 1: the cross-track error transmitted in the protocol is relative to the look-ahead position, not the actual aircraft position
In detail: XTE = cross-track error at lookahead position (as shown at page 4)
transmitted cross-track error = XTE * Sensitivity / 100
The sign may be inverted by setting Polarity = L

NOTE 2: The transmitted true bearing is calculated from the look-ahead position to the waypoint position (not from the actual aircraft position).

10.1.7.2   Aviation protocol

Baud rate is set at 9600 bps.
The serial output messages (sentences) are in the following format.

```
<STX><id><data><it><id><data><it>...<id><data><it><ETX>
<STX> ...............ASCII "start of text" character (1 byte, 02h)
<id> ...............item designator (1 byte, from following table)
<data> .............item data (format listed in following table)
<it> ...............item terminator (1 byte, 0Dh)
<ETX> .............ASCII "end of text" character (1 byte, 03h)
```

Item desig.	Format	Lengh	Description
A	sdd mm hh	9	Present latitude s =sign: N for north, S for south dd = degrees mm = minutes hh = hundredths of minutes
B	Sddd mm hh	10	Present longitude s = sign: E for east, W for west ddd = degrees mm = minutes hh = hundredths of minute
C	ddd	3	Track (magnetic): ddd = degrees
D	ddd	3	Ground speed: ddd = knots
E	ddddd	5	Distance to active waypoint: ddddd = nm x 10
G	sdddd	5	Cross track error: s = sign: R for right, L for left of course dddd = distance off course, hundredths of nm NOTE: the cross-track error transmitted is the same as NMEA protocol
I	dddd	4	Desired track (magnetic): dddd = degrees x 10 NOTE: the software does not transmit this information correctly, instead it sends the same as item L
K	ddd[dd]	3 - 5	Active waypoint identifier: ddd[dd] = ASCII waypoint identifier
L	dddd	4	Bearing to active waypoint (magnetic): dddd = degrees x 10
Q	sddd	4	Magnetic variation: s = sign: E for east, W for west ddd = degrees x 10
T	---------	9	Warnings: The 4th character will be an "A" when the navigation data is flagged, otherwise, all characters will be dashed. NOTE: the software always transmits „-----" (all dashes)

Table 10.1.7.2: Aviation protocol

10.1.7.3   Pin assignment COM 3 port for MT-VisionAir X devices

For the pin assignment of the serial COM 31 ports (RS232-Port 1) for 50-pin MDR central connector refer to the following table:

Signal	Pin
COM 3 RxD	20
COM 3 TxD	21
GND COM 1–4	19

Table 9.7.8: Pin assignment COM 3 port

10.2 Connection diagram

At the source selector input must be provided with a selector switch (toggle switch) for HEADING. The MT-VisionAir X autopilot interface is to be operated as a HEADING source.

Central connector MDR 50
Autopilot analog out 1 = PIN 5 = Autopilot heading
= course deviation calculation only

(Autopilot analog out 2 PIN 6 Autopilot altitude n/a)

Autopilot GND = PIN 4 GND for Autopilot output 1 & 2

Mandatory: 1 signal wire for + and –

GPS

Heading Source

GPSS Switch
(separate switch required)

Heading Mode Switch
(selected by
AP-Command Unit
and switched by
AP-Processor)

AP-Command-Unit
e.g.

AP-Processor

Aileron Control Servos

Aileron Control Servos

10.3 Initial operation

10.3.1 Mode of operation MT-Autopilot Guidance
→ AUX
  → AP   interconnection to the autopilot

  → APRTE   autopilot follows the route
  → APDCT   autopilot follows the direct
  → APHDG   input of heading
      to correct an input type in further digits
      Confirm the input with Y
      N terminates and the AP status remains as before

  → APOFF   disconnect the autopilot

10.3.2 AP-Guidance: Status display
APRTE   AP RTE above route information
              (right lower part of the screen)
APDCT   AP DCT same place
APHDG   AP TRK and magnetic track (3 digits)
              (same place) – it is in fact a track, not a heading!

10.3.3 Logic for Termination of Autopilot Guidance

Once the autopilot is in the OFF state, a neutral signal (0 V) is emitted, which leads to a „wing level" status.

When the destination is reached, either at the end of the Direct vector or at the end of the last route segment the status is switched to AP OFF → „Wing level status."

The AP HDG status remains active, there is no terminating condition.

Remarks:

In case of failure of the MT system or of the GPS the control voltage is reset to the neutral value after approximately 3 seconds (no heading change by the MT autopilot module).

10.3.4 Polarity test

In order to check polarity a minimum speed of 5 knots is required, so the functionality should be checked during taxiing.

(1) Turn on all required devices (MT-VisionAir X, autopilot computer, etc.) and select the appropriate input switch of the autopilot computer (e.g. HDG-Mode, Nav Mode, MT-Switch).

(2) Wait for GPS SatFix and switch to FLT mode by pressing <K>.
     Chart is positioned.

(3) Using the following procedure set a Direct to a point left of intended taxi direction (see diagram):
     NAVWPT, choose destination, press DCT.
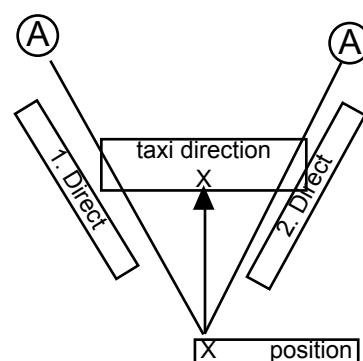
(4) Select <AUX>, <AP> and <APDCT> to activate the autopilot.

   With the aircraft moving in the taxi direction, there is a deviation from the DCT course. In this case the rudder must now be correctly deflected (laterally to the left).

   This is only possible with a ground speed of more than 5 knots.

   At a ground speed under 5 knots the autopilot is deactivated and the rudder is brought into neutral position. The status of the autopilot is displayed instead of "ModeMAP" or "ModeFLT".

Testing the autopilot in the simulator with the aircraft standing still:
Procedure (4) can also be carried out without the aircraft moving using only the built-in simulator. In this case it is not necessary to use a SatFix mentioned in (2).

If the rudder deflection is in the wrong direction, the polarity can be changed using the parameter **Polarity** in the file MTPRO.INI (section [AUTOPILOT]).
The parameter **Polarity** is by default set to "R".
By changing "R" to "L" the deviation voltage can be inverted (see also section MTPRO.INI").

10.3.5 Dynamic calibration

Dynamic calibration is dependent on aircraft type and model, it must be performed for each aircraft as each one reacts differently. As demonstrated in the following diagrams the operation of the autopilot is observed and the following values set in the file MTPRO.INI:

The sensitivity is set to 100 in MTPRO.INI, meaning that the autopilot has a maximum turn rate when **XTE** is 1.25 nm (Nautical Miles).

The value of 250 is suggested by Moving Terrain based on tests and experience. However it can vary with different aircraft types. A sensitivity of 250 means that the sensitivity is set to 250 % and a maximum turn rate is achieved beginning at an **XTE** of 0.5 nm (two-minute turn assumed).

Sensitivity should only be changed if the aircraft tends to oscillate (reduce sensitivity) or reacts sluggishly to course changes (increase sensitivity).

Dynamic calibration can only be performed in flight.

10.3.6   Behaviour of aircraft with various sensitivity settings

Case 1: Oscillatory convergence => Aircraft turns to course slowly
Possible cause: sensitivity set too low.
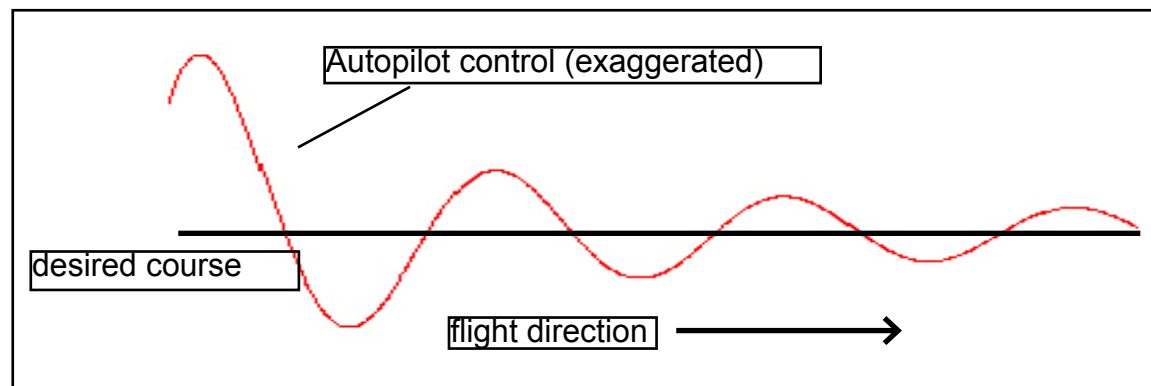
Case 2: Oscillatory divergence => Aircraft tends to oscillate
Possible cause: sensitivity set too high or much too low, e.g. in very unstable aircraft
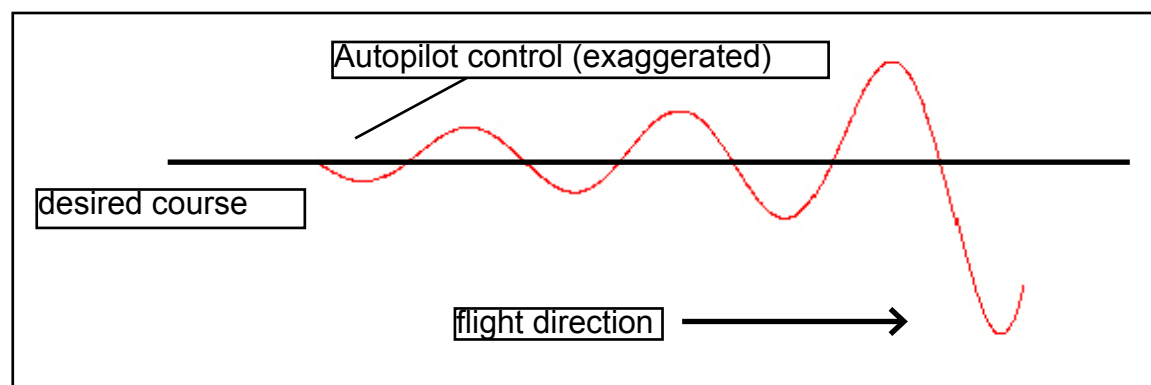
Case 3: Asymptotic behavior => Aircraft intercepts course
=> Sensitivity OK
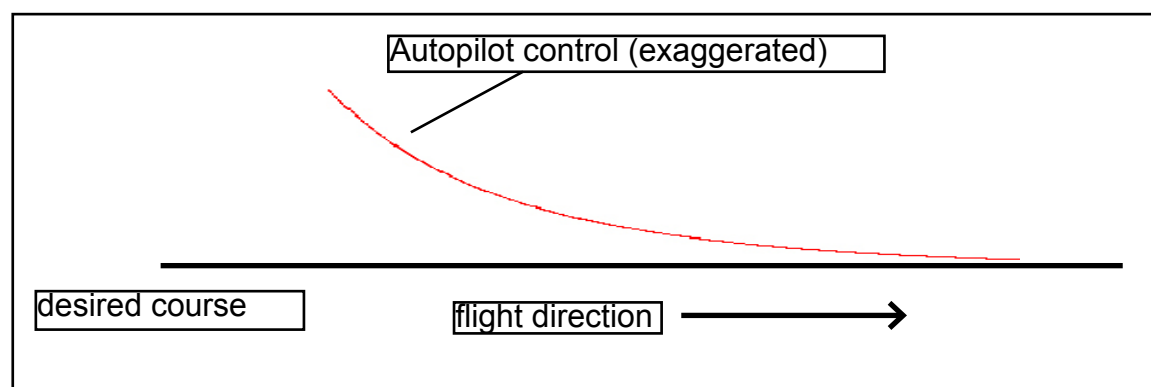
11. MT TCAD Interfaces

This chapter covers the installation (connections and configuration) of the different TCAS interfaces supported by the MT-VisionAir X. When **starting up for the first time after installation of the components,** the connected TCAS unit has to be selected. The selection will be saved for future use.

The selectable TAS sources are displayed by pressing the keys <AUX> <TCAS> → <TAS1SEL> and <TAS2SEL> in the MT main menu each giving the following options:
- **** NOT INSTALLED ****
- **Avidyne/Ryan**
- **ZAON**
- **FLARM**
- **GARRECHT TRX1090**

| NOTE | After a change of a TAS source a restart of the system will be necessary. |

11.1 MT TCAD Interface for Avidyne TAS600 series

11.1.1 System components Avidyne TAS600 series
Views, dimensions and weight

Total view of the components:
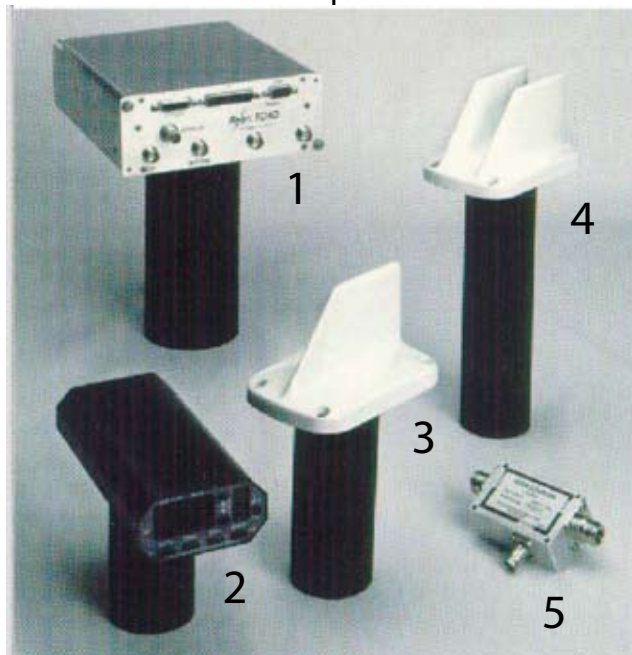
Fig. 11.1.1 (1): View of components

The overall system weight is 4.18 kg.
For a description of the components and the dimensions please refer to the table on the following page.

Dimensions of the components:

Component		Width [cm]	Height [cm]	Depth (with connectors) [cm]
No. in fig.	Name			
1	Processor	18.41	7.87	23.68 (29.65)
2	Operating panel	8.28	3.94	17.15 (21.59)
3	Directional antenna (serial)	8.23		13.06
4	Directional antenna (parallel)			
5	Transponder coupler	4.57	4.07	6.86

Table 11.1.1 (2): Dimensions of components

11.1.2 Avidyne TAS600 series standard installation of antennas

The Avidyne TAS600 series has two double antennas (two serial antennas in a single casing). Together both antennas are responsible for direction determination (bearing).

Type of antenna		Installation location	Diagram
Serial 2 antennas integrated in one casing		top	The diagram of the single casing antenna alternately points forward and back
Parallel 2 antennas parallel side by side		bottom	The diagram of the single casing antenna alternately points left and right.

Table 11.1.2: Installation of antennas

Function

The four different antenna diagrams are wired sequentially. The bearing is calculated from the various signal strengths of the pulses received.

Distance is calculated from the time differential between the transmitted pulse and the received response pulse (as in any secondary radar).

11.1.3 Avidyne TAS600 series installation recommendations for serial antennas (head antennas)

The installation location should be close to the longitudinal axis of the aircraft.
For plastic covers install a ground plane (foil inside)

*   Radius larger or equal 30 cm

*   Diameter larger or equal 60 cm (l = 27 cm)

*   At least 20 cm distance from other antennas.
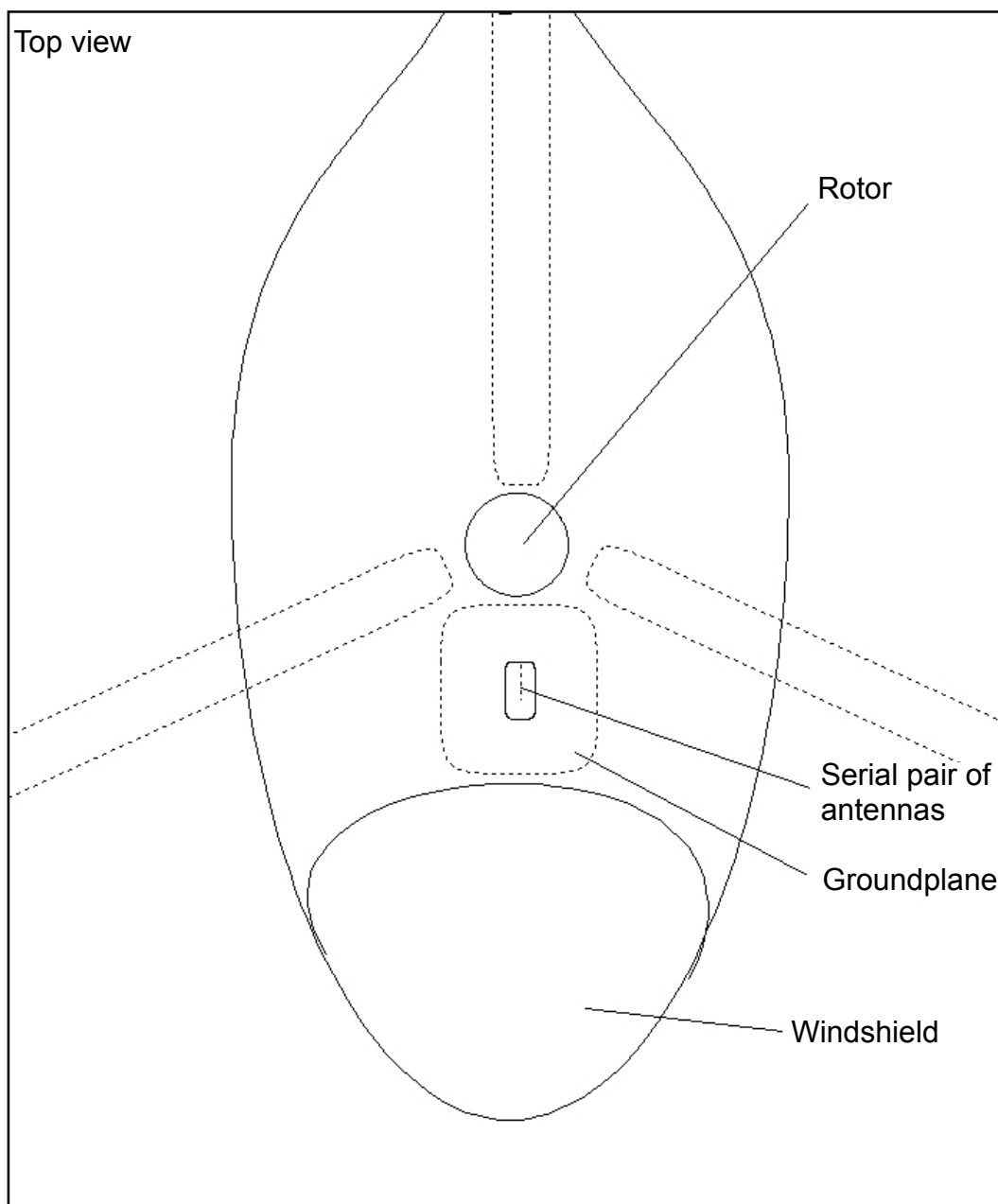
Fig. 11.1.3: Installation recommendation for serial antennas

11.1.4 Avidyne TAS600 series installation recommendations for parallel antennas (lower antennas)

The installation location should be close to the longitudinal axis of the aircraft.

- At least 1 m distance from transponder and DME.

- At least 30 cm distance from other antennas (e.g. glide slope, ILS).

Important:
The installation of both antennas should be symmetrical.
The serial antenna should have free visibility forwards.

Serial pair of antennas in one casing

Parallel pair of antennas
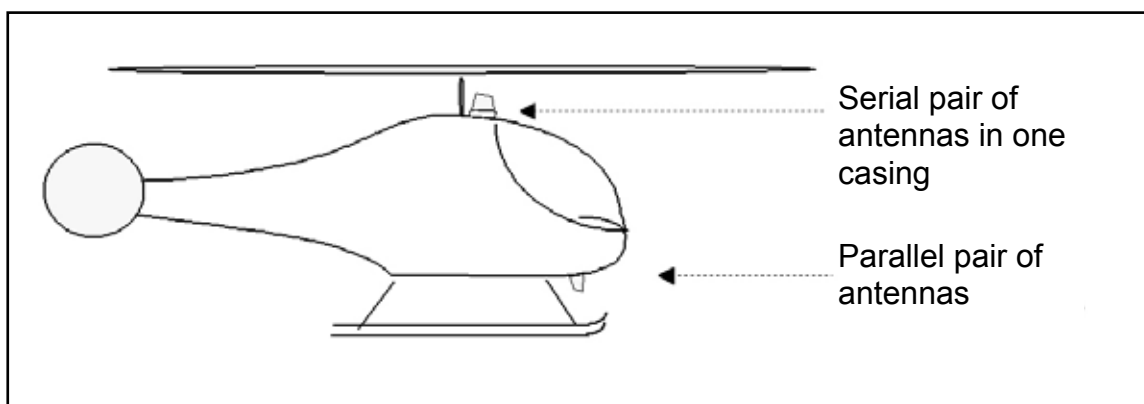
Fig. 11.1.4: Installation recommendation for parallel antennas

11.1.5 Avidyne TAS600 series non-standard installation of antennas

The installation location of the two antenna types may be swapped, e.g. if free forward visibility is not available for the serial antenna on top.

- Example Agusta 109 (pitot tubes mask the upper installation location).

Important:
For a non-standard installation with the serial antennas at the lower location the same recommendations apply as for the standard installation of the parallel antennas:

- Minimum 1 m distance from transponder and DME

- Minimum 30 cm distance from other antennas (e.g. glide slope, ILS)

11.1.6 Connection TCAD (Avidyne TAS600 series)

Any RS-232 port (RX/TX/GND 2, RX/TX/GND 3, or RX/TX/GND 4) on the TAS Processor may be used to connect to MT-VisionAir X (see the wiring diagram in this section).

The transmit line (TX) must be connected to the display receive line, and the receive line (RX) must be connected to the transmit line. Use twisted, shielded pairs or triples. Only one device can be connected to an RS-232 port.

NOTE	Because the MT provides the control to take the TAS out of Ground mode, the "No Avidyne Display" jumper (Pin 15 of J1) need not be grounded.
	The RS-232 transmit and receive lines from MT must be connected to the TAS to meet bi-directional communication requirements. Each display should be connected to its own RS-232 Processor port. There is no distinction of a master or slave display. Do not parallel RS-232 display connections.
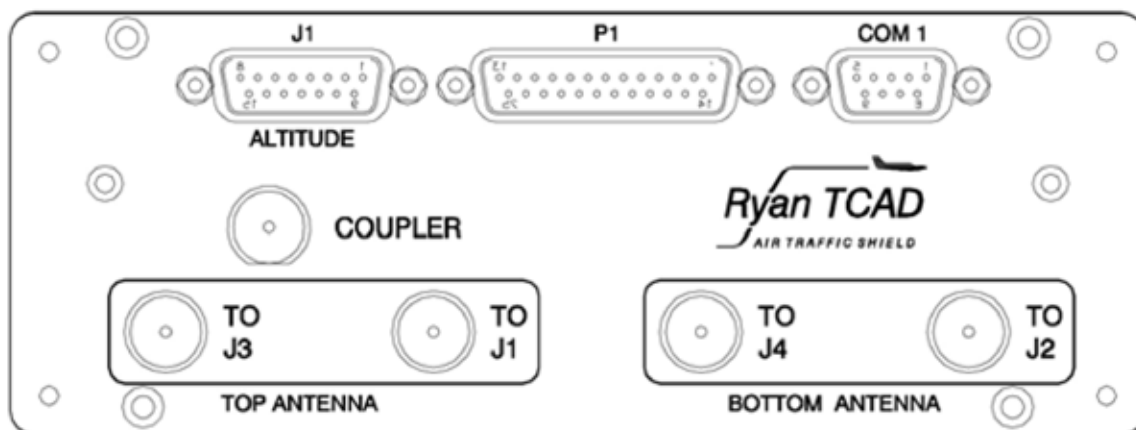
Fig. 11.1.6. (1): TAS processor front panel view

NOTE	The TAS processor antenna terminations must be connected to antennas or appropriate loads before applying power to the processor. Failure to connect the antenna terminations can cause transmitter damage. See manual "Avidyne TAS Installation Manual Revision 4 – October 3, 2005".

The cabling must be Null Modem crossover, i.e.

TCAD	VX
RxD – TxD	
TxD – RxD	

Wiring diagram for the TAS processor, P1
(as in "Avidyne TAS Installation Manual Revision 4 – October 3, 2005", page 45, figure 21)
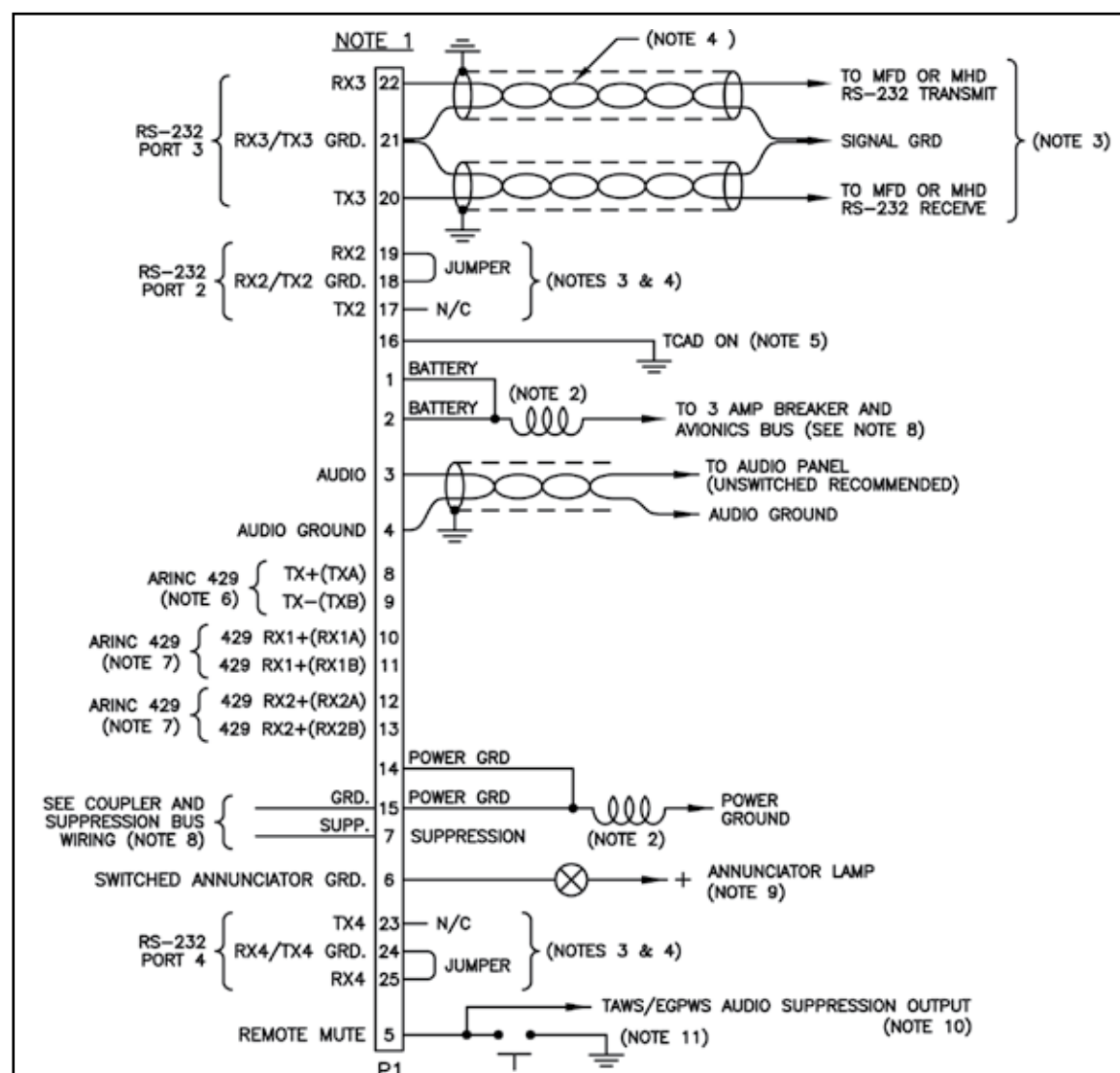
Notes
1. For Installations in high EMI/RFI environments, shielded cable or overall braided shield should be used for all interconnections. The shield should be grounded at the Processor end only.
2. Supplied Inductors. Mount as close to P1 as practical.
3. Any RS-232 port can be used for a display. Jumper as shown if the port is not to be used. Transmit and receive lines must be connected to each display to meet "handshake" requirements. Do not parallel connections. The signal ground should be connected to the signal ground at the display.
4. Shielded, twisted pairs may be used for RS-232 connections. Multi-conductor twisted/shielded cable may be used.
5. Pin 16 of P1 must be grounded for operation. It can be routed through a switch on the panel, or permanently grounded to permit turning the system on through the avionics master (the system can then be isolated by the circuit breaker).
6. ARINC 429 output for compatible displays. See paragraph 1.13.
7. Accepts ARINC 429 labels. See paragraph 1.13. Both inputs must be high or low speed. No configuration is required.
8. See Figure 13 for unidirectional suppression. Otherwise connect suppression directly to the bus as shown in Figure 24.
9. Pin 6 supplies a ground when the Annunciator light should be illuminated. The current limit is 1A maximum. The light is normally white and is labeled "Traffic" or "Traffic Alert".
10. If audio muting is necessary for priority of announcements, use this audio suppression output to mute the TAS (Processor part number suffix of -5 and subsequent). The line is pulled low to mute the TAS. If the TAWS/EGPWS drives or pulls the audio suppression output high, then the output must be diode isolated.
11. The remote mute input is required except when the Avidyne ½ 3ATI Traffic Display is used. The switch is momentary.

Fig. 11.1.6 (2): Wiring diagram for TAS processor

11.1.7 Pin assignment COM 1 port for MT-VisionAir X devices

For the pin assignment of the serial COM 1 ports (RS232-Port 1) for 50-pin MDR central connector refer to the following table:

Signal	Pin
COM 1 RxD	45
COM 1 TxD	46
GND COM 1–4	19

Table 11.1.7: Pin assignment COM 1 port

NOTE	If only one TAS source is connected TAS1SEL has to be used, the output port is COM1. If 2 different TAS sources are selected, the output port for TAS1SEL is COM1, for TAS2SEL it is COM3.

11.1.8 Configuration for the operation of the Avidyne TAS600 series with Moving Terrain

Display as MFD (Multi-Function Display) without Avidyne display.

1) Preconditions for the certified operation of the device are:

• Annunciator light (labeled "Traffic" or "Traffic alert") must be installed.

• Mute switch (labeled "Mute/Update") must be installed.

• Feed into the audio system of the aircraft

• MFD is optionally certified.

2) Configuration

See "Avidyne TAS Installation Manual Revision 4 – October 3, 2005, page 34, Figure 11: Block Diagram of Electrical Wiring".

a) 1 switch ON/OFF to GND
   Can be replaced with a permanent ground wire and + to the unit (permanent power)

b) 1 switch Mute to GND (warning signal only to be interrupted, not switched off)
   • The mute switch must be within easy reach of the pilot.
   • The mute switch interrupts the optical and acoustic warning for a certain period.
   • The mute switch does not turn off the loudspeaker nor the TCAD.

c) 1 switch for annunciator light to GND

d) Connection to the audio system of the aircraft

e) Optional: gear down switch or weight-on-wheel switch
   (also works without a gear down/ w.o.w. switch due to recognition of

the altitude change from the altitude encoder)

Important: Apply power to the transmitter (including the Ryan TCAD) only when antennas (or substitute resistors) are connected!

11.1.9 Selection of the TAS source in MT program

(1) Press keys <TCAS> → <TAS1SEL>
(2) Select **Avidyne/Ryan** via pressing <UP> / <DOWN>.
     Press <USE> to confirm your selection.

NOTE	After a change of a TAS source a restart of the system will be necessary.

11.1.10 Entry in mtpro.ini

Check by pressing Shift+1
[TCAS]
PORT = 1

11.1.11 Testing of Avidyne TAS600 series

To start the system press the keys <TCAS> → <ON>.

To watch incoming data a simulated move of the aircraft is necessary. Please start the SIMULATION mode by pressing: <AUX> → <TRACK> → <SIM ON>.

The simulation starts with course 227°, speed 100 kts and altitude of 8000 ft.
As soon as transponder signals will come in, they will be displayed on the chart or in MFD mode.

How to adjust the simulator?

Turn
   L or X   Left turn: each key press turns the aircraft to the left
              0,2 degrees.
   M or Y   Right turn: each key press turns the aircraft to the right
              0,2 degrees

Please check the infobox to find out the current MT (Magnetic track).

Altitude

J or 1	Decrease altitude by 100 feet
I or 2	Increase altitude by 100 feet

Speed

H or 3	Increase ground speed by 10 knots
G or 4	Decrease ground speed by 10 knots (limited to 10–4000 knots)

Check the status message in the status window on the left rim:

• TCAS Avidyne OK: the reception of TCAS data is approved.

• NO DATA : no reception of TCAS data.
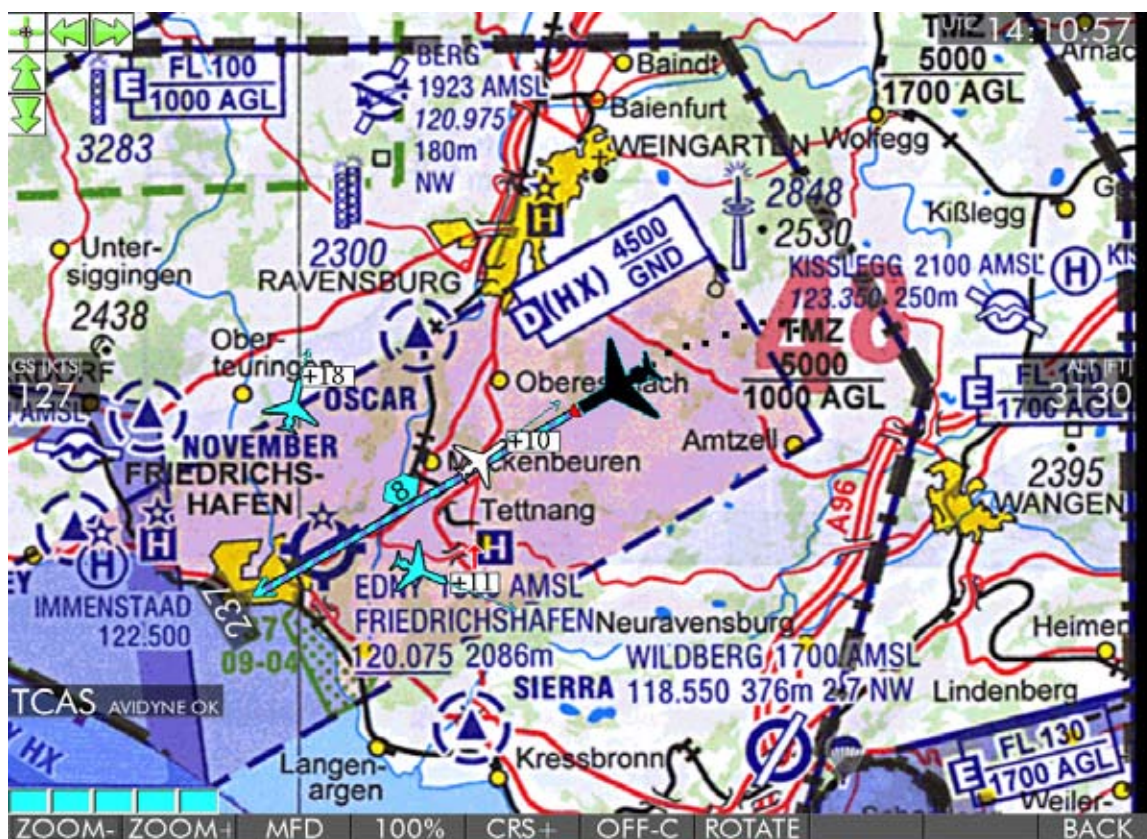
Fig. 10.1.10: TAS monitoring screen

Key	Function
ON/OFF	Turning ON / OFF of TAS 6XX monitoring
UNR	TAS 6XX in UNRESTRICTED MODE
GND	TAS 6XX in GROUND MODE
TAS1SEL	Selection of TAS source
BACK	Back to further options / main menu of MT program

Table 10.1.10: Description of keys and functions on TAS monitoring screen

11.2 ZAON Interface (discontinued from 2015 on)

11.2.1 Necessary equipment for the use of ZAON XRX

Required cable: standard 1:1 RS232 cable with male and female connector

11.2.2 Pin assignment COM 1 port for MT-VisionAir X devices

Signal	Pin
COM 1 RxD	45
COM 1 TxD	46
GND COM 1–4	19

Table 11.2.2: Pin assignment COM 1 port

NOTE	ZAON XRX interface can not be combined with other TAS sources and has to be connected to COM1.

11.2.3 Configuration of ZAON XRX

Besides the standard configuration like operating range, type of aircraft, etc. make sure that the ZAON XRX sends data via the COM port.

Procedure:

(1) Switch ZAON XRX on.

(2) Agree to the warning notice.

(3) Press key <MENU> to display the selection menu.

(4) Select **COM** via pressing <UP> / <DOWN>.
Press <MENU> to confirm the selection.

(5) Select **Profile 1** via pressing <UP> / <DOWN>.
Press <MENU> to confirm the selection.

(6) Select **Exit** via pressing <UP> / <DOWN>.
Press <MENU> to confirm the selection.

The configuration of the ZAON XRX for the use with MT is finished.

11.2.4 Starting up / Testing of ZAON interface

(1) Connect MT and ZAON XRX with a standard 1:1 RS232 cable.

(2) Switch on MT and ZAON XRX in any order.

(3) Press key <TCAS> in the MT Menu.
When **starting up for the first time,** choose the connected TCAS unit (ZAON) with <TAS1SEL>. The selection will be saved for future use.

(4) After that, activate the display on the MT unit by pressing the keys <TCAS> → <ON>.

(5) Check the status message in the status window in the upper left corner.

Possible status messages:

- TCAS DATA OK: the data transmission from the ZAON XRX is successful.

- NO DATA: no data transmission from ZAON XRX.
  In this case check the following items: cable connection, protocol-settings:

11.2.5 The graphic display

The white text in the aircraft symbols shows the difference in height between your aircraft and the traffic. The number (e.g. 22) stands for 2200 feet.

Fig. 11.2.5: ZAON monitoring screen

Because of the strong bearing deviation specified by ZAON (±45°), the display of aircrafts is realized as an arc with an opening angle of 90°.
The width of the arc depends on the distance of the aircrafts to be depicted and the scale of the map used. ZAON gives the following tolerance values:

Distance [nm]	Tolerance [nm]
> 6.0	± 1–2
3.0–5.9	± 1
2.0–2.9	± 0.2–0.5
1.0–1.9	± < 0.2
< 1.0	± 0.1

Table 10.2.5 (1): ZAON tolerance values

The colour of the arc is defined by the relative height and the distance to your aircraft.

Aircraft (position)	Colour
Above the critical cylinder	blue
Below the critical cylinder	brown
Within the height of the critical cylinder, distance out of danger zone	white
Within the critical cylinder, dangerously close	red

Table 11.2.5 (2): Display of ZAON data

11.3 MT-PowerFLARM Interface

It is recommended to use Powerflarm Core device. Refer to PowerFLARM Core Manual EN, Version 150 here: http://flarm.com/support/manuals-documents/

11.3.1 Connector layout for RS232 Connector on Powerflarm Core:
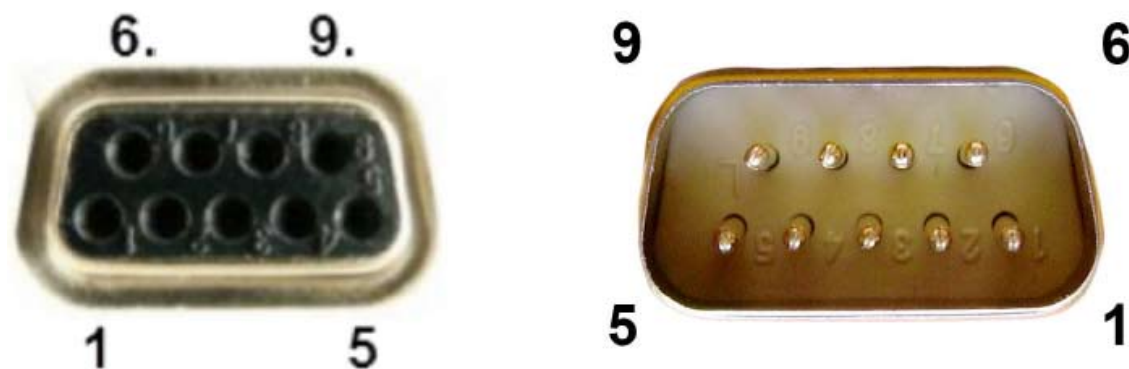
Fig. 11.3.1: RS232 connector Powerflarm Core

1: Audio OUT (referenced to GND; H/W versions >= 1.1 only)
2: TX, Core sends (RS232)
3: RX, Core receives (RS232)
4: Do not connect
5: GND
6: Do not connect
7: +12 to +28VDC power supply
8: Core supplies +5VDC for PDA
9: Core supplies +3VDC for display Pin

Pin 2 transmits NMEA-0183 Version 2.0 data at a configured data rate (default is 19,2kBaud)

11.3.2 Adjustments for connection to MT VisionAir X

Set Baud rate to 38400.
Use protocol version 61.See http://flarm.com/wp-content/uploads/2015/12/FTD-14-FLARM-Configuration-Specification-1.03.pdf, p. 9f.

11.3.3 Connection to 50-pin MDR central connector for MT-VA X

Please install to the connector as given in layout for COM 1:

Signal	Pin
COM 1 RxD	45
COM 1 TxD	46
GND COM 1–4	19

Table 11.3.3: Pin assignment COM 1 port

NOTE	If only one TAS source is connected TAS1SEL has to be used, the output port is COM1. If 2 different TAS sources are selected, the output port for TAS1SEL is COM1, for TAS2SEL it is COM3.

11.3.4 Entry in mtpro.ini

Check by pressing Shift+1
[TCAS]
PORT = 1

11.3.5 Settings in MT program

- TCAS rights must be set: Please contact MT.
- FLARM is to be set in TAS sources as follows:

    (1) Press keys <TCAS> → <TAS1SEL>.
    (2) Select **FLARM** via pressing <UP> / <DOWN>.
    This selection is necessary when connecting PowerFLARM.
    Press <USE> to confirm your selection.

NOTE	After a change of a TAS source a restart of the system will be necessary.

11.3.6 Activating of PowerFLARM traffic warning
To start the system press the keys <TCAS> → <ON>.

11.3.7 Testing of PowerFLARM interface

Testing procedure is the same as for the MT TCAS Interface for Avidyne TAS600 series. Refer to section "8.1.10 Testing of Avidyne TAS600 series".

Check the status message in the status window on the left rim.

Possible status messages:

*   TCAS FLARM OK: the data transmission from PowerFLARM is successful.

*   NO DATA: no data transmission.

PowerFLARM sends this airtraffic types:

Type of signal	Symbolics on MT display
FLARM	airtraffic shown at position as diamond or aircraft symbol
ADS-B	airtraffic shown at position as diamond or aircraft symbol
Transponder Mode C	undirected airtraffic, shown as range ring
Transponder Mode S	undirected airtraffic, shown as range ring

Table 11.3.7 (1): Display of signals detected by PowerFLARM
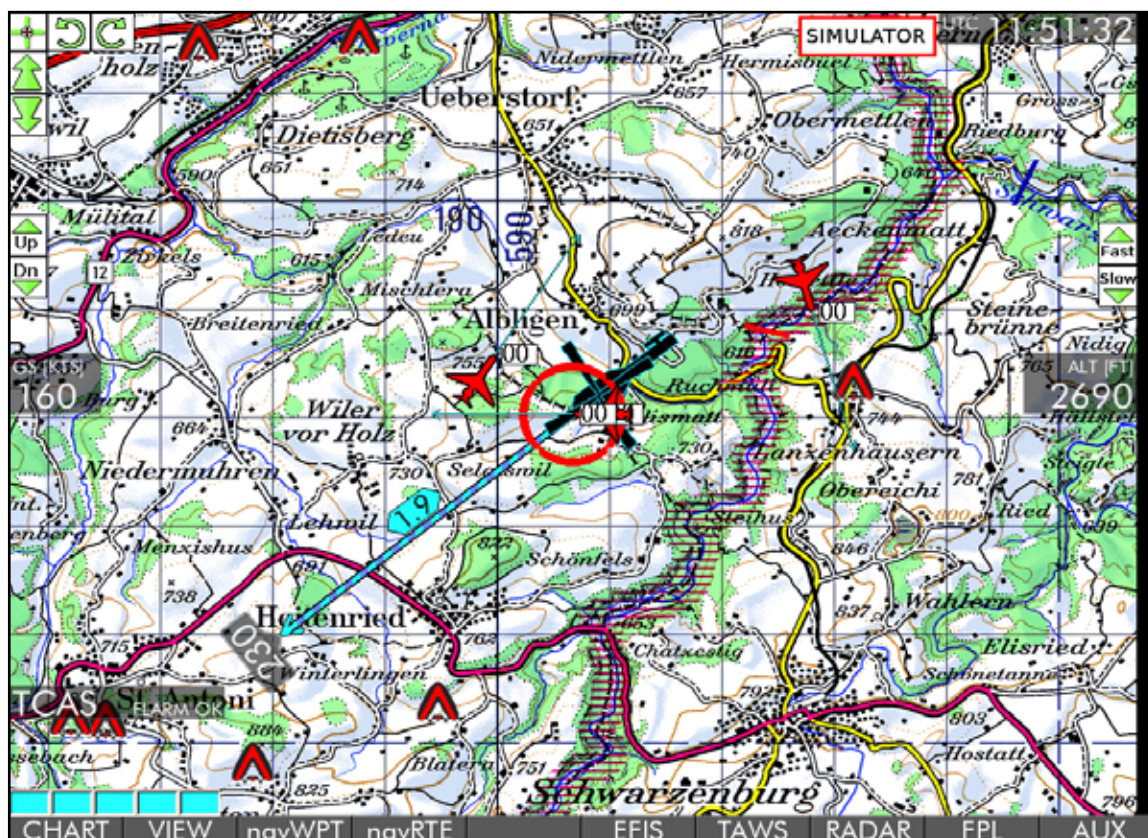
Fig. 11.3.6: PowerFLARM monitoring screen

Air traffic within the optical range of the PowerFLARM sensor is displayed on the chart in relation to the terrain.

If the scale of the chart is too detailed to display all detected aircraft the symbols are displayed on the rim of the screen in correspondent position.

To see the position of the airtraffic on the chart choose → ZOOM → ZOOM-

Color coding of traffic deteced by PowerFlarm for all types of signals

Aircraft symbol	Colour
Above the critical cylinder	blue
Below the critical cylinder	brown
Within the height of the critical cylinder, distance out of danger zone	white
Within the critical cylinder, dangerously close	red

Table 11.3.7 (2): Display of PowerFLARM data

11.4 Combination of Avidyne TAS600 series Interface with PowerFLARM Interface

11.4.1 Requirements for parallel use of interfaces

Requirements MT

- TCAS rights for combined use must be set: Please contact MT.

Settings in MT program

(1) Press keys <AUX> → <TCAS> → <TAS1SEL>.
(2) **Avidyne/Ryan** via pressing <UP> / <DOWN>.
    Press <USE> to confirm your selection.
(3) Press keys <AUX> → <TCAS> → <TAS2SEL>.
(4) Select **FLARM** via pressing <UP> / <DOWN>.
    Press <USE> to confirm your selection.

NOTE	After a change of a TAS source a restart of the system will be necessary.

COM Port selection

Selected Source	COM Port
AVIDYNE/RYAN	1
FLARM	3

Table 11.4.1: COM Port selection for combined TAS sources

11.4.2 Entry in mtpro.ini

Check by pressing Shift+1
```
[TCAS]
PORT = 1

[TCAS2]
PORT = 3
```

11.4.3 Connections to TAS sensors

Refer to the explanations in the the prior chapters.

COM 1 pin assignment for Avidyne TAS600 series on 50-pin MDR central connector of MT-VisionAir X

COM 3 pin assignment for PowerFLARM core on 50-pin MDR central connector of MT-VisionAir X

Signal	Pin
COM 3 RxD	20
COM 3 TxD	21
GND COM 1–4	19

Table 11.4.2 (2): Pin assignment COM 3 port

11.4.4 Inital operation of the combined signal interface of Avidyne/Ryan TAS signal with PowerFLARM signal

(1) Start the system.

(2) Allow GPS reception (from Fast Integral GPS)

(3) Start TCAS by pressing <AUX> → <TCAS> → <ON>.

(4) Check the status message in the status window on the left rim.

Possible status messages:

• TCAS AVIDYNE FLARM   Installation successful, all data transmitted.

• TCAS NO DATA   Both TAS sources failed, installation not successful.
• TCAS FLARM   Only FLARM data are transmitted.
• TCAS AVIDYNE   Only Avidyne data are transmitted

11.5 GARRECHT TRX1090 Interface

The use of a TRX-1090-ADS-B receiver is supported by MT VisionAir X.

For connection and configuration of this interface please contact the customer's service at Moving Terrain.

NOTE	GARRECHT TRX1090 interface can not be combined with other TAS sources and has to be connected to COM1.

12. MT Stormscope

12.1 System components

MT-Stormscope requires the following components:

Hardware
*   MT-VisionAir X with COM port for data transfer
*   GPS receiver (MT Fast Integral GPS recommended) with antenna
*   WX-500 / WX-670 Sensor with data transfer cable and antenna

Software
*   MT-Stormscope display software

12.2 Block diagram

The components of the system must be correctly connected:
* Connection for power and GPS to the MT-VisionAir X are explained in the basic manual.

* Connection of the antenna, WX-500 / WX-670 and power supply for the WX-500 / WX 670 shown in the appropriate operation manuals.

* For the connection of the WX-500 / WX-670 sensor with the planned and labelled COM port (COM 4) that is fed out to MT-VisionAir X unit. A crossed RS232 data cable must be used.

12.3 Pin Assignment
COM 4 pin assignment for WX-500 / WX-670 on 50-pin MDR central connector of MT-VisionAir X

Signal	Pin
COM 4 RxD	22
COM 4 TxD	23
GND COM 1–4	19

Table 12.3 : Pin assignment COM 4 port

12.4 Entry in mtpro.ini

```
[STORMSCOPE]
PORT = 4
```

13. MT-VGA-Output Device for external screens

13.1 Technical description

Seperate device MT-VGA-Output Device, PN MTEX/HW-22-00
USB connection to the unit

Further parts needed:
VGA cable (not part of the delivery) to connect the external screen

We recommend to connect "MT Passenger Entertainment and Information System" with 10,4" screen and mounting - DO 160 tested, PN MTEP/ES-00-00.
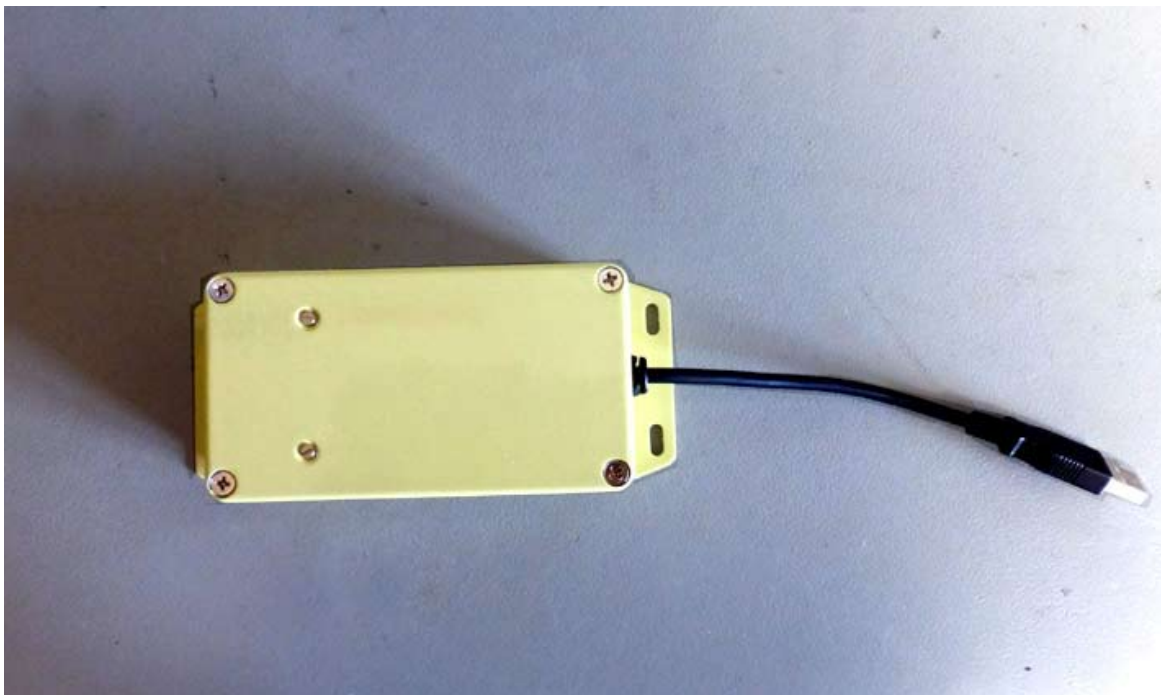
13.2 Connection to MT-VisionAir X via USB

The USB is to be connected to the central connector MDR50
The MT-VGA-Output Device is powered by MT-VisionAir X (USB connection).
Interlock the USB plug connection with a bracket or tape against vibrations to ensure continous power supply.

13.3 Usage

No inputs required!

13.4 Dimensions in mm

Top View of Assembly

Flanged Lid

SECTION A-A
End View of Assembly

A

A

B

B

50.50

55.45

(Inner Box Width)

4.25

102.00

SECTION B-B
Side View of Assembly

Flanged Lid

112.00

31.00

27.00

2.00

(Inner Box Height)

(Wall Thickness)

106.95

(Inner Box Length)

Box

Lid

C

SECTION C-C
Side of Slot

2.00

60.50

37.25

(Center Distance)

10.50

16.25

6.00

124.00

C

138.00
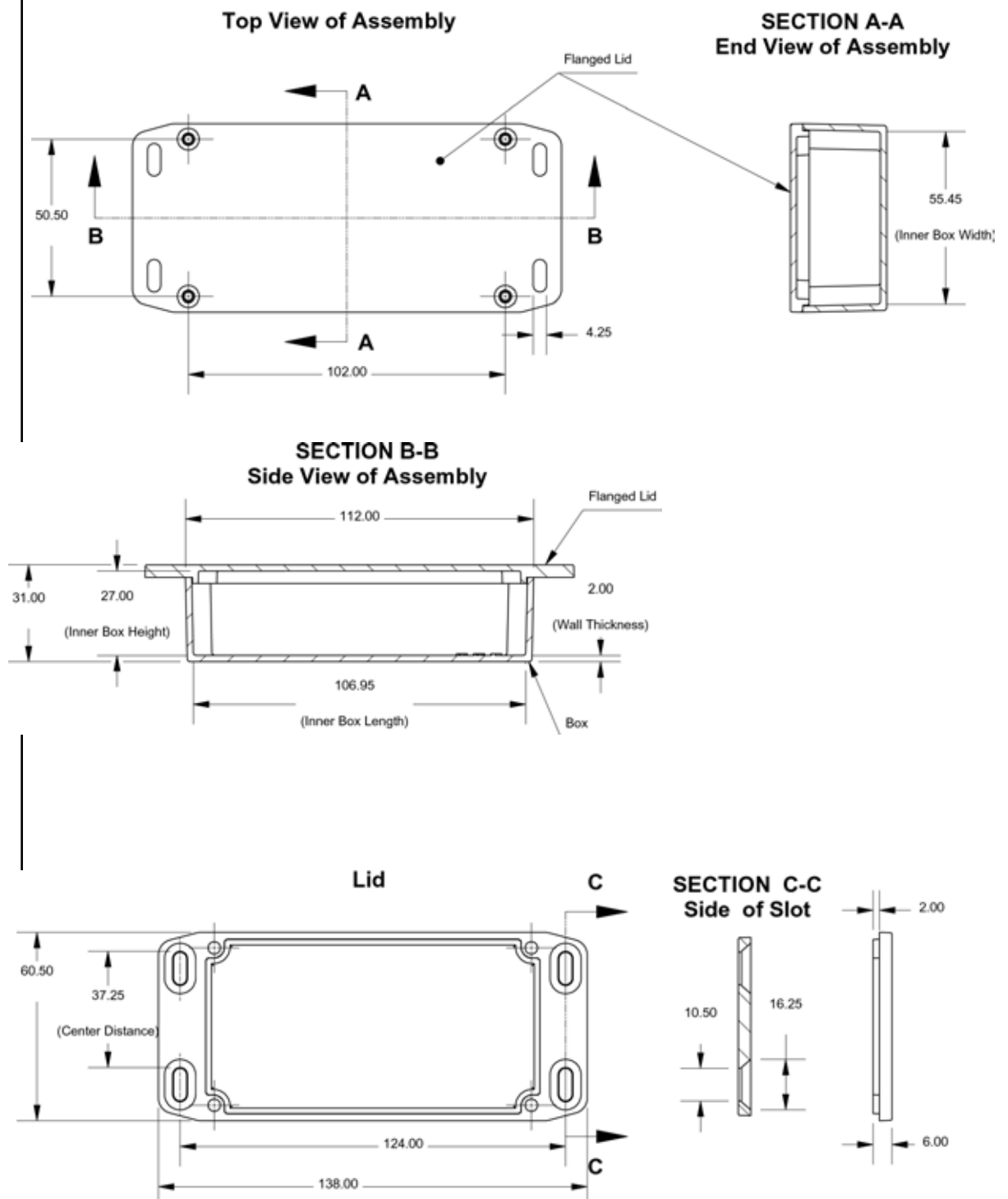
13.5 Functional Diagram

External Screen
   Power   VGA

MT-VGA-Output
   VGA

MT-VisionAir X: central connector with
   USB   Power   Fast Integral GPS

13.6 Connection USB to MDR 50 central connector

see "Installation manual for MT-VisionAir X" PN MTEX/IA-62-07.

13.7 Installation advices for simultanous operation of MT-Video-Input Device and MT-VGA-Output Device

If both devices are in use, one of it has to be connected to an USB port on the rear side of the unit.

We recommend to connect the MT-Video-In Device to the rear USB on the left side with the longer tunnel.

The Easy mount must be modified: a notch must be cut out to lead the USB cable through. Please see pictures for the recommended placing which will not effect the stability and functionality of the Easy Mount.
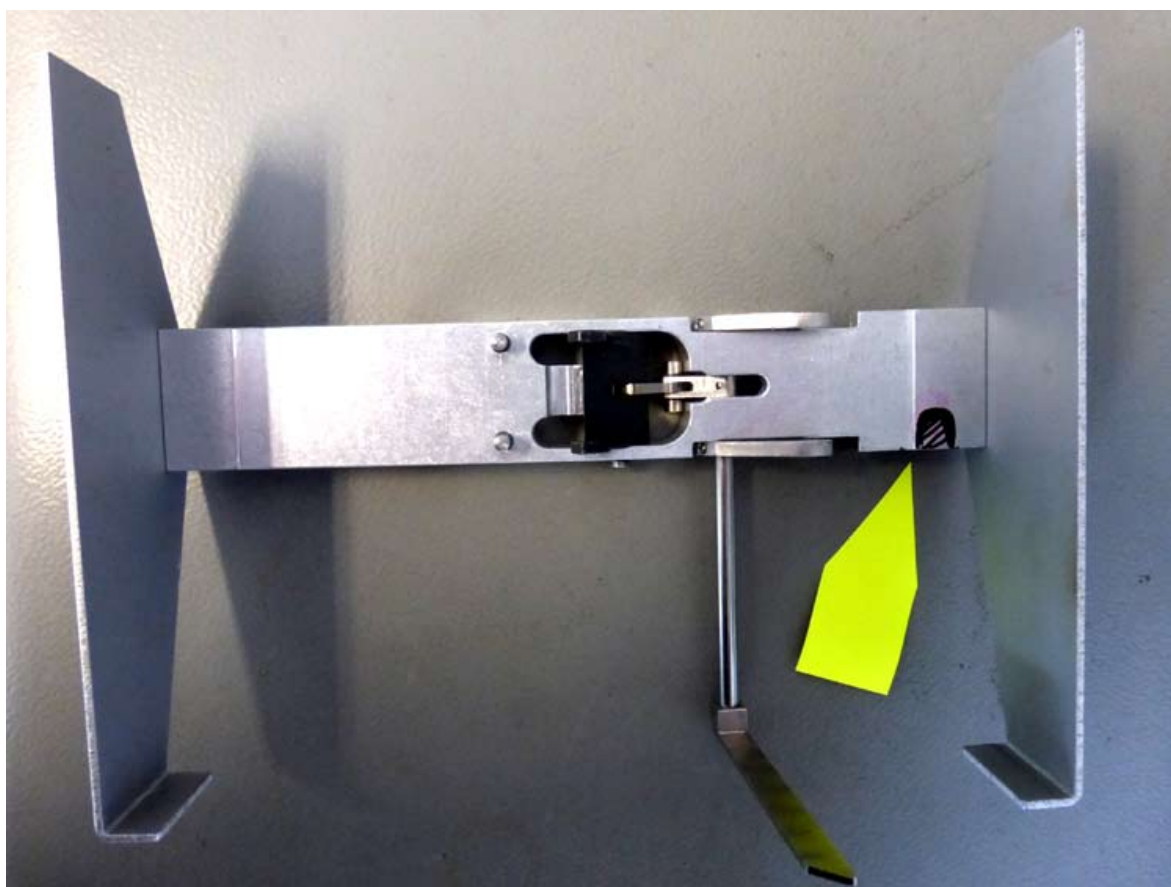
Easy mount with marked notch (front view total)

Easy mount with marked notch (front view detail, turned 90° counter clockwise)
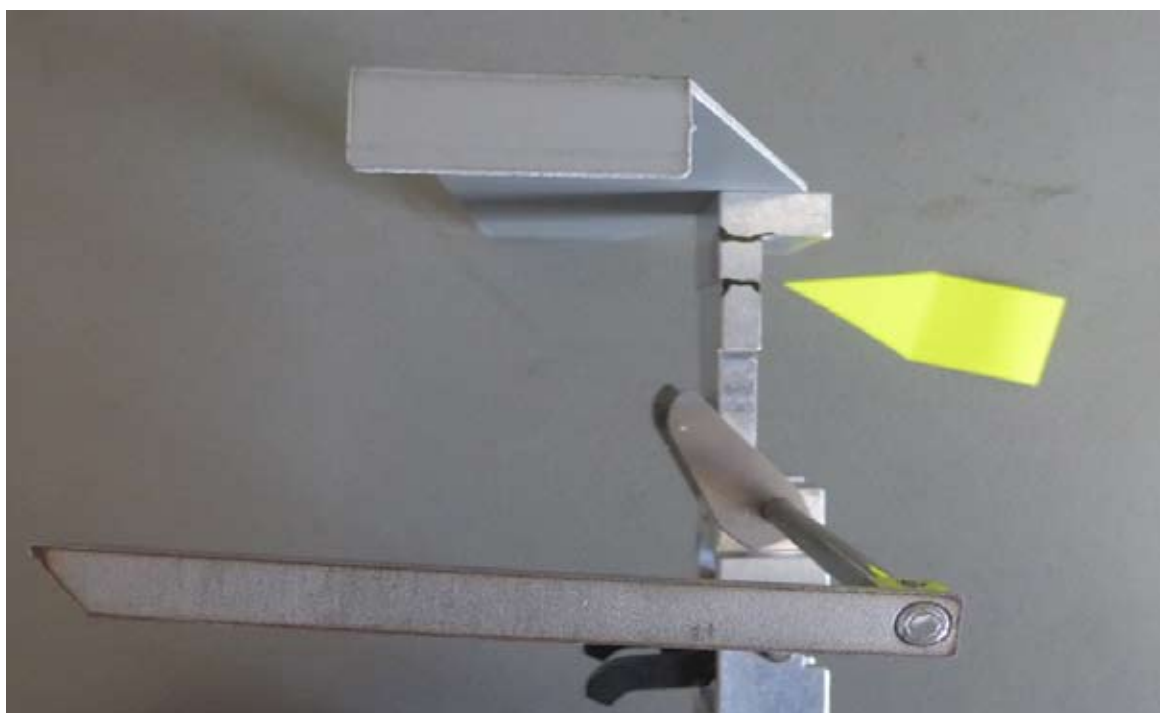
Easy mount with marked notch (bottom view)

14. MT-DVI Output Device for external screens

14.1 Technical description

Seperate device MT-DVI-Output Device, PN MTEX/HW-27-00
USB connection to the unit

Further parts needed:
DVI cable (not part of the delivery) to connect the external screen

MT-DVI Output Device top view

DVI output

14.2 Prerequisites

OS 13.5 for MT VisionAir X.
SW Version 6.0 or higher.
MT VGA must be enabled.

14.3 Connection to MT-VisionAir X via USB

The USB is to be connected to the central connector MDR50
The MT-DVI Output Device is powered by MT-VisionAir X (USB connection).
Interlock the USB plug connection with a bracket or tape against vibrations to ensure continous power supply.

14.4 Usage

No inputs required!

14.5 Dimensions in mm

Top View of Assembly

Flanged Lid

A

B   B

A

50.50

102.00

4.25

**SECTION A-A
End View of Assembly**

55.45

(Inner Box Width)

**SECTION B-B
Side View of Assembly**

112.00

Flanged Lid

31.00   27.00

(Inner Box Height)

2.00

(Wall Thickness)

106.95

(Inner Box Length)

Box

Lid

C

60.50

37.25

(Center Distance)

124.00

138.00

C

**SECTION C-C
Side of Slot**

2.00

10.50   16.25

6.00
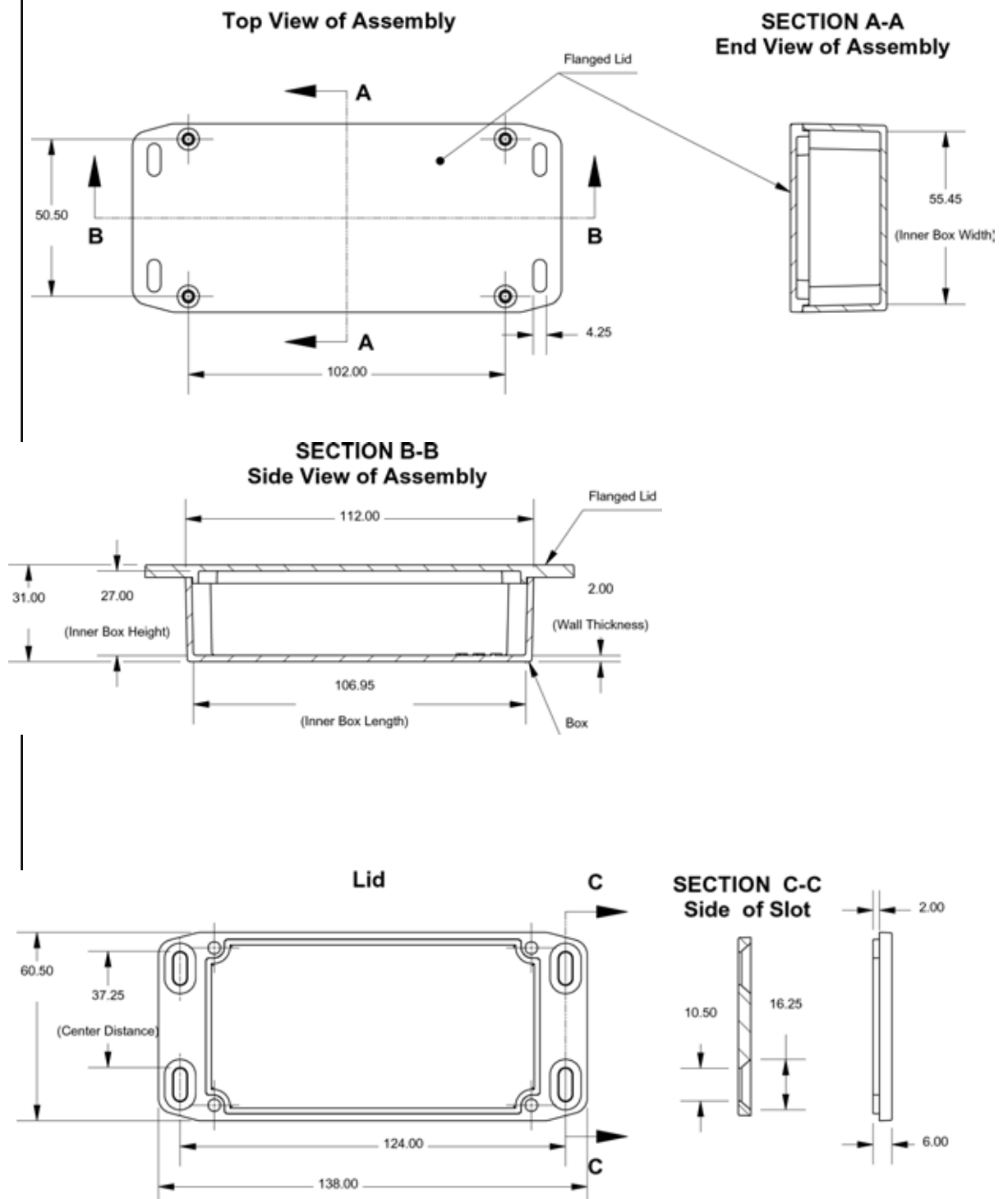
14.6 Functional Diagram

14.6 Connection USB to MDR 50 central connector

see "Installation manual for MT-VisionAir X" PN MTEX/IA-62-07.

15. MT Video Input Device (MT Camera)

15.1 Technical description

Seperate device

Connection to MT-VisionAir X via USB

Power supply via MT-VisionAir X (USB connection)

Processible signals: Composite Video (FBAS, RS 170)
                         PAL
                         NTSC

Input: 1 x FBAS (composite video input, 75 Ohm) via BNC
                Cinch connection via BNC-Cinch adapter possible

Displaying: Full screen in 4: 3 format with max. resolution 1024 x 768 pixels

15.2 Directions for use

Usage via hotkey "C"   =   on the frame keyboard

C switch to video in
C switch back to MFD screen with Moving Map functions

15.3 Dimensions in mm

Top View of MT Video Input Device Flanged Lid

A

50.00

40.50

B

B

A

90.50

126.50

SECTION A-A

25.50

45.23

(Inner Box Width)

19.00

(Inner Wall Height)

SECTION B-B
Side View of MT Video Input Device

6-32 UNC
⌴ Ø4.00 � 3.00
(Threaded Holes)

Flanged Lid

1.90

(Wall Thickness)

20.70

95.23

Box

(Inner Box Height)

(Inner Box Length)

Flanged Lid

4.00

1.45

Ø3.50

10.50

C

42.90

25.00

92.90

(Center Distance)

9.00

C

113.00
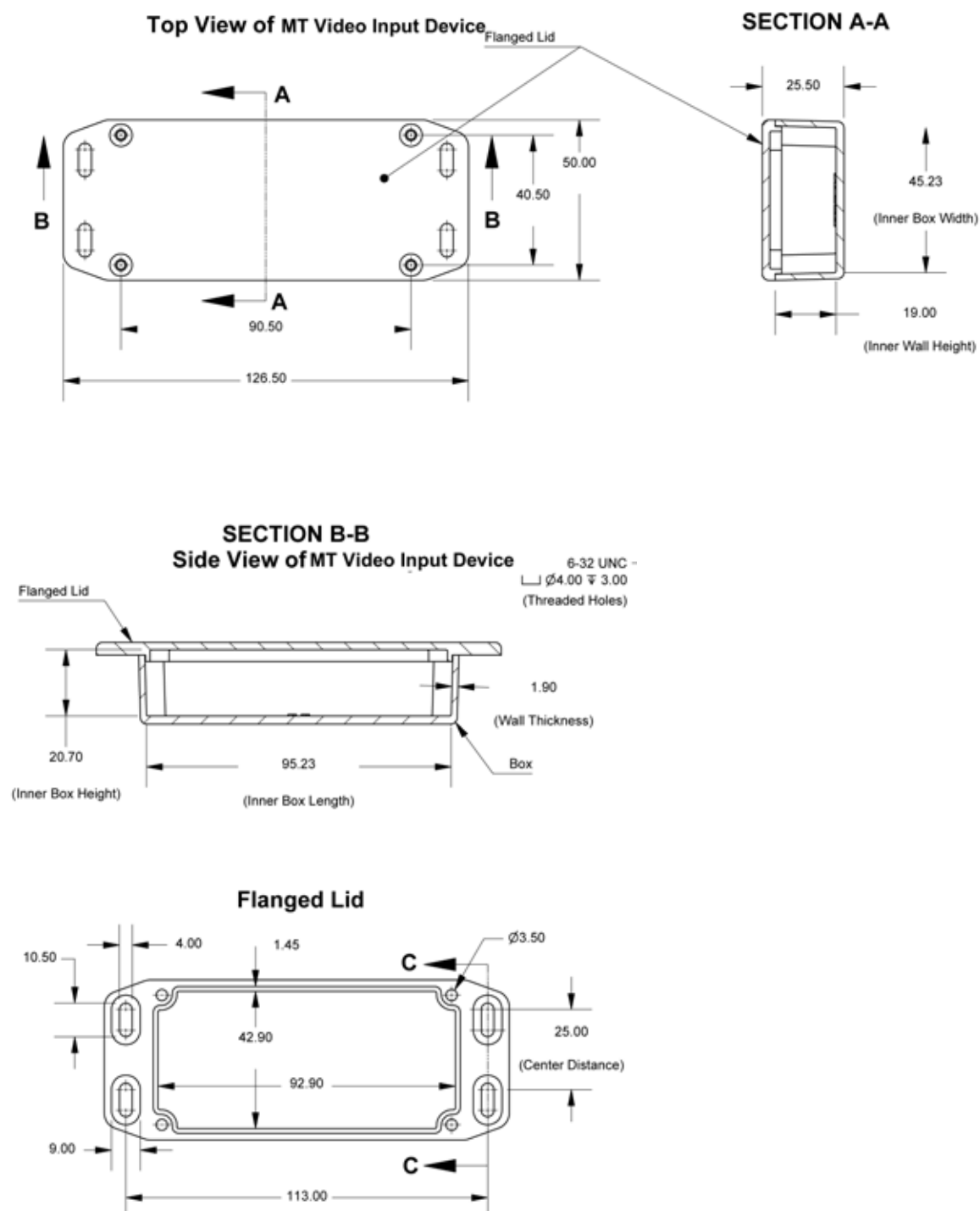
15.4 Adaptation of parameter in mtpro.ini

15.4.1 How to access the mtpro.ini for setting the parameters

• Connect USB keyboard (no need to connect the mouse)

• Press SHIFT + 1 (or the equivalent keyboard combination to print an exclamation mark, "!")

• The configuration editor will appear full screen

• After making the desired changes to the configuration, press:

• CTRL + X, then Y and finally ENTER to exit the editor and confirm the changes

The editor closes and Moving Terrain program resumes full screen.
It is now necessary to restart the unit to reread the new configuration.

15.4.2 MT-Camera Parameters

Parameters in mtpro.ini, section [CAMERA].
Note: If this section is not in the file, add it, make sure you use squared brackets.

Parameter	Possible values	Description
profile=	(empty)	Generic PAL video source This is the „factory default" and the software assumes this setting if the „Profile" entry is not found
	maxviz	Selects the Max Viz IR camera (video standard: NTSC) 3
	maxviz-rot180	Same as „maxviz", but the image is rotated upside-down

Table 14.4.2: Parameter for MT-Camera in mtpro.ini

Example:

```
[CAMERA]
profile=maxviz-rot180
```

16. MT-VGA-Input Device

16.1 Technical description

Seperate device MT-VGA-Input Device, PN MTEX/CA-15-00
Cables: 1. VGA cable
               2. Special USB cable (blue, mounted to MT-VGA-Input Device)

16.2 Connection to MT-VisionAir X

Connection 1: VGA from external computer to MT-
VGA-Input Device, PN MTEX/CA-15-00

Connection 2: Special USB cable to one of the direct USB
ports of MT-VisionAir X on the rear side.

16.3 Prerequisites

OS 13.5 for MT VisionAir X.
SW Version 6.0 or higher.
MT Camera must be enabled.

16.4 Directions for use

Usage via hotkey "C"   =   on the frame keyboard (normal keypress, not hold)

C   switch to VGA input
C   switch back to MFD screen with Moving Map functions

15.5 Dimensions MT-VGA-Input Device in mm

Top View of Assembly

148.00
[5.827]

109.50
[4.311]

A

B

70

B

84.00
[3.307]

94.00
[3.701]

Flanged Lid

A

**SECTION A-A
End View of Assembly**

34.00
[1.339]

87.16
[3.432]
(Inner Box Width)

27.75
[1.093]
(Inner Wall Height)

**SECTION B-B
Side View of Assembly**

29.75
[1.171]
(Inner Box Height)

Flanged Lid

Box

2.25
[.089]
(Wall Thickness)

112.66
[4.435]
(Inner Box Length)

Top View Looking Inside Box

6-32 UNC
⌴ Ø3.50 ⍌ 3.00
(Threaded Holes)

115.00
[4.528]

89.50
[3.524]

78.00
[3.071]

HAMMOND
1590BB

103.50
[4.075]

119.50
[4.705]

Flanged Lid

4.25
[.167]

Ø3.50
[.138]

C

110.36
[4.345]

84.86
[3.341]

10.50
[.413]

10.00
[.394]

1.82
[.072]

C

**Side View of Slot
SECTION C-C**

6.00
[.236]

82.0°

16.25
[.640]

2.00
[.079]

15.6 Installation diagram
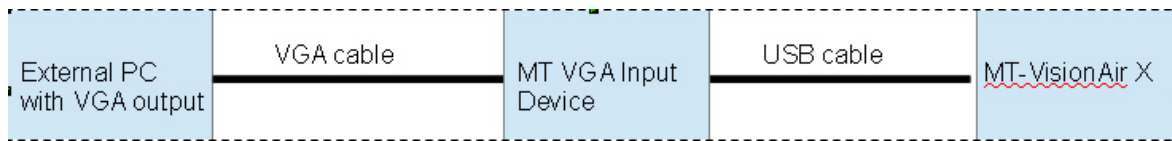
We recommend the usage of this USB port.
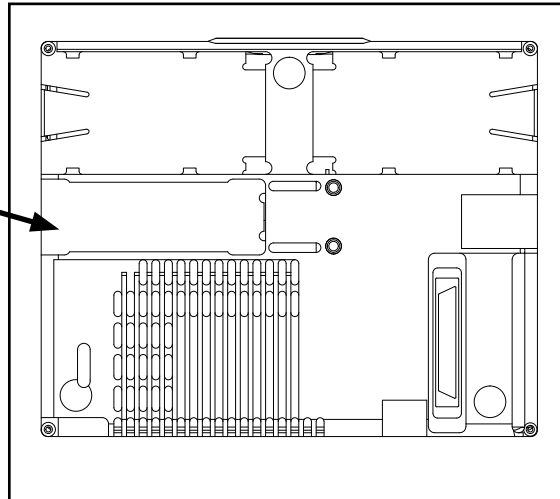
Suggestion: Modification of Easy Mount

We recommend to connect the MT-VGA-Input Device to the rear USB on the left side with the longer tunnel.

The Easy mount must be modified: a notch must be cut out to lead the USB cable through. Please see pictures for the recommended placing which will not effect the stability and functionality of the Easy Mount.
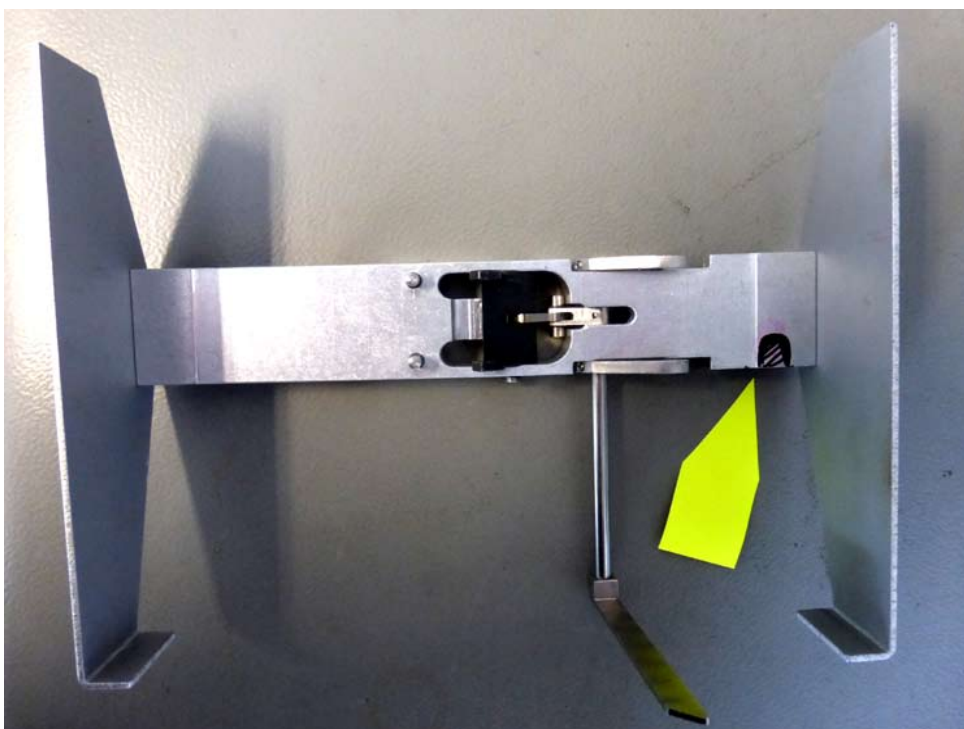
Easy mount with marked notch (front view detail, turned 90° counter clockwise)
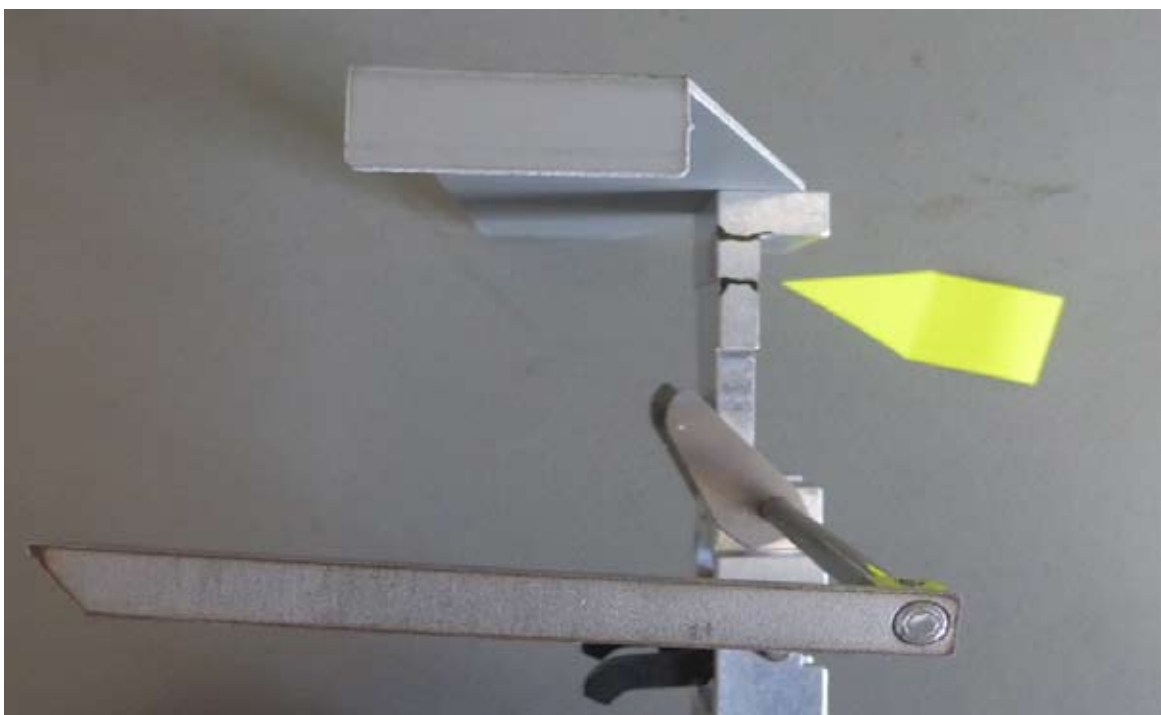
Easy mount with marked notch (bottom view)

INTENTIONALLY LEFT BLANK

17. MT-VisionAir X - External Dimming

17.1 Functionality

External dimming mode is activated by setting the lowest brightness level manually
Use the * button (left corner) to set to the lowest brightness

The brightness indicator shows 5 black squares:
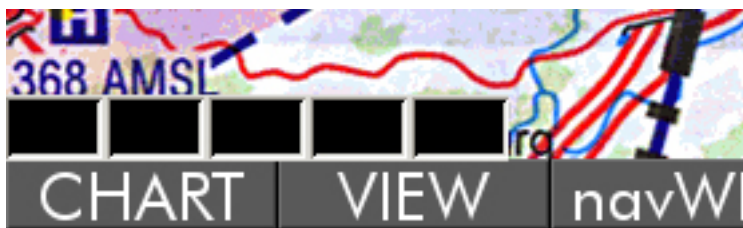
16.1.1 No external dimmer connected

If no external dimmer is connected, the brightness actually goes to minimum = analog input voltage is zero

16.1.2 External dimmer connected

If external dimmer is connected, then it directly controls the system brightness.

Note 1   NVG mode is not impacted
Note 2   The „manual" brightness levels (1 to 5) work normally

16.1.3 Entries in mtpro.ini for [DIMMING]

Example:

```
[Dimming]
ADCMin=72
ADCMax=180
BrightMin=1
BrightMax=75
NLExp=5.0
```

Values are to be verified.

17.2 Wiring

Voltage between Pin 31 and PIN 4 (GND) on the MDR50 central connector.
See "Installation manual" PN MTEX/IA-62-02 page 42,43

Input voltage   0 – 28V
0V = minimum brightness
28V = maximum brightness

18. MT Mission Management System (MT-MMS)

18.1 Requirements

1. A supported Iridium Satphone or Modem
The MMS software module has been tested successfully with:

*   Iridium 9555 Satphone

*   Iridium 9575 Satphone

2. An active SBD (Short Burst Data) contract on the Satphone, linked to the appropriate e-mail addresse(s) which will be used for tracking (see chapter MT OPS Center). The contract is linked to the IMEI number of the telephone.

3. The MMS module must have been purchased for this VisionAir X unit.

4. The MT-VisionAir X must be connected via USB to the Iridium Satphone
NOTE: if the central connector is used, then it is necessary to install an external USB hub between unit and satphone (this applies for MT-VisionAir X with SP boards, TT board units can be used directly. To check board type use: <AUX> <SETUP> <VERSION> <VERSION>).

5. The Satphone must have a clear view of the sky or be connected to an external antenna.

18.2 Usage

NOTE: The Iridium Satphone must be switched on manually during preflight and should be turned off manually, as well, after the flight. The MT-VisionAir X software cannot control the Satphone power.

No other operation should be needed on the Satphone while using the MMS functions.

To turn on aircraft tracking: on the VisionAir X button bar press AUX --> MMS --> TrkON

When tracking is on there will be a thin gray message area on the bottom left of the map screen (just to the right of the brightness indicator). It will show the MMS tracking status, including error conditions.

By default the system will try to send a position report every 60 seconds approximately, but will retry every 15 seconds in case of error.

Depending on several factors the ground tracking software (MT OPS Center)

should show the position report with an average delay between 6 and 20 seconds after it has been generated by the onboard VisionAir X.

To turn off aircraft tracking: on the VisionAir X button bar press

AUX --> MMS --> TrkOFF

The message area on the bottom of the screen will disappear.

To set a custom position report interval:
- Press: AUX --> TRACK,
- Type the special command: PRI nn J (where „nn" is the tracking interval in seconds).

Example: AUX --> TRACK, PRI45J will set the position report interval to 45 seconds.

A message window will confirm the change (press BACK to clear it).

NOTE 1: The tracking status and interval is remembered between sessions, so that if it was ON on last shutdown, it will start active on the next flight.

NOTE 2: Each successful position report transmits an Iridium SBD packet with a size of 16 bytes. Failed transmission attempts are not charged. This information can be used to estimate tracking costs according to the SBD contract linked to the Satphone.

Example for the typical standard SBD contract with no options:
Minimal billable SBD packet size = 30 bytes ; Fee for minimal billable SBD packet = 0.05 $.
The onboard software will report the position approximately every 60 seconds (thus approximately 60 times per hour).
Thus one hour of tracking will be billed approximately as: 0.05$ x 60 min = 3$

18.3 List of MMS status messages on the VisionAir X

18.3.1 „Normal operation" messages

Message text	Explanation
OFFLINE	May appear briefly when MMS is switched on or when the system starts with MMS already active. It will change to a different status message as soon as MMS starts the first position report.
MMS: Sending position report...	The position report is being sent, it usually takes 3 to 30 seconds depending on the instantaneous quality of the satellite signal.
MMS: Last position report OK	Last position report was successfully sent to the Iridium satellite

18.3.2 Common error conditions (usually temporary)

Message text	Explanation
Satphone not found(unplugged?)	The USB cable between the VisionAir and the Satphone may be unplugged or the phone may be switched off
Satphone comm problem(cable?)	The Satphone was detected but the software does not get responses when sending commands. Either the USB cable is not firmly connected or there is another hardware/software condition which garbles the communication between the VisionAir and the phone. In extreme cases could be due to strong electromagnetic interference especially if the USB cable is not shielded.
Satphone locked by Iridium	There could be a problem with the Iridium SBD contract linked to the Satphone.
Satphone: no network coverage	The Satphone is not registered on the Iridium network (satellite link is not available)
Iridium: bad reception (18)	Satellite link dropped while sending the last message
Iridium: bad reception (32)	Satellite link quality was not good enough to send the last message

Message text	Explanation
Satphone busy (Voice call?)	The Satphone reports that its radio channel is busy, it means either that it is not yet fully initialized or a Voice/Data call is in progress. Tracking will resume as soon as the Satphone is available (the software checks its status every 15 seconds)
Iridium timeout, will retry	The last message could not be transmitted within the time allowed by the network, transmission will be retried within 15 seconds
Unknown Iridium error (0)	May appear briefly if the Satphone is not ready to communicate. If it persists it may indicate a software or hardware fault.

18.3.3 Uncommon error conditions (hardware or software faults, may need maintenance)

Message text	Explanation
Unknown Iridium error (x)	The VisionAir X has received an unknown error code from the Satphone (the error code is reported in place of the „x", for diagnostic purposes)
Iridium queue full gnd station	The message queue is full at the Iridium ground station. Either the ground tracking software (MT OPS Center) is not configured correctly or it has not been run for a long time, so that tracking messages have accumulated.
Iridium message error (12)	This error should be reported to MT for VisionAir X diagnostic, may also indicate a Satphone hardware/firmware fault.
Iridium error at gnd station	Temporary or permanent error at the Iridium ground gateway
Iridium message error (14)	This error should be reported to MT for VisionAir X diagnostic, may also indicate a Satphone hardware/firmware fault
Iridium: network access denied	Could indicate a problem with the Satphone and/or SBD contract with Iridium
Satphone locked by Iridium(16)	Could indicate a problem with the Satphone and/or SBD contract with Iridium
Iridium: protocol error (19)	This error should be reported to MT for VisionAir X diagnostic, may also indicate a Satphone hardware/firmware fault
Iridium antenna fault (33)	Possible hardware fault with the Satphone or physical problem with the antenna (either internal or external if connected)
Iridium radio is disabled (34)	Possible hardware problem with the Satphone, or unusual configuration

Message text	Explanation
Iridium: temporary error (36)	Should be a temporary condition due to the Sat-phone not being able to successfully register on the Iridium network
SBD service temp.disa-bled(37)	May indicate an Iridium network error or a problem with the SBD contract
SBD temporary overload (38)	The phone is temporarily refusing to send SBD messages to lower the load on the Iridium network. It is a built in feature of Iridium Satphones („Traffic management period") and should not harm normal operations.
Satphone hardware error (64)	Possible hardware problem with the Satphone „Band violation (attempt to transmit outside permit-ted frequency band)"
Satphone hardware error (65)	Possible hardware problem with the Satphone „PLL lock failure; hardware error during attempted transmit"

18.4 MT Operations Center 1.0

See User manual.

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19. Mission Management System: Rescue Track communication via ITAS (Iridium Transceiver Antenna System)

19.1 System Components and Prerequisites

19.1.1 Hardware

MT-VisionAir X, software version higher than X.5.1 (OS13)
Iridium Transceiver Antenna System (ITAS)
    9602 SBD Modem + enclosure
    Power/Serial M12/8pin connector
    Serial interface: 19200 bps
    Max message size: Tx 340 Bytes, Rx 270 Bytes

The ITAS connects to the MT VisionAir X via serial port (by default COM3).

Connection via MDR50: minimum equipped with power, Fast Integral GPS and COM3 (please refer to pin assignment)

In addition to the ITAS, the RescueTrack feature will work with Iridium Satphones (9555, 9575).

Restriction: During voice calls SBD messages cannot be transmitted nor received, and the software has no way to know beforehand if the pilot is dialing a phone number nor receiving a call.
The effect is that the RescueTrack control center will not see position reports during voice calls and will not know the reason.

19.1.2 Contract with Iridium Provider for SBD (Short Burst Data)

Prerequisite for the conclusion of the SBD contract is the knowledge of the IMEI number of the ITAS and the selection of the billing mode.
Note: Mo ACK is not required.

19.1.3 Contract with Rescue Track

The ITAS equipment (identified by its IMEI code) needs to:
a) Have an active SBD contract, which must be set up to send SBD data to a specific RescueTrack IP address
b) Be associated to the Moving Terrain account by RescueTrack

As such it is necessary to request assistance from RescueTrack:

a) Ask RescueTrack - What is the „direct IP" address to put on the SBD contract?

b) Ask RescueTrack to associate the IMEI code of the ITAS device to the MT test account

Once the ITAS has an SBD contract and is associated with the Moving Terrain test account in Rescue Track it is possible to log into their website for testing:

Usually MT takes care of all steps and delivers a tested system.

Contact Convexis GmbH: phone +49 7121 9455-0.
daniel.korn@convexis.de
Florian.Schenk@convexis.de

19.2 Software

19.2.1 Basic Information

Prerequisite Software version X.5.1 and higher on OS 13.
The option must be enabled.

19.2.2 Settings on the MT-VisionAir X System

19.2.2.1   MTPRO.INI

How to work with mtpro.ini:
- Connect an USB keyboard
- Press SHIFT + 1 (or equivalent for „!") to call the configuration text editor
- Edit the desired parameters
- When finished press CTRL + X, then ‚Y' to confirm and save the changes (‚N' will discard all changes)
- The new configuration can then be applied quickly by pressing SHIFT + 2: the VisionAir X will reinitialize. Otherwise the system has to be shut down and restarted for the changes to take effect.

Configuration (usally already done before delivery)
- A new ITAS section is added, where the corresponding serial port can be specified:

```
[ITAS]
Port = 3
```
Default port, if not indicated or set to 0 (zero), will be COM3

- Under the [MMS] section specify whether the Mission Management System will use MT or RescueTrack protocol:

```
[MMS]
Mode = RescueTrack
```

The default, when missing, is: Mode = MT

There are two additional parameters (optional) that can be used under the [MMS] section:

```
UpdateOnStatusChange = 1
```
When this is set, the VisionAir X will send a position update to RescueTrack as soon as the pilot selects a new status.

```
UpdateOnTargetChange = 1
```
When this is set, the VisionAir X will send a position update as soon as the pilot selects a new DCT destination.

Otherwise the standard time between position updates is 60 seconds.

19.2.2.2   Setting of ITAS Module for Communication

→ AUX → SETUP -> DIAL-UP
Choose IRIDIUM TRANSCEIVER ANTENNA SYSTEM (ITAS) by pressing UP / DOWN and confirm with USE.

This setting will be saved.

19.2.2.3   How to Activate the Data Transfer to and from Rescue Track

The tracking system is always on and the position data is transmitted every 120 seconds to the Rescue Track server.
The initialization of the communication with RescueTrack was carried out at the factory.

An interruption / shutdown can take place by switching off the ITAS module.

19.3 Rescue Track MMS on the Screen
→ AUX → MMS

```
Received messages (latest on top)              RescueTrack status
```

```
2015-02-21 14:57 from: Sender
Text of received message 5   N42°12.1 E013°20.5          Frei auf Funk >
2015-02-21 14:50  from: Sender
Text of received message 4                              Frei auf Wache >
2015-02-21 14:40  from: Sender
Text of received message 3                          Einsatz übernommen
2015-02-21 13:25  from: Sender                                        >
Text of received message 2
2015-02-21 13:20  from: Sender                          Am Einsatzort >
Text of received message 1
                                                         Sprechwunsch >

                                                         Außer Dienst >

                                                   Patient übernommen
                                                                     >
       (in the background: normal map screen)
                                                       Im Krankenhaus >

                                                         Ferry Flight >


GOTO  DCT  msgUP msgDN                                             BACK
```

19.3.1 Description

Left half: Incoming news, latest at the top.
Right half: Standardized messages sent by the helicopter.

19.3.2 Incoming Messages

The last 5 incoming messages are displayed in the left half of the screen, the latest at the top.
Automatically, the latest message is set active (green high-lighted).
It is possible to select one of the other messages
    → msgUP to the top or
    → msgDN down.
The selected message will be green high-lighted.

As soon as the message contains coordinates, these options are available on the button bar:

→ GOTO →   the map is centered on the given coordinates
    (NOTICE: This terminates the MMS menu!)
→ DCT →   set a DIRECT to the given coordinates
    The destination is displayed as RTDEST.

19.3.3 Note on an Incoming Message on the Moving Map

As soon as a new message arrives, a message symbol in the the info block in the main menu (moving map) is shown.

As soon as the pilot looks into the message with → AUX → MMS, the symbol will be deleted in the info box.
The notice of the message is displayed on the moving map
  B L I N K I N G to increase attention.

19.3.4 Selection of Standardized Status Messages: Bezels 2-0

By pressing the corresponding key the message will turn "cyan".
Automated sending together with the next position report
The communicated message stays „green", until another message will be selected.

Color coding for current status:

    „cyan" highlighting   = Selected but not yet transmitted
    „green" highlighting   = Selected and transmitted

19.3.5 BACK

Back to Main Menu – Moving Map.

19.3.6 Saving of Current Setting

The tracking setting remains stored and will be activated immediately at system startup. If the communication with the ITAS module is not given, an error message appears.

19.4 ITAS System Components and Connection

19.4.1 Technical Information for ITAS Test Cable

19.4.1.1   Data Sheet (copyright: Hirschmann Car Communication Inc.)

Pin Out Configuration (B1)

M12-8 Connector Contact #	Color	Signal Name	DB9 & Banana Plug Connections
1	White	Chassis Ground (IO-6_GND)	Not Connected
2	Brown	Signal Ground (GND)	DB9 pin 5 and Black Banana plug
3	Green	Serial data RX (SAT_RX0) *	Pin 3 of DB9 Connector
4	Yellow	Serial data TX (SAT_TX0) *	Pin 2 of DB9 Connector
5	Pink	Power In/out (8-32 V DC) PWR_IN	Red Banana Plug
6	Gray	On/Off Control Input Enabled(ON/OFF)	Pin 4 of the DB9 Connector
7	Blue	Network Status line (11_trg / NTW_STA)	Not Connected
8	Red	Tamper Detect (TAM_DET)	Not Connected

* RX AND TX ARE RELATIVE TO THE ANTENNA

SHIELD DRAIN WIRE CONNECTED TO M12-8 CONNECTOR SHELL (A1)

M12-8 FEMALE CONTACT #

CONNECTOR BANANA PLUG

DB9 CONNECTOR, FE

CONNECTOR BANANA PLUG, RED

PINK WIRE

BLACK WIRE

TX, RX, GND AND MODEM ON/OFF Line

SCREWS 2 PCS

(RED)

(BLK)

0 ±5

150 ±15

150 ±15

HEAT SHRINK TUBE ADHESIVE LINED

24 AWG 8 CONDUCTOR PUR JACKET-BLACK Shielded Type

IDENTIFICATION LABEL

CONNECTOR M12-8 PLUG (Female)

REF Ø 6.5

REF 100

Description of change

A	1	INITIAL RELEASE
	1	SHIELD DRAIN WIRE WAS CONNECTED TO CONTACT #1
B	1	NOTE UPDATED

19.4.1.2   Installation Advices

All installation advices are based on HIRD - SX - 0129x-01 (ITAS 832 SP), please refer to the data sheet.

TX and RX is related to the respective device.
Standard ComPort on MT in Com3 on the MDR50 central connector.
)
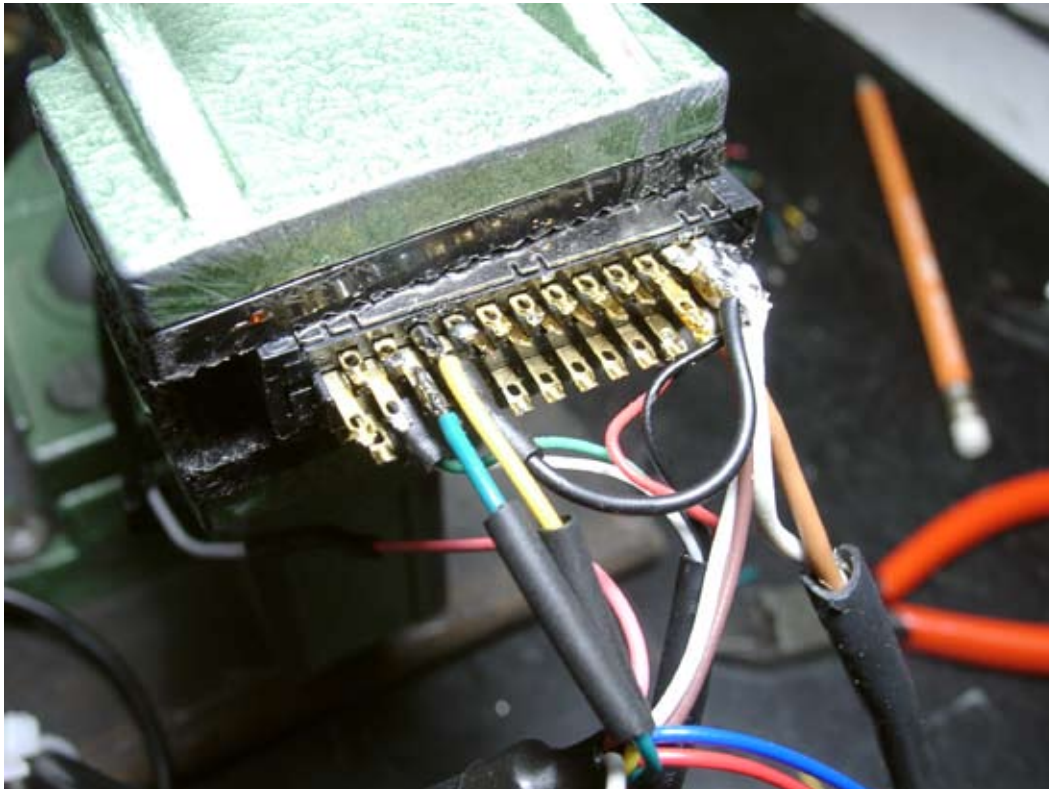
On/Off Control activation pin (pin 6/grey in M12-8 ITAS) is to be connected to pin 5 =
- External Power Source: 8—32 VDC (5VDC optional[1])
- Power Consumption: 1 Amp max transmit
- 65mA Standby
- on/off signal line
- Transient Protection: SAE J1113/11/12
- Reverse Voltage Protection: 24V tested

Note: On/Off control through power-line results in a 30sec start-up delay.

19.4.1.3   Example Installation

ITAS   MT
M12-8 connector   MDR 50 pin

ITAS M12-8		MT MDR 50 pin
1	white - not connected	1
2	brown / black: signal ground	2
3	green: serial data RX	3
4	yellow: serial data TX	4
5	pink / white extension: power input	
6	gray ON/OFF control	
7		19
8		21
		20
		26
		27
		28
		29

ACFT 28V   ACFT Gnd
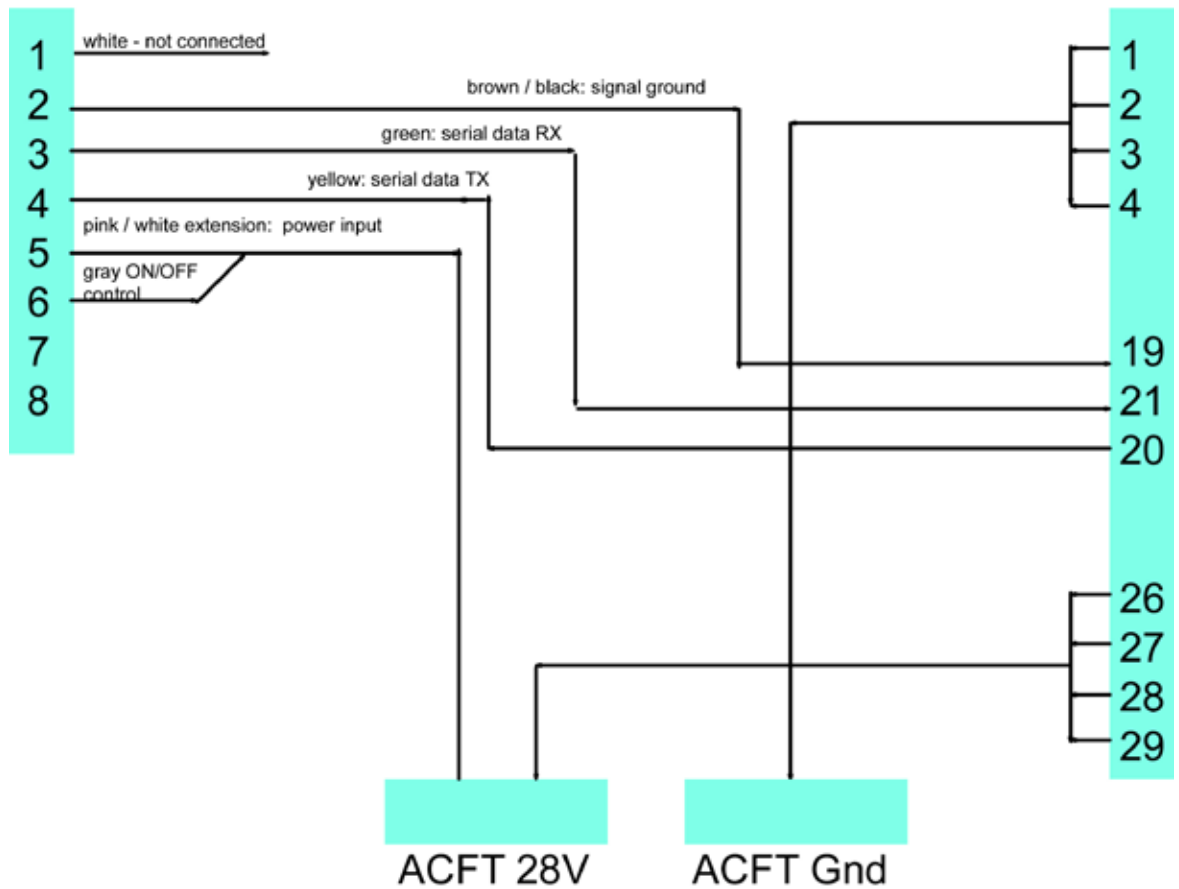
19.4.1.4   Test Procedure

→ AUX → TRACK -> type MTITESTJ and start simulator.
→ AUX → TRACK -> SIM ON

MT Internal test procedure to check the COM port (not open for customers)

shift 4   to get a terminal

nano .xinitrc
 type # as leading character in front of the last line and
 delete # in front of the 2. last line.
 COM port will not be blocked, MT program will not start automatically

reboot

minicom -b 19200 -D /dev/ttyUSB2
 opens COM3 with 19200 baud

ati4
 type in minicom
 answer should be „IRIDIUM 9600 Family"
 communication with modem established

strg-z x
 exit minicom

nano .xinitrc
 revert the # in front of the last / 2. last line and save

reboot

19.4.2 Technical Information for ITAS Module
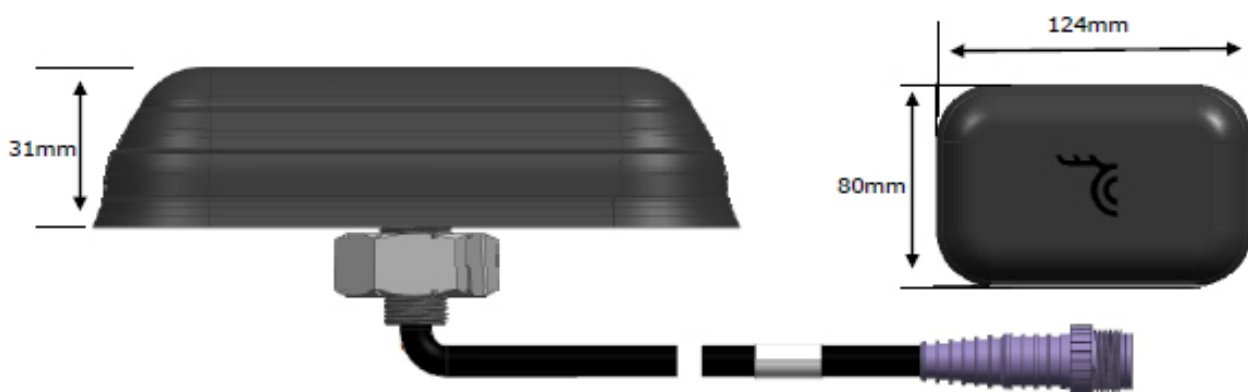Copyright: Hirschmann Car Communication Inc. (We accept no liability for errors.)

Hirschmann Solutions
A business unit of Hirschmann Car Communication

Installation Instructions
Iridium Transceiver Antenna (ITAS/Q-Puck)

Technical Data

124mm
80mm
31mm

Dimensions	124mm x 80mm x 31mm / 4.9 x 3.1 x 1.22 in.
Weight	ca. 500 g / 17.6 oz.
Temperature range	-40°C to +85°C / -40°F to +185°F
Protection class	IP66 (acc. IEC 60529)
ESD Protection	± 15 kV
IRIDIUM Antenna	
Frequency range	1616 - 1626.5 MHz
Gain / Ganancia	3 dBic[x]
Polarization	RHCP
Axial ratio	< 4 dB
Lightning protection	DC grounded
Iridium Communication	
Transmit power	1.6W [1]
Max. message size	Tx 340 Bytes, Rx 270 Bytes [1]
Data type	Short-burst data (SBD); no voice
Latency (message transmission)	20 sec (typ)[1]
Default Baud Rate	19200 bps
Start-up delay	30 sec on power-up; no delay with on/off line when powered[2]; 3 sec optional

Data Interfaces	
Type	1 serial RS-232C
Connector	M12/8P male
Cable length	254mm pigtail
Extension cables	Consult HCC
Power	
Voltage supply	8-32 VDC or 5 VDC regulated (depending on product version)
Current consumption	1.5 Amp max transmit; 6.5mA stand-by; on/off signal line
Transient protection	SAE J1113/11/12 (only for 8-32 VDC supply power product version); compliant to test-pulses 1, 2a, 2b, 3a, 3b, 4, 5b (load-dump transient suppressed)
Reverse Voltage protection	24V tested

[1] according to Iridium 9602 Modem Specification and subject to change

[x] dBic: referenced to an isotropic radiator, circular polarization

[2] refer to Iridium 9602 Developers Guide (available on request)

Customer specific product versions may deviate from the data published in this document.

Product Family / Familia de Productos

Order Code (customer specific versions not listed) ITAS	Power Version	External on/off line	Remarks
HIRD - SX - 0129x-01 (ITAS 832 SP)	8-32V	enabled	Electrical Installation see 5a or 5b
HIRD - SX - 0129x-30 (ITAS 832 SP)	8-32V	disabled	Electrical Installation see 5c
HIRD - SX - 0130x-01 (ITAS 5 SP)	5V regulated	enabled	Electrical Installation see 5a or 5b

Order Code (customer specific versions not listed) ACCESSORIES	Length	Configuration	Remarks
Extension Cables	various	Straight or angled	Please contact Hirschmann

Installation Procedure

Mounting requirements and restrictions

- Choose appropriate mounting location on flat surface—allowing unobstructed view to the sky
- Max. tolerable material thickness of mounting surface: 3 mm/ 0.118 in.
- Safely drill 15 mm/ 0.6 in. mounting hole at desired location (see Sketch #1)
- Unscrew mounting nut (see Sketch #2)
- Insert threaded antenna mounting stud through mounting hole (see Sketch #3)
- Slide slotted mounting nut on and screw back on to antenna mounting stud.
- Maximum tightening torque is 5Nm.
- Connect connector to mating connector on extension cable or device (Sketches #4 and #5a-c)
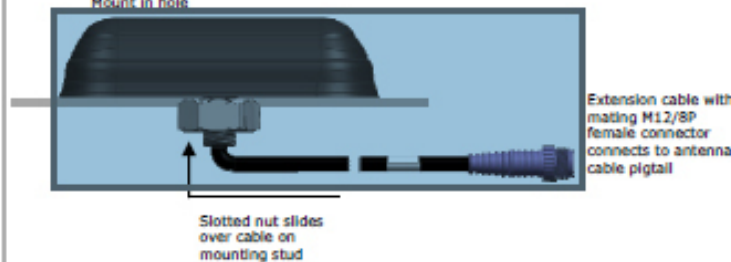- 24 AWG recommended wire gauge for extension cable.
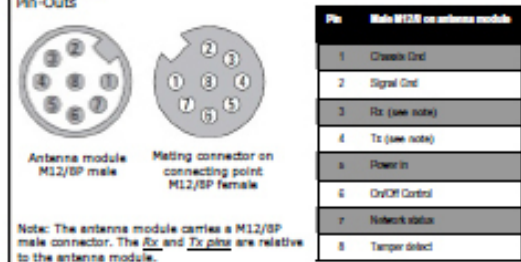
Sketch #1
Required Mounting hole

Ø 15.0 ± 0.2 mm
0.59 ± 0.008 in

Sketch #2
Mounting Nut

27 mm
1 1/16 in

Sketch #3
Mount in hole

Extension cable with mating M12/8P female connector connects to antenna cable pigtail

Slotted nut slides over cable on mounting stud

Sketch #4
Pin-Outs

Antenna module M12/8P male

Mating connector on connecting point M12/8P female

Note: The antenna module carries a M12/8P male connector. The *Rx* and *Tx pins* are relative to the antenna module.

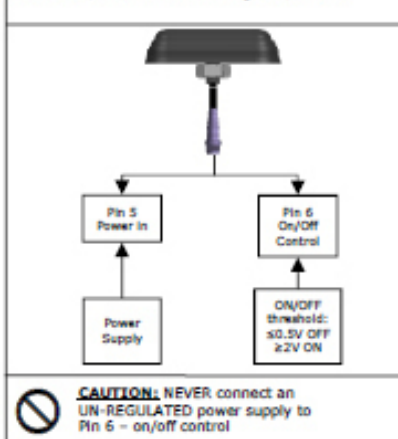| Pin	Male M12/8 on antenna module
1	Chassis Gnd
2	Signal Gnd
3	Rx (see note)
4	Tx (see note)
5	Power in
6	On/Off Control
7	Network status
8	Tamper detect

Sketch #5a
External ON/OFF control ENABLED
Modem ON/OFF controlled through power-line
(regulated power supply only)

Pin 5 Power in | Pin 6 On/Off Control

Regulated Power Supply

ⓘ On/Off control through power-line results in a 30sec start-up delay
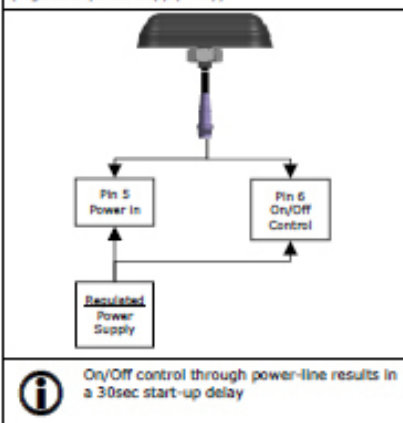
Sketch #5b
External ON/OFF control ENABLED
Modem ON/OFF controlled through ON/OFF line

Pin 5 Power in | Pin 6 On/Off Control

Power Supply | ON/OFF threshold: ≤0.5V OFF ≥2V ON

🚫 **CAUTION:** NEVER connect an UN-REGULATED power supply to Pin 6 – on/off control

Sketch #5c
External on/off control DISABLED
Modem ON/OFF controlled through power-line

Pin 5 Power in | Pin 6 On/Off Control NOT CONNECTED

Power Supply

ⓘ On/Off control through power-line results in a 30sec start-up delay
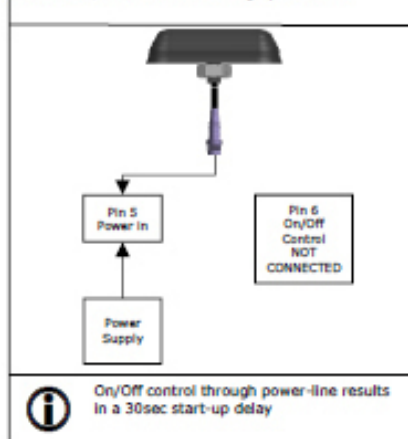
Reference Documents

- For technical information regarding the Iridium 9602 modem please reference the most recent Iridium developers guide (latest version at time of printing: Release 3.1—Oct. 29, 2012); the developers guide is available for ITAS-customers through Hirschmann Solutions
- For AT-command reference please refer to the most recent Iridium ISU AT Command Reference (latest version at time of printing: MAN0009 Version 2—July 27, 2012); the ISU AT Command Reference is available for ITAS-customers through Hirschmann Solutions

Caution Notes / Disclaimer

- On ITAS-units with enabled external ON/OFF line NEVER connect an UN-REGULATED power supply to Pin 6 – on/off control. The on/off control through Pin 6 needs to be made through an GPIO type interface or a regulated power supply.
- By default the ITAS is set to 3-wire interface. Do NOT use AT-commands to convert the Iridium 9602 modem to 9-wire interface.
- The ITAS product is Iridium certified according to Iridium LLC's requirements. Systems using the ITAS have to be approved/certified by Iridium LLC or through an Iridium partner.

Document Revision History

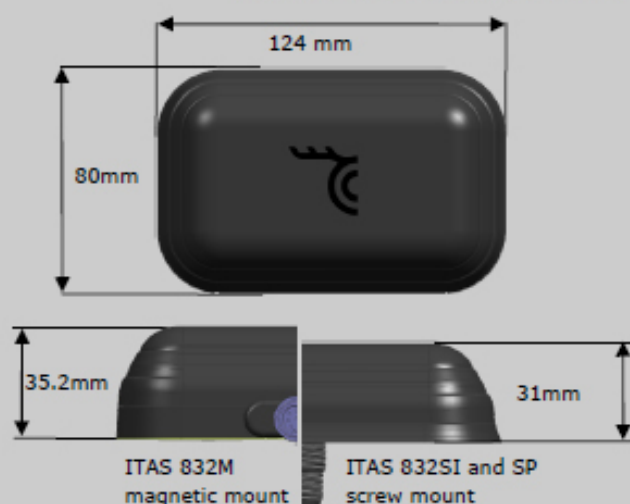| Release Date	RCO-No	Description of doc-change
4/30/2013	1304-06	Initial release
5/08/2014	-	Corrected values for current consumption and start-up delay

Product Specification

Product Datasheet

Communications – IRIDIUM

Transmit Freq:	1616 – 1626.5 MHz
Transmit Power:	1.6W [1]
Max Message Size:	Tx 340 Bytes Rx 270 Bytes [1]
Latency:	20 sec (typ) [1]

[1] according to Iridium 9602 Modem Specification and subject to change

Power

External Power Source:	8—32 VDC (5VDC optional[1])
Power Consumption:	1 Amp max transmit
	65mA Standby
	on/off signal line
Transient Protection:	SAE J1113/11/12
Reverse Voltage Protection:	24V tested

[1]Utilization of the Iridium satellite network is not guaranteed when the modem's voltage drops below 5 VDC.

Dimensions / Mechanicals

Length/Width/Height:	124.3mm/80.3mm/31mm
	(35.2mm for magnet mount)
Weight:	ca. 540g
Mounting options:	Through hole (hole diameter 15mm)
	magnetic mount option available 2013

ITAS 832M magnetic mount

ITAS 832SI and SP screw mount

Data Interfaces

Type:	1 Serial RS-232C
Default baud rate:	19200
Interface protocol:	AT Command Set
Flow control:	Software
Connector:	Direct connect or pigtail
	M12-8M male (3-wire RS232C)
Cable:	254mm multicond. (ITAS 832SP)
	tbd. multicond. (ITAS 832M)
Extension Cables:	Customized on request

Pin	Male M12/8 on antenna module
1	Chassis Gnd
2	Signal Gnd
3	Rx (see note)
4	Tx (see note)
5	Power In
6	On/Off Control
7	Network status
8	Tamper detect

ITAS module M12/8P male

Mating connector (connecting cable) M12/8P female

Note: The antenna module carries a M12/8P male connector. The Rx and Tx pins are relative to the antenna module.

Environmental Specification

Operating Temperature:	-40C to +85C
Storage Temperature:	-40C to +85C
Low Pressure storage:	up to 16hrs at 40,000 ft.
Humidity:	SAE J1455 (test conditions avail.)
Cyclic humidity:	4 days @ -40 to 85C
Thermal Shock:	36 4hr cycles; -40 to 85C
Shock:	SAE J1455
Vibration:	SAE J1455
Protection Class:	IP66

Certifications (including pending)

Iridium, FCC, CSA, CE

Order Codes

ITAS 832SI	8-32V, integrated M12/8	HIRD-SX-0126x-01
ITAS 832SP	8-32V, 254mm cable M12/8	HIRD-SX-0129x-01
ITAS 832M	8-32V, tbd cable M12/8	HIRD-MX-0128x-01
ITAS 5x	5V version	upon request

166   MTEX/IA-62-07 – Installation Manual

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20. Check List for Acceptance after Installation

This check list is intended for the use of the pilot. Please check following items to ensure that MT-VisionAir X has been correctly installed.

20.1 General installation check

Check point	Correct?
The unit can be easily inserted into / removed from the Easy mount?	☐
The power supply takes place via the Ground Clearance Switch / Hot Bus / Battery Bus?	☐
The GPS positions correctly (SATFIX)?	☐
The correct GPS source is selected?	☐
The GPS signal is not shielded by a heated windshield?	☐

20.2 Check Moving Terrain with satellite telephone

20.2.1 Check satellite telephone antenna

Check point	Correct?
The distance between GPS antenna and satellite telephone antenna is at least 1.3 m?	☐
The Sat Tel antenna has optimal view (about 180°) to the sky?	☐
The position of the satellite telephone antenna is suitable for reception? • Is it neither installed vertically nor installed vice versa? • Please inform yourself in detail about the installation!	☐
The extension of the antenna was done according to the guideline?	☐
Ground plane installed?	☐

20.2.2 Check telephone connection (satellite telephone)

Check point	Correct?
The satellite telephone is supplied/loaded by on board power?	☐
The satellite telephone is connected correctly with MT?	☐
Cable connection with the central connector at the MT established?	☐

20.2.3 Check satellite telephone in use

Check point	Correct?
Telephone switched on?	☐
Captains PIN deactivated?	☐
The satellite telephone can receive data?	☐

20.2.4 Check settings in the Moving Terrain

Check point	Correct?
The UTC (see Info Box) is transmitted by GPS?	☐
The correct telephone source is selected?	☐

20.3 Check Moving Terrain with UMTS

Check point	Correct?
Security PIN code deactivated with a cell phone?	☐
The correct telephone source is selected?	☐
The field intensity in the info box shows enough %?	☐

20.4 Check the autopilot connection

Check point	Correct?
The acceptance test has been carried out?	☐

20.5 Check further Com Port connection(s)

Check point	Correct?
TCAD: AUX TAS Sel: Check TAS signal: Avidyne OK / FLARM OK	☐
Stormscope AUX Stormscope OK -> Stormscope OK	☐
ITAS: Data transfer confirmed?	☐

21. Technical Specifications

21.1 MT-Vision Air X
(subject to change without notice)

Item	Specification
Type	Electronic charting system and Multi Function Display with optimized size for cockpit use. The system may serve for helicopters and fixed wing, and can be applied by panel mount or mobile use.
Screen	TFT active matrix display 6.5" (diagonal), 1024x768 pixels, 16 million colours, LED backlight. Viewing angle: left / right side 80° (typ.) up side 80° (typ.) down side 60° (typ.) Sunlight readable Surface finish: clear + anti reflection
Presentation	– Landscape (typ.) – Portrait (special software required) Arrangement of keys enables both presentations
NVG	Night vision goggles compatibility with special software option
Keyboard	Silicone keypad with 36 alphanumeric keys + 10 multi function keys + ON/OFF switch + * key to adjust screen luminance in 8 steps. Gold plated contacts on both – matrix and key - sides. Keys illuminated blue (NVG compatible), dimmed together with display luminance.
Ports	4 USB ports: 1 for direct insertion of UMTS / modem stick 2 service ports (e.g. for updates) 1 via central connector 4 COM ports (via central connector) 1 COM for internal SiRF IV GPS 2 analog out (e.g. Autopilot) (via central connector) 1 VGA (via USB and MT-VGA out device) Audio I/O (via central connector) 1 Ethernet port
Central connector	Type: 50-pin MDR central connector for – Power – GPS – USB (e.g. for updates) – COM 1–4 – Autopilot – Audio I/O Lateral or rear connection possible

Item	Specification
Casing	Aluminum, scratch proof black powder coating
Weight	585 g
Dimensions (W x H x D)	157 mm x 126 mm x 33.1 mm
Power supply	12–28 V nominal, max 32 V (e.g. for APU) min 7 V (battery)
Aircraft side required fuses	Operating voltage 12 V -> min. 5 A, slow Operating voltage 24 V -> min. 2 A, slow
Power consumption	14 W + reserve wattage up to approx. 30 W for optional equipment
Environmental conditions	Temperature and altitude low ground: Category C4 Survival temp low short-time: –55 °C (short –10 °C) Minimum temperature low operation: –20 °C Operating temp low operating –10 °C Temperature high ground survival: +85 °C Temperature high short-time operation: +50 °C Temperature high operating: +50 °C
Shock and g loading	Operational Shock Test according to RTCA DO-160F, section 7.2.1 in X-Y-Z-Axis
Vibration	Operational Vibration Test according to RTCA DO-160F, section 8.8.3. Random Test Procedure for Category U2: Unknown Helicopter / fixed wing frequencies.
Mounting	"Easy Mount" for panel or yoke / side mounting. Performed Operational Shock Test according to RTCA DO-160F, section 7.2.1 in X-Y-Z-Axis.
Required dimensions for panel cutout	Width: 160.5 mm or respectively min. 157.5 mm (with latches in the rack) Height: 128 mm Depth: 46 mm (all dimensions incl. + 0.5 mm tolerance)
Options	
Option GPS	Internal GPS (SiRF IV technique)
Option Touch function	*Resistive Touch screen (discontinued)*
Option Rechargeable battery packs	Pack of 2 slim battery for 2 h 15 min Loading station
Option VGA out	Passenger Entertainment Screen 10" via USB and VGA-Out Device

Table 20.1: Technical specifications MT-VisionAir X

21.2 Fast Integral GPS

The Fast Integral GPS is a product of Moving Terrain AG.

Item	Specification
Frequency	L1, 1575.42 MHz
C/A Code	1023 MHz
Channels	50 max.
Positioning update rate	4 Hz
High sensitivity	160 dBm
Support	DGPS, WAAS, EGNOS, MSAS AssistNow Online (14 days Almanac data)
Base setting	WGS-84
Dimensions (W x H x D)	49 mm x 23 mm x 81 mm
Extension cable	4 line RS232 data cable with RX, TX, power, ground. Shielding: Aluminium foil in combination with copper mesh tin coated, approx. 90 % covering

Table 20.2: Technical specifications Fast Integral GPS

21.3 COM Ports in MT-VisionAir X

Ports	Assignment to	
COM 1	Signal from TAS 600 series [Signal from ZAON]* Signal from FLARM Signal from Garrecht TRX1090 * no longer supported from ZAON	Protocol in <TCAS> <TAS1SEL>: – Avidyne/Ryan – ZAON – FLARM – Garrecht TRX1090
COM 2	GPS signal	Protocol in <AUX> <SETUP> <GPS>: – Integral GPS – Fast Integral GPS – Trimble – King KLN90 – Garmin 430/530 – Universal FMS – FLARM
COM 3 (1)	Signal from FLARM (only used, if FLARM is combined with Avidyne/Ryan)	Protocol in <TCAS> <TAS2SEL>: – FLARM and mtpro.ini [TCAS2] PORT = 3
COM 3 (2)	Serial port for autopilot guidance	Protocol set in mtpro.ini
COM 3 (3)	Serial port for ITAS modul	Protocol set in mtpro.ini
COM 3 (4)	Serial port for Crossfill from Garmin	no entry in mtpro.ini Check possible conflict with TCAS combined!
COM 4	Stormscope WX-500 / WX-670	Protocol set in mtpro.ini
COM 5	Internal COM port exclusively for internal GPS SiRF IV technique	

Table 20.3: COM Ports assignment

NOTES   Technically COM ports 1–4 are equivalent.

In mtpro.ini the following is to be obtained:
– Modem = COM 0 is mandatory!
– Specification of COM port = 0 can be set to several ports which are not in use.

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