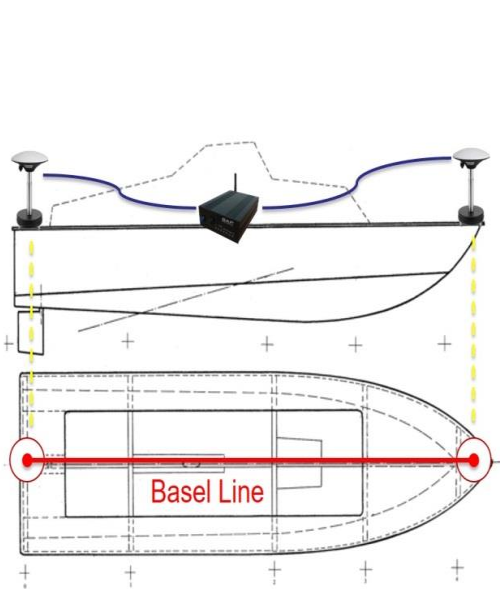# T-Cruise AIS System (TCAS)

## The GIS integrated system for Tracking Vessels

# TCAS ( T-series + AIS Transceiver )



Basel Line

**System**
Processor: 1GHz
Flash ROM: 6GB
RAM: 512MB
**Radio**
Bluetooth ClassII, V2.1 EDR
WiFi IEEE802.11 b/g/n
GNSS L1/L2 GPS/GLONASS
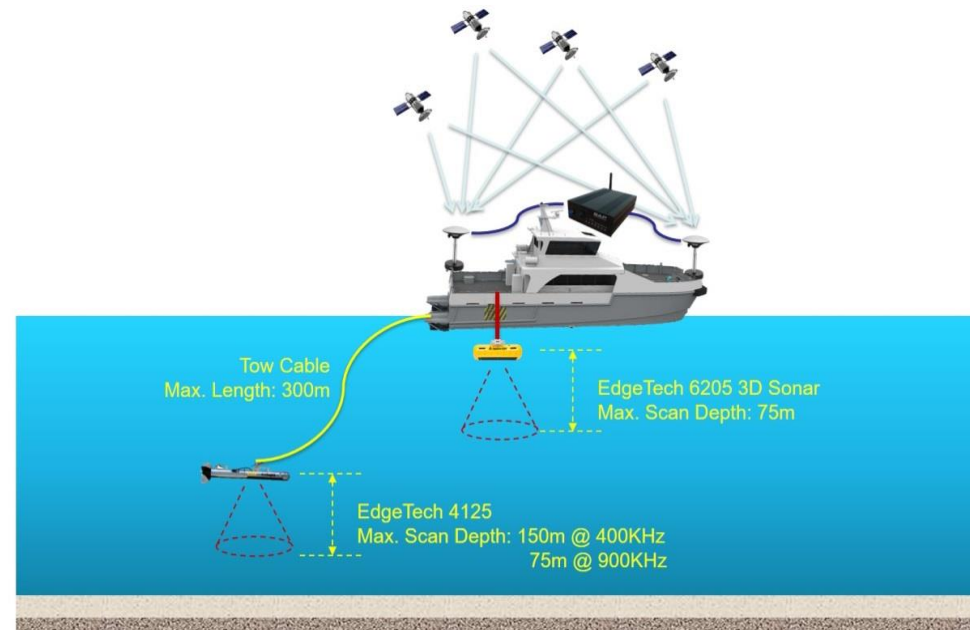**Sensor**
Gyro
E-compass
G-Sensor
**Interface**
Dual-GNSS Antenna Connecto
USB Connectors
RS-232 x 3
Power Button

**GNSS Positioning System**
Receiver Type: Dual GNSS (GPS/GLONASS) RTK
76 Channels
Update rate: 10 Hz
Horizontal Accuracy (RMS)
  Autonomous: 1.2m
  SBAS (WAAS): 0.25m
  RTK: 10mm + 1ppm

Heading Accuracy
  < 0.17° rms @ 0.5 m antenna separation
  < 0.09° rms @ 1.0 m antenna separation
  < 0.04° rms @ 2.0 m antenna separation
  < 0.02° rms @ 5.0 m antenna separation
  < 0.01° rms @ 10.0 m antenna separation
Pitch/roll accuracy: < 1° rms

Tow Cable
Max. Length: 300m

EdgeTech 6205 3D Sonar
Max. Scan Depth: 75m

EdgeTech 4125
Max. Scan Depth: 150m @ 400KHz
75m @ 900KHz

## Easy install all in one system

## Scope of TCAS

1. GPS based vessel tracking system for waterway and marine applications

2. Implement the vessel tracking system from sea to land.

3. Fully integrated with the GIS system supporting sonar detection, side scan operation, AIS location, ship navigations, and good transportation

4. Fully handshake well with VTS system, TimeZero or open sources called OPENCPN

# Real-time Tracking of Tows

- Where is my tugboats

- How deep we are now

- Provides more accurate locations of tows.

- Allows lockmasters to better manage lockage in special waterway.
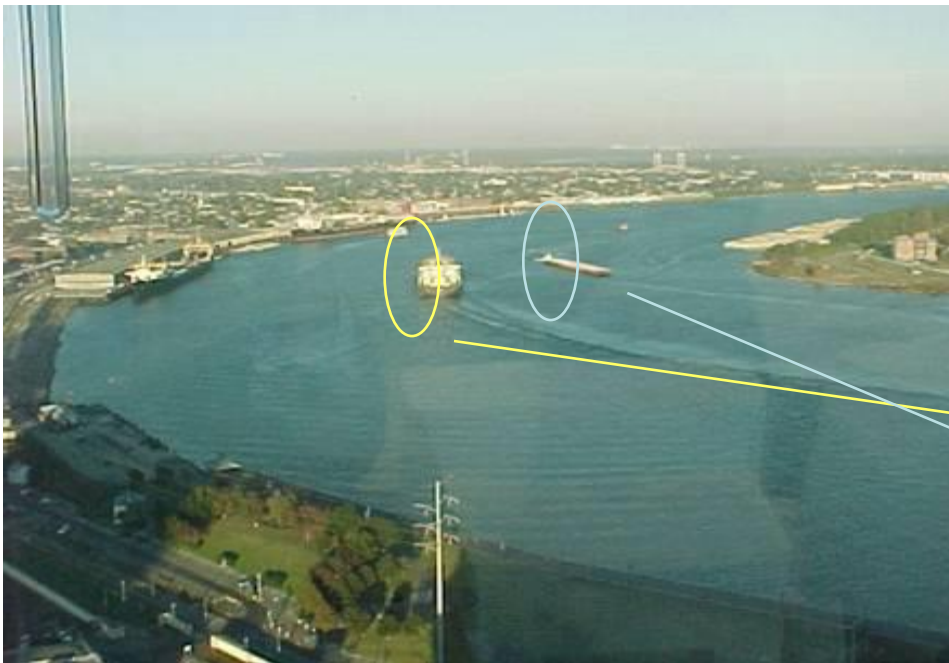
# Vessel Tracking

- AIS Transceiver for tracking tows and vessels in real-time is well developed.

- Vessel tracking is well established in many locations:

  - U.S. Coast Guard VTS areas and IRVMC.

  - European waterways.

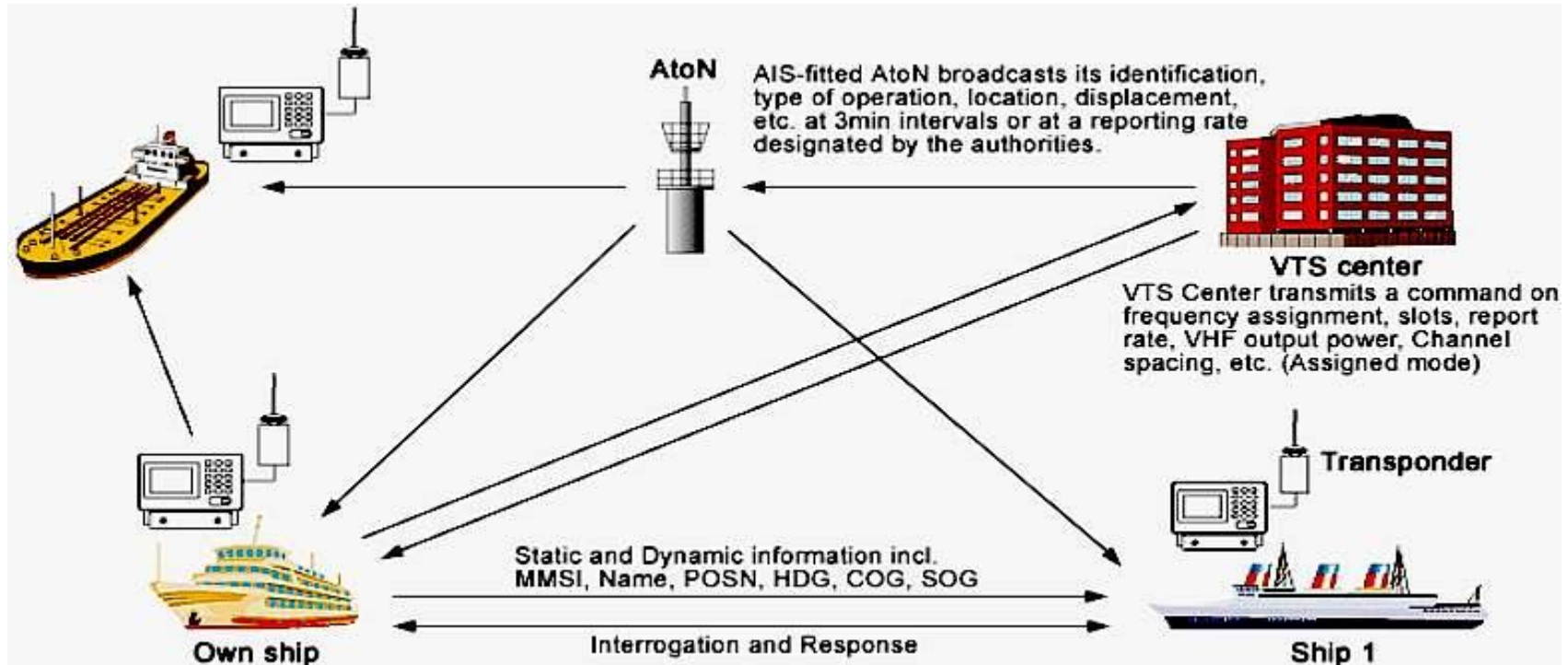  - Port security and fisheries enforcement world-wide.

VTS Centers

- **Vessel Traffic Services Centers:**
  - Provide monitoring and navigational advice for vessels in confined and busy waterways.
  - Shift from safety and navigation emphasis to security.
- **Integrate data broadcast from vessels and from land-based sensors at central location.**
  - Vessel data: AIS
  - Land-based sensors: radar, VHF, infrared, closed circuit TV.
- **Put no additional burden on the mariner.**

# VTS Vessel Display

# View of The Monitoring Structure



**AtoN** — AIS-fitted AtoN broadcasts its identification, type of operation, location, displacement, etc. at 3min intervals or at a reporting rate designated by the authorities.

**VTS center** — VTS Center transmits a command on frequency assignment, slots, report rate, VHF output power, Channel spacing, etc. (Assigned mode)

**Transponder**

Static and Dynamic information incl. MMSI, Name, POSN, HDG, COG, SOG

Interrogation and Response

**Own ship**

**Ship 1**

- <u>A</u>utomatic <u>I</u>dentification <u>S</u>ystems.
- Developed by IMO (International Maritime Organization) to improve maritime safety, protect the environment, and improve VTS operations.
- Includes ship-to-ship, ship-to-shore and shore-to-ship communications.
  - Automatically broadcasts position, ID, and other static, dynamic, and voyage related data.
  - Receives data from other AIS units.

# AIS

- Ship-to-ship, ship-to-shore and shore-to-ship communications with broadcasting radius ~20-30 miles.

- Required on commercial vessels on international voyages.

  - Towing vessels over 26 feet and 600 hp.

  - Self propelled commercial vessels over 65 feet.

  - Passenger vessels with more than a specified number of passengers.

- Vessels in VTS and Vessel Movement Reporting Service (VMRS) areas.

# AIS Data & Equipment

- Automatically broadcasts static, dynamic, and voyage related data.
  - Static data:
    - Vessel ID, length and beam, type, antenna location.
  - Dynamic data:
    - Position, course, speed, heading, rate of turn.
  - Voyage related data:
    - Draft, hazardous cargo type, destination, ETA.
- Receives data from other AIS units.
- Vessel unit includes positioning (e.g., GPS), microprocessor and VHF-FM transceiver.

**Standard AIS Datalink**
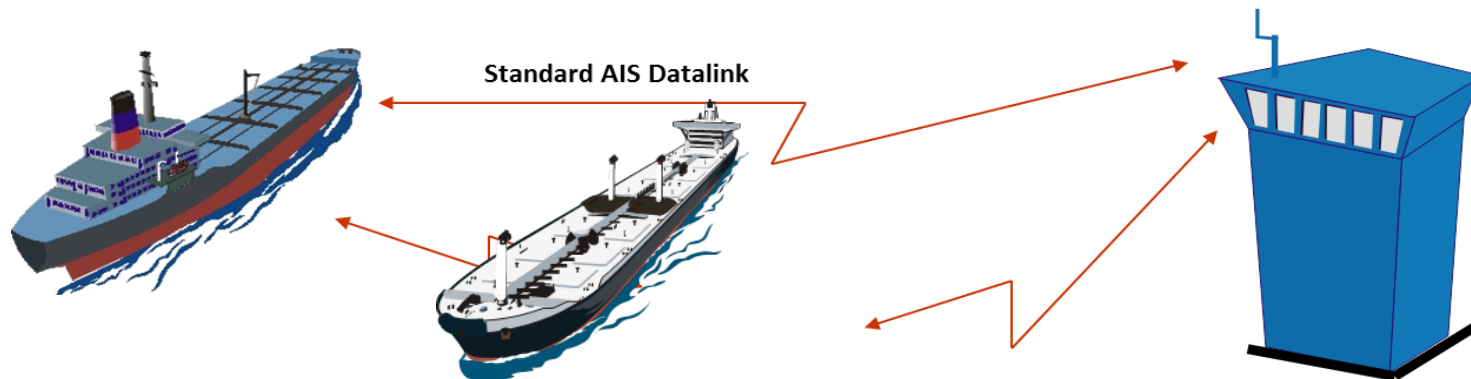
## AIS Benefits

- Improved safety and security:
  - Safer operations in foul weather.
  - Better environmental protection.
  - Better emergency response.
- Improved efficiency:
  - Reduced transit times.
  - Better scheduling of lockages and vessel tie-ups.
  - Better scheduling of inspections and pilotage services.

# Vessel Tracking Lockage Information System

- Collects, manages and displays appropriate information for a scheduling system.
    - Integrates tow tracking and traffic (and lock) management.
    - The information needed depends on the type of traffic and lockage management.

- Geographic scope ranges from:
    - Single lock and adjacent pools.
    - Multiple locks and pools.
    - Entire seaway.

- Vessel location data ranges from:
    - Existing data (OMNI).
    - Near-real time locations (e.g., every hour).
    - Real time locations.

# Issues for Finding Tow Locations

- Key issues are *how to solve of* and *when to determined of* finding and communicating tow locations.

- How much does real time or near-real time vessel tracking add for reducing congestion or increase efficiency?

- How much positional and temporal accuracy is needed on the waterway to the lockage?

## Tracking Questions

- What type of vessel tracking is best?

  ## - Type A/ Type B

    - When will AIS be required on the tug boats?
    - How much cost it will need to be?

- How to find locations?
    - Automatic: Remote sensing, AIS, etc.
    - Manual (reporting by tows).
    - Radar scan

- When to report locations?

# Alternatives

1. Track tows using the existing (OMNI) data.

2. Track tows using near-real time data reported by the vessel/carrier (IRVMC).

3. Track tows using real time tow tracking with traffic management centers of VTS system

4. Do nothing.

## Tow Tracking Summary

- Real time and near-real time tow tracking is certainly feasible on VTS.

- Technologies for tow tracking can be well recorded.

- Integration of tow tracking and lock scheduling is feasible, but hpw fast we could implemented.

# TCAS Summary

- The BAP T-series is the innovated rugged platform which has been designed to perform high accuracy GNSS positioning with dual antenna interfaces and heading features. Jointly with the BAP GCP Software Suite, the platform has become the most powerful all in one system for offering the high accuracy position and sensor information.

- With AIS Class B Transceiver will be able to support lots of marine used to environmental applications.
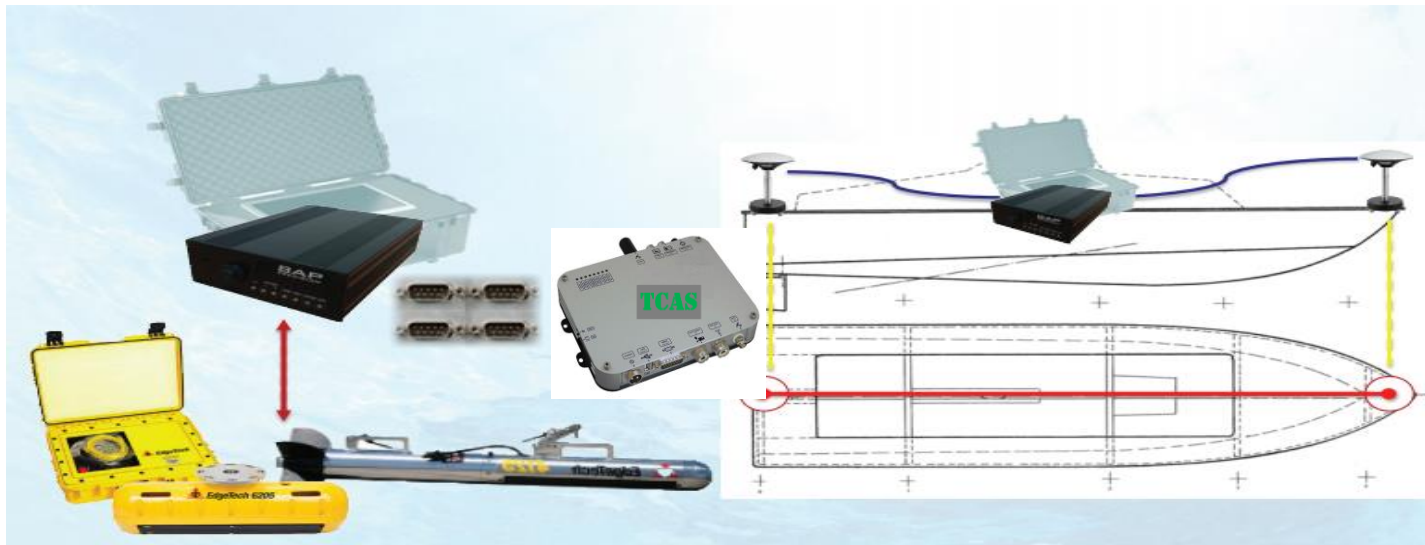
# Highlight of TCAS

## T-series Box

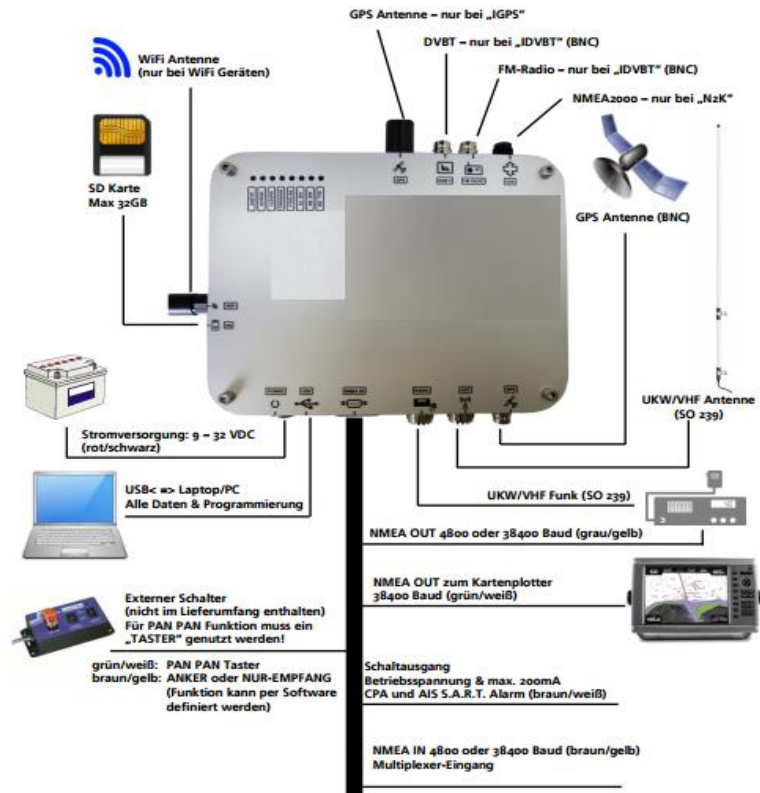| GNSS Sensor Performance | | |
|---|---|---|
| Receiver Type | 270 Channels, L1/L2 GPS/ GLONASS | |
| SBAS Tracking | 3-channel, parallel tracking | |
| Update Rate | 10 Hz standard, 20 Hz optional | |
| Horizontal Accuracy | RMS (67%) | 2DRMS (95%) |
| RTK | 10 mm + 1 ppm | 20 mm + 2 ppm |
| SBAS (WAAS) | 0.25 m | 0.50 m |
| Autonomous, no SA | 1.20 m | 2.50 m |
| Heading Accuracy | < 0.17° rms @ 0.5 m antenna separation | |
| | < 0.09° rms @ 1.0 m antenna separation | |
| | < 0.04° rms @ 2.0 m antenna separation | |
| | < 0.02° rms @ 5.0 m antenna separation | |
| Pitch / Roll Accuracy | < 1° rms | |
| Heave Accuracy | 30 cm rms (DGPS) , 5 cm rms (RTK) | |
| Timing (1PPS) Accuracy | 20 ns | |
| Cold Start | < 40 s typical (no almanac or RTC) | |
| Warm Start | < 20 s typical (almanac and RTC) | |
| Hot Start | < 5 s typical (almanac, RTC and position) | |
| Heading Fix | < 10 s typical (Hot Start) | |
| Maximum Speed | 1,850 kph (999 kts) | |
| Maximum Altitude | 18,288 m (60,000 ft) | |
| Interface | | |
| Power Supply | DC and AC | |
| Power Button | Yes | |
| RS-232 | 4 Ports | |
| GNSS Antenna | 2 GNSS Antenna TNC Connector | |
| USB Host | USB 3.0 x 3 | |
| Ethernet | RJ-45 | |
| LED Indicator | Yes | |

## AIS Transceiver

- Integrated VHF splitter with pre-amplifier
- Integrated GPS antenna
- Integrated NMEA2000 adapter
- Integrated DVBT antenna switch
- Additional USP port for more connectivity
- 38400 or 4800 Baud rate selection possible by software
- 8 operating LEDs for more convenience
- SD Card recorder for blackbox employment
- Enlarged voltage input
- Integrated multiplexer
- Separate cable harness for "silent mode" or "PAN PAN" persistent signal
- Plotter independent CPA alert
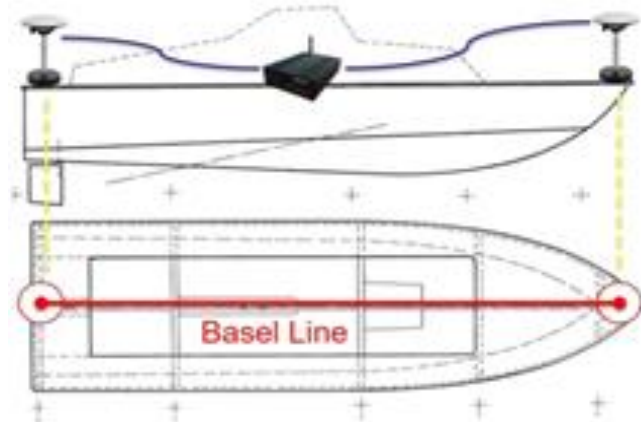- Plotter independent AIS S.A.R.T. alert

# Additional AIS Transceiver in TCAS Specification and Specialty

- Integrated GPS antenna
- Integrated NMEA2000 adapter
- Integrated DVBT antenna switch
- Plotter independent AIS S.A.R.T. alert
- Plotter independent CPA alert
- USB port
- SD Card recorder
- AIS receiver and transmitter with integrated GPS receiver
- 1 transmitter, 2 receiver
- Responsivity: -107dBm minimum, typically -112dBm
- Data rate: 38400 or 4800 Baud, bi-directional
- NMEA telegram type: VDM
- Adapter VFH antenna: 50 Ohm, SO2239
- Adapter GPS antenna: 50 Ohm, BNC
- Cabin mounting, IP60, -25°C – 55°C
- Dimensions: 198mm (L) 158mm (W) 47mm (H)
- Weight: approx. 275 grams

- The ClassB unit easyTRX2S receives AIS ClassA and ClassB signals and transmits own data according to ClassB standard.
- DVBT enables to watch TV nearly wherever you want. Create you own sports bar aboard. By means of an internal antenna switch in every easyTRX2S unit with the appendix "DVBT" the VHF marinaband is divided for the different applications. TV signals within the marinaband were separated, pre-amplified and forwarded to your digital TV receiver. This receiver will decode the signal and pass them to your TV set.
- The integrated NMEA2000 Adapter enables to connect this AIS transceiver into the latest NMEA2000 network standard aboard.
- NMEA2000 is a new data form which enables to plug different devices in a row on the data stream. Each units takes his special data out of the stream. This is also called "BUS-system".
- The ClassB device needs a separate GPS antenna and an own VHF antenna. As an alternative you can run the easyTRX2S with the VHF antenna switch easySPLIT-OCB for using your existing VHF antenna. A separate GPS antenna is still needed. An other alternative is the VHF/GPS combi antenna.

# Specialty



WiFi Antenne (nur bei WiFi Geräten)

SD Karte Max 32GB

GPS Antenne – nur bei „IGPS"
DVBT – nur bei „IDVBT" (BNC)
FM-Radio – nur bei „IDVBT" (BNC)
NMEA2000 – nur bei „N2K"

GPS Antenne (BNC)

UKW/VHF Antenne (SO 239)

Stromversorgung: 9 – 32 VDC (rot/schwarz)

USB< =:> Laptop/PC
Alle Daten & Programmierung

UKW/VHF Funk (SO 239)

Externer Schalter
(nicht im Lieferumfang enthalten)
Für PAN PAN Funktion muss ein „TASTER" genutzt werden!

grün/weiß: PAN PAN Taster
braun/gelb: ANKER oder NUR-EMPFANG
(Funktion kann per Software definiert werden)

NMEA OUT 4800 oder 38400 Baud (grau/gelb)

NMEA OUT zum Kartenplotter 38400 Baud (grün/weiß)

Schaltausgang
Betriebsspannung & max. 200mA
CPA und AIS S.A.R.T. Alarm (braun/weiß)

NMEA IN 4800 oder 38400 Baud (braun/gelb)
Multiplexer-Eingang



Abbildung 1-AIS-Netzwerk



Basel Line

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