



FURUNO®

21" Multi-color High-resolution S-BAND RADAR

Models **FR-2135S/2165DS**

- Daylight-bright rasterscan 21-inch multi-color, high-resolution display
 - New microprocessing technology with high-speed, high-density gate array and sophisticated software
 - Easy operation by combination of discrete keys, rotary controls, and menu operation, all logically arranged
 - Electronic Plotting Aid (EPA) fitted standard
 - Automatic Radar Plotting Aid (ARPA) exceeding IMO and IEC standards (option)
 - Reliable CPA and TCPA warning in any plotting mode, accurate target data processing and display
- Meeting the latest IMO and IEC requirements such as:
 - Easy creation of radar maps-a combination of map lines and symbols-including fairways, coastlines, own ship safety contours, etc.
 - Sea and ground stabilization
 - True and relative vectors with adjustable length for prediction of future situation
 - True and relative target trails
 - Heading marker on the bearing scale, etc.



The future today with FURUNO's electronics technology.

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Catalogue No. R-166b

TRADE MARK REGISTERED
MARCA REGISTRADA

With New Powerful Signal Processors and Radar Mapping

FR-2135S: S-band, 30 kW, TR up

FR-2165DS: S-band, 60 kW, TR up



12 ft antenna

Complies with the following Regulations and Standards:

- IEC 60936-1 Shipborne radar
- IEC 60872-1 ARPA (with optional ARP-26)
- IEC 60872-3 EPA
- IEC 60945 General requirements

The FR-2135S and FR-2165DS are designed for a wide range of users such as coasters, fishing boats, yachts, cargo ships and passenger ships requiring a second radar or 10 cm radar features. The S-band radar assures target detection in adverse weather where X-band radars are heavily affected by sea or rain clutter. It is recommended that the vessel install both X-band and S-band radars.

The equipment is available in a variety of configurations: 30 or 60 kW output, short or long antenna radiator, with standard electronic plotting facility and optional Automatic Radar Plotting Aid (ARPA). These plotting aids are essential in shipborne radar to reduce the workload of ship personnel, and improve the standard of collision avoidance.

The display unit employs a 21" high-resolution multi-color monitor which provides an effective diameter of 275 mm. Radar echoes are presented in a selected color with a day or night background color for easy observation in all lighting. Different colors

are assigned to marks, symbols and text for user-friendly operation. The control head has logically arranged controls in a combination of push keys, rotary controls and a well-organized menu structure, and can be separated from the display unit via a flexible cable. The display pedestal contains all major modules and may be separated from the monitor part.

Operational features include all functions required by the IMO and IEC, such as, Head-up/Course-up/North-up orientation, parallel index lines, True Motion, sensor status message for compass, SDME, GPS and other electronic position-fixing systems, wind parameters, depth sounder data, etc. interfaced in IEC 61162.

Other features include two VRMs, range marker on the EBL, two EBLs with capability of offcentering and instant flipback, custom macro keys, multiple pulseshifts, storage of operator-created maps, optional chart cards and a Video Plotter module.

Reliability and Advanced Serviceability

Enhanced Serviceability



"Pull and lift" concept allows the service technician to easily see all surfaces of the display unit and the inside of the display base.

Radar Plotting Facilities

Target detection is enhanced by sophisticated signal processing techniques such as 16-level quantization, echo stretch, echo average, noise reducer, radar interference rejecter.

The new IMO Resolution defines 3 types of radar plotting facilities: Electronic Plotting Aid (**EPA**), Automatic Tracking Aid (**ATA**), and Automatic Radar Plotting Aid (**ARPA**). All these Plotting Aids generate CPA and TCPA and collision alerts, complying with all IMO and IEC standards. The FR-2135 and 2165DS provide EPA and ARPA.

EPA (standard):

Electronic plotting of 10 targets with adjustable vector lengths and alarm of collision risk.

ARPA (Optional ARP-26 required):

Automatically tracks 30 targets which have been acquired manually or automatically, trial maneuverable, complying with A.823 (19).

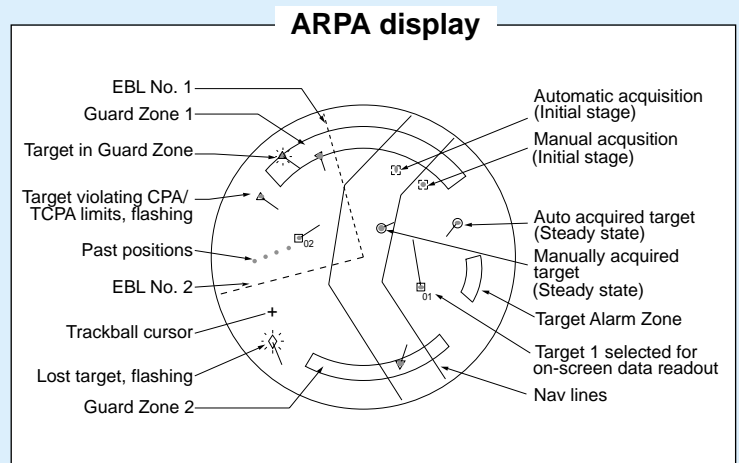
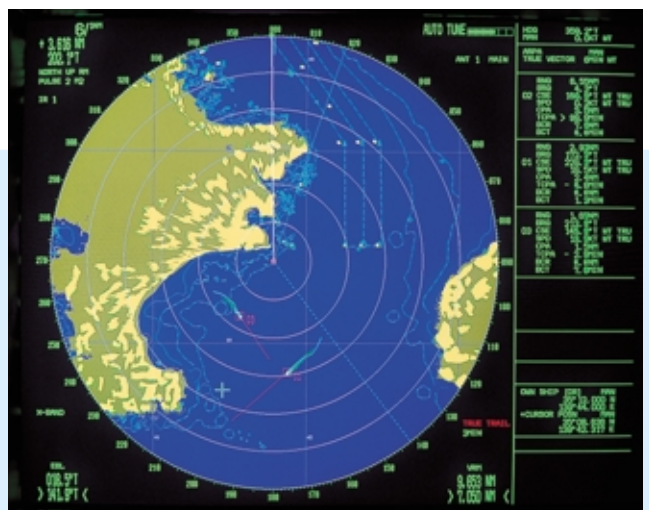


Chart Display

VideoPlotter RP-26 (optional)

The RP-26 offers an integrated navigation display showing a digitized chart with overlaid real-time radar image.

- Map Area:** 0.125 to 96 nm
- Latitude Limits:** Between 85°N and 85°S
- Plot Interval:** 10, 30 s, 1, 5, 10, 30 or 60 min
- Built-in Memory:** 6,000 points for ships track and marks, 98 waypoints, 25 routes
- Tracking Speed:** 120 knots max.



SPECIFICATIONS OF FR-2135S/2165DS

ANTENNA RADIATOR

1. **Type** Slotted waveguide array
 2. **Beamwidth**

	FR-2135S radiator		FR-2165DS radiator	
Radiator type	SN5AF	SN7AF	SN4A	SN5A
Length	9 ft	12 ft	8 ft	9 ft
Beamwidth (H)	2.3°	1.9°	2.6°	2.3°
Beamwidth (V)	25°	25°	25°	25°

3. **Rotation** 21 rpm (50 Hz) 26 rpm (60 Hz)

RF TRANSCEIVER

1. **Frequency** 3050 MHz ± 30 MHz(S-band)
 2. **Output power** FR-2135S: 30 kW, FR-2165DS: 60 kW
 3. **Pulselengths and PRR**

Range scales	P/L (μs)	PRR (Hz)
0.125, 0.25, 0.5	0.08	2200
0.75, 1.5	0.08/0.3	2200/1100
3, 6	0.08/0.3/0.6	2200/1100/600
12, 24	0.6/1.2	1100/600
48, 96	1.2	600

4. **IF** 60 MHz, Logarithmic. BW 28/3 MHz
 5. **Noise figure** 4 dB

DISPLAY

1. **Picture tube** 21" high-resolution color CRT (1280x1024 pixels), Raster scan non-interlace
 Effective display diameter 275 mm
 IMO type Yellow or green echoes in 16 levels
 Regular type Yellow or green echoes in 16 levels or 3 colors depending on echo strengths

2. **Minimum range and discrimination** 35 m on short range

3. Range scales

Range (nm)	0.125	0.25	0.5	0.75	1.5	3	6	12	24	48	96
Rings (nm)	0.025	0.05	0.1	0.25	0.25	0.5	1	2	4	8	16

(16, 32 and 120 nm range scales can be menu-added in Regular Type)

4. Accuracy

- Range: 1% of range in use or 15 m, whichever is greater
 Bearing: Better than 1°

5. Presentation

- Head-up, Head-up TB, North-up, True Motion
 Sea or ground stabilization

6. Plotting facilities

- EPA 10 targets (standard)
 ARPA Automatic Radar Plotting Aid for 30 targets automatically or manually acquired, 2 guard zones 0.7-32 nm. Complies with A.823(19).

7. Radar map

- Nav lines, coastlines, buoys, etc. produced by operator as required by IMO and IEC standards.
 150 points x 10 areas stored in PROM.

INTERFACE

Analog RGB video, H/V sync

Digital in IEC 61162-1

Input: \$- GGA, \$- GLL, \$- RMA, \$- RMB, \$- RMC, \$- BWR, \$- BWC, \$- WPL, \$- RTE, \$- DPT, \$- DBT, \$- DBS, \$- VDR, \$- MWV, \$- VBW, \$- VHW, \$- VWT, \$- VWR, \$- ZDA, \$- MTW*, \$- VTG* *not in IMO type

Output: \$RAOSD, \$RARSD, \$RATTM

POWER SUPPLY (Specify when ordering)

- AC set: 115/230 VAC,
 320VA (FR-2135S), 400VA (FR-2165DS)
 DC set: 24 VDC (FR-2165DS)

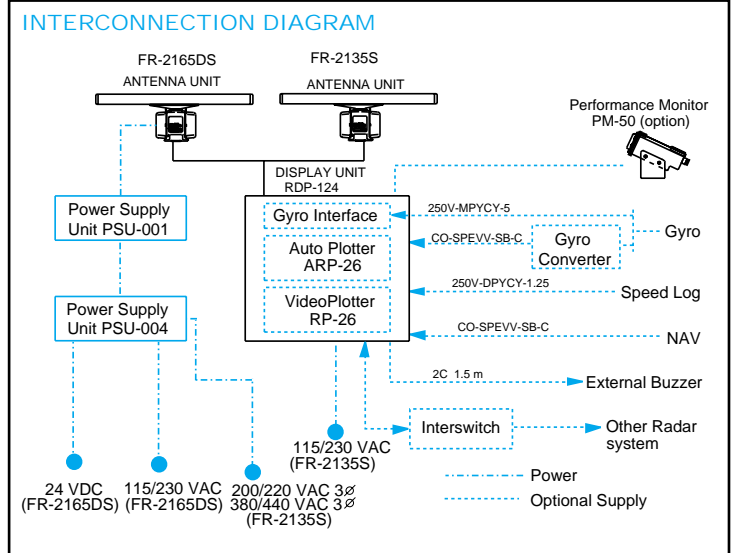
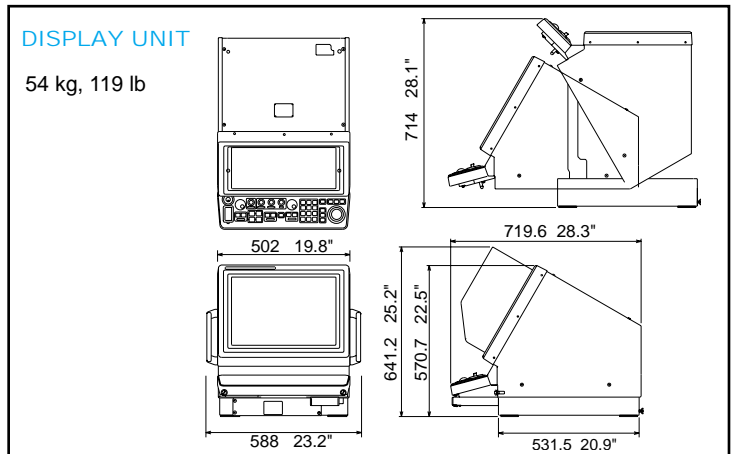
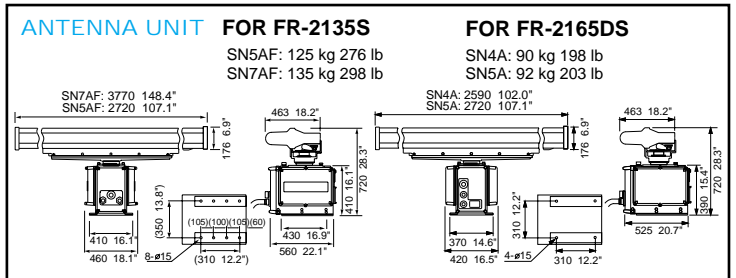
EQUIPMENT LIST

Standard

- | | |
|--|--------|
| 1. Display Unit with Hand Grip | 1 unit |
| 2. Antenna Unit | 1 unit |
| 3. Power Supply Unit PSU-001 for FR-2165DS | 1 unit |
| 4. Power Supply Unit PSU-004 | 1 unit |
| 5. Relay Board Kit OP03-150 | 1 set |
| 6. Installation Materials and spare parts | 1 set |

Option

- Performance monitor PM-50
- ARP-26 Auto Plotter for ARPA
- RP-26 VideoPlotter
- Chart ROM card for RP-26
- RAM card for RP-26
- Interswitch box RJ-7/8
- Gyro Interface GC-8
- Display Pedestal
- Stepdown Transformer for 380/440 VAC



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

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