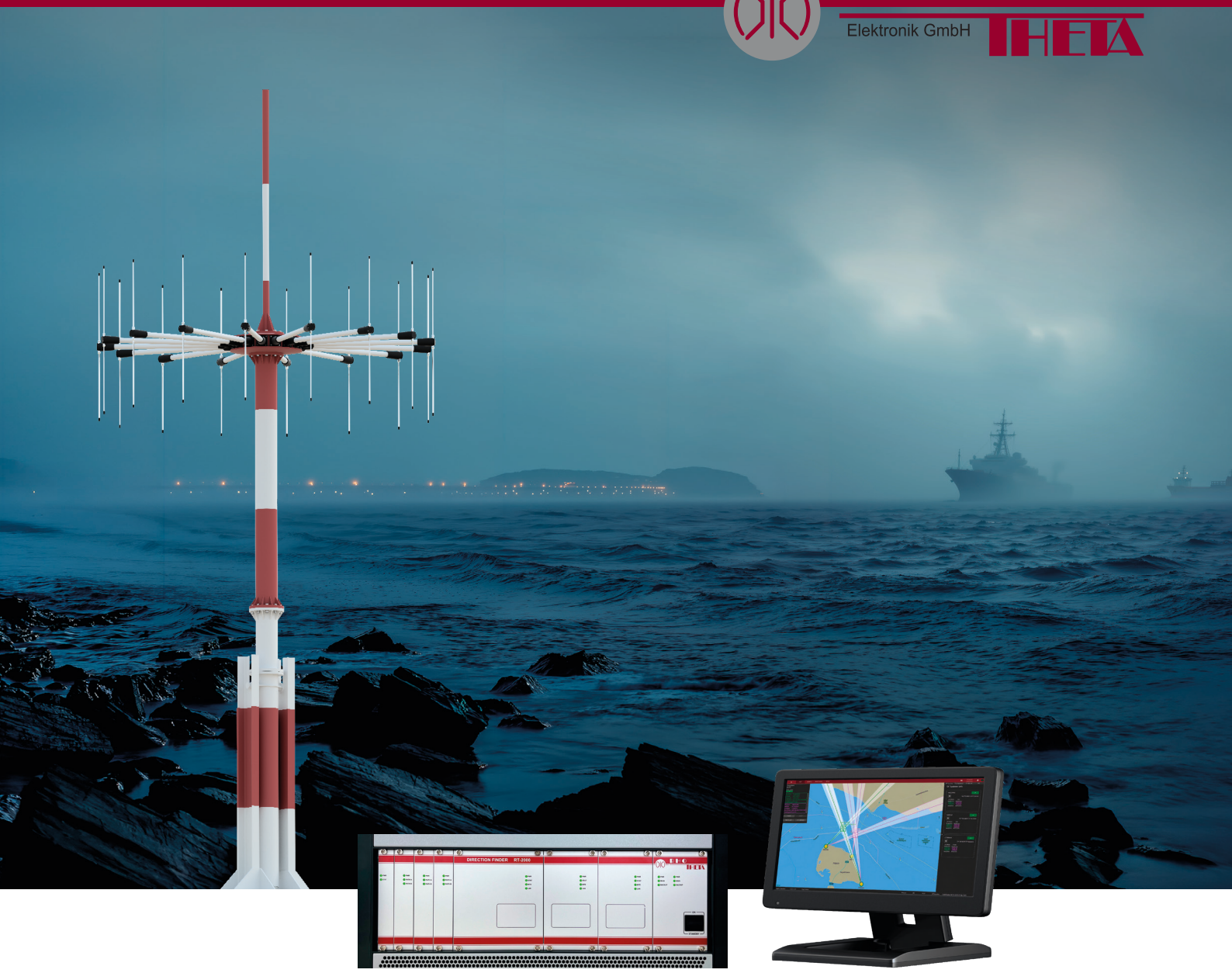
RHO Elektronik GmbH THETA



MULTICHANNEL RADIO DIRECTION FINDER RT-2000

The professional standard for Vessel Traffic Services (VTS) and Search and Rescue (SAR): The RHOTHETA RT-2000 locates the source of any radio transmission – instantly, automatically, and with a bearing accuracy of 1° RMS. From a single station to a nationwide coastal network. Fully integrated into existing VTS infrastructure. Built for the demands of continuous maritime operations.



BLIND SPOTS AT SEA

Ports are busier than ever: Vessel traffic in coastal waters and access channels is on the rise and with it, the demands placed on vessel traffic controllers. Radar shows what is moving. AIS shows which vessels are reporting their position. Yet neither system tells vessel traffic controllers where a radio message is actually coming from. This blind spot has consequences. But it need not remain a blind spot any longer.

Respondent F noted that fishermen sometimes switch off their AIS equipment for competitive reasons: "They don't want the other vessels to know where the fish is, or crab, or whatever they are fishing for."

Emmens, T. et al. (2021): The promises and perils of Automatic Identification System data.

The identification problem

Shore-based traffic management relies on radio communication. Every radio contact begins with the vessel identifying itself – by name, call sign or MMSI – and this identity must be correctly matched to a target on the radar screen. In theory, this is quite simple. In practice, it is a constant source of error.

Overloaded channels mean that several vessels are transmitting on the same frequency. Accents, background noise and similar call signs lead to confusion. And if a vessel fails to report its position – whether due to equipment failure, a GPS failure or deliberate silence – controllers are forced to work with incomplete information at precisely the moment when they can least afford to do so. Interference adds to the pressure. A stuck transmit button or an unauthorised transmission can block a critical communication channel without warning. Identifying the source takes time, which is often not available in traffic situations or, in particular, during emergencies.

RHOTHETA RT-2000: Every vessel has a voice. We'll find its source.

WHERE RT-2000 MAKES THE DIFFERENCE

Improved situational awareness

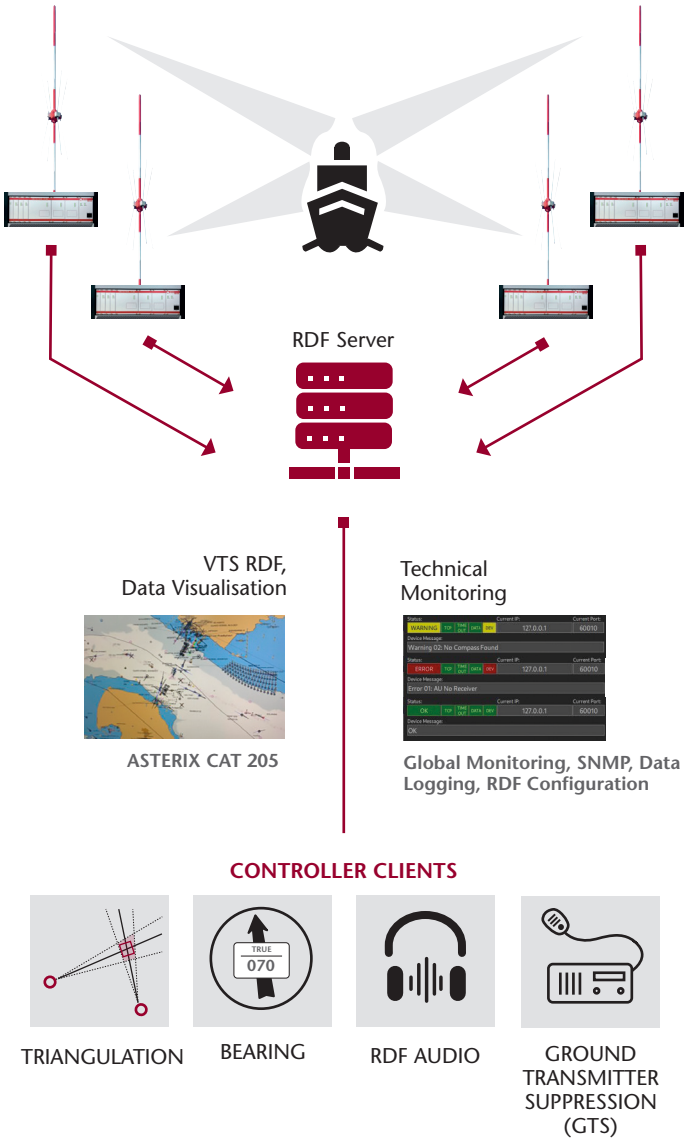


The RT-2000 automatically displays the bearing and geographical position of each transmitting vessel directly on the VTS radar screen. Call signs are immediately and unambiguously assigned to radar targets – this makes identification faster and more reliable, prevents errors in reporting before they escalate, and reduces the workload on operating staff even during periods of heavy traffic.

Support for vessel navigation



In areas with limited radar coverage or in adverse weather conditions, vessels can quickly lose their bearings. The RT-2000 determines a vessel's position solely on the basis of its radio signals, thereby providing reliable navigation support and guidance without requiring position data from the vessel itself.



HOW THE RT-2000 WORKS

The RT-2000 uses the Doppler principle to determine the direction of any radio transmission within its frequency range. Bearing data from one or more RDF sensors is fed to a central RDF server in real time. One sensor delivers a bearing line. Multiple RDF sensors triangulate the position.

1. **Receive & Decode:** The system simultaneously monitors up to 92 channels across the full frequency range – including the marine band VHF (154–163 MHz) and COSPAS-SARSAT (406 MHz) – capturing radio transmissions with a minimum signal duration of just 50 ms.

2. **Calculate & Locate:** For each transmission, the RT-2000 calculates a precise bearing. Where multiple RDF sensors are deployed, cross-bearings determine the geographic location of the transmitting vessel.

3. **Display & Integrate:** Results appear as bearing lines and precise locations on the VTS radar screen – or are transmitted via ASTERIX CAT 205 or JSON API to existing VTS management and surveillance systems.

4. **Monitor & Manage:** The DF Commander MK2 software gives operators full remote control of all connected RHOTHETA RDF sensors from a single interface. SNMP-based real-time monitoring captures the network topology, infrastructure components, and system status, enabling the assessment of system availability as well as immediate fault detection and resolution in plain text.

- **Built for continuous operation:** >30,000 h MTBF, 15-year service life, built-in test equipment and integrated test transmitter.

RT-2000 is designed for **high availability and reliability**. It supports comprehensive and individually configurable redundancy concepts at the system and network levels, thereby ensuring uninterrupted operation even in the event of component or connection failures. This makes the system suitable for continuous operational use within a VTS environment.

High-precision direction finding with 1° RMS bearing accuracy

Scalable architecture from single port to nationwide VTS network

Seamless integration into existing VTS and surveillance systems

Emergency response

If a GPS module fails, a transponder malfunctions or a seafarer reports a position that cannot be independently verified, the RT-2000 locates the vessel using radio signals alone. Operators can maintain contact, verify the vessel's actual position and guide it safely through the situation – without relying on data from the vessel itself.

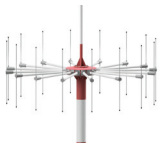
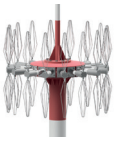
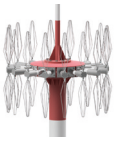
Detecting and locating interference

Accidentally triggered EPIRB or SART emergency beacons, faulty equipment and unauthorised transmissions can disrupt maritime radio communications without warning. The RT-2000 continuously monitors all frequencies, identifies the source of any interference and pinpoints its position on the nautical chart – enabling immediate corrective action to be taken.

System Characteristics*

PARAMETER	CONDITION	DATA
DF Method		Doppler
Number of DF Channels	Simultaneous operation	Up to 92
Frequency Range	Full DF range	117.975 – 470.000 MHz
	Marine band VHF	154.000 – 163.000 MHz (Ch 0 … 28/60 … 88)
	COSPAS-SARSAT	406.000 – 406.100 MHz (19 Ch A to S)
Channel Spacing		5 kHz / 8.33 kHz / 12.5 kHz / 25 kHz
Bearing Sensitivity	for ± 2° fluctuation	≤ 5 µV/m, typ. 3 µV/m
Bearing Accuracy	Antenna depending, Measured in undisturbed wave field, with unmodulated signal, with sufficient signal strength	≤ 1° RMS
Bearing Resolution		0.1°
Minimum Signal Duration		50 ms
Operating Temperature Range	Bearing Channel	-40°C … +55°C
	RDF Antenna	-50°C … +80°C
Service life		15 years

Antenna Options*

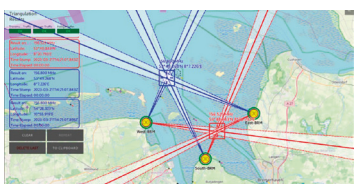
ANTENNA TYPE	VHF WIDE APERTURE	UHF MEDIUM APERTURE	WIDEBAND MEDIUM APERTURE	VHF SMALL APERTURE	WIDEBAND SMALL APERTURE
Antenna view					
Frequency range	117 – 174 MHz	225 – 470 MHz	117 – 470 MHz	117 – 174 MHz	117 – 410 MHz
Number of elements	16	16	16	4	4
Diameter	270 cm	100 cm	100 cm	25 cm	25 cm
Weight	67 kg	62 kg	62 kg	10.4 kg	11 kg
Immunity to reflections	high	high	medium	standard	standard
Bearing Accuracy	typ. 0.5° RMS	typ. 1° RMS	typ. 1° RMS	typ. 1° RMS	typ. 1° RMS
Max. Wind Speed	275 km/h	275 km/h	275 km/h	275 km/h	275 km/h

* The information contained in this brochure is for reference only. The manufacturer reserves the right to modify specifications without prior notice.

RT-2000 – Perfect when paired with:

► DF Commander MK2

Software for the remote control, monitoring and integration of radio direction finder systems into VTS network architectures.



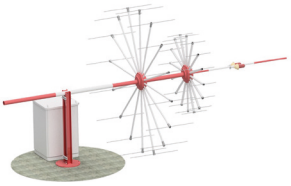
► Local Homing Display

Fits even in small workspaces (on a 10-inch monitor) – can be integrated into existing panels: The target acquisition display shows bearing direction, reference data and signal quality in real time, in a display tailored to the vessel traffic controller.



► DF Antenna Mast

The mast design enables easy access to the antenna, allowing for convenient maintenance and servicing operations.



This brochure contains AI-generated images.



RHOTHETA RT-2000: BUILT FOR SAFETY

Rev 1.00

LOCATE WHAT RADAR CANNOT LOCATE.

- Determines the bearing and position of radio transmitters fully automatically
- Delivers precise location even when GPS and transponder data are faulty or unavailable
- Identifies sources of interference and unauthorised transmissions
- Supports lost vessels and emergency navigation

PRECISION DATA FOR SAFE DECISIONS.

Creates a reliable foundation for

- Faster vessel identification and reduced controller workload
- Targeted navigation assistance in critical situations
- Immediate interference detection
- Life-saving support in SAR and emergency operations

SCALABLE. INTEGRATABLE. STANDARDS-BASED.

- Modular architecture for single stations and coastalwide VTS networks
- High availability through modular redundancy options
- Seamless integration via ASTERIX CAT 205, JSON API and SNMP
- The RT-2000 Direction Finder System complies with the recommendations of IALA Guideline G1111-7
- Audio streaming, technical monitoring in real time
- Your reliable partner throughout the entire product life cycle

The Leader in Direction Finding

RHO Elektronik GmbH THETA

www.rhotheta.com

BUILT TO FIND

RHOTHETA: The Leader in Direction Finding

Comprehensive expertise, decades of specialization, and a focus on the needs and requirements of our customers: Building on this foundation, RHOTHETA Elektronik GmbH, based in Murnau, has been developing and manufacturing state-of-the-art, reliable radio direction-finding systems since 1989.

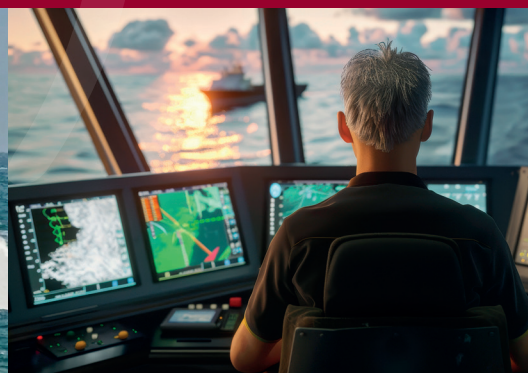
The innovative product portfolio is designed for professional applications where terrestrial radio direction finding – as a supplement to and independent of GPS – is essential for reliable, safe, and fail-safe positioning: **in the maritime and airborne sector, in air traffic control (ATC), in vessel traffic services (VTS), and in search and rescue operations (SAR)** for professional maritime and air rescue.

However, we are not only a manufacturer of highly available systems, but also a reliable partner – throughout the entire product life cycle: Our products save lives, and we take this responsibility seriously.





Quelle: DGzRS



Talk on the air? We‘ve got the Where.

RHO Elektronik GmbH THETA



Coordinates: N 47.6842° / E 11.1982° / (WGS 84)

RHOTHETA Elektronik GmbH
Dr.-Ingeborg-Haeckel-Str. 2
82418 Murnau
Germany

Tel.: +49 88 41 4879 - 0
Fax: +49 88 41 4879 - 15
E-Mail: email@rhotheta.de

RHOTHETA International
8201 Peters Road Suite 1000
Ft Lauderdale, FL 33324
USA

Tel.: +1 954 - 495-8700
Fax: +1 954 - 476-5926
E-Mail: info@rhothetaint.com
www.rhothetaint.com