



# **SCANTER 2001<sup>i</sup> Transceiver Instruction Manual**

**262001-HT Rev. K**

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## 2

### The SCANTER 2001<sup>i</sup> Product Family

The SCANTER 2001<sup>i</sup> family is a series of transmitter/receiver units - transceivers - developed for use in Radar Sensor applications for Ships Radar Systems, Vessel Traffic Services, Coastal Surveillance Radar Systems and Surface Movement Radars.

The backbone of the SCANTER 2001<sup>i</sup> is a standard structure comprising of a few basic electronic modules of the transceiver.

A minimum configured SCANTER 2001<sup>i</sup> includes 8 modules (modulator, receiver, magnetron, blower assy, mains distribution unit, motherboard, processing crate with transceiver controller and a signal distribution unit).

A maximum equipped unit with an additional receiver/transmitter group and all possible signal processing, includes 15 modules.

The cabinet is identical for all SCANTER 2001<sup>i</sup> transceivers. It holds all modules, both basic modules and additional modules, and interconnecting cabling as well.

The product range of the SCANTER 2001<sup>i</sup> supports 7 system configurations - ranging from a basic single unit with one transmission frequency to two redundant units with frequency diversity.

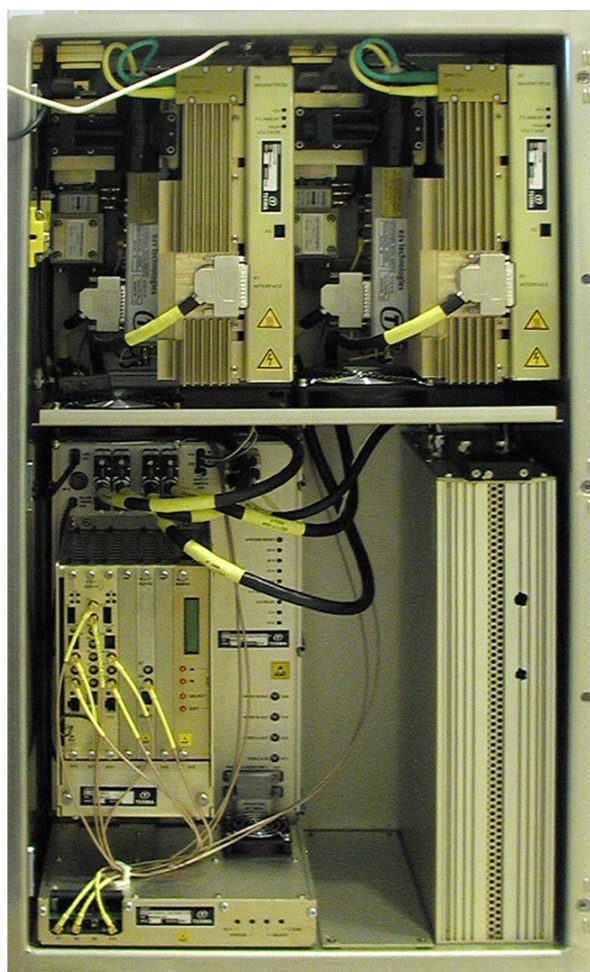


Fig. 2.1 Inside the transceiver (X-band)

## 2.1 System Configurations



### Single X-band / Single S-band

Standard radar transceivers



### Single, Semi-Redundant

One cabinet with two identical modulators, magnetrons and receivers. On error in one modulator/receiver group, the other group continues to operate



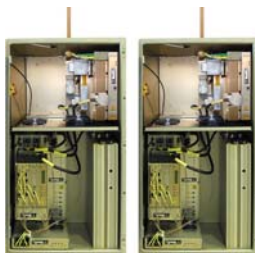
### Single, Frequency Diversity (FD)

One cabinet with two identical modulators - receivers and magnetrons using different frequencies. On error in one the modulator/receiver groups, the system continues operation with reduced performance (with one frequency only)



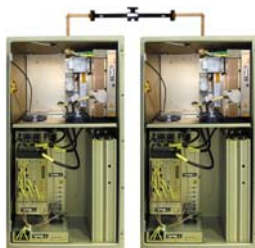
### Dual Redundant

Two identical transceivers. On error on the active transmitter, the other transceiver takes over and operation continues after 3 seconds (automatically or manually)



### Dual X and S-band

Two transceivers operating on two different frequency bands, X and S. On error or reduced performance in the active transceiver, the other will take over. This change-over may happen automatically or manually



### Dual Frequency Diversity (FD)

Two identical transmitters transmitting at the same time on different frequencies. The video signals of the two frequencies are combined giving increased performance. On error in one of the transceivers, the system continues operation with reduced performance (with one frequency only)



### 3 Functional Description

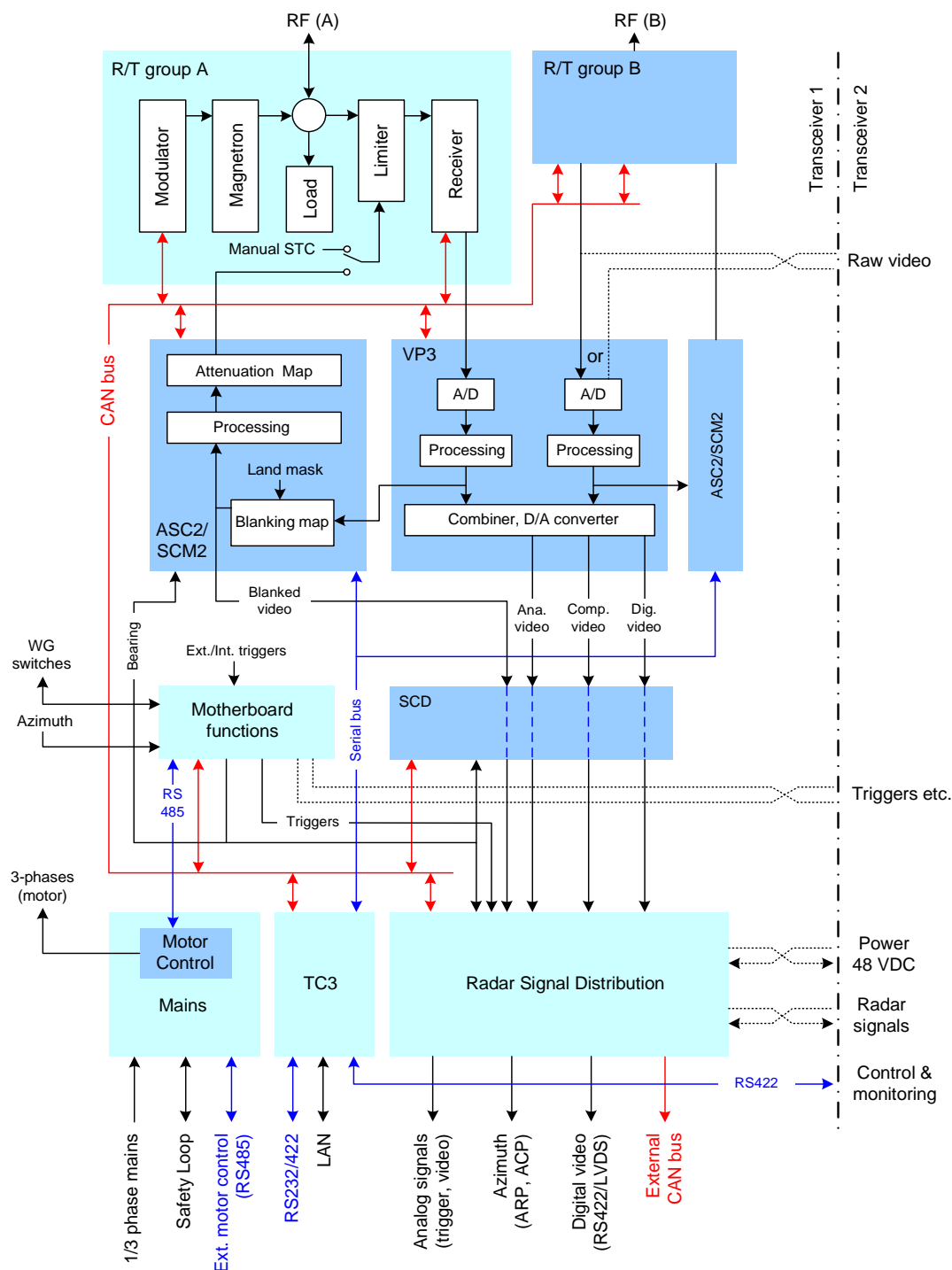


Fig. 3.1 Functional block diagram

#### 3.1 Transmission

A magnetron is used to generate the RF pulse at a frequency determined by the magnetron only. A waveguide is used to apply the RF pulse to the antenna and the following propagation in free air. A 4-port circulator is used to guide the RF pulse

to the antenna (and for redundant systems, the pulse also passes a waveguide switch) and to guide received echoes to the receiver. The circulator is a part of the receiver and includes a dummy load to absorb reflections from the antenna unit.

The magnetron is controlled by a modulator, in which high voltage is generated and in which the programmable pulse width (PW) is determined.

The output power from the magnetron is measured internally and can be set up to give a warning when a lower limit is reached.

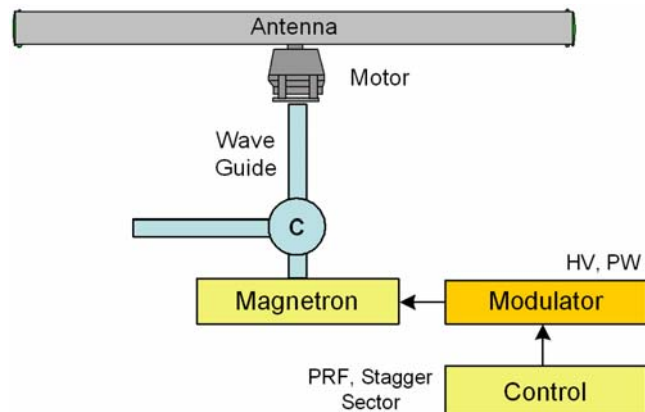


Fig. 3.2 Transmission

The sample used for forward power measurement is also used to produce a true T0 trigger and used for AFC purposes as well.

When the modulator has to fire off the magnetron is determined by a timing and control circuit which is a part of the motherboard. These are parameters such as pulse repetition frequency (PRF), stagger and sector transmission which are all changeable parameters. The stagger function allows for suppression of second-time-around echoes and of running rabbits (interference from other radars).

## 3.2 Antenna and Azimuth

The antenna is a slotted waveguide antenna (SWG antenna) and depending on the purpose it can be horizontally and/or circularly polarized, a standard SWG antenna, a high gain antenna or a large aperture antenna. All types available have varying length, where the length oftenly is determined by the requirements to horizontal beam width and requirements to the physical size. Having a frequency diversity system with two different frequencies, the system benefits from the SWG antenna, as different frequencies is radiated horizontally in different angles and results in two hits on targets (time diversity).

To rotate the antenna, a motor and a gearbox is used - from 1.1 kW to 7.5 kW depending on the antenna type and the application. The motor is controlled by a frequency converter which is housed in the Mains Distribution Unit (for 1.1 kW motors) or in an external cabinet.

As it is necessary to know the direction of the antenna, an encoder (or two for redundancy) is mounted in the turning unit. This encoder applies the system one pulse per rotation (an ARP - Antenna Rotation Pulse) and another 8192 pulses per rotation (ACP's - Antenna Count Pulses). The ARP tells the system when a rotation starts and the ACP's give the information about direction - 8192 pulses corresponds an azimuth resolution of 0.0439 degree.

## 4 Modular Unit Structure

The SCANTER 2001<sup>i</sup> transceiver is based on plug-in modules and embedded software. Each module is a line replaceable unit (LRU).

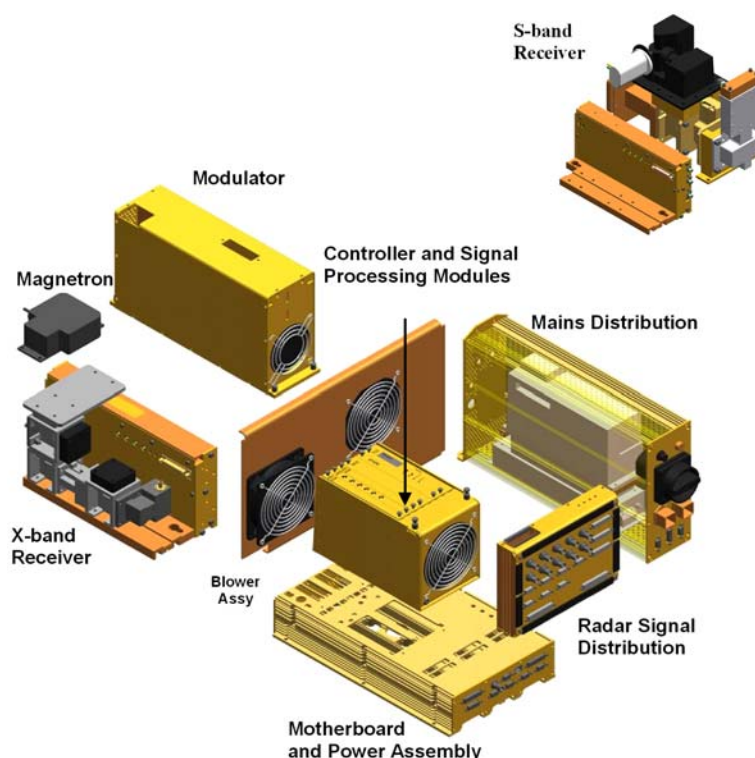


Fig. 4.1 Modules of the transceiver



Fig. 4.2 Crate

In the crate there is space for the following modules:

ASC2-A / SCM2-A (A10)  
 VP3 (A11)  
 ASC2-B / SCM2-B (A12)  
 SCD (A13)  
 TC3 (A15)

Slot A14 is a spare with a blind cover mounted.





## 4.1 Modules / Line-Replaceable Units (LRUs)

In the following brief descriptions of the functional operation of the line-replaceable units are given. The LRUs are:

LRU name	Terma no.
Mains Distribution Unit (multiple variants)	262075-xxx
Motherboard and Power Assembly	262039-001
Transceiver Controller TC3	262032-001
Modulator	303830-001
Receiver, X-band, 9.1-9.3 GHz	254400-001
Receiver, X-band, 9.3-9.5 GHz	254400-002
Receiver, S-band, 3.05 GHz	255180-001
Video Processor VP3	254003-001
ASC2A / VP3	262815-001
ASC2A / VP3 / ASC2B	262816-001
SCM2A / VP3	262819-001
SCM2A / VP3 / SCM2B	262820-001
Sea Clutter Discriminator (SCD)	262162-001
Dummy board, SCD	262212-001
Radar Signal Distribution (RSD)	262060-001
Stabilized Azimuth Unit (SAU)	313435-001
Blower assy, middle	262072-001
Blower assy, crate	262047-001
Magnetron, X-band, 25 kW	
9.170 GHz	262149-006
9.225 GHz	262149-008
9.375 GHz	262149-001
9.410 GHz	262149-002
9.438 GHz	262149-005
9.490 GHz	262149-003
Magnetron, X-band, 4 kW	
9.375 GHz	262270-003
9.410 GHz	262270-002
Magnetron, S-band, 3.050 GHz	262159-001

#### 4.1.4

### Motherboard and Power Assembly (MPA)

The MPA unit includes generation of all power supplies, system timing and functions as a normal motherboard as well, i.e. holds connections to other modules.

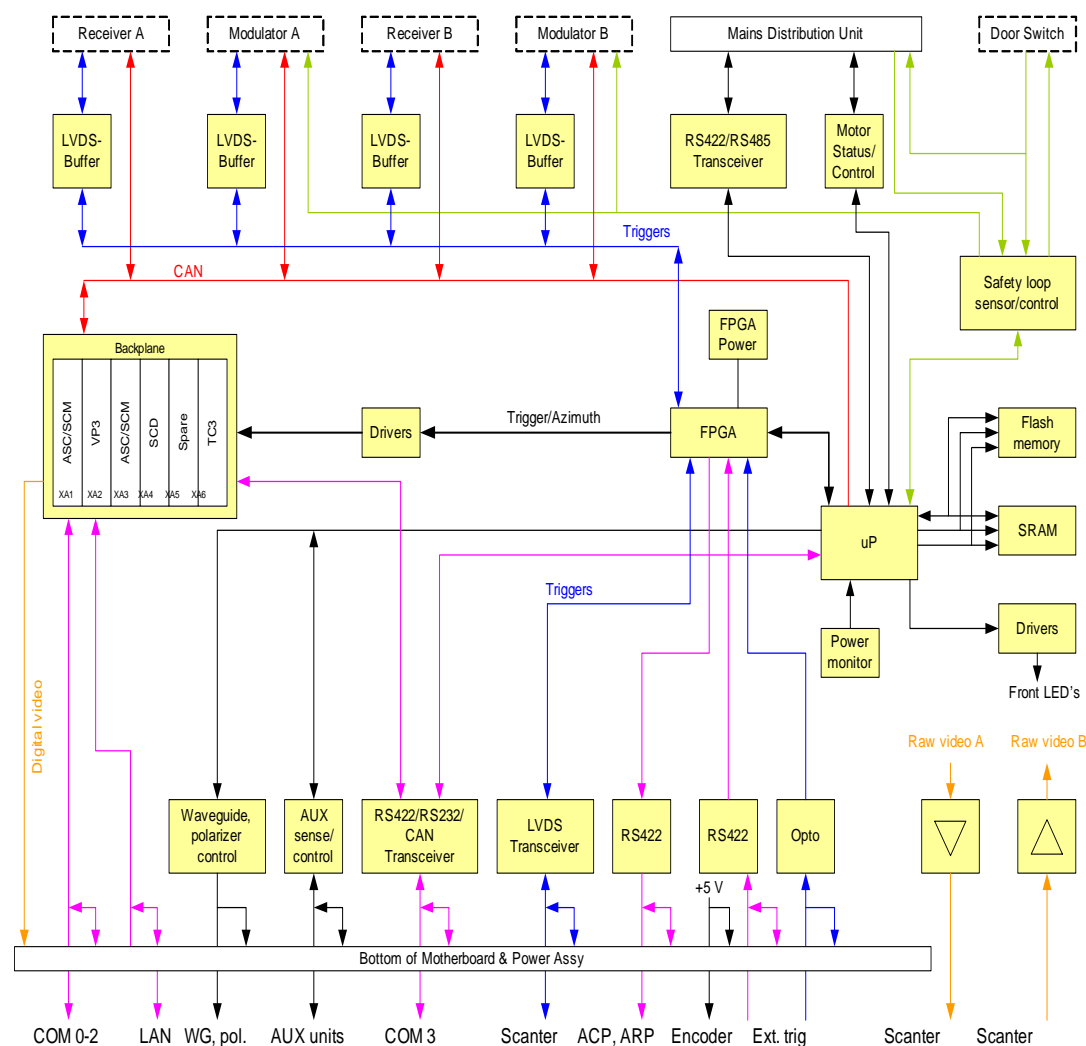


Fig. 4.7 Block schematic, Motherboard & Power Assembly

The motherboard consists of a back plane for the processing crate, microcontroller, timing functions and a number of internal and external interface connectors (the latter mentioned outside the cabinet, at the bottom of the module).

The 6-connector back plane holds the transceiver controller (TC3) and the optional video processor (VP3). The CAN bus is dedicated to the VP3, TC3 and 2 spare boards. Each slot-position has a dedicated function.

The microcontroller has several tasks. Some of the main tasks are parameter settings and status request from other units.

The FPGA controls the overall timing (triggers) in the transceiver, generates STC-trigger and converts azimuth data from the encoder.

The interfaces towards internal RxTx units are: Receiver, modulator, antenna motor control, indicator panel on front door, blowers, and RSD.

#### 4.1.6

### Modulator

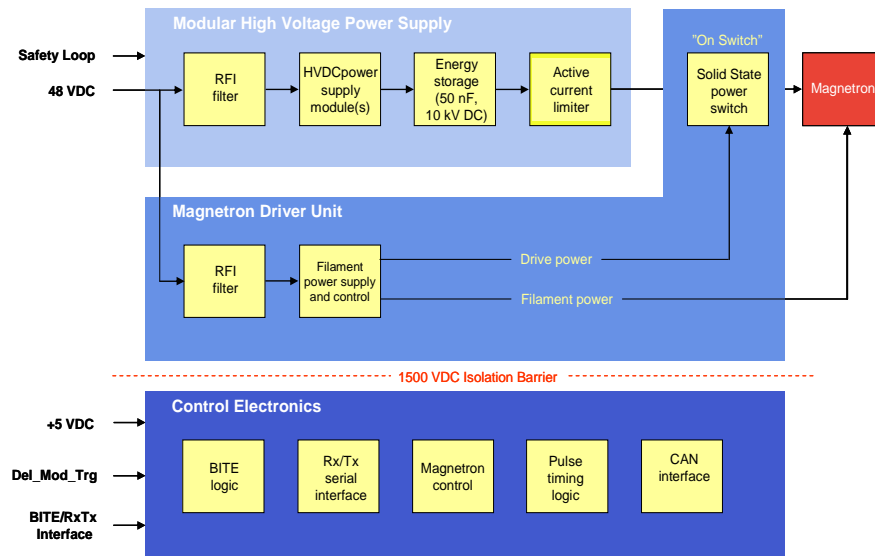


Fig. 4.16 Block schematic, Modulator

##### 4.1.6.1

#### High-Voltage Power Supply

The high voltage power supply provides the high voltage and energy storage for the magnetron pulses. The output current from the power supply is limited by an active current control function during the magnetron output pulse.

##### 4.1.6.2

#### Magnetron Driver Unit

The magnetron driver unit delivers energy from the high voltage power supply to the magnetron in the form of pulses with controlled rise time, duration and fall time. The magnetron driver contains filament power supply for the magnetron and the measurement circuitry to monitor magnetron performance.

##### 4.1.6.3

#### Control Electronics

The control electronics provides the interface between the modulator and the radar system. The control electronics includes the following functions:

- **microcontroller**, implements the interface to the TC3 unit and manages the configuration data required for the magnetron.
- **timing logic**, implementing the sequencing and timing required to produce the output pulses.
- **signal interface**, implements the interface to the radar system timing unit and other functions.
- **error handling logic**, implements functionality required to protect magnetron and modulator while keeping the radar functional.
- **power interface**, implements isolated control and measurement channels to the power processing functions.



Fig. 4.17 Modulator

#### 4.1.6.4 Enclosure

The modulator enclosure is designed to provide easy assembly and installation of the modulator assembly. The enclosure protects personnel against contact with high voltage and provides EMI shielding.

Due to oil cooling the enclosure might get hot.

#### 4.1.6.5 High Voltage Auto-adjust

When a new magnetron is installed, the menu "30 min. post storage" is chosen and with that the magnetron is running half an hour with reduced power supply (to avoid flash-overs when a stored magnetron is installed).

Together with the above mentioned menu, it is possible to enable or disable the function "HV auto-adjust". When this function is enabled, the magnetron power supply from the modulator (approx. 8.5 kV) will be adjusted to obtain an RF output of 25 kW to take into consideration the production deviations of magnetrons.

Spare parts:	None
Preventive maintenance:	None
Repair:	Return module to Terma AS



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