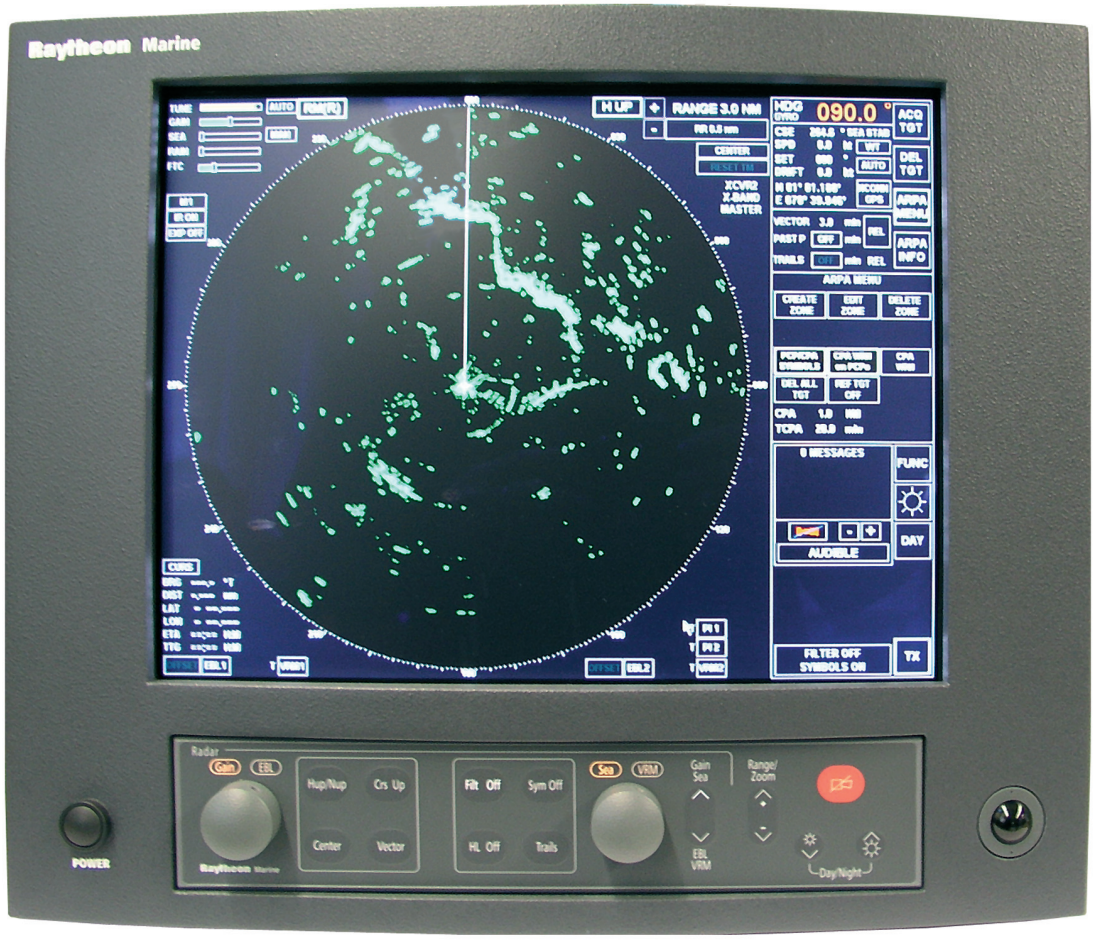
Raytheon Marine

NSC 18

Navigational Radar System

Service Manual



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Safety Regulation

SAFETY REGULATION

▶ **Warning!**
Caution during maintenance and repairs: Avoid contact with live electrical circuits!
All relevant safety regulations such as, e.g. VDE, VGB4, OSHA 1919 and other relevant safety standards must be ob served.

▶ **Caution!**
Maintenance and repairs must only be carried out by trained and qualified personal with knowledge of the national safety regulations for electrical devices.

Observe handling regulations!
Electrostatic sensitive components.

Removal or insertion of a subgroup or printed wiring board with live voltage can lead to severe damage.

Never insert fuses with other values than those stipulated!

▶ **Caution!**
If acting without authority any modifications the NSC 18 can be affects the functionality and lose the GUARANTY.

Radiation Hazard

CAUTION

UNDER NORMAL OPERATING CONDITIONS, THE ELECTROMAGNETIC ENERGY EMITTED BY THIS RADAR OPERATION IS SAFELY BELOW GOVERNMENT EXPOSURE MAXIMUM STANDARDS.

1. THE TRANSMITTER SHOULD ONLY BE OPERATED WHEN THE ANTENNA IS ROTATING.

2. THE RADAR SYSTEM SHOULD BE TURNED OFF BEFORE APPROACHING WITHIN 6 FEET OF THE ANTENNA FOR X–BAND.

3. THE ANTENNA SHOULD NOT BE RELOCATED OR REPOSITIONED WITHOUT CONSULTING THE RAYTHEON MARINE COMPANY SERVICE ORGANIZATION OR AN AUTHORIZIED DEALER.

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Safety Regulation

HIGH VOLTAGE

There is absolutely no danger in handling the external controls of the radar while the radar is in operation. In the radar‘s interior, however are high voltages which are fatally dangerous to anyone careless handling interior components. Be absolutley sure that the radar power switch is **OFF** before performing repair work or maintenance .

Furthermore, even when the power switch is turned off, a high voltage remains in certain parts of the radar circuits. In particular, be careful of the magnetron heater circuit, cathode–ray tube anode circuit, etc.. Utilizing a length of wire with one end fully grounded or an insulated srewdriver, ground all high voltage sections to discharge the residual charges and ensure that no charges remain before touching any part of the high voltage sections. In any case, the most dangerous thing to do is to touch any part of the high voltage sections without making sure that the radar power switch is off.

ATTENTION

Exercise care when approaching a rotating antenna. Be sure to turn off the radar power switch before performing maintenance or inspection of the antenna. Also, make sure that nothing or no one is near the antenna when turning on the radar power supply.

MICROWAVE RADIATION

A short exposure to the microwaves radiated by the radar antenna is harmless. However, avoid prolonged exposure to the microwaves. Never look directly into the wave guide while checking transceiver operation, since microwaves are especially harmful to the eyes.
The radiation of microwaves can be checked with a neon tube . The neon tube will glow in the presence of microwaves.

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Dimensional drawing	900–014.HP005
Dimensional drawing X–Pedestal SU70–10NR	NB99–HP0048
Sector diagram for echo reflections	
blanked transmission	
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1 Installation

1.1 SAFETY INFORMATION

CAUTION

When electrical equipment and desks are opened, live parts are exposed, which, if touched, can cause an electric shock.

– SAFETY REQUIREMENTS –

When carrying out assembly work on the equipment, installing or removing parts, or rewiring, it is absolutely essential that the equipment be disconnected from the power supply.

1.1.1 Technical Specification

Display

Safe distance to Standard–Magnetic–Compass	1.00 m
Safe distance to Steering–Magnetic–Compass	0.60 m
Reduced safe distance to Standard–Magnetic–Compass	0.60 m
Reduced safe distance to Standard–Magnetic–Compass	0.40 m
TFT Display Size	15 inch
PPI Diameter (IMO)	9 inch (180mm)
Resolution	1024 x 768

Power Supply

24V DC	+ 30 % – 10 % (acc. to IEC 60945)
350 W peak (incl. transceiver and scanner motor)	

Inputs

Gyro	NMEA/Course Bus
GPS	NMEA
Speed	NMEA / PULSE
Log	NMEA
AIS	NMEA

Transceiver

RF power	10kW
Frequency	9410 MHz (X–Band)

Pedestal

Scanner size	6 foot
Horizontal Beam Width	1.2°
Vertical Beam Width	25°
Rotation Rate	22 rpm
Wind Load	100 kts

1.1.2 Checks made prior to putting into operation

For the NSC 18 system to function correctly the following equipment and devices must be operating correctly:

- Power supply
  - to all the equipment concerned
  - 10 to 32 VDC for the NSC system

- Sensors and the relevant transmission systems
  - Gyro compass
  - Log
  - Navigation receiver

1.2 Scope of supply

Remove the system components from the box .
Check all the system components for visual defects or damage occasioned during carriage.
Place all the system components on a secure base.

1.3 Planning the installation and instructions for installation

1.3.1 NSC 18 Radar Display (see dimensional drawing 900–014HP006)

Conditions at installation site:

The device must be located in a position where it can be easily seen, and from which it is comfortable to operate.

The data required for flush mounting the equipment are provided in dimensional drawing and are binding [cut-out section and drilling scheme].

NOTE

Before starting work check that there is sufficient room beneath the cut-out section you have selected to carry out the necessary sawing work!

1.3.2 X–band Pedestal with 6 ft. Antenna

Conditions at installation site:

The installation area must be subject to high temperatures or exceeding vibrations.

The installation must be carried out to allow easy access to the unit for easy maintenance operation.

The X–band Pedestal with 6ft. Antenna must be installed:

- the highest possible location
- the farthest possible from obstacles which could cause blind sectors on the representation

NOTE

The antenna radius must be free.
That means lines or other things must be fixed at all.

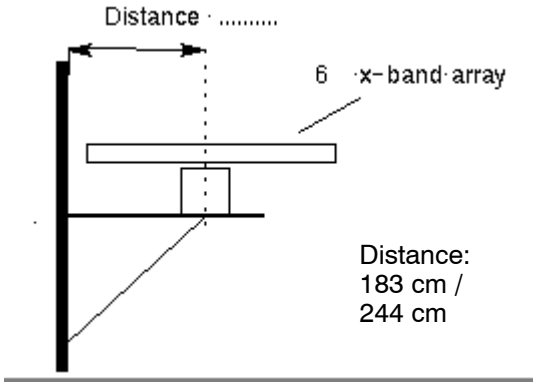


Figure: 1−1 X−band pedestal with antenna − Distance between Mast and Antenna

1.4 Installation and putting into operation

1.4.1 NSC 18 Radar Display (mechanical installation)

1. Disassemble the NSC 18 mounting base frame.
   It consists of an upper and lower base frame.

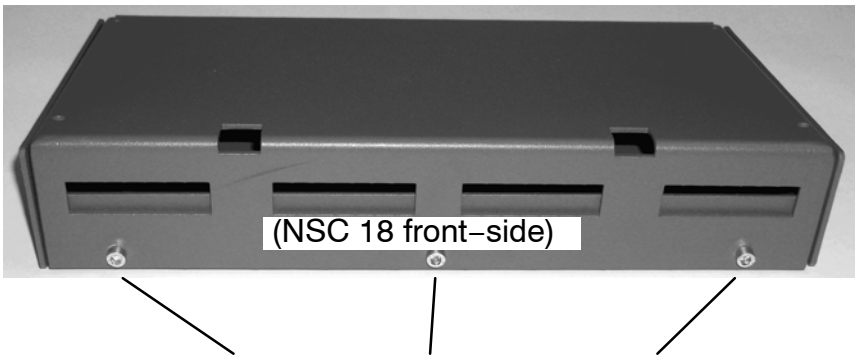


Figure: 1–2 complete mounting base frame

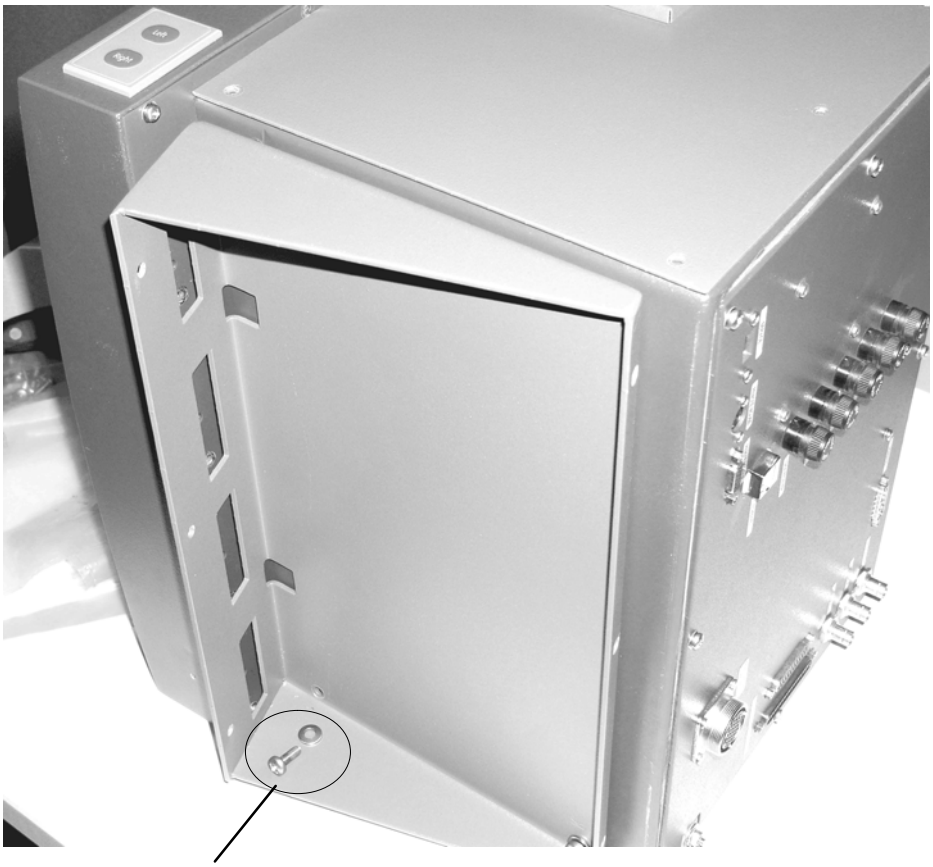
2. Fix the lower base frame depending on the place of installation
   of the NSC 18 Radar Display (dimensional drawing 900–014.HP005)

Figure: 1–3 lower base frame

Align the lower base frame accordingly and mark the holes to be drilled as per drilling plan by means of, for example, a punch.
Fastening screws are not included in our scope of delivery.

3. Fasten the upper base frame of the mounting base frame to the NSC 18 Radar Display. You will find washers and cross–head screws in the accessories kit.

   For this purpose, place the NSC 18 Radar Display onto its left side. To save it from any damage, put a blanket underneath the display.



Material needed for fastening the upper base frame to the display:
4 washers and 4 cross–head screws.

Figure: 1–4 mounting the upper base frame

4. Mounting the NSC 18 Radar Display completely:
   Slide the NSC 18 Radar Display into the lower base frame as shown in Figure: 1–5.

   The upper base frame must completely take up the pins.
   Figure: 1–6 shows how to slide the upper into the lower base frame
   (for better clarity, upper base frame is shown without NSC 18 Radar Display).

Figure: 1–5 Slide the NSC 18 Display into the lower base frame

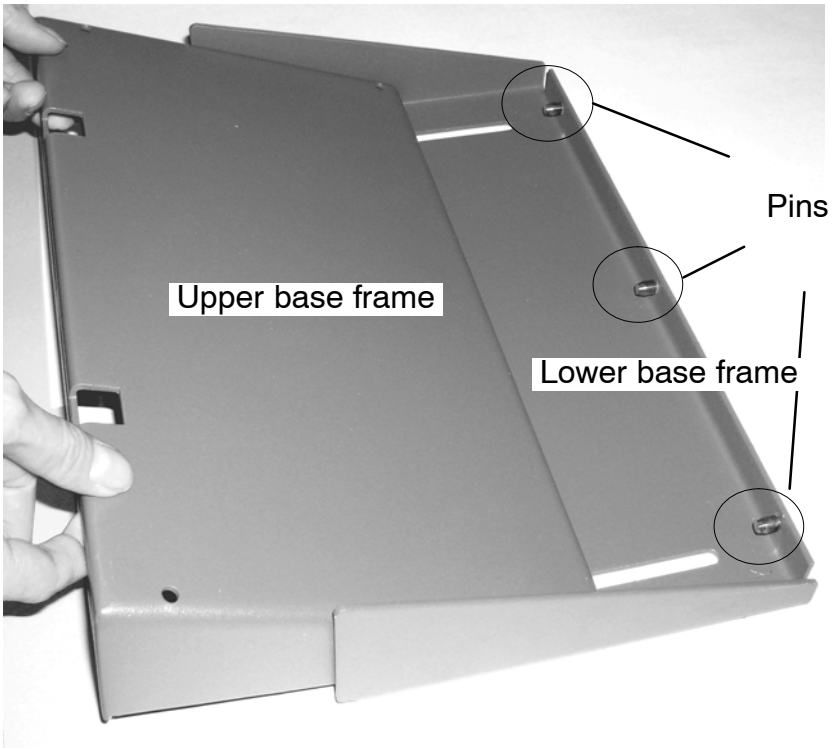


Figure: 1–6 NSC 18 Radar Display mounting

5. Align the drilling holes of the upper and lower base frame and assemble both frames by means of the hexagon screws and washers.

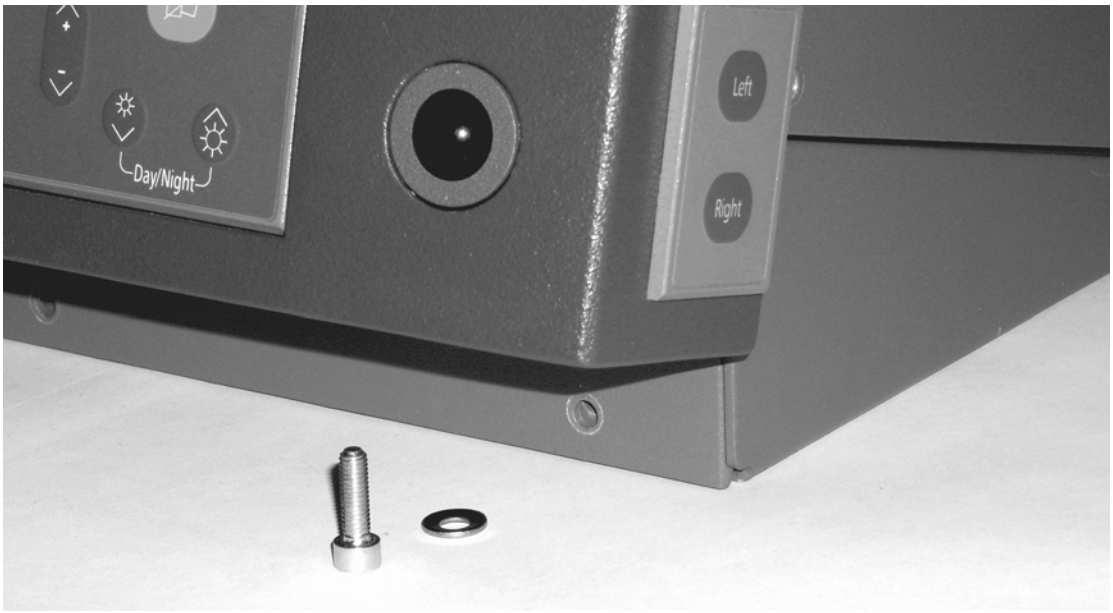


Figure: 1–7 Assembling the mounting base frame

1.4.2 X–Band Pedestal with 6ft. Antenna (mechanical installation)

See dimensional drawing NB99–HP0048.

1.4.2.1 Pedestal

After the pedestal has been positioned properly on the mounting plate tighten the four bolt securely.
Pull up the pedestal cover; loose with care the cover bolts.

The mounting details with all mechanical accessories are outlined in .

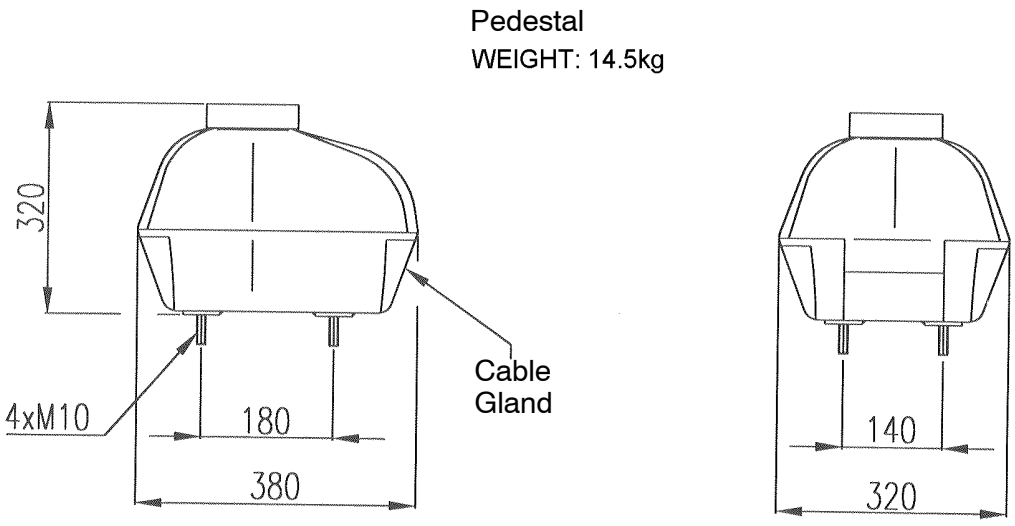


Figure: 1–8 Pedestal dimensions

Apply a thin layer of silicone grease to the pedestal seal.

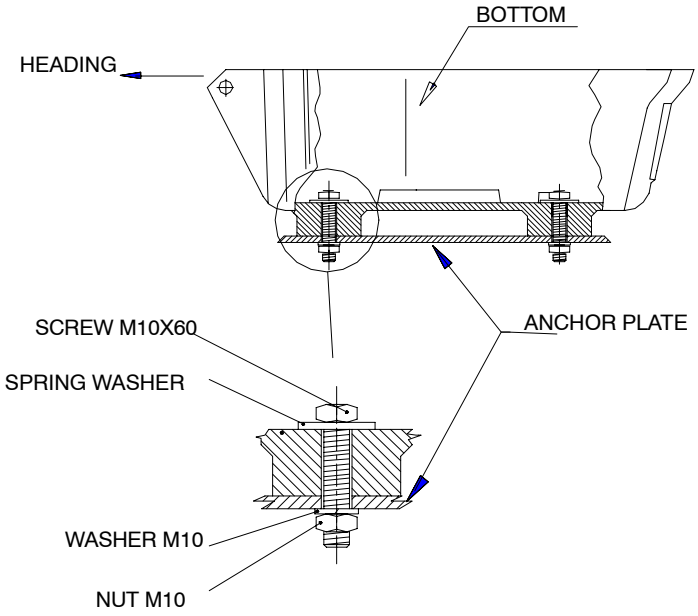


Figure: 1−9 Pedestal installation scheme

Pull down the scanner cover; tighten with care the cover bolts.
Be sure to avoid water infiltration.

1.4.2.2 Antenna

The following procedure must be used to install the antenna unit.

- remove the protective cover both from the antenna waveguide and from the waveguide transition on the pedestal
- lubricate with grease the supporting base of the pedestal and the antenna mounting surface;
- insert the antenna in order to match the waveguide with the waveguide transition;
- mount the array assembly using four M8 x 30 screws with a flat washer and a spring washer.

1.4.3 NSC 18 Radar Display (electrical installation)

NOTE

Before you start with the cable setting–up procedure switch SHIP MAIN FUSE or FUSES **OFF**.

1.4.3.1 Cable Connection between Connection Module and NSC 18 Radar Display

See connection diagram 900–014HP013.

Electrical installation consist of (Figure: 1–10):

- preparing the grounding cable of the connection module to the shops hull
- connect the cables from the connector module to the NSC 18 Radar Display

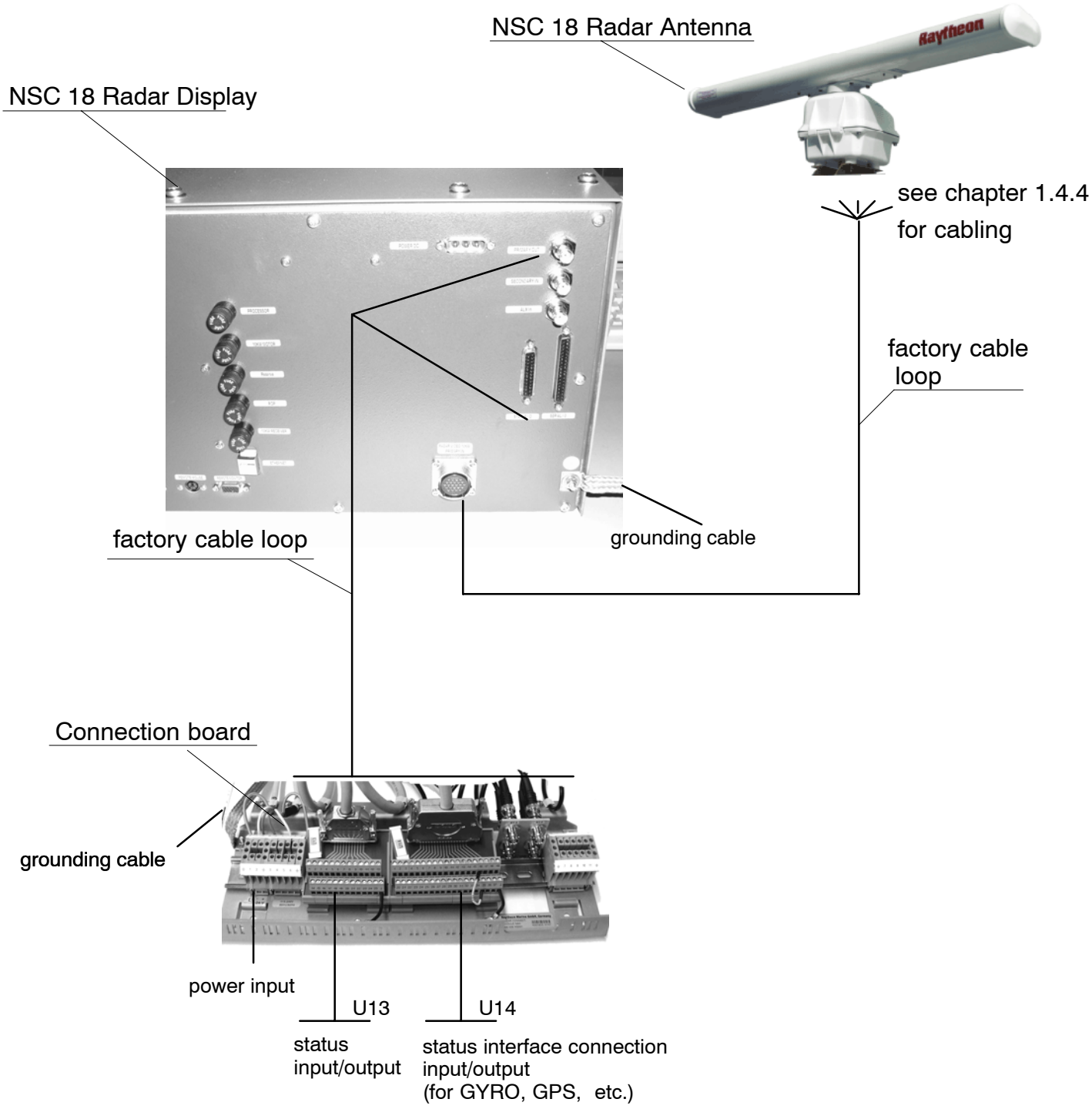


Figure: 1–10 NSC 18 cable connection

1.4.4 X–Band Pedestal with 6 ft. Antenna (electrical installation)

Electrical installation consists of:

- preparing and connecting the interconnecting cable between the NSC 18 radar display and pedestal;
- preparing the grounding cable of the pedestal to the ships hull.

To install the cable use the supplied installation kit. Use appropriate cable lugs to connect the conductors to the terminals.

NOTE

Before you start with the cable setting–up procedure switch the pedestal SAFETY SWITCH to **OFF**.

1.4.4.1 Cable Setting–up procedure

Special tools:
Hand crimping tool for contact diameter f 1.6 mm

Refer to Figure: 1–11 and Figure: 1–12 for examples of crimping for standard and coaxial conductor.

1 Arrange in advance 30 mm. of shrinkable sleeve with inner diameter of 25 mm.

2 Insert cable through cable gland of the pedestal

.

3 Strip the cable for about 90 cm; collect the braided wire shields and shorten it to obtain a length suitable to be tightened between the clamp located just after the input cable gland. Push the shrinkable sleeve over the wires.

4 Tighten the cable gland on the pedestal.

5 Shrink the piece of sleeve in correspondence with the metallic cable clamp and tighten it to assure a first fixing point of the cable in the pedestal.

6 The second fixing point is established by an adhesive plastic support already present in the scanner unit.
The cable is fixed with a cable−stop band contained in the kit.

7 Strip all the conductors for about 5 mm.
Procedure to prepare coaxial cables:
strip the cables for about 5 cm, then separate the core from the shield; roll−up the shield and protect it with shrinkable sleeve leaving 5 mm uninsulated. Strip also the core for about 5mm. Crimp all the conductors with supplied lugs for terminal connection.
With reference to Figure: 1−13, carry out the connection with the terminal boards J8 and J9 separating the conductors assigned to J8 from those assigned to J9 with two cable ties for a length of 10 cm.

NOTE

Be sure that no pieces of conductor or other pieces remain inside the unit after this task.

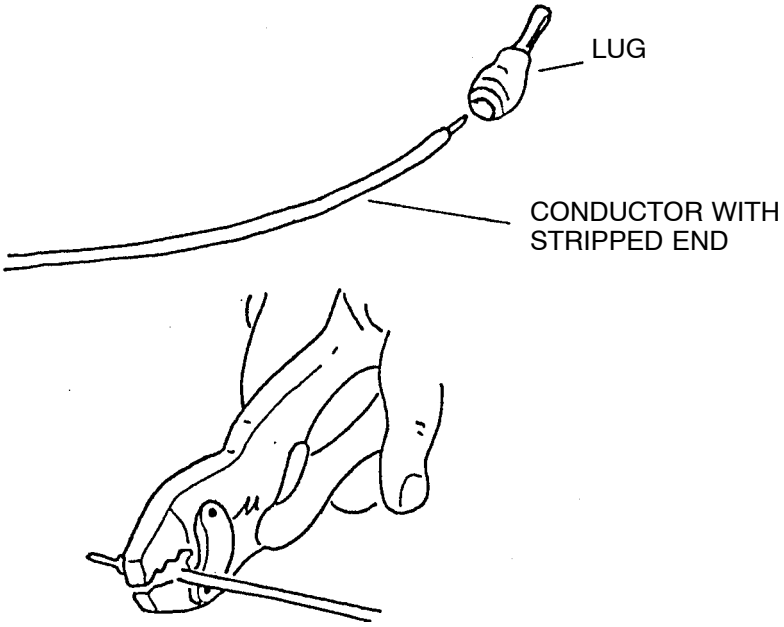


Figure: 1–11 Fitting Lugs

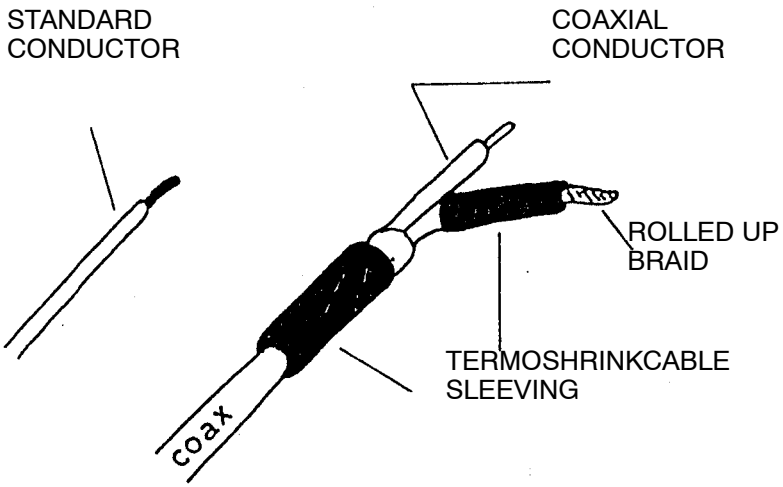
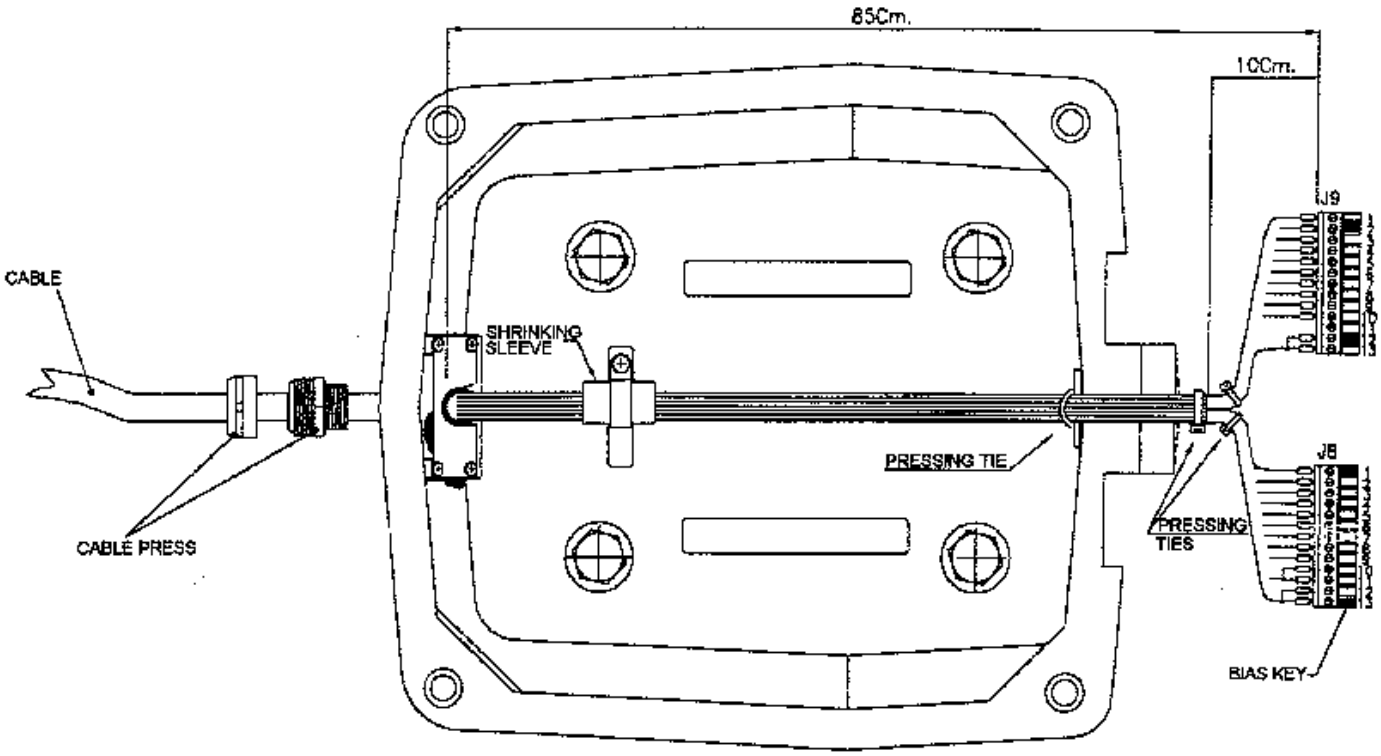


Figure: 1–12 Setting–Up Coaxial Cables



Cable ∅ 14mm			
Cable No.	Description	Cable ∅	Cable Identification
1 – 9	AWG20 conductor, soldered copper, format 19x0.20, isolated PVC 1,55mm max.	0.5	Brown–Black, Red–Black Orange–Black, Yellow–Black Green–Black, Blue–Black Violet–Black, Gray–Black White–Black
10 – 21	AWG20 conductor, soldered copper, format 19x0.127, isolated PVC 0,94mm max.	0.062	Numbered from 1 to 3
22 – 24	RG174 coaxial		Numbered from 1 to 3
25	Poly strip		
26	Full shield Soldered copper > 85%		
27	PVC grey strip, RMG label, step 50 cm, ext. diam max 15mm		

Figure: 1–13 Cable installation to pedestal

1.4.4.2 Connection of pedestal terminal boards (J8, J9)

J8 Terminal board	Function	Conductor–conductor section (sq.mm.)
1	P.MOT	BLACK/BROWN 0.5
2	P.MOT	BLACK/RED 0.5
3	N.MOT	BLACK/ORANGE 0.5
4	N.MOT	BLACK/YELLOW 0.5
5	GND	BLACK/GREEN 0.5
6	GND	BLACK/BLU 0.5
7	+24 V	BLACK/VIOLET 0.5
8	+12 V	BLACK/GREY 0.5
9	–12 V	BLACK/WHITE 0.5
10	TRG–S	GND COAX 1
11	TRG	COAX 1
12	TRG–R–S	GND COAX 2
13	TRG–RTN	COAX 2

Table 1–1 Connection of pedestal J8 terminal board

J9 Terminal board	Function	Conductor–conductor section (sq.mm.)
1	ACP	BROWN 0.08
2	HL	RED 0.08
3	SB–OP	ORANGE 0.08
4	RAD 0	YELLOW 0.08
5	RAD 1	GREEN 0.08
6	MAG I	BLU 0.08
7	TN–IND	VIOLET 0.08
8	TN–REG	GREY 0.08
9	TUNE	WHITE 0.08
10	PM	BLACK 1
12	VD–S	GND COAX 3
13	VD	COAX 3

Table 1–2 Connection of pedestal J9 terminal board

1.4.4.3 Signals Description

Name	Description	Value/feature
P_MOT	Positive motor power supply	+24 VDC ± 20% I = 0.3 A (typical), 10 A (peak)
N_MOT	Negative motor power supply	–24 VDC ± 20% I = 0.3 A (typical), 10 A (peak)
GND	Ground	
GND	Ground	
+24V	+24 VDC voltage	24 VDC ± 10% I = 1 A (typical), 1.5 A (peak)
+12V	+12 VDC voltage	12 VDC ± 10% I = 0.5 A (typical), 0.7 A (peak)
–12V	–12 VDC voltage	–12 VDC ± 10% I = 0.7 A (typical), 1 A (peak)
TRG	Transmission trigger	positive logic width = 10 VDC; duration 1µs impedance 50Ω
TRG–S	Trigger ground	
TRG–RTN	Trigger return	positive logic width between 5 and 10 VDC duration = 1µs; impedance = 50Ω (*always to be loaded, also when not used*)
TRG–RTN–S	Trigger return ground	
ACP	Azimuth Clock Pulse	open collector V_{MAX} = 15 VDC; I_{MAX} = 10 mA; 2048 pulses/revolution
HL	Head Line (North)	positive logic open collector V_{MAX} = 15 VDC; I_{MAX} = 10 mA duration = 50 ms at 22 r.p.m.

Name	Description	Value/feature
SB_OP	Standby / Operation selector(see Table 1–4)	open collector V_{MAX} = 5 VDC; I_{MAX} = 10 mA
RAD0	Pulse Width selector (LSB)(see Table 1–4**)**	open collector V_{MAX} = 5 VDC; I_{MAX} = 10 mA
RAD1	Pulse Width selector (MSB)(see Table 1–4)	open collector V_{MAX} = 5 VDC; I_{MAX} = 10 mA
MAG I	Magnetron power indicator	voltage between 8 and 12 VDC high impedance
TN_IND	Tune indicator	voltage between 0 and 4 VDC high impedance
TN_REG	Tune regulator	adjustable voltage between 0 and 5 VDC high impedance
TUNE	Tune voltage	between 0 and 30 VDC (12 VDC typical) high impedance
PM	Performance Monitor (not used)	open collector V_{MAX} = 12 VDC; I_{MAX} = 10 mA
VD	Video output (negative)	4 Vdc peak; impedance = 50Ω
VD–S	Video ground	

Table 1–3 Interface signals

Pulse Width	SHORT (80 ns)	MEDIUM (300 ns)	LONG (600 ns)	EXTRALONG (1.2 µs)
PRF	FAST (3200 Hz)	MEDIUM (1600 Hz)	SLOW (800 Hz)	VERY SLOW (500 Hz)

Table 1–4 Suitable frequencies for the TRG trigger signal

1.5 Putting into Operation

1.5.1 Operation X–Band Pedestal with 6 ft. Antenna

SAFETY SWITCH

The ON/ OFF switch Figure: 1–14 located on the pedestal is a sefety switch only, its purpose is to enable / disable antenna rotation for maintenance porposes.

NOTE

During normal operating conditions as well as maintenance the antenna rotation can be stopped by setting the safety switch to the **OFF** position

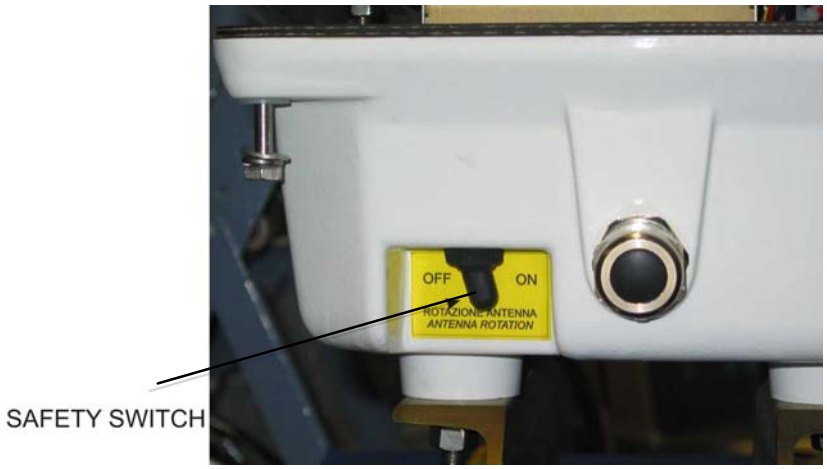
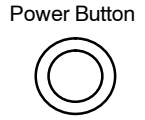


Figure: 1–14 Safety switch on the pedestal

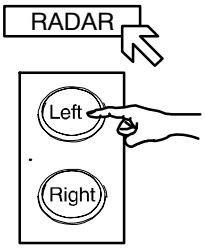
1.6 Operation NSC 18 Radar Display

NOTE

Now you have to switch the SHIP MAIN FUSE or FUSES **ON**.



Press the button 5s, the main power has to be switched.
(Placed front–side lower left–side.)



- The **Radar Utility Selector** window appears in the display. Select the RADAR softkey in the window and press the **Left** button on the trackball.

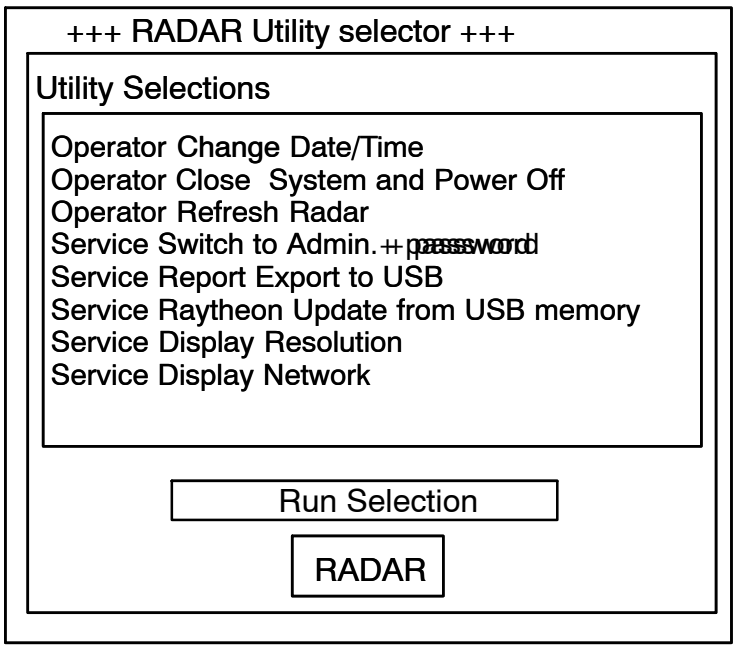


Figure: 1–15 RADAR Utility selector

- After some minutes (approx. 2min.), the message STANDBY appears in the image center.

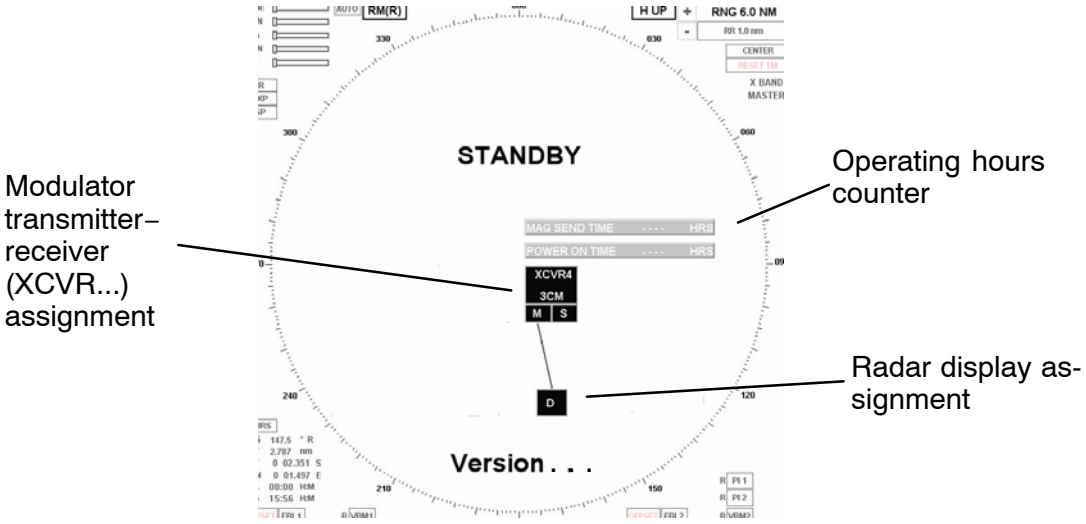


Figure: 1–16 NSC Radar in STANDBY mode –System configuration diagram –

- NSC Radar is in STANDBY mode.

The NSC beeps when
the NSC radar software detects an internal or external malfunction;
a simultaneous alarm message is displayed (maybe).
Acknowledging the alarm message switches off the acoustic signal.
The alarm message is hidden, but it can be called up again.

NSC status:
The transceiver is not transmitting.
The antenna is not rotating.
No radar video in PPI, STANDBY.
Service and setup menu accessible.
The operating temperature is maintained by the magnetron.

Now you can start with NSC 18 System Setup, Test and Calibration see chapter 2.