RADAR TRAINER
Mod. M702-E/EV

INTRODUCTION

This Radar trainer is designed to study radar technologies and systems used in maritime navigation.
All devices are of professional type.

The **Radar Trainer mod. M702-E/EV** features an up-to-date real marine digital radar, properly modified to teach the operation, installation and maintenance of a radar system.

The trainer consists of a main unit, including:

- a **Mimic panel** with the functional diagram of the radar and the test point on the most significant signals
- the **Display unit** contains radar control and management; components and circuits are completely visible
- a **Screen** displays the information received and processed by the radar system
- the **Radar Image Simulator** generates a radar image with moving targets, thus accurately reproducing the operation of an outdoor scanner unit;
- a **Fault simulator**

The training program can be expanded using the following **additional optional devices (not included)**:

- **Scanner Unit mod. M702-SU/EV**: it is a real radar outdoor unit including transmission and receiving circuits and slot antenna (for outdoor use) or dummy load (for indoor use)
- **Electronic Compass mod. M702-C/EV** that supplies information on navigation direction and North
- **GPS Receiver mod. M702-G/EV** that supplies information on geographic position

RADAR TRAINER mod. M702-E/EV

TRAINING PROGRAM:

- Introduction to radar techniques
  - Incident and reflected wave
  - Pulse duration/repetition frequency ratio
  - Power/range ratio
  - Continuous-wave (CW) radar
  - Radar equation
- Proper interpretation of radar diagram with reference to physical phenomena and to technological limits
- Block description and circuit analysis of radar
- PRF (Pulse Repetition Frequency) generator and transmitter trigger
- Gate signal generator
- Solid state modulator
- Magnetron transmitter
- Control of antenna rotation
- Circulator and limiter for input protection
- Solid-state preamplifier and mixer
- Logarithmic receiver
- Echo signal processing and acquisition
- Interference rejection
- Correlation and integration
- Mini ARPA (Automatic Radar Plotting Aids) anti-collision system and guard zones
- Video circuits:
  - Horizontal and vertical deflection
  - Video signal and memory
  - On-screen display (OSD) for navigation and data setting
- Radar image generator
- "Switch mode" power supply
- Instructions of use
- Measurements on radar different parts
- Troubleshooting

TECHNICAL SPECIFICATION:

Silk-screen printed panel:

- Compact panel
- 28 test points at the most significant points of the circuits
- Cards mounted near the related electric diagram
- Dimensions: 650 x 800 mm

Example of display on the indicator

Active elements:
- Rings
- Target
- Mini-Arpa
- Cursor
- Bar graphs...

Indicator:

- Screen: 15", high resolution, RGB color TFT LCD
- Pull-Down and Pull-Up menus
- Mini ARPA functions:
  - with automatic tracking up to 12 targets with manual initialization
  - inquire object for target data acquisition
- Representation: PPI raster scanning with image shown continuously and updated
- Freeze frame: it "freezes" the image to study it
- Echo stretch: it points out the slightly perceptible echoes
- Computing speed:
  - speed calculation (kT)
  - course calculation (°)
- Guard Zones (GZ):
  - Sectorial GZ: 3 maximum available selectable guard zones
  - Polygonal GZ: 6 maximum available guard zones selectable by maximum 6 points
  - When an echo appears within the area limits, a visual and acoustic alarm is enabled
- Plot:
  - it leaves the tracks of all echoes, for the representation of the last positions
  - selectable: 15s, 30s, 1m, 3m, 6m
- Off-center representation: 55% of the ray in all directions and ranges
- Ranges:
  - 1/16, 1/8, 1/4, 1/2, 3/4, 3/2, 3, 6, 12, 24, 48 Nautical Miles (N.M.)
  - 0.25, 0.5, 1, 1.5, 3, 6, 12, 24, 48, 96 km
- Fixed markers:
  - 6: ¾ to 48 N.M. range
  - 2: 1/16 to 1/2 N.M. range
- Distance between fixed markers: 1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4, 8 N.M.
- Mobile markers: 2 with value display
- Electronic cursors: 2 with value display
- Electronic pointer: 1 with value display
- Reference line: 1
- Controls:
  - GAIN
  - FTC (Fast Time Constant)
  - STC (Sensitivity Time Control)
  - Electronic tuning of Local Oscillator: manual or automatic
  - Pulse duration: short or long
  - Interference Rejection
  - Echo Stretch
  - Navigation modes: Head-UP, North-UP or Course-UP
  - EBL (Electronic Bearing Line)
  - VRM (Variable Range Marker)
  - HL (Head Line)
- Indication of ship data:
  - Latitude
  - Longitude
  - Speed
  - Actual course

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- Illumination of two-color background:
  - Blue for the day (2 settings)
  - Black for the night (2 settings)
  - Object color
- Joystick for EBL and VRM positioning, changing of menu functions, cursor positioning, off-centering, etc…
- NMEA-0183 interface for electronic compass
- NMEA-0183 interface for SATNAV/GPS/Loran C

Radar Image Simulator:

- The simulator accurately reproducing the operation of an outdoor scanner unit
- Output radar image with:
  - 4 moving targets
  - coastline
  - noise caused by the weather
  - noise caused by other radars
- Continuous repetition of the image

Fault simulator:

- Positioned on the side of the main unit; locked with key
- 15 faults, insertable also simultaneously

Power supply: 230 Vac 50 Hz single-phase - 140 VA
(Other voltage and frequency under request)
Dimensions: 760 x 910 x 410 mm (without Scanner unit)
Total weight: 70 kg

SUPPLIED WITH

STUDENT HANDBOOK
THEORETICAL-EXPERIMENTAL MANUAL. PRACTICAL EXERCISES: MEASUREMENT, PARAMETERS VARIATION

TEACHER HANDBOOK
DESCRIPTION OF THE FAULT SIMULATOR

SCANNER UNIT (optional) mod. M702-SU/EV

The Scanner unit is a real radar outdoor unit including transmission and receiving circuits and slot antenna (for outdoor use) or dummy load (for indoor use)

Scanner Unit
mod. M702-SU/EV

TECHNICAL SPECIFICATION:

- Stand for antenna inserted in the Trainer unit
- Slot antenna (for outdoor use):
  - Type: slotted waveguide 4 ft with radome
  - Biasing: horizontal
  - Radiation amplitude (-3 dB): horizontal 1.8°, vertical 25°
  - Speed of rotation: 22 r.p.m. ± 2 r.p.m.
  - Gain: 27 dB
- Transmitter-Receiver:
  - Peak power: 4 kW
  - Frequency: 9410 MHz ± 30 MHz
  - Modulator: solid state
  - Receiver: logarithmic
  - Pulse amplitude: 0.08 µs (1/16, 1/8 ,1/4, 1/2, 3/4 ,3/2 N.M.), 0.3 µs (3/4, 3/2, 3, 6, 12 N.M.), 0.6 µs (3, 6, 12 N.M.), 1.2 µs (12, 24, 48 N.M.)
- 15 m multicore cable for connecting the antenna with the main unit
- 25mm diam. mast **(not included)** for outdoor use
- Dummy load (optional - for indoor use): mod. M702-DL/EV

ELECTRONIC COMPASS (optional) mod. M702-C/EV

This modern compass based on Solid-State sensor (remote unit) supplies information about the boat's course even in difficult sea conditions continuously.

TECHNICAL SPECIFICATION:

- Measures:
  - Prow: 0° to 359°
  - Accuracy: 1° (static), 2° (dynamic)
  - Display resolution: 0.1°
- Data interface: RS422 compatibility
- Cables included: power supply and data
- Interface: NMEA0183
- Power supply: from Radar Trainer
- Sensors:
  - 3-axis magnetic compass
  - 3-axis accelerometer
  - 3-axis rate gyro
- Fixture system: tripod (included)

Remote unit mod. M702-C/EV

Display unit mod. M702-C/EV

GPS RECEIVER (optional) mod. M702-G/EV

This modern system for professional use can receive and process GPS (Global Position System) data and supply them to the Radar Trainer. It consists of an indoor unit that can be perfectly and easily assembled to the trainer and of an outdoor antenna provided with tripod.
The wide and high-resolution, Touch-Screen LCD display included in the indoor unit, allows the planning of the system and the display of the received information.
It can display the data of 12 satellites simultaneously. Functions of track planning, distance, speed and alarm are available.

TECHNICAL SPECIFICATION:

General characteristics:

- Accuracy:
  - position: 25m CEP (Circular Error Probability)
  - speed: 0.1 m/s
  - time: ±1 µs
- Maximum speed: 515 m/s (about 1000 kn)
- Data interface compatibility: RS232 e RS422
- Cables included: power supply, antenna (10m) and data

Indoor unit:

- LCD display: backlit, STN type, dimensions 120x90 mm
- Channels: 12
- Refresh speed: 0.1 s
- Power supply: from Radar Trainer mod. M702-E/EV

Outdoor Unit:

- Polarization: circular clock-wise
- Frequency: 1575.42 MHz
- Antenna Gain: 3.5 dBi
- Power supply Gain Low Noise: 30 dB
- Impedance: 50 Ω
- Azimuth coverage: omnidirectional

Outdoor unit - mod. M702-G/EV

Internal unit - mod. M702-G/EV

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