TELEPHONICS
A Griffon Company

RADAR 1600
WEATHER RADAR SYSTEM

INSTALLATION MANUAL

July 2001

Prepared by:
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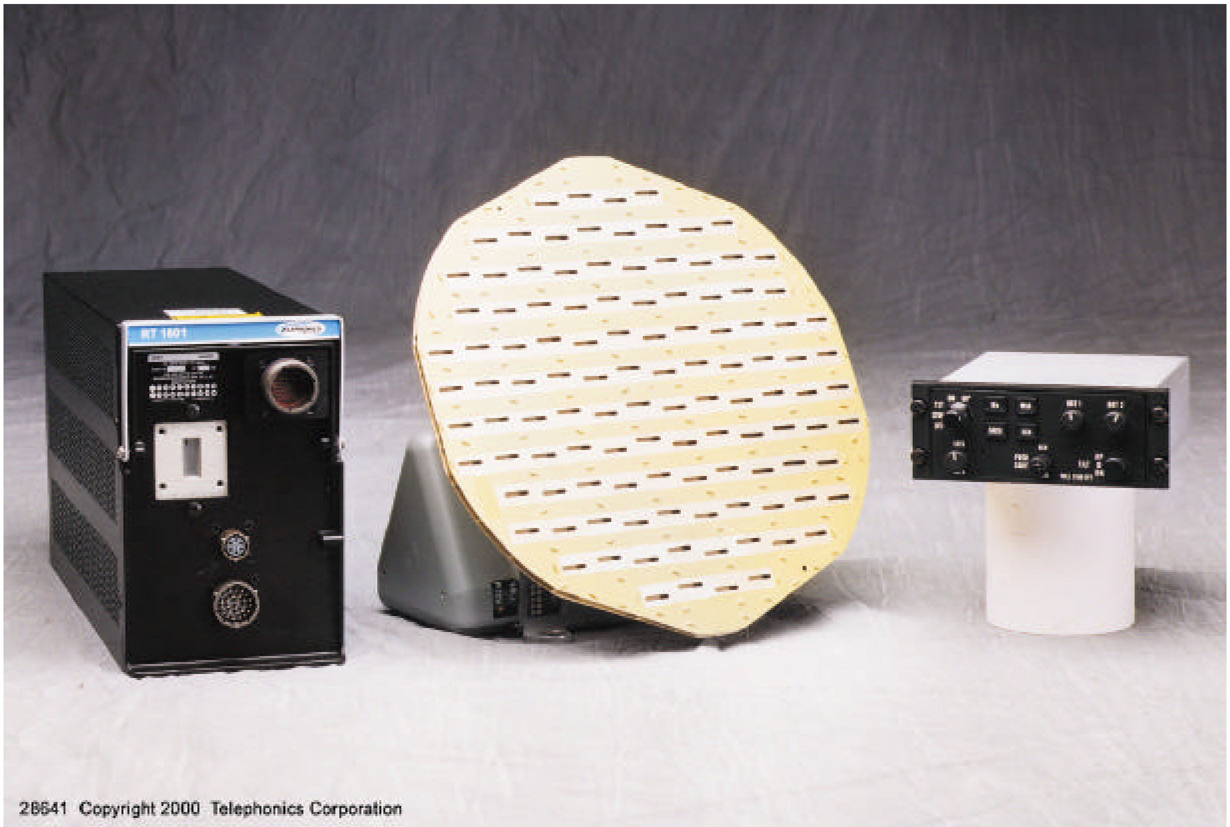
USA

TM106601 (7/01)

TELEPHONICS
A Griffon Company
COMMAND SYSTEMS DIVISION

RDR-1600
WEATHER RADAR SYSTEM
INSTALLATION MANUAL



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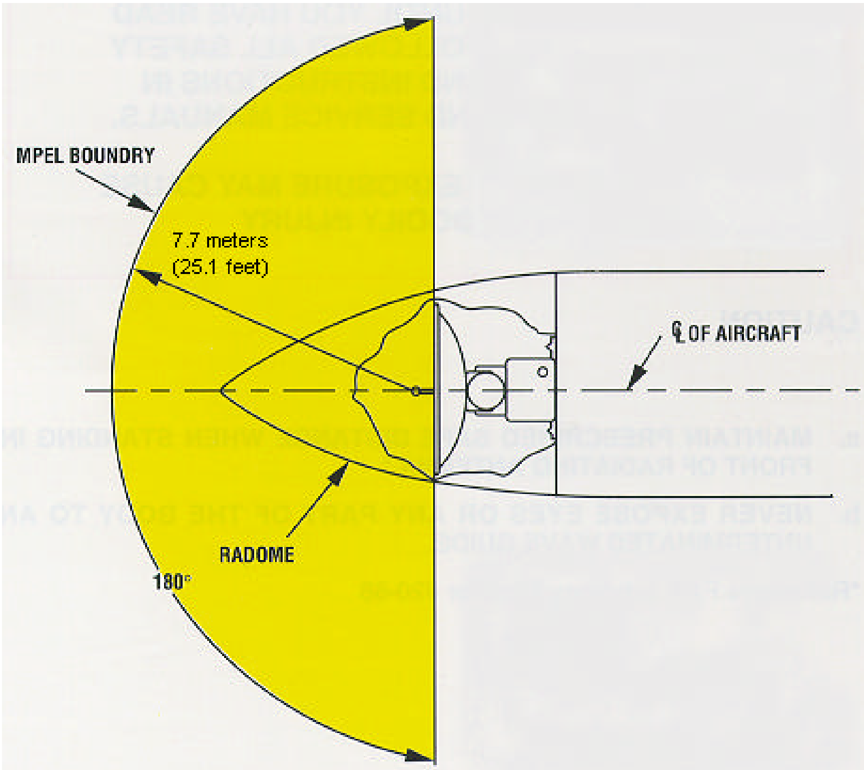
CAUTION

Maintain prescribed safe distance when standing in front of radiating antenna.

Never expose eyes or any part of the body to an unterminated wave guide.

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

In order to avoid the envelope in which the radiation level exceeds the U.S. Government standard of 1 mW per square centimeter, all personnel should remain beyond the distance indicated in the illustration below. The distance to the MPEL boundary is calculated upon the basis of the largest antenna available with the RDR-1600 system, rated output power of the transmitter and in the non-rotating or boresight position of the antenna. With a scanning beam, the power density at the MPEL boundary is significantly reduced.



AC 20-68B

DATE 8/8/80

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: RECOMMENDED RADIATION SAFETY PRECAUTIONS FOR GROUND OPERATION OF AIRBORNE WEATHER RADAR

1. PURPOSE. This circular sets forth recommended radiation safety precautions to be taken by personnel when operating airborne weather radar on the ground.

2, CANCELLATION. Ac 20-68A, dated April 11, 1975, is canceled.

3. RELATED READING MATERIAL.

a. Barnes and Taylor, Radiation Hazards and Protection (London: George Nevnes Limited, 1963). P. 211.

b. U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, “Environmental health microwave, ultraviolet radiation and radiation from lasers and television receivers – An Annotated Bibliography,” FS 2.300: RH-35, Washington, U.S. Government Printing Office, pp. 56-57.

c. Mumford, W.W., “Some technical aspects of microwave radiation hazards,” Proceedings of the IRE, Washington, U.S. Government Printing Office, February 1961, pp. 427-447.

4. BACKGROUND. Dangers from ground operation of airborne weather radar include the possibility of human body damage and ignition of combustible materials by radiated energy. Low tolerance parts of the body include the eyes and testes.

5. PRECAUTIONS. Management and supervisory personnel should establish procedures for advising personnel of dangers from operating airborne weather radars on the ground. Precautionary signs should be displayed in affected areas to alert personnel of ground testing.

a. GENERAL.

(1) Airborne weather radar should be operated on the ground only by qualified personnel.

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(2) Installed airborne radar should not be operated while the aircraft is in a hangar or other enclosure unless the radar transmitter is not operating, or the energy is directed toward an absorption shield which dissipates the radio frequency energy. Otherwise, radiation within the enclosure can be reflected throughout the area.

b. Body Damage. To prevent possible human body damage, the following precautions should be taken:

(1) Personnel should never stand nearby and in front of a radar antenna which is transmitting. When the antenna is not scanning, the danger increases.

(2) A recommended safe distance from operating airborne weather radars should be established. A safe distance can be determined by using the equations in Appendix 1 or the graphs of figures 1 and 2. This criterion is now accepted by many industrial organizations and is based on limiting exposure of humans to an average power density not greater than 10 milliwatts per square centimeter.

(3) Personnel should be advised to avoid the end of an open waveguide unless the radar is turned off.

(4) Personnel should be advised to avoid looking into a waveguide, or into the open end of a coaxial connector or line connector to a radar transmitter output, as severe eye damage may result.

(5) Personnel should be advised that when high power radar transmitters are operated out of their protective cases, X-rays may be emitted. Stray X-rays may emanate from the glass envelope type pulser, oscillator, clipper, or rectifier tubes, as well as magnetrons.

c. Combustible Materials. To prevent possible fuel ignition, an installed airborne weather radar should not be operated while an aircraft is being refueled or defueled.

M.C. BEARD
Director of Airworthiness

AC NO: 43-14

DATE: 2/24/77

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: MAINTENANCE OF WEATHER RADAR RADOMES

1. PURPOSE. This advisory circular provides guidance material useful to repair facilities in the maintenance of weather radar radomes.

2. CANCELLATION. AC 43-202, dated 6/11/65, and AC 90-20, dated 11/12/64, are cancelled.

3. GENERAL. A radome is a covering whose primary purpose is to protect a radar antenna from the elements. It is a part of the airframe and, therefore, should have certain physical as well as electrical properties. Physically, a radome should be strong enough to withstand the airloads that it will encounter and it should be contoured to minimize drag. These properties vary with the shape, design speed, and size of the airplane on which it is to be installed. Electrically, a radome should permit the passage of the radar's transmitted signals and return echoes with minimum distortion and absorption. In order to do this, it should have a certain electrical thickness. The electrical thickness of a radome is related to the physical thickness, operating frequency, and the types of material and construction used. This relationship is defined by a number of complex mathematical equations which are of interest only to radome design engineers. These equations show that, for given physical properties, a radome should have a certain electrical thickness for a certain narrow range of operating frequencies. (This is the reason why C-band radomes will not give optimum performance with X-band radars and vice versa.) Also, a very small variation in physical thickness may cause a sizable variation in electrical thickness. Radar efficiency, definition, and accuracy of display depend upon a clear, nondistorted, reflection-free antenna view through the radome. Consequently, a radome should be precisely built for optimum performance.

4. RADOME CHARACTERISTICS. There are two general types of radomes, the "thin wall" and "sandwich" types. Thin wall radomes are considered to be thin relative to the wavelength of the radar. They are generally useful when the radar frequency is low enough to permit a skin thickness which will satisfy the structural requirements. Sandwich radomes consist of two

Initiated by: AFS-804

or more plastic skins separated by a dielectric core. The core may consist of honeycomb plastic section, hollow flutes, or foam plastic. The dielectric and separation of the skins will depend upon the wavelength of the radar frequency or frequencies.

5. RADOME DAMAGE. Probably the most frequent damage to radomes is holes in the structure caused by static discharges. These can be large holes that are readily apparent, or small pin holes that are almost imperceptible. Any hole, regardless of size, can cause major damage to a radome since moisture can enter the radome wall and cause internal delamination. If the moisture freezes, more serious damage may occur. If enough moisture collects, the radiation pattern will be distorted and the transmitted signals and return echoes seriously attenuated. Ram air through a hole can delaminate and break the inner surface of the radome and result in separation of the skins or faces of the material from the core, weakening the radome structure. Other types of damage are characterized as dents and scratches caused by impact with stones and birds and improper handling of the radome when it is removed for maintenance of the radar antenna. This type of damage is easily found by inspection.

6. MAINTENANCE.

a. High performance radar radomes are very precisely constructed and sometimes the slightest change in their physical characteristics, such as excessive layers of paint, can adversely affect radar system performance. All repairs to radomes, no matter how minor, should return the radome to its original or properly altered condition, both electrically and structurally. The performance of proper maintenance to precision radomes requires special knowledge and techniques and the use of proper tools and materials. An improper minor repair can eventually lead to an expensive major repair. A radome having undergone major repairs should be tested to ascertain that its electrical properties have not been impaired. The testing of radomes requires test equipment that usually is found only in repair facilities specializing in radome maintenance. Even minor repairs may affect one or all of the following:

(1) Transmissivity. Which is the ability of a radome to pass radar energy through it.

(2) Reflection. Which is the return or reflection of the outgoing radar energy from the radome back into the antenna and waveguide system

(3) Diffraction. Which is the bending of the radar energy as it passes through the radome.

b. These electrical properties, when altered by improper repair, may cause loss of signal, distortion and displacement of targets, and can clutter the display to obscure the target. Poor radome electrical performance can produce numerous problems which may appear to be symptoms of deficiencies in other units of the radar system. The following are examples of improper repair:

(1) Use of wrong materials - not compatible with original radome materials.

(2) Patches of different thickness.

(3) Poor fabrication techniques.

(4) Nonvoid-free patches

(5) Repairs overlapping.

(6) ‘Holes plugged with resin, screws, metal, wood, and plastic plugs.

(7) Cuts or cracks simply coated with resin

(8) Tape (including electrical tape) over hole or crack and covered with resin.

(9) Oversize patches.

(10) Too much or too little resin

(11) Exterior coatings - too many coats, too thick, uneven thickness - metallic base paints

(12) Filled honeycomb cells.

(13) Repairs made without removing moisture or moisture contamination from inside of radome wall.

(14) Abrupt changes in cross-sectional areas.

(15) Patches projecting above outside contour lines.

(16) Improper cure.

(17) Wrong size cells or density of honeycomb.

(18) Excessive overlap in honeycomb joints.

(19) poor bonding of skin to core.

(20) Gaps in honeycomb core.

AC 43-14 **2/24/77**

7. RECOMMENDATION. Both the physical and electrical properties of radomes should be given careful consideration during repair operations. These properties are carefully controlled during manufacture and should not be altered by improper repairs.

J.A. FERRARESE
Acting Director, Flight Standards Service

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FMii	Max. Permissible Exposure Level	July 2001	
FMiii	AC 230-68B	July 2001	
FMv	AC-43-14	July 2001	
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SERVICE BULLETIN LIST

Service Bulletin No.	Related Equipment	Date	Purpose
No RDR-1600 SB's have been issued			

CHAPTER 1

GENERAL INFORMATION

1.1 GENERAL

The Telephonics RDR-1600 Weather and Search and Rescue Radar System provides six primary modes of operation: three air-to-surface search and detection modes, two radar weather avoidance modes, and one navigational beacon mode. The navigational beacon has the capability to receive and decode both standard 2-pulse and DO-172 6-pulse transponders.

The Telephonics RDR-1600 Weather and Search and Rescue Radar System are primarily designed for fixed and rotary wing aircraft engaged in patrol, search and rescue missions, and for transporting personnel and equipment to remote sites (off-shore oil rigs, etc.).

1.1.1 Basic System Functions

The RDR-1600 Radar System consists of three flight-line replaceable units (LRU): a Receiver-Transmitter (RT), Radar Control Panel (CP), and an Antenna Drive unit with antenna (DA). In addition to the above LRUs, additional equipment (not supplied by Telephonics) is necessary to operate the radar system. This additional equipment includes one or two Multifunction Displays (MFD) which are necessary to display the radar data, modes of operation and controls. For antenna stabilization, a gyro or Attitude Heading Reference System (AHRS) system is required.

The beacon mode requires that a tight tolerance magnetron be employed in the Receiver Transmitter for reliable interrogation of beacon transponders. Also, special circuitry is incorporated in the Receiver Transmitter unit to optimize the receiver portion to process narrow bandwidth weather targets.

All system controls are located on either the Radar Control Panel or the EFIS Display Unit. The Radar Display Unit provides search gain, beacon gain, mode of operation, and antenna tilt control. The EFIS Display Unit provides range information. Only one Radar Control Panel can be used in the RDR-1600 radar system, but two EFIS displays can be employed. This will allow the pilots to select gain, mode and tilt on the control panel. Different range values can be selected on each display for the pilot and for the co-pilot.

The presentation of data on the MFD will vary from manufacturer to manufacturer. Refer to the MFD manufacturer for the exact presentation of data on the display. In general, the MFD display shall display in text format the modes of operation, beacon code selected, fault codes, antenna tilt, search gain, and beacon gain. The range rings, range ring markers in nautical miles, and target data shall be displayed in graphical format.

Built-in-test (BIT) circuits provide rapid checkout of system performance in the air or on the ground. A TEST function, as selected on the radar control panel, is a user - initiated BIT to validate the system operation. The RDR-1600 radar system runs Continuous BIT to detect a fault within the system. If a fault should occur within the system, then a fault will be displayed in all modes of operation.

1.1.2 Operational Modes

1.1.2.1 Search Modes

There are 3 search modes available to the operator. Each mode has features to enhance detectability in different scenarios. Search Mode 1 (SR1) can detect and display surface targets down to a minimum range of 500 feet when a range selection of 10 nm or less has been selected. This mode uses a short transmitted pulse and special clutter rejection circuitry and is designed for short-range (i.e. 0.5, 1, 2, 5, and 10 nm) mapping of targets in a sea clutter environment. Once a range of 20 nm or greater has been selected, then the transmitter will switch to a long pulse and the clutter rejection circuit is disengaged (effectively becomes search mode 3).

Search Mode 2 (SR2) can detect and display surface targets down to a minimum distance of 500 feet when a range of 10 nm or less has been selected. This mode uses a short transmitted pulse and is designed for short-range (i.e. 0.5, 1, 2, 5, and 10 nm) precision ground mapping. Once a range of 20 nm or greater has been selected, then the transmitter will switch to a long pulse. Under these conditions, SR2 effectively becomes search mode 3.

Search Mode 3 (SR3) is used for long-range ground mapping or searching for topographical features such as bodies of water, islands, high ground, bridges, etc. This mode will return the greatest amount of ground clutter. This mode can also be used for oil slick detection in calm to moderate sea states.

1.1.2.2 Weather Avoidance Modes

Weather Mode (WX) will display continuous enroute weather information relative to rain cloud formation, rainfall rate, thunderstorms with moisture, and areas of icing conditions. Digital circuitry provides a means for determining the relative density of the rainfall areas. With the display, the pilot can see storm areas in the flight path and can also distinguish corridors of relative calm through the storms.

The system detects the strong returns from high-density rainfall and converts them into red areas on the radar display. Yellow areas that represent areas of lower rainfall rates usually surround these areas. Areas with the lightest rainfall are green in the display.

A sensitivity timing control (STC) circuit ensures that the echo signals are displayed with approximately equal intensity from similar targets at distances from near zero range to approximately 45 nm (12 inch antenna array). The gain control for the weather mode is preset, and not selectable by the operator.

Weather Alert Mode (WXA) will cause the red areas of the display to flash at approximately 1.25 Hz rate. The flashing of the red areas is a MFD function, and some MFDs are not capable of flashing the red areas. If the MFD is not capable of flashing the red areas, then this function will not operate.

This mode will also active the Target Alert function within the RT-1601. The target alert function will be activated if a red storm cell is detected within 25 nm beyond the selected range and within ±10° of boresight. This feature warns the pilot that a danger exists on the present flight path beyond the selected range. This feature is also necessary to warn the pilot in the event that the pilot is not looking at weather (navigation information, checklist, etc.) on the MFD display.

1.1.2.3 Beacon Mode

In the beacon mode, the system can interrogate and receive pulses from a fixed transponder(s) located within a range up to 160 nm. Maximum range will vary depending upon the receiver sensitivity of the beacon, and transmitted power of the beacon. The coded replies are received on a special beacon frequency (9310 MHz). The MFD will display the location, in range and bearing relative to the aircraft, of beacon returns from both 2-pulse and DO-172 6-pulse transponders.

A special beacon code is assigned to each beacon signal received. The code can be displayed to identify a particular beacon reply on the screen. The beacon decoding ranges are different for the two types of beacons. The 2-pulse beacon can only be identified when the indicator is in the 2, 5, 10, 20, 40 or 80 nm range. The DO-172 6-pulse beacon replies can only be identified when the indicator is in the 2, 5, 10, or 40 nm range.

1.1.2.4 Dual Mode of Operation

The RDR-1600 radar system can operate in single mode or dual modes of operation. The Dual modes of operation consist of WX/BCN, WXA/BCN, SR1/BCN, SR2/BCN, or SR3/BCN. Weather and search modes are not allowed to operate at the same time.

1.2 EQUIPMENT PART NUMBERS AND DESCRIPTIONS

1.2.1 RDR-1600 System Components

Table 1.2-1. RDR-1600 System Components

Telephonics Part Number	Type	Description
379-2011-001	RT-1601	Provides pulsed X-band output signal to sector scanned antenna. Reflected signal is amplified by receiver, filtered, digitized, and sent on to the display. The magnetron frequency is tunable and is designed to operate at 9375 $\pm$ 5 MHz to permit reliable triggering of the beacon transponder. Operating parameters permit optimum performance in each of the five primary modes (three search, weather, and beacon).
4000504-0301	DA-1203A	Radar Antenna Drive unit. Positions antenna array in azimuth and elevation axis. Motor driven, with line-of-sight stabilization. Scans 120° sector. Stabilization in accordance with pitch and roll signals from the aircraft vertical gyro and control panel Tilt control. The tilt is selectable $\pm$ 15° from horizontal. Mates with the 10-inch and 12-inch antenna arrays.
4000504-0302	DA-1203A	Same as the –0301 except for inverted mounting.
4000504-0303	DA-1203A	Same as the –0301 except includes counterweights which are necessary for the larger antenna. Mates with the 18-inch antenna array.
4000504-0304	DA-1203A	Same as the –0301. Special customer label.

Table 1.2-1. RDR-1600 System Components (Cont)

Telephonics Part Number	Type	Description
4000504-0305	DA-1203A	Same as the –0301 except includes counterweights which are necessary for the larger antenna. Mates with the 18-inch by 12-inch antenna array.
4000525-4510	AA-4510A	Phased array antenna; 45,000 feet; 10-inch diameter round; mates with DA-1203A.
4000525-4512	AA-4512A	Phased array antenna; 45,000 feet; 12-inch diameter round; mates with DA-1203A.
4000525-4518	AA-4518A	Phased array antenna; 45,000 feet; 18-inch diameter round; mates with DA-1203A.
4000525-5510	AA-5510A	Phased array antenna; 55,000 feet; 10-inch diameter round; mates with DA-1203A.
4000525-5512	AA-5512A	Phased array antenna; 55,000 feet; 12-inch diameter round; mates with DA-1203A.
4000525-5518	AA-5518A	Phased array antenna; 55,000 feet; 18-inch diameter round; mates with DA-1203A.
4000525-1812	AA-1812A	Phased array antenna; 30,000 feet; 18-inches wide by 12-inches high; mates with DA-1203A.
4005094-0502	Mounting Adaptor	Mounts DA-1203A antenna drive to allow for bulkhead clearance when using an AA-4518A, AA5518A, or AA1812A antenna arrays.
3614278-1101	CP-113A	Black 28 VDC
3614278-1102	CP-113A	Gray 28 VDC
3614278-1201	CP-113A	Black 28 VDC NVG YEL
3614278-1119	CP-113K	Black 5 VAC
3614278-1120	CP-113K	Gray 5 VAC
3614278-1219	CP-113K	Black 5 VAC NVG GRN
3614278-1220	CP-113K	Gray 5 VAC NVG GRN
3614278-1319	CP-113K	Black 5 VAC NVG GRN
3614278-1320	CP-113K	Gray 5 VAC NVG GRN
3614278-1419	CP-113K	Black 5 VAC
3614278-1420	CP-113K	Gray 5 VAC
3614278-1520	CP-113K	Gray 28 VDC
3614278-1619	CP-113K	Black 28 VDC NVG GRN
3614278-1620	CP-113K	Gray 28 VDC NVG GRN
3614278-1719	CP-113K	Black 28 VDC
3614278-1819	CP-113K	Black 28 VDC NVG YEL
3614278-1919	CP-113K	Black 28 VDC NVG YEL
3614278-1127	CP-113P	Black 28 VDC
3614278-1128	CP-113P	Gray 28 VDC
3614278-1130	CP-113P	Black 28 VDC NVG GRN COMPATIBLE

1.2.2 CP-113 Unit Description

1.2.2.1 CP-113 Function Select Switch

Table 1.2-2. CP-113 Function Select Switch

Telephonics Part Number	Model Name	OFF	STBY	TEST	ON	60°	LOG
3614278-1101	CP-113A	X	X	X	X	X	X
3614278-1102	CP-113A	X	X	X	X	X	X
3614278-1201	CP-113A	X	X	X	X	X	X
3614278-1119	CP-113K	X	X	X	X	X	
3614278-1120	CP-113K	X	X	X	X	X	
3614278-1219	CP-113K	X	X	X	X	X	
3614278-1220	CP-113K	X	X	X	X	X	
3614278-1319	CP-113K	X	X	X	X	X	
3614278-1320	CP-113K	X	X	X	X	X	
3614278-1419	CP-113K	X	X	X	X	X	
3614278-1420	CP-113K	X	X	X	X	X	
3614278-1519	CP-113K	X	X	X	X	X	
3614278-1520	CP-113K	X	X	X	X	X	
3614278-1619	CP-113K	X	X	X	X	X	
3614278-1620	CP-113K	X	X	X	X	X	
3614278-1719	CP-113K	X	X	X	X	X	
3614278-1819	CP-113K	X	X	X	X	X	
3614278-1919	CP-113K	X	X	X	X	X	
3614278-1127	CP-113P	X	X	X	X	X	
3614278-1128	CP-113P	X	X	X	X	X	
3614278-1130	CP-113P	X	X	X	X	X	

1.2.2.2 CP-113 Mode Push Buttons

Table 1.2-3. CP-113 Mode Push Buttons

Telephonics Part Number	Model Name	WX (RDR)	WXA	NAV (MAP)	RNG UP/DN	SRCH	OBS	BCN
3614278-1101	CP-113A	X	X	X	X	X	X	X
3614278-1102	CP-113A	X	X	X	X	X	X	X
3614278-1201	CP-113A	X	X	X	X	X	X	X
3614278-1119	CP-113K	X	X			X		X
3614278-1120	CP-113K	X	X			X		X
3614278-1219	CP-113K	X	X			X		X
3614278-1220	CP-113K	X	X			X		X
3614278-1319	CP-113K	X	X			X		X
3614278-1320	CP-113K	X	X			X		X
3614278-1419	CP-113K	X	X			X		X
3614278-1420	CP-113K	X	X			X		X
3614278-1519	CP-113K	X	X			X		X
3614278-1520	CP-113K	X	X			X		X
3614278-1619	CP-113K	X	X			X		X
3614278-1620	CP-113K	X	X			X		X
3614278-1719	CP-113K	X	X			X		X
3614278-1819	CP-113K	X	X			X		X
3614278-1919	CP-113K	X	X			X		X
3614278-1127	CP-113P	X	X			X		X
3614278-1128	CP-113P	X	X			X		X
3614278-1130	CP-113P	X	X			X		X

1.2.2.3 CP-113 Additional Switches and Controls

Table 1.2-4. CP-113 Additional Switches and Controls

Telephonics Part Number	Model Name	TILT	PULL STAB OFF	BCN GAIN	SRCH GAIN	CODE	BRT	OFF
3614278-1101	CP-113A	X	X	X	X	X	X	X
3614278-1102	CP-113A	X	X	X	X	X	X	X
3614278-1201	CP-113A	X	X	X	X	X		
3614278-1119	CP-113K	X	X	X	X	X	Note 2	
3614278-1120	CP-113K	X	X	X	X	X	Note 2	
3614278-1219	CP-113K	X	X	X	X	X	Note 2	
3614278-1220	CP-113K	X	X	X	X	X	Note 2	
3614278-1319	CP-113K	X	X	X	X	X		
3614278-1320	CP-113K	X	X	X	X	X		
3614278-1419	CP-113K	X	X	X	X	X		
3614278-1420	CP-113K	X	X	X	X	X		
3614278-1519	CP-113K	X	X	X	X	X		
3614278-1520	CP-113K	X	X	X	X	X		
3614278-1619	CP-113K	X	X	X	X	X		
3614278-1620	CP-113K	X	X	X	X	X		
3614278-1719	CP-113K	X	X	X	X	X		
3614278-1819	CP-113K	**Note 1**	X	X	X	X		
3614278-1919	CP-113K	X	X	X	X	X		
3614278-1127	CP-113P	X	X	X	X	X		
3614278-1128	CP-113P	X	X	X	X	X		
3614278-1130	CP-113P	X	X	X	X	X		

Notes

☞ 1. Tilt Pot zero is at the 9 o'clock position

2. Dual Brightness Pots

1.3 ADDITIONAL EQUIPMENT REQUIRED FOR COMPLETE INSTALLATION

1.3.1 Additional Available Equipment

Table 1.3-1. Additional Equipment Available

Accessory	Telephonics Part Number	Description	Type	Telephonics Part Number
RDR-1600 Installation Kit	4007550-0508	Kit Includes:		
		• RT-1601 J1 mating connector	MS3126F16-26S(SR)	2088376-0013
		• RT-1601 J3 mating connector	D38999/26WE35SN (MIL-C-38999/26)	---
		• RT-1601 Waveguide Quick Disconnect	---	4005095-0501
		• DA-1203A mating connector	KPT06F16-23S	2088376-0037
		• CP-113K mating connector	Positronics HDC50F20JVL0	24220-0013
RT-1601 Mounting Trays	4007261-0502	Standard Mount without vibration isolators		
	4007261-0503	Standard Mount with vibration isolators		
	4007543-0502	Side Mount without vibration isolators		
	4007543-0506	Side Mount with vibration isolators		

1.3.2 Equipment Required But Not Supplied

Table 1.3-2. Equipment Required But Not Supplied

Accessory	Description
Radome	Radome kits and installation directions must be ordered directly from the radome manufacturer or supplied by aircraft manufacturer. The radome provides a radar window for the radar signal while retaining the original nose configuration of the aircraft. The DA-1203A is mounted directly behind the radome. The radome must have a transmisstivity of 90% or better for proper radar operation. Refer to Advisory Circular AC No.43-14 in the front portion of this manual.
Electrical Cables	The radar system wiring harness shall be constructed as shown in the System Wiring Diagram (see paragraph 2.9). Quadraxial cable (024-00064-0000) is required for transmission of ARINC 453 data from the RT to the MFD display system.
Stabilization Requirements	The RDR-1600 radar system will work with vertical gyros with an output of 40 to 220 mV/°. The RDR-1600 radar system will accept ARINC 429 Pitch and Roll data from an AHRS system.
Waveguide	Flexible or rigid waveguide may be used between the RT and the DA. The following types of waveguide shall be used: EIA WR90 MIL-W 85E RG52/U (Copper/Bronze) MIL-W 85E RG67/U (Aluminum) British WG16 IEC R100 This waveguide must have a plate (flat) flange on one end and a choke flange on the other.

1.4 LEADING PARTICULARS

1.4.1 RDR-1600 Radar System

Table 1.4-1. RDR-1600 Radar System

Characteristic	Description
System Power Requirements	
System	5.0 Amps at 28 VDC. 3.0 VA at 115 VAC, 400 Hz (power factor 0.68)
Panel Lighting	0.4 Amps at 5 Volt 0.1 Amps at 28 VDC
Display Range / Range Marks [nm]	0.5 0.25, 0.5 1 0.5, 1 2 0.5, 1, 1.5, 2 5 1.25, 2.5, 3.75, 5 10 2.5, 5, 7.5, 10 20 5, 10, 15, 20 40 10, 20, 30, 40 80 20, 40, 60, 80 160 40, 80, 120, 160 240 60, 120, 180, 240
Minimum Tracking Range	500 feet
Displayed Modes of Operation	Standby (STBY) Test (TEST) Weather (WX) Weather Alert (WXA) Search 1 (SR1) Search 2 (SR2) Search 3 (SR3)
System Self Test	
Initiated BIT	Test Mode – The display will show the radar test pattern.
Continuous BIT	Monitors faults in the Receiver Transmitter, Antenna Drive, and Radar Control Panel.
Transmitted Power	10 KW Peak Power
Transmit and Receive Frequencies	Transmit Receive
Weather Mode	9375 ± 5 MHz 9375 ± 5 MHz
Search Mode	9375 ± 5 MHz 9375 ± 5 MHz
Beacon Mode	9375 ± 5 MHz 9310 ± 5 MHz

Table 1.4-1. RDR-1600 Radar System (Cont)

Characteristic	Description
Transmitted Pulse Width and Pulse Repetition Frequency (PRF)	Pulse Width PRF
Search 1 (10 nm or less)	0.2 μ Sec 1500 Hz
Search 2 (10 nm or less)	0.2 μ Sec 1500 Hz
Search 3, Search 1, Search 2	2.35 μ Sec 200 Hz
Beacon	2.35 μ Sec 200 Hz
Weather	2.35 μ Sec 200 Hz
Weather Performance Index and Avoidance Range	PI Avoidance
10 inch Antenna	208.7 dB 190 nm
12 inch Antenna	212.9 dB 229 nm
18 inch Antenna	219.7 dB 305 nm
18 inch by 12 inch Antenna	216.3 dB 265 nm
Sensitivity Timing Control (STC)	
10 inch Antenna	40 nm
12 inch Antenna	40 nm
18 inch Antenna	45 nm
18 inch by 12 inch Antenna	45 nm
Antenna Gain and Beam Width	Gain Azimuth Elevation
10 inch Antenna	25.5 dBi 10° 10°
12 inch Antenna	27.6 dBi 8.0° 8.0°
18 inch Antenna	31.0 dBi 5.5° 5.5°
18 inch by 12 inch Antenna	29.3 dBi 5.5° 8.0°
Antenna Scan Angle	120° or 60°
Antenna Scan Rate	28° / Sec
Antenna Tilt Control	± 15°
Antenna Stabilization	± 30°
Antenna Stabilization Accuracy	± 1°

1.4.2 RT-1601 Receiver Transmitter

Table 1.4-2. Leading Particulars RT-1601 Receiver Transmitter

Characteristic	Description
Size	Short ½ATR
Weight (maximum)	17.3 lbs (7.8 kg)
Mounting	Mounting Tray
Pressurization	None Required
TSO	C63c, Class 7 C102
RTCA Documents	DO-172 DO-173 DO-178A, Level 2 DO-160A
DO-160A Environmental Categories	D1A/MON/XXXXXXBBABA
DO-160C Environmental Categories	[D1]WBA(MON)XXXXXXBBABAAAXXX

1.4.3 DA-1203A Antenna Drive

Table 1.4-3. DA-1203A Antenna Drive

Characteristic	Description
Size	See Figure 2.9-6 DA-1203A Antenna Drive Outline Drawing
Weight (maximum)	See Figure 2.9-6 DA-1203A Antenna Drive Outline Drawing
Mounting	Directly to bulkhead, inverted or standard, 18” and 18”x12” antennas require special mounting adaptor.
TSO	C63b
RTCA Documents	DO-172 DO-173 DO-160A
DO-160A Environmental Categories	F2A/JLY/XXXXXXABABA (-50°C)

1.4.4 CP-113 Radar Control Panel

Table 1.4-4. CP-113 Radar Control Panel

Characteristic	Description
Size	See Figure 2.9-7 CP-113 Radar Control Panel Outline Drawing
Weight (maximum)	1.7 lbs (0.77 kg)
Mounting	Panel Mounted, DZUS
TSO	C63c
RTCA Documents	DO-172 DO-173 DO-178A, Level 2 DO-160A
DO-160A Environmental Categories	F1A/PKS/XXXXXXABABA

1.4.5 Antennas

Table 1.4-5. Antennas

Characteristic	Description
Size	See Figure 2.9-6 DA-1203A Antenna Drive Outline Drawing
Weight (maximum)	See Figure 2.9-6 DA-1203A Antenna Drive Outline Drawing
Mounting	Mounts directly to the Antenna Drive
TSO	C63b
RTCA Documents	DO-172 DO-173 DO-160A
DO-160A Environmental Categories	
AA-4510A	C2A/JLM/XXXXXXABABA, 45,000 FT.
AA-4512A	C2A/JLM/XXXXXXABABA, 45,000 FT.
AA-4518A	C2A/JLM/XXXXXXABABA, 45,000 FT.
AA-5510A	F2A/JLY/XXXXXXABABA, 55,000 FT.
AA-5512A	F2A/JLY/XXXXXXABABA, 55,000 FT.
AA-5518A	F2A/JLY/XXXXXXABABA, 55,000 FT.
AA-1812A	B1AYXXXXXXABABA, 20,000 FT.

1.5 SYSTEM COMPONENT DESCRIPTION

1.5.1 General

The RDR-1600 Radar System consists of three flight-line replaceable units (LRU): a Receiver-Transmitter (RT-1601), radar Control Panel (CP-113), and an Antenna Drive unit with antenna (DA-1203A). In addition to the above LRUs, additional equipment is necessary to operate the radar system. One or two Multifunction Displays (MFD) are necessary to display the radar data and modes of operation. For antenna stabilization, a gyro or Attitude Heading Reference System (AHRS) system is required.

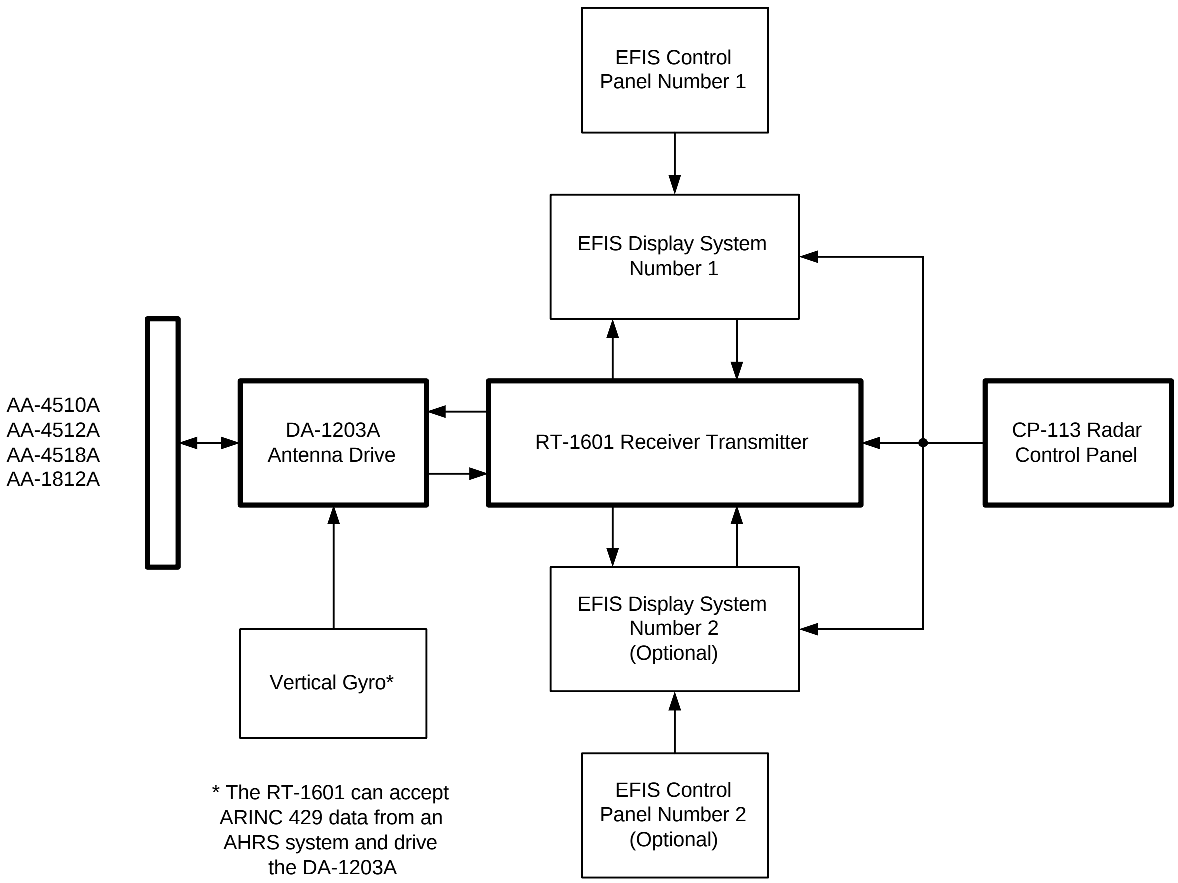


Figure 1.5-1. RDR-1600 Radar System

1.5.2 RT-1601 Receiver Transmitter

The RT-1601 Receiver Transmitter is housed in a short ½ ATR form factor case. Overall dimensions can be found on the receiver-transmitter outline drawing. The RT unit's mounting tray, which is designed for front loading, provides positive positioning and holding of the unit to the aircraft. The mounting tray is mounted to the aircraft, and the RT unit can easily be removed and replaced for servicing. Depending upon installation requirements different models of the mounting tray are available.

The RT-1601 contains a tight tolerance magnetron that is required to operate with a beacon transponder. This lightweight X-band transmitter provides a peak power of 10 KW with the capability of transmitting a long and short pulse. The long pulse is for weather, beacon, and long-range search. A short pulse is used in short-range search to provide for high resolution of small targets.

Within the RT, there are two receivers: one for weather returns and one for beacon returns. Target data from the receivers are filtered and converted into digital data that can be displayed on the MFD. There are two ARINC 453 data busses to provide radar target data to two MFDs.

Note

☞ Previous Telephonics Weather Radar Systems contained an NC-104B Navigation concentrator LRU. The NC-104B allowed the radar system to operate in various control and display configurations employing non-Telephonics equipment. This function has been incorporated in the RT-1601. This eliminates the need for using an NC-104B. The RT-1601 is fully compatible with systems that previously used NC-104B and RT-1401B.

Two versions of NC-104B are available:

- NC-104B (Previously used part number 3614331-1004) is the preferred version. It is described as NC-104B (-1004) in this manual.
- NC-104B (Previously used part number 3614331-1005). In this manual, it is described as NC-104B (-1005). Use of this version should only be considered after consultation with Telephonics engineering and engineering personnel of the non-Telephonics equipment to be used.

The RT can be configured with a strapping pin on the unit connector to simulate either the NC-104B (-1004) or the NC-104B (-1005). The radar operation is identical in either configuration, but the digital ARINC 429 control data is different. The primary configuration of the RT-1601 should be NC-104B (-1004). This configuration is compatible with numerous MFD systems. The NC-104B (-1005) configuration is not recommended unless required by the MFD system.

The configuration of the RT will determine which version of the radar control panel is used. See the radar control panel section to determine which version of the CP-113 should be used based upon the configuration of the RT.

1.5.3 DA-1203A Antenna Drive

The DA-1203A Antenna Drive unit scans and stabilizes the flat plate antenna array in 120° or 60° sectors. The antenna array can consist of several sizes: 10 inch round, 12 inch round, 18 inch round, and 18 inch by 12 inch rectangular. The RT provides control signals and power supply voltages to scan the antenna drive.

The antenna drive can receive pitch and roll stabilization signals from either an analog gyro or a digital AHRS system. If an AHRS system is used, then the digital ARINC 429 pitch and roll information must be applied to the RT-1601 where the digital data is converted into analog pitch and roll information used by the DA-1203A.

Where it is inconvenient to make waveguide connections at the top of the antenna (standard mounting), an inverted version is available which permits making connections at the bottom. This version has internal wiring changes to accommodate the inverted operation.

1.5.4 CP-113 Radar Control Panel

The CP-113 radar control panel is DZUS mounted to the aircraft panel and provides mode and control data to the RT-1601 and mode information to the MFD. The controls to the RT consist of both analog and digital signals. The basic controls consist of RT on/off, modes of operation, antenna tilt, search gain, and beacon gain.

Depending upon the configuration of the RT, panel color, functions, and back lighting, there are several versions of the CP-113 radar control panel that can be used within the RDR-1600 radar system. If the RT-1601 is configured as an NC-104B (-1004), then either a CP-113A or CP-113K shall be used. When the RT-1601 is configured as an NC-104B (-1005) then a CP-113P shall be used.

The RDR-1600 may consist of two MFD displays. The MFD system is used to display radar data and to provide the RT-1601 with range information. The two MFD displays can select separate ranges, but there can only be one radar control panel in the system. This system will allow for independent ranges on each display, but both displays will have the same mode, search gain, beacon gain, and antenna tilt.

The customer-selected MFD system must be compatible with the RDR-1600 radar system. This system must provide compatible ARINC 429 control and range data, and must be able to correctly interpret the ARINC 453 radar data information. To determine compliance, contact the MFD system manufacturer.

1.5.5 Antennas

The RDR-1600 radar system uses flat plate, fixed phased array antennas that are mounted to the DA-1203A antenna drive assembly. The antenna is used for both transmitting and receiving, and can be remotely controlled from the tilt control on the radar control panel to any position of beam tilt between 15° above and 15° below the horizontal (zero degrees attitude).

The antenna is shipped separately from the DA-1203A and must be assembled by the installation agency. When using the 18" and 18"x12" antennas, a Mounting Adaptor must be used to provide clearance between the bulkhead and the antenna. This mounting adaptor is not necessary when using a 10" or 12" antenna.

1.6 EQUIPMENT OPERATION AND CONTROLS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers containing flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when the system is transmitting.

CAUTION

Tests involving the radiation of RF energy by the radar antenna must not be made while the radar antenna is directed toward close-by large metal objects such as hangers, doors, or the inside of the hanger. Use test or standby mode where applicable.

1.6.1 Operating Precautions

Flash bulbs can be exposed by radar energy.

Since storm patterns are never stationary, the display is constantly changing, and continued observation is always advisable where areas of turbulence prevail.

1.6.2 License Requirements

A Private Aircraft Radio Station License is required to operate this system when installed in an aircraft. The Federal Communication Commission (FCC) has type-accepted and entered this equipment as "Telephonics Type RT-1601 Radar Receiver Transmitter". When completing Form 404, Station License Application, the exact description must be used.

1.6.3 Operating Controls and Display Features

1.6.3.1 CP-113 Operating Controls

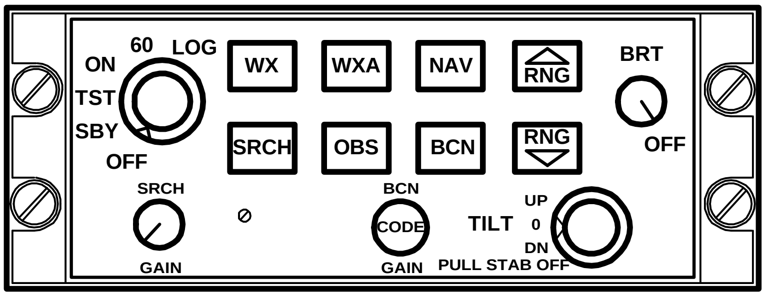


Figure 1.6-1. CP-113A Radar Control Panel

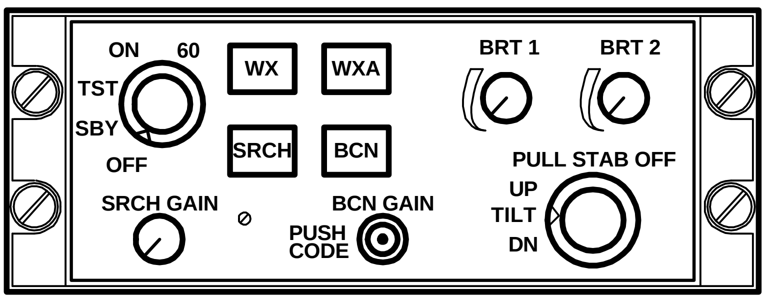


Figure 1.6-2. CP-113K Radar Control Panel (With Brightness Pots)

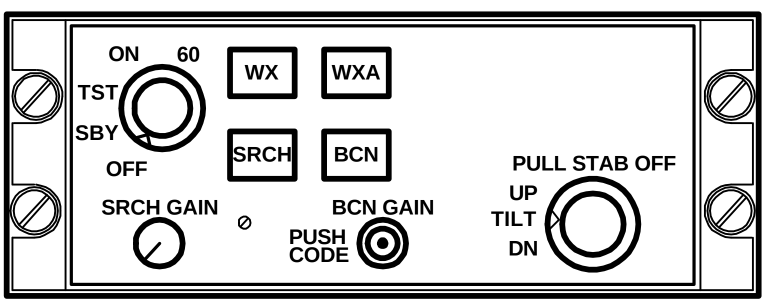


Figure 1.6-3. CP-113K Radar Control Panel (Without Brightness Pots)

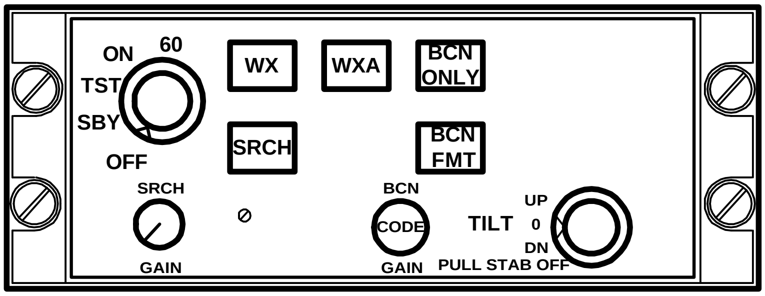


Figure 1.6-4. CP-113P Radar Control Panel

Table 1.6-1. CP-113 Function Select Switch Description

Function Select Switch	Description
OFF	Deactivates the weather radar system by removing power to the radar R/T. This switch is hardwired to the radar system.
STBY	Places the radar R/T in Standby mode. Radar displayed data is not present in Standby. Standby mode is used during the warm-up period of the radar system and when the aircraft is on the ground.
TST	Causes the radar R/T unit to send a radar test pattern to the radar display system. The radar transmitter is not active in Test mode.
ON	In this position, the radar system is turned on. The radar will scan 120° (or 90° in some systems), the transmitter is active, and the receiver will send weather (target) data to the display system.
60°	Directs the antenna to sector scan 60° about the boresight of the aircraft. This position will work in weather, search (map), and beacon modes.
LOG	Selects Flight Log mode to be displayed on the Multi Function Display (MFD). In Flight Log mode, the MFD will display the log of waypoints stored in the Navigation system.

Table 1.6-2. CP-113 Mode Button Description

Radar Mode Push Buttons	Description
WX	Places the radar in Weather mode.
WXA	Places the radar in Weather Alert mode. This will cause the areas of highest displayed precipitation to flash. In some radar systems the color Red will flash and in other radar systems the color magenta will flash. In some EFIS display systems this function will not work. These systems do not have the ability to flash the color on and off. In the RDR-1400C radar system using an NC-104B, this will also cause Target Alert to be activated.
NAV	Sequentially selects the following display modes on an Multi Function Display (MFD): 120° sectored mode with no navigation data 120° non-map CDI display of navigation data 120° map mode display of navigation data 360° map mode display of navigation data
RNG (UP)	Increments the selected range to next higher range setting for a sectored map display on the Multi Function Display (MFD). This is not functional if not connected to an MFD.
RNG (DN)	Decrements the selected range to next lower range setting for sectored map display on the Multi Function Display (MFD). This is not functional if not connected to an MFD.
BCN	Pressing this button will select the two Beacon type formats to be selected. Sequentially pressing the Beacon button will select the following beacon modes: Beacon A, Beacon B, Beacon Off, … The Beacon modes are as follows: Beacon A - DO-172 compatible beacon Beacon B - Standard two-pulse beacon Beacon Off – Removes beacon identification from the display.
OBS	Selects Omni Bearing Select (OBS) mode on the sector map display on the Electron Horizontal Situation Indicator (EHSI) and Multi Function Display (MFD). OBS mode displays aircraft course pointer on weather mode radar displays. The course pointer position is manually controlled from the CRS knob on the EFIS display.
SRCH	Pressing this push button selects the three Search modes in sequential cyclic manner (i.e. Search 1, Search 2, Search 3, Search 1, Search 2, Search 3, etc.). Search modes are as follows: Search 1 - Sea clutter rejection. Active on the ten mile range or less. Search 2 - Short range precision mapping. Active on the ten mile range or less. Search 3 - Normal surface mapping Search mode is compatible with both Beacon mode and Navigation mode.

Table 1.6-3. CP-113 Additional Switches Description

Additional Switches and Controls	Description
TILT UP / DN	The Tilt control is a rotary potentiometer that controls the tilt of the antenna ± 15°. For radar systems that use the DA-1203A, this pot is hardwired to the DA-1203A. The Tilt Control of the CP-113K, which is used with the RDR-1400C radar system (DA-1203A), will be hardwired to the DA-1203A and will also output ARINC 429 Tilt information. This is the only CP-113 that will allow both analog and digital tilt control.
PULL STAB OFF	This switch is connected to the Tilt Control knob. When the Tilt Control Knob is pressed in, then the stabilization function is active. When this knob is pulled out, the stabilization function is turned off.
(ROLL TRIM ADJ)	This is a recessed pot that will adjust the antenna in the azimuth axis so that the antenna will scan parallel to the earth when no roll is applied to the radar system. This is to adjust out any mechanical errors that may exist between the gyro's platform and the antenna drive that is mounted on the bulkhead.
BCN GAIN	The Beacon Gain is a rotary potentiometer that controls the gain of the Beacon receiver.
SRCH GAIN	The Search Gain is a rotary potentiometer that controls the gain of the Search receiver.
CODE	Pressing this switch selects Beacon Codes in a sequential cyclic fashion (i.e. Code 0, Code 1, Code 2, … Code 15 or Code 0, Code 1, Code 2, … Code 9). The selected code is annunciated on the display. When DO-172 Beacon (Beacon Mode A) is selected via the BCN switch, the total of sixteen codes (0-15) can be selected by the Code switch. Selecting a Standard two-pulse Beacon (Beacon Mode B) via the BCN switch, the total of ten codes (0-9) can be selected by the Code switch. The Code button is not active unless the Beacon mode has been selected.
BRT	This potentiometer controls the brightness of the Multi Function Display (MFD). The Brightness control has no function within the CP-113.
(BRT) OFF	This switch blanks the Multi Function Display (MFD). This switch has no function within the CP-113.
STAB OFF	When the slide switch is in the STAB position the stabilization function is active. When the slide switch is in the OFF position the stabilization function is turned off.

1.6.3.2 MFD Display

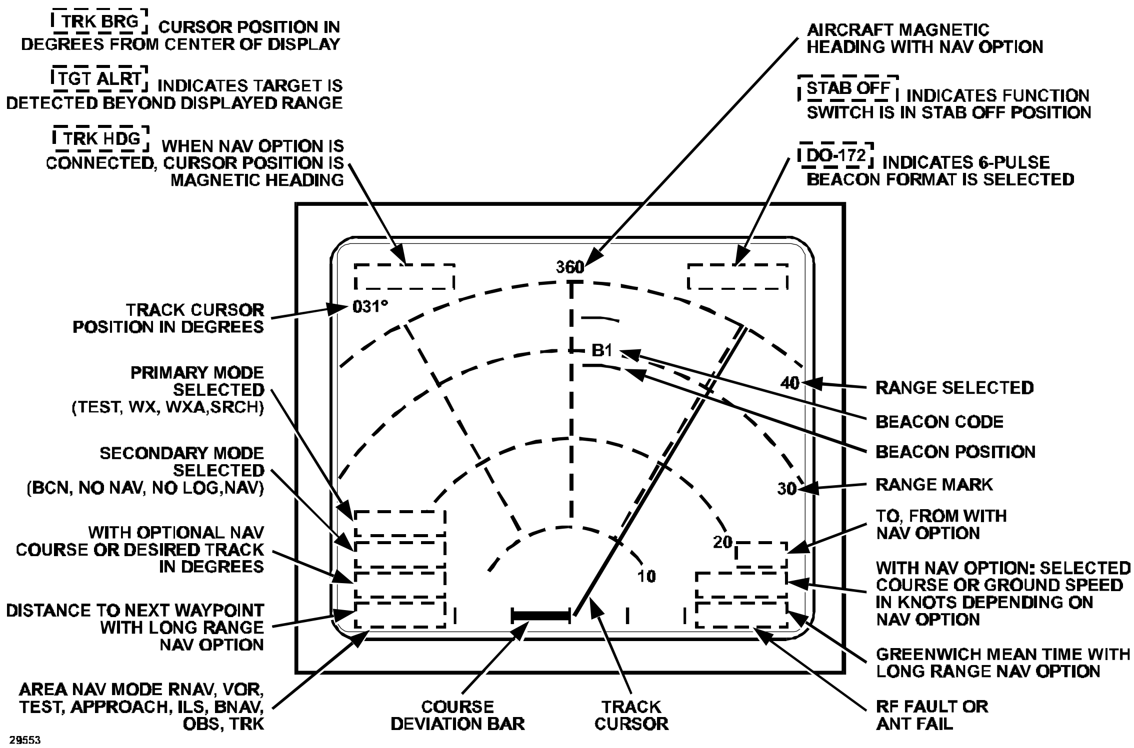


Figure 1.6-5. Generic MFD Display (Radar Only Mode)

The formatting of the display will vary from manufacturer to manufacturer. Refer to the MFD manufacturers "Pilot's Guide" for proper operation of the MFD control panel and display formatting.

As shown above in the Generic MFD Display, there are several required features that should be provided on all MFD displays. Depending upon the MFD display, the text fields may be in other locations within the display area.

1.6.4 Operating Procedures

1.6.4.1 General

The operator can perform or select several system functions using the controls on the display. For all discussions in this section, the CP-113K will be used. The basic operating procedures are described in the following paragraphs.

Operation of GAIN and TILT controls is similar to the controls on other airborne radar systems. In the WX, WXA, and TEST modes, the gain is preset to obtain a calibrated (red display) function at a predetermined storm cell level. In the search modes (SR1, SR2, SR3), the SRCH GAIN control setting is an operator function and is important in obtaining a definitive picture during varying topographic conditions. Also, in the beacon mode (BCN), the BCN GAIN control is used to adjust the beacon receiver gain.

Operating the TILT control is covered in pilot's manuals for radar systems. This control is important. Improper use can allow a potentially dangerous storm to remain undetected. For additional information, refer to Bendix publication ACS-927, Airborne Weather Radar Antenna Stabilization Criteria.

The Control Panel pushbuttons are of the push-on/push-off type. The first time the button is pressed and released, it turns on a function. The next time the button is pressed, it turns off the function. The mode select buttons are all push-on/push-off type.

The four primary mode buttons on the Control Panel (WX, WXA, SRCH, BCN) are all electrically interlocked by internal circuitry. If one of the buttons has been pressed to select a mode, pressing one of the other four mode buttons will override the previous selection. Only one of the four mode buttons can operate at a time.

If the WX mode is selected, and then (say) the SRCH mode is pressed, the display will go to SR1 mode. However, if the SRCH button is pressed again the display will go to SR2 mode. If the WX button is pressed again, the mode will change to the WX mode.

The currently selected mode (or modes) shall always be displayed. Refer to the MFDs Pilot's Guide for the location of the mode on the display.

1.6.4.2 Turn On Procedure

(a) Turn the Function Select Switch from the OFF to the STBY position.

(b) Wait about 100 seconds for the equipment to warm up and then move the Function Select Switch to the TEST position.

(c) Check the display. The test pattern should appear approximately l00 seconds after the Function Select Switch is rotated from the OFF position to the TEST position. The range should be 80 miles. The test pattern will be for 120-degree scan, and will also contain the alphanumerical information for mode, range, range marks, etc. RT FAULT should appear on the display (this is normal operation when in the TEST mode). The word TEST should appear on the display.

(d) Adjust brightness control on the MFD for desired screen brightness.

(e) When safe conditions exist (see operating precautions in previous paragraph), place Function Select Switch in the ON position to activate the radar system. The display will automatically appear in the WX mode.

1.6.4.3 Primary Mode Selection Procedures (WX, WXA, SR1, SR2, SR3, BCN)

1.6.4.3.1 Weight-on-Wheels (WOW) Override

If the system has been installed to use the weight on wheels function during ground operation and taxi situations, the transmitter will not go to the ON position but remains in the test mode displaying the test pattern until the aircraft is airborne.

WOW Override

The WOW switch may be overridden by rotating the control knob on the Control Panel from TEST to ON to TEST to ON in less than 2 seconds. Upon completion of that action the system shall go into normal radiate ON condition and permit selection of normal operating modes. If the Control panel switch is returned to TEST or Standby modes, then system operation shall return to normal. If the WOW switch has been overridden and the WOW switch is in the airborne condition, the system modes shall operate normally and any override conditions deleted.

(a) Observe the existing mode; indicated in the display.

Note

☞ When the indicator is first turned ON, the WX mode will occur at 80 nm range.

(b) To change the existing mode to one of the other primary modes, simply press the new mode button. It is not necessary to press-off the previous mode button.

Note

☞ The RT-1601 Receiver Transmitter has a special feature. In SR1 or SR2 mode, at 2 NM range or less, a red band will appear, with the outer edge at the 500 foot point in the display. This area will not be detected.

1.6.4.4 Range Selection Procedure

The range selection is controlled by the MFD. The range buttons are located on the MFD control panel (except if using a CP-113A). Refer to the MFDs Pilot's Guide for details on the range selection.

(a) Momentarily press the RNG UP button to increase the maximum range displayed by one increment (for example, 20 to 40).

Note

☞ Display will erase completely and rewrite on the new selected range.

(b) Observe that the range selected is shown on the display, along the last range mark.

(c) Observe that the distance to each of the other range marks is shown at the right side of each concentric range arc.

(d) To decrease the maximum range displayed, momentarily press the RNG DN button.

(e) Repeat step (a) or (d) as necessary to obtain the desired range.

1.6.4.5 Stabilization (STAB OFF) Control Procedure

(a) Pull the TILT Control knob out to turn off the antenna stabilization off.

(b) Observe that the words STAB OFF appear on the display.

Note

☞ The antenna is not stabilized in the horizontal plane, and will cause the display to vary with aircraft attitude.

(c) Push the TILT Control knob in to restore antenna stabilization.

(d) Observe that the words STAB OFF disappear from the display.

Note

☞ The STAB OFF function is normally not used. It is employed only when the antenna stabilization system or gyro fails, or is suspected of failure.

1.6.4.6 TEST Pattern Selection Procedure

(a) Initially, turn Function Select Switch from OFF to TEST position.

(b) Check the display. The test pattern should appear approximately 100 seconds after the Function Select Switch was rotated from the OFF position to the TEST position. The exact point of test pattern termination or range duration of each color is not important. The presence of three distinct colors, in proper order, is important. See the RDR-1600 Pilot's Guide for the pattern that will appear in the-80-mile range.

1.6.4.7 60° Scan Selection Procedure

(a) To change the display from 120° to a 60° scan, turn Function Select Switch from ON to 60°.

(b) Observe that the antenna now scans only 60° and the display indicates a 60° sector scan.

(c) To return the system to the 120° scan, turn Function Select Switch from 60° to ON.

Note

☞ If the antenna BORESIGHT signal is not being received by the RT-1601, the fault ANT FAIL will appear in the display's fault field.

1.6.4.8 Beacon Mode Selection (BCN)

The RDR-1600 radar system will receive, decode, and display beacon replies from a standard 2-pulse beacon transponder and from a DO-172 6-pulse beacon transponder when the beacon mode is selected. All beacon transponders within the selected range (160 mile maximum) will be displayed. Each beacon transponder is assigned a numerical code, based upon the pulse spacing (2-pulse) or based upon a binary number (6-pulse). The display range must be set for 2,5,10,20, or 40 miles to obtain identification of the DO-172 beacon reply on the screen. The 2-pulse beacon can be identified up to the 80-mile range.

(a) Press-on the BCN button to select the beacon mode. The beacon mode can be selected at any time, with any other mode also selected (WX, WXA, SRI, SR2, SR3). The word BCN will appear on the display.

(b) Press the BCN (on BCN GAIN knob) button to select the desired beacon format. Sequentially pressing the Beacon button will select the following beacon modes: Beacon A, Beacon B, Beacon Off, … The Beacon modes are as follows:

Beacon A	DO-172 compatible beacon
Beacon B	Standard two-pulse beacon
Beacon Off	Removes beacon identification from the display.

(c) To identify a DO-172 6-pulse beacon, press the BCN button until A1 appears on the display. The characters B1 will be displayed when the standard 2-pulse beacon has been selected. The displaying of the beacon format will vary depending upon the MFD manufacturer. Please refer to the MFD Pilot's Guide for beacon format display.

(d) Press the PUSH CODE (located on the BCN GAIN knob) button to select the desired beacon code number. The beacon codes are displayed sequentially (Al through A15 for the DO-172 format and B1 through B9 for the 2-pulse format) in the lower left corner of the display.

(e) Set the display range to between 2 and 40 miles for DO-172 codes, or between 2 and 80 miles for 2-pulse codes. When a beacon reply is received that corresponds to the selected code, the number (e.g. B3) will appear within the beacon symbol.

Note

☞ With either beacon format, the first mark in the beacon reply indicates the location (range) of the beacon. The beacon display will flash if a primary mode is also selected (providing the MFD is capable – see MFD Pilot's Guide for display details).

(f) Adjust the BCN GAIN control as required. Beacon returns are frequently very strong and the gain must be reduced as the beacon is approached.

(g) To remove the beacon display, press the BCN button until the beacon mode is off.

1.6.4.9 Two-Pulse Beacon Interrogation and Codes

The transmitter of the RT-1601 sends an interrogation signal to the ground-based beacon transponders when the BCN B mode is selected on the display. All of the ground beacons that receive the signal reply by sending a two-pulse signal back to the aircraft. All beacons operate at the same frequency. Each beacon transponder in a given area is assigned a different code (spacing between the two pulses) that they emit upon each interrogation.

All of the responding beacons within the area of the display will appear on the indicator screen. Each beacon location will appear as two short curved lines on the screen. The two curved lines will be spaced corresponding to the pulse spacing from the transponder.

The first pulse received from the transponder generates the curved line closest to the aircraft as the antenna scans the beacon. The actual beacon location will be at the center of this curved line.

There is a delay between the time that the beacon transponder receives a radar pulse and then sends a reply (first of two pulses). The delay time will affect the beacon range location on the display, and is usually adjustable on the beacon.

If the transponder delay is too long, the beacon will appear farther away than it actually is. If the transponder delay is less, the beacon will appear closer on the screen than it actua1ly is.

Note

☞ Refer to the beacon transponder manual for correct delay adjustment.

The PUSH CODE button on the radar control panel permits identifying each beacon displayed. Repeatedly pressing the button will sequence through 9 beacon codes. The spacing between the two pulses of a beacon's reply determines the beacon’s code (see Table 1.6-4).

Assume you are looking for a beacon with pulse spacing of 6.0 miles. This beacon signal is coded "B3" on the display. To find the beacon proceed as follows.

(a) Turn on the system and press the BCN mode button.

(b) Observe that the word B1 appears on the display.

Table 1.6-4. Typical Two-Pulse Beacon Transponder Pulse Spacing

CODE DISPLAYED	SPACING BETWEEN BEACON PULSES (IN MILES)
1	3.6 to 4.3
2	4.4 to 5.3
3	5.3 to 6.3
4	6.3 to 7.3
5	7.3 to 8.3

CODE DISPLAYED	SPACING BETWEEN BEACON PULSES (IN MILES)
6	8.3 to 9.3
7	9.3 to 10.3
8	10.3 to 11.3
9	11.3 to 13.0

Note

☞ Pulse spacing is determined by Motorola specifications for the SST-181E X-band radar transponder.

(c) Sequentially press the PUSH CODE button, and observe the code number that appears on the display. (e.g. B1, B2, B3, …, B9).

(d) Stop pressing the PUSH CODE button when code B3 appears

(e) Fly the aircraft until a beacon symbol appears on the screen. If it is the desired beacon, B3 will appear above the first mark in the beacon return.

Note

☞ Range must be set between 2 miles minimum and 80 miles maximum for 2-pulse beacon identification to function. No decoding will occur beyond 80 miles or less than 2 miles. Also, for optimum identification, adjacent numbered codes should not be assigned to transponders in the same area. Refer to Table 1.6-4.

1.6.4.10 DO-172 Six-Pulse Beacon Interrogation

The DO-172 6-pulse beacon transponder produces a display (reply) similar to the standard 2-pulse beacon transponder reply previously described. Each DO-172 beacon location will appear as two curved lines (frame marks) on the screen, with one, two, three, or four additional curved lines between the two frame marks. The number of curved lines between the frame marks, and the spacing of the lines, is determined by the beacon code of the transponder. For example, assume that the reply for beacon code A15 is being displayed. The binary code for 15 is 1111, so there will be four equally spaced lines between the two frame marks. Beacon code A13 would appear as a line, then a space, then two more lines between the frame marks, for binary number 13. The first line after the first frame mark represents the least significant bit in the binary number (e.g. number 1101 will appear as 1011).

Depending upon the display range selected and the location of the beacon, the lines between the frame marks may be too close to distinguish or properly identify the number, and should not be used for identifying the reply. The PUSH CODE button on the radar control panel permits identifying each DO-172 beacon reply in the same manner as the 2-pulse beacon reply previously described, except 15 beacon codes are possible with the DO-172 6-pulse beacon.

A pulse from the radar transmitter interrogates the DO-172 beacon. The interrogation frequency is between 9370 MHz and 9380 MHz. The pulse width is between 2.20 µsec and 2.65 µsec. When the DO-172 beacon transponder receives the pulse at the proper amplitude, a reply is transmitted at 9310 MHz ±5 MHz after a fixed delay of 4.7 µsec. The beacon reply signal consists of two-to-six pulses spaced at intervals of 3.0 µsec between leading edges. Each pulse is 0.5 µsec wide. The first pulse is the first frame pulse and establishes the beacon range as previously described. The final pulse, occurs 15 µsec after the first pulse; this is the other framing pulse. The pulses between the first and last pulse establish the beacon code. Table 1.6-5 lists all the possible pulse combinations. Observe that a condition exists for a zero code, when only the two frame marks would be transmitted. This zero code reply is reserved for fault indications.

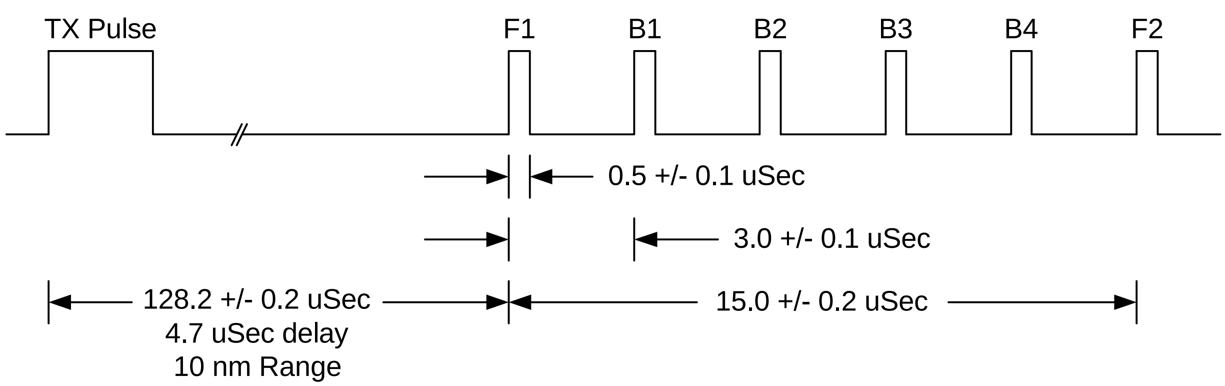
When an unknown beacon reply appears on the screen while flying in the BCN mode, the reply can easily be identified by stepping through the beacon codes with the PUSH CODE button until the selected code appears in the beacon symbol on the screen. If both a 2-pulse reply and a 6-pulse reply are being received and the two beacons are assigned the same code (e.g. B3), they can still be identified, since only the beacon replies that agree with the format selected by the BCN button will be identified on the screen.

Note

☞ Range must be set between 40 miles maximum and 2 miles minimum for DO-172 beacon identification to function. No decoding will occur beyond 40 miles or under 2 miles

Table 1.6-5. DO-172 Beacon Transponder Codes

BEACON IDENTIFICATION CODE	FIRST FRAME PULSE	FOUR CODE PULSES IN BINARY CODE 1 (LSB)	2	4	8 (MSB)	SECOND FRAME PULSE
0	1	0	0	0	0	1
1	1	1	0	0	0	1
2	1	0	1	0	0	1
3	1	1	1	0	0	1
4	1	0	0	1	0	1
5	1	1	0	1	0	1
6	1	0	1	1	0	1
7	1	1	1	1	0	1
8	1	0	0	0	1	1
9	1	1	0	0	1	1
A (10)	1	0	1	0	1	1
B (11)	1	1	1	0	1	1
C (12)	1	0	0	1	1	1
D (13)	1	1	0	1	1	1
E (14)	1	0	1	1	1	1
F (15)	1	1	1	1	1	1



1.6.4.11 Target Alert Function

The RDR-1600 system has the capability to detect high-density (red level) storm cells that are present beyond the range being displayed on the indicator when operating in the WXA mode. At each selected range, the system looks ahead for an additional 25 miles. If a high-density storm cell (red level) is present, the word TGT ALRT will flash on the display (The display of Target Alert will vary with MFD – See MFDs Pilot's Guide for more information). The function is automatic on all ranges except the 240 nautical mile range.

When TGT ALRT occurs, the operator should increase the range setting on the display to locate the storm and take the necessary actions to avoid the storm cell. This feature is particularly useful when operating at short ranges during search modes.

1.7 ASSOCIATED PUBLICATIONS

P/N	Title	Application
*	MFD Pilot's Guide	MFD Display Information
*	MFD Installation Manual	and control panel operation
TM106701	RT-1601 Maintenance Manual	RT-1601 Maintenance Overhaul
006-05953-005	Weathervision Radar Antenna Maintenance Manual (IB 21000A)	DA-1203A Antenna Drive Maintenance Overhaul
006-05314-002	CP-113 Radar Control Panel Maintenance Manual	CP-113 Maintenance Overhaul
TM106801	RDR-1600 Pilot's Guide	RDR-1600 Operation

*Refer to associated MFD manufacturer's documentation.

CHAPTER 2

INSTALLATION

2.1 GENERAL

This chapter contains information for the installation of the Telephonics RDR-1600 Weather Radar System. Included are equipment outline drawings, installation pictorials and electrical interconnect diagrams of the different system configurations. These drawings should be reviewed by the installing agency and requirements peculiar to a particular airframe established before installation is begun.

2.2 UNPACKING

Use care when unpacking the Telephonics RDR-1600 Weather Radar System components. Open shipping cartons and carefully remove all items. Check the components to ensure that all items ordered have been included. Retain shipping cartons and packing material for future shipping or storage.

Visually inspect all units for any possible damage that may have occurred during shipment, such as dents, deep abrasions, chipped paint, cracked glass, etc. If any equipment has been damaged in transit report the extent of damage to the transportation carrier immediately.

2.3 PRE-INSTALLATION CHECK

Bench test the equipment to ensure that it is operable before installation. Bench test procedures are given in the RDR-1600 Maintenance Manual. A continuity and insulation test should be made on all cables and wiring harnesses fabricated by the installing agency.

2.4 INSTALLATION PLANNING

2.4.1 Outline and Interconnect Drawings

Outline drawings of the units in the RDR-1600 radar system and the interconnect diagrams are located at the end of this chapter. Interconnect diagrams provide for either an analog gyro system or an AHRS system installation.

For interconnecting information, refer to Figure 2.9-8 for an analog gyro system and Figure 2.9-9 for an AHRS system installation.

The installer must fabricate cable assemblies. Mating connectors are not supplied with each unit of the system. See Table 1.3-1.

2.4.2 Location of Equipment

The locations chosen for units of the RDR-1600 Weather Radar System, and the method of installation will vary with each particular type of aircraft. The units should be installed in a convenient location for ease of operation and accessibility for inspection and maintenance. The area should be free from excessive vibration, heat and electronic noise generating sources. If the system is to be deployed in hot climate areas, additional air circulation/cooling around the RT1601 is recommended. In addition, since all weather radar receiver-transmitter units are high power pulse generating devices, they are potential sources of RFI. Consider this factor when selecting a location for the RT unit. The cable should not be bundled with ADF loop lines. Other restrictions on unit locations are those imposed by transmission line and waveguide length limits. It is recommended that total waveguide length should be held to a maximum of 10 feet including bends.

Note

☞ When the transmitter is keyed, a magnetic field occurs, created by the heavy dc current drawn. A magnetic shield P/N 4004660-0501 is available when the R-T unit interferes with the magnetic compass. The indicator contains a magnetic shield that encloses the unit, eliminating this type interference.

2.4.3 Primary Power Requirements

The RDR-1600 Weather Radar System operates primarily from the aircraft's 28 VDC power system. Power to the control panel is needed depending on which model number has been selected for use. In addition to the dc power requirement, the system requires roll and pitch output voltages from the aircraft's vertical gyro for operation of the antenna stabilization system. The associated 115V, 400 Hz power requirements must be in phase with the reference voltage. DC, AC, and vertical gyro connections to the RDR-1600 Weather Radar System are shown in the interconnect diagrams, at the end of this chapter.

2.4.4 Roll and Pitch Information

It is important that the connections to the vertical gyro outputs be made according to the system interconnect diagram, Figure 2.9-8 and Figure 2.9-9. The DA-1203A stabilization servo system requires a two-wire pitch input signal within a range of 40 to 220 mV per degree. Roll information requires a two-wire input voltage within the range of 40 to 220 mV per degree. This requirement is met by most vertical reference sources. It is important to remember that phasing must be such that aircraft nose down and right roll gives signals at the antenna plug which shall be in-phase with reference (115V input power to antenna) voltage.

The Pitch and Roll information to the DA-1203A may come form an analog vertical gyro or from an ARINC 429 AHRS system. If the information is coming from an AHRS system, the ARINC 429 data must be converted to analog data by the RT-1601.

2.5 INSTALLATION OF SYSTEM COMPONENTS

2.5.1 Radar Antenna

2.5.1.1 Assembly of Antenna Array and Antenna Drive Assembly Procedure

(a) Remove the V-band coupling assembly (see Figure 2.9-6) from the antenna drive assembly.

(b) Butt the antenna array against the antenna drive assembly making certain that the array engages the two guide pins located on the drive assembly. Secure the array/drive assembly together by re-installing the V-band coupling assembly.

CAUTION

Antenna arrays are available with different altitude specifications. Be sure that the array altitude rating is greater than the desired maximum aircraft operating altitude. Refer to Table 1.2-1.

(c) Torque the two cap screws on the V-band coupling assembly 22 to 24-inch-pounds.

2.5.1.2 Installation of The Antenna and Antenna Drive (DA-1203A) Assembly Procedure

The radar antenna assembly is designed for mounting to the forward bulkhead, in the nose section of the aircraft, behind a radome fabricated for the operating frequency of the radar system. The total space required for the radar antenna can be determined from the dimensional information contained on the radar antenna drawing, Figure 2.9-6.

CAUTION

Check that antenna is free to move in azimuth (retaining pin removed) prior to applying power.

The antenna base hole pattern (see Figure 2.9-10) is compatible with the mounting holes provided by the airframe manufacturers. The standard mounting provisions provided in the aircraft should include a means for adjustment of the antenna, approximately ±2.0 degrees in the pitch axis, by the use of shims under the mounting pads.

Using an accurate spirit level prior to the actual mounting of the antenna can check alignment of the mounting pads. Antenna alignment can be checked in service by means of the electrical tests outlined in Paragraph 2.6.

2.6 POST-INSTALLATION CHECK

Note

☞ When an 18-inch array is installed on the antenna drive unit, a spacer is required between the bulkhead and the drive unit to prevent the array from hitting the bulkhead during the 120° scans. Refer to Table 1.2-1.

(a) Shock Mounting and Ventilation

Shock mounting is not required. The antenna is designed to operate in the unpressurized nose section of aircraft and ventilation is not required.

(b) Pressurization

The antenna with a high altitude array is designed to operate within ambient air pressures ranging from sea level (and below) to an altitude of 55,000 feet, without pressurization. The antenna is installed in the nose section of the aircraft, which is not normally pressurized. Thus, if the RT unit is installed in the pressurized cabin section, the electrical and RF transmission lines feeding the antenna must be brought into the nose section through the use of an airtight seal at the bulkhead feed through. A pressure window should also be placed in the installation waveguide.

(c) Orientation

The mounting position of the antenna must satisfy the following conditions:

(1) Centerline of antenna must be located at aircraft centerline or within three inches below horizontal centerline on vertical centerline.

(2) Azimuth scan axis of antenna must parallel spin axis of the stabilizing vertical gyro.

(3) Tilt axis of antenna must parallel pitch axis of aircraft. This should result in the azimuth spin axis of the antenna lying mutually perpendicular to the roll and pitch axes of the aircraft.

(4) To insure that targets are displayed in their proper relative positions with respect to the aircraft, the radar beam must radiate forward, perpendicular to the pitch axis of the aircraft, and in the plane of flight path when the antenna is positioned at zero degrees in both azimuth and tilt. The antenna stabilization system will function properly only when the azimuth spin axis of the antenna parallels the spin axis of the stabilizing vertical gyro. Should an ambiguity exist between the two spin axes, an inherent error is developed in the system. The error is evidenced by uneven azimuth illumination of terrain as the antenna scans. This condition is undesirable and may cause some confusion when interpreting the radar display. Therefore, it is important that the antenna and gyro spin axes be in coincidence (both pitch and roll planes) when the antenna is being mounted. THE SAME REFERENCE CRITERION FOR MOUNTING THE GYRO SHOULD BE EMPLOYED FOR LEVELING AND MOUNTING THE ANTENNA.

(d) Waveguide RF Connection

The waveguide input flange, shown oriented to the rear of the antenna housing (Figure 2.9-6, DA-1203A Antenna Drive Outline Drawing), has a quick-disconnect assembly to facilitate waveguide connection. The guide pins on the quick-disconnect assembly are offset; assuring that the waveguide will be connected only in the proper position.

(e) Radome

Refer to Advisory Circular AC No.43-14 in the front portion of this manual.

To allow the most satisfactory radar beam radiation, the nose section in front of the antenna (radome) should be fabricated for X-band (9375 MHz, 3.2 cm wavelength) signals. A radome having less than 90% transmisstivity, at all incidence angles defined by the scan and tilt coverage, will result in some degradation of system performance, and should not be used.

The radome installed should allow the widest possible angle of useful beam radiation (120 degrees, 60 degrees to each side of aircraft heading). Radar range, in terms of that attainable without a radome, is equal to the square of the radome transmisstivity percentage.

If in doubt of the quality of radome material, a flight test may be performed that evaluates performance over the anticipated ranges and tilt angles that are desired for the type of aircraft.

2.6.1 Installation of RT-1601 Receiver Transmitter

The receiver-transmitter may be installed in any convenient location within the limits imposed by the waveguide lengths and environmental criteria. Mounting trays provide for either horizontal or vertical mount. See Figure 2.9-5, RT-1601 Receiver Transmitter Outline Drawing.

The mounting tray for the receiver-transmitter is designed for front loading. Clean all mounting surfaces before installing the mounting tray to ensure a good electrical bond to the airframe. See Figure 2.9-5.

The total mounting space required can be determined from dimensional information contained in the RT unit outline drawing, Figure 2.9-5. At least three (3) inches of free space must be allowed to the front left side of the R-T unit's cooling hole areas.

2.6.2 Installation of CP-113 Radar Control Panel

All control panels use DZUS fasteners to secure them to the instrument panel. Use the CP-113 outline drawing, Figure 2.9-7, as a guide to position the control panel and to cut and drill the instrument panel. Attach the DZUS fastener brackets behind the instrument panel in the location shown on the CP-113 outline drawing.

The control panel connector assemblies have slide locking lever tabs. To install the connector, depress the locking lever tab, insert the connector, and release the tab. To remove the connector, depress the tab and pull the connector out.

2.6.3 Installation of Waveguide and Cables

2.6.3.1 Cabling

The cables should be supported firmly enough to prevent movement. They should be carefully protected wherever one may chafe against another, or against some other object. Extra protection should be provided in all locations where the cables may be subject to abuse. Shields on shielded wires should be grounded as shown on the system interconnect diagrams, Figure 2.9-8 and Figure 2.9-9.

Shields on shielded wires should not be grounded to the airframe. Ordinarily, shields will be carried through any obstruction via a thru-bulkhead connector and grounded internally to the R-T or associated unit. If shielding cannot be carried through by use of a bulkhead connector pin, precautions should be taken to insure that each segment of the shielded lead be grounded at only one point using a ground connection of not more than two inches in length. The above consideration does not apply to coaxial cable.

2.6.3.2 Waveguide

A transmission line, composed of waveguide sections, must be installed in the aircraft. The waveguide should be installed in as direct path as possible between the R-T unit and the antenna.

Note

☞ Waveguide runs between transmitter and antenna should be designed for minimum length to avoid unnecessary attenuation of the radar signal. Runs in excess of 10 feet are not recommended.

The following installation information is provided (for those who may not be familiar with installing waveguide in aircraft) to help devise a transmission line that will provide proper performance. If special parts must be used to solve installation problems, the exact configuration of these parts should be carefully determined during the mock up. When a satisfactory mock up system has been designed, make a drawing to help describe the complete list of parts to be ordered. The drawing should indicate the length and part numbers of the standard component sections of waveguide and should identify special nonstandard components. Drawings with sufficient dimensioning to completely define the non-standard part should be submitted when ordering such components.

The following points should be observed in the use of rigid waveguide components:

- Use standard rigid components wherever possible.
- Minimize the number of joints in the waveguide run to minimize the overall VSWR value.
- Clamp rigid waveguide to a solid portion of the aircraft structure at least once in each three feet of waveguide run.
- Use clamps so designed so that they will not distort the waveguide walls.

- Before ordering nonstandard large radius waveguide bends, see if the same result can be obtained by using standard bends with additional length in the straight sections.
- When specifying unavoidable special bends in rigid waveguide, use an exact radius of 2.214 inches to the waveguide centerline for all shaft bends in either E or H plane and seven inches centerline radius or greater in large bends.
- Each individual section of rigid waveguide should contain no more than one bend. This procedure simplifies maintenance of the transmission line.
- Remember to allow sufficient clearance to permit access to flange connecting screws.
- Use waveguide quick disconnects wherever joints are to be broken repeatedly for maintenance, inspection, or access to other equipment, or to assure good joint sealing in relatively inaccessible locations.
- Be certain that the mating of a choke flange and a cover flange makes each joint in the waveguide run. This type joint will permit proper RF sealing of the line. Each waveguide section should have a choke flange and a cover flange at its opposite ends, where possible. Carefully avoid specifying nonstandard flanges, such as choke flanges with tapped screw holes.
- Axial twists in rigid waveguide, up to 90 degrees, should be considered as being made in approximately an eight-inch length of waveguide. Before specifying twists in rigid waveguide, make certain that the same result cannot be more easily accomplished by properly oriented bends in a section of flexible waveguide.

The following points should be observed in the use of flexible waveguide components:

- Use standard flexible components wherever possible. Minimize the number of joints in the waveguide run.
- Locate a flexible section at the points of attachment to the antenna unit and the RT unit. These sections will provide expansion joints in positions where the installation or removal or rigid waveguide would be exceedingly difficult.
- Flexible waveguide should be used instead of rigid sections containing complex bends wherever possible. Compound bends and apparent twists can be obtained through the use of flexible waveguide, usually at lower cost and with some simplification of installation.
- In any single installation, attempt to use the same length of flexible waveguide for all flexible sections of the transmission line.
- Clamp flexible waveguide firmly to a solid portion of the aircraft structure at least once in each 18 inches of waveguide run.
- Design flexible waveguide clamps carefully so that they do not distort the waveguide walls.
- Use waveguide quick disconnects wherever joints are to be broken repeatedly or to assure good joint sealing in relatively inaccessible locations.
- Use flexible waveguide to produce the same effect as a twist in rigid waveguide components. Any combination of two alternate (right and left) 90-degree bends in either the E or H plane (broad or narrow wall) with any 90-degree bend in the opposite plane between them will produce an effective waveguide twist. Such flexible components are less expensive and more easily installed than rigid twists.

With an antenna connected to the waveguide installation, it may be desirable to test the entire waveguide run including antenna for total VSWR. This must be done with the antenna pointing into free space to avoid the possibility of reflective target interference. The total VSWR will be the result of many factors in the waveguide and antenna. A long waveguide run may tend to increase the VSWR. Therefore, a short run is more desirable. Ratios as high as 2:1 have been experienced without noticeably disturbing the system operation, however, a lower VSWR is desirable. Insertion loss is also increased with excessive waveguide length. The suggested maximum waveguide length, including bends, should not exceed 10 feet for best performance.

2.7 POST-INSTALLATION CHECK

WARNING

Tests involving radiation of RF energy by the radar antenna must not be made in the vicinity of refueling operations, or when personnel are standing directly in front of the radar antenna. RF energy is generated in all modes except standby and test. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

CAUTION

Tests involving the radiation of RF energy by the radar antenna must not be made while the radar antenna is directed toward close-by large metal objects such as hangars, doors, or the inside of the hangar. Use test mode or turn the indicator function switch to off where applicable.

Note

☞ Two persons with a means of communication between them can perform the following procedures efficiently. One person stationed in the cockpit, and the second person mobile between the transmitter location and the antenna. The radome should not be installed when performing these procedures.

2.7.1 Visual Inspection Procedure

(1) Manually rotate the antenna in tilt and azimuth axes to verify that no binding action exists, and that aircraft structure does not interfere with free movement.

(2) Check the waveguide, cable, and black box installation to determine they are mechanically and electrically secure.

(3) Check for free and proper operation of all indicator controls.

(4) Check that primary power sources are functioning.

2.7.2 Control Panel and MFD Display Check Procedure in Test Mode

CAUTION

After elapse of the turn-on delay, the "RT fault" indication should not appear on the MFD display in any mode except test. If "RT fault" appears in any mode except test (or does not appear in the test mode), a malfunction exists and corrective action should be taken.

(1) Rotate the Function Select Switch on the Radar Control Panel to the TEST position. Observe that RT FAULT appears in the fault field and TEST appears in the mode field on the display(s).

(2) Observe that the complete test pattern appears after approximately 100 seconds from turn on. Check that the red area in the test pattern is steady. See RDR-1600 Pilot's Guide for typical test pattern. The range will automatically set to 80 miles.

(3) Check that the test pattern displays the colored bands in the sequence shown. Width of the bands is not significant.

(4) Observe that "ripple" moves along the outer band on the display(s), indicating that up dating is occurring.

(5) Adjust the TILT control on the Radar Control Panel to +5°, then +10°, then +15° checking that the array plate tilts upward smoothly, and without interference.

(6) Adjust TILT control on the Radar Control Panel to -5°, then -10°, then -15°, checking that the array plate tilts downward smoothly, and. without interference. Return the TILT control on the Radar Control Panel to 0° position.

2.7.3 Antenna Stabilization Check

Note

☞ The following tests require accurate positioning of the vertical gyro in both pitch and roll. If a tilt table is not available, the gyro may be positioned by reference to the flight director or artificial horizon, or some other method of accurately tilting the gyro in the aircraft. See Figure 2.7-1 for location of antenna checkout aids. This calibration procedure should be performed after any period of gyro or antenna maintenance.

Note

☞ When the RDR-1600 weather radar system is being calibrated to the aircraft's gyros, the antenna scan, in the azimuth axis, must be stopped, but the stabilization must be enabled. When the RDR-1600 weather radar system is in Standby mode, the antenna will stop scanning.

When the RT-1601 is configured as a NC-104B-1005, stabilization will be allowed in the Standby mode (Stab Disable pin from the DA-1203A - Pin A is high). Whereas, when the RT-1601 is configured as a NC-104B-1004, stabilization will not be allowed in the Standby mode (Stab Disable pin from the DA-1203A - Pin A is grounded).

This creates a problem if calibrated to the gyros when the RT-1601 is configured as a NC-104B-1004. If the unit is in Standby mode, the antenna is not scanning, but the stabilization is off. If the unit is turned to Test mode the stabilization is enabled, but the antenna is scanning.

To calibrate the gyros when the RT-1601 is configured as a NC-104B-1004, the following steps shall be performed. Disconnect the Stab Disable pin from the DA-1203A (Pin A). Place the unit in Standby mode, and then follow the instructions listed below. Reconnect the Stab Disable pin to the DA-1203A (Pin A) when finished.

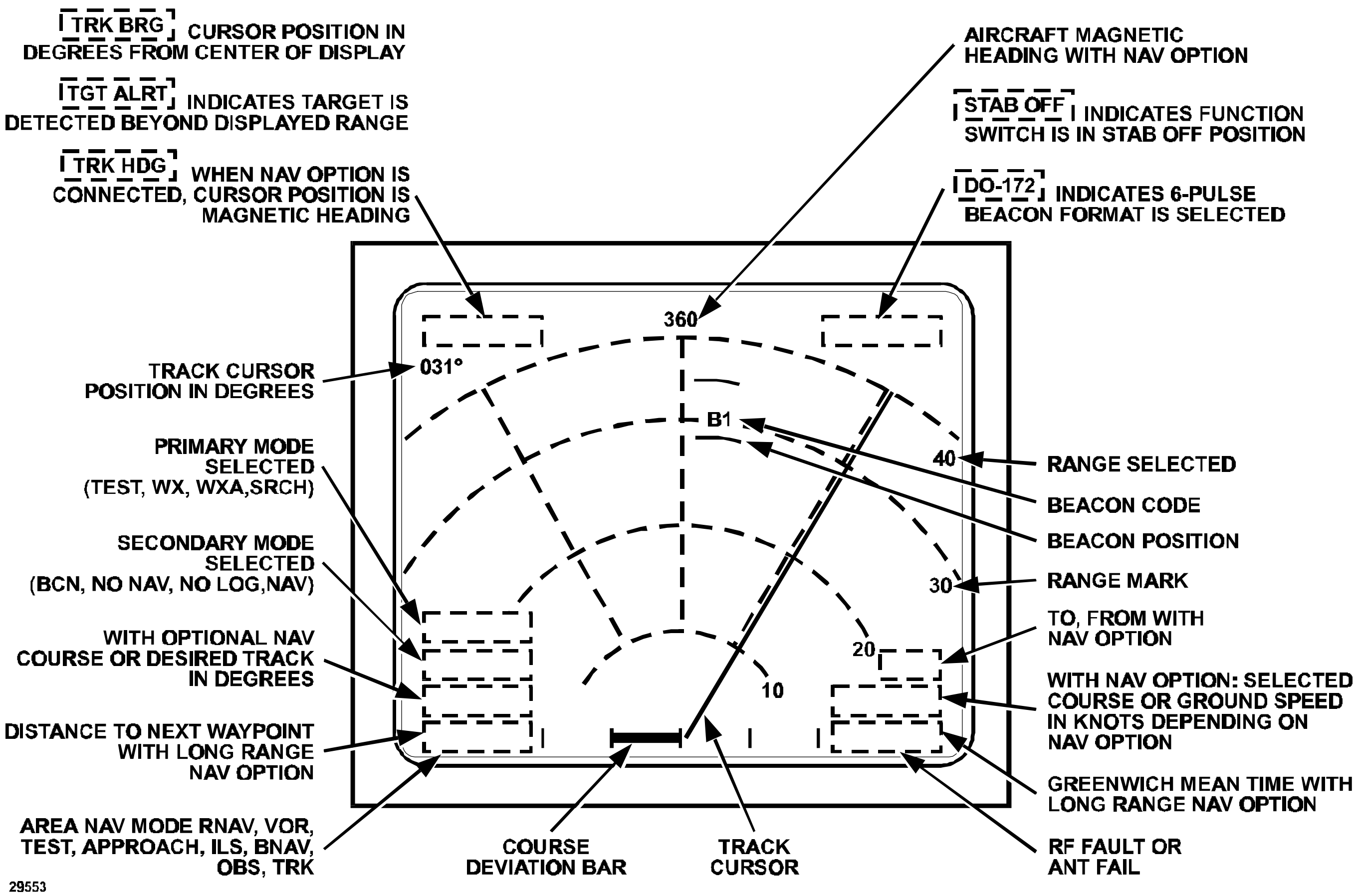


Figure 2.7-1. Generic MFD Display

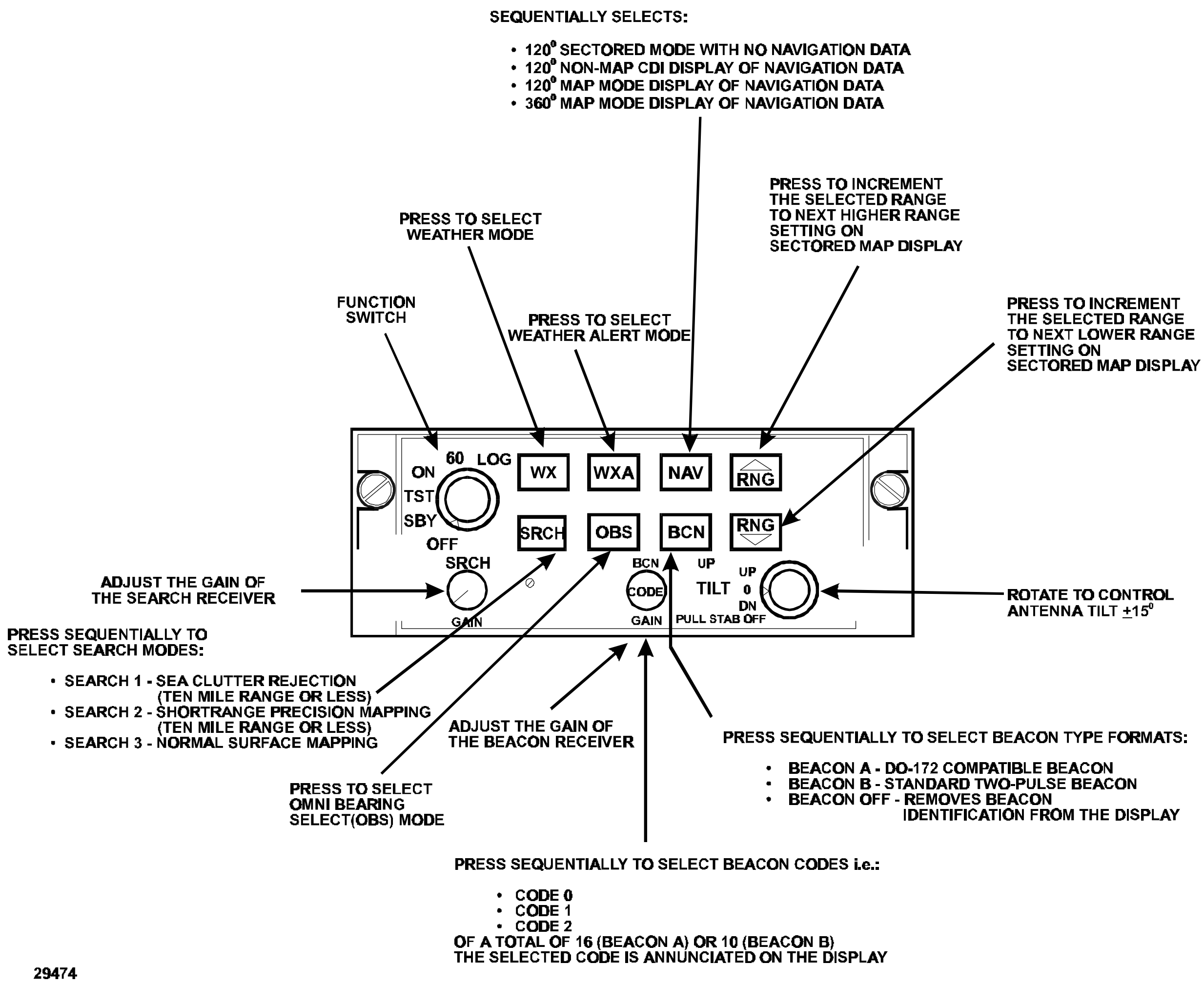


Figure 2.7-2. Radar Control Panel

2.7.4 Antenna Checkout Aids

2.7.4.1 Tilt Check Procedure

(a) Rotate the Function Select Switch on the Radar Control Panel to STBY.

(b) Place the aircraft vertical gyro to zero degrees pitch and zero degrees roll.

(c) Set the TILT control on the Radar Control Panel to position the antenna at 0°. The antenna elevation position should be 0° ±1°.

(d) Set the TILT control to position the antenna to the 10° up. The antenna elevation position should be +10° ±3°.

(e) Set the TILT control to position the antenna at the 10° down reference mark. The antenna elevation position should be -10° ±3°.

2.7.4.2 Pitch Calibration Check Procedure

(a) With the Function Select Switch on the Radar Control Panel in STBY position, manually position the antenna to zero degrees azimuth and insert the retaining pin into the 0° slot to lock the antenna in azimuth.

(b) Adjust the TILT control on the Radar Control Panel to position the antenna exactly at zero degrees in elevation.

Note

☞ Do not make further adjustments to the TILT control until pitch and roll calibration is completed.

(c) Position the aircraft vertical gyro for 10° nose up and zero degrees bank. The antenna elevation position should be 10° down. If not, adjust the PITCH gain potentiometer on the antenna drive assembly for proper deflection.

(d) Position the aircraft vertical gyro for 10° nose down and zero degrees bank. The antenna elevation position should be 10° ±1.5° up.

(e) Momentarily (10 seconds maximum) rotate the function switch to the TEST position on the radar indicator. The antenna should return to 0° elevation position. Return the function switch to the STBY position.

CAUTION

Do not leave function switch in the test position for more than 10 seconds or antenna azimuth drive will engage.

(f) Unlock the antenna azimuth drive by disengaging the retaining pin.

2.7.4.3 Roll Calibration Check Procedure

(a) Set the ROLL-TRIM (recessed pot below the SRCH button) potentiometer on the Radar Control Panel to midrange (see Figure 1.6-3 for location).

(b) With the Function Select Switch on the Radar Control Panel in the STBY position, manually position the antenna to 60° clockwise and lock the azimuth drive by inserting the retaining pin into the 60° CW slot.

(c) Position the aircraft vertical gyro to zero degrees pitch and 30° right roll. The antenna elevation position should be 26° up. If not, adjust the ROLL gain potentiometer on the antenna drive assembly for 26° deflection.

(d) Position the aircraft vertical gyro to zero degrees pitch and 30° left roll. The antenna elevation position should be 26° ±1.5° down.

(e) Momentarily (10 seconds maximum) rotate the function switch to the TEST position on the Radar Control Panel. The antenna should return to 0° elevation position. Return the function switch to the STBY position.

CAUTION

Do not leave function switch in the test position for more than 10 seconds or antenna azimuth drive will engage.

(f) Unlock the azimuth drive by disengaging the retaining pin. Store the retaining pin for future use.

2.7.5 RF Operation Check Procedure

WARNING

Whenever the function switch is in the "ON" or "60°" position, RF energy is being radiated. Do not allow personnel to stand within 15 feet of the area being scanned by antenna. Tests involving the radiation of RF energy must not be made in the vicinity of refueling operations. Always use "test" or "standby' positions as applicable.

(1) Rotate the Function Select Switch on the Radar Control Panel to the TEST position. Rotate the Function Select Switch on the Radar Control Panel to the ON position after the system has been in TEST for at least 100 seconds. Use WOW override if WOW function is installed.

(2) Check for target reflections of local weather (if any) by indexing the RANGE pushbuttons on the MFD Control Panel(s) (or CP-113A) to each range position while tilting the antenna upward above the horizon, using the TILT control on the Radar Control Panel.

(3) Index the RANGE pushbuttons through the ten range positions. Note that the corresponding range and range mark intervals appear in the alphanumeric area of the display. Note that targets on display (if any) shift their relative position.

(4) Change the mode setting and note that display(s) change accordingly.

(5) For two display configurations only: Change the range on both displays and note that each display changes range independently of each other (providing that the system configuration allows for both displays to range independently of one another).

Note

☞ When the radar system is operating in a search 1 or 2 mode, and display number one's range is at 10 nautical miles or less, and display number two's range is greater than 10 nautical miles, the radar system will convert to dual scan mode. The antenna scan from right to left will update display number one, and the antenna scan form left to right will update display number two.

(6) Rotate the function switch to STBY.

2.7.6 Interference Test Procedure

(1) Operate the system on all functions and modes, and check that this does not affect other electronic equipment in the aircraft.

(2) Operate the system on all functions and check that it is not affected by any of the functions of the other electronic or electrical equipment in the aircraft.

(3) Upon successful completion of the foregoing post-installation tests, install the radome preparatory to preflight checkout of the system.

2.8 PREFLIGHT CHECK AND FLIGHT CHECK PROCEDURES

2.8.1 Preflight Check Procedure

2.8.1.1 Single Indicators

Note

☞ The preflight check assumes that the system has been properly installed and passed the post-installation checks, that the aircraft is pointed toward a non-reflective area, and that fuel trucks or personnel are not close to the radar line-of-sight.

CAUTION

After elapse of the turn-on time delay, the "RT fault" indication should not appear on the display in any mode except test. If "RT fault" appears in any mode except test (or does not appear in the test mode), a malfunction exists and corrective action should be taken.

(1) Energize the radar bus and vertical gyro reference bus. Ensure that 28 VDC and 115 VAC power is being supplied to the system. Check that the vertical (stabilization) gyro is erected.

(2) Vary the external panel lighting voltage (dim control) for maximum panel brightness. Check the white panel markings for even light distribution. Reduce the lighting voltage. The panel lighting should dim.

(3) Rotate the Function Select Switch on the Radar Control Panel to the TEST position.

(4) Set the TILT control on the Radar Control Panel to any position.

(5) Note that RT FAULT appears in the fault field on the MFD display. The word TEST should appear in the mode field on the MFD display. The test pattern should appear on the display within 100 seconds. Adjust BRT control on the MFD display as required.

Note

☞ The width of the test pattern bands is not critical, nor is the position of the bands relative to the range marks.

(a) Check that the test pattern displays five colored bands. Starting with the closest band to the origin, the bands will be green, yellow, red, yellow, and green. The red band represents the most intense level. All range marks will be visible and displayed in blue letters.

(b) Observe the update action as a small "ripple" moving along the outer green band, indicating that the antenna is scanning the full 120°.

Note

☞ Basically, the test pattern can be thought of as a weather target. Therefore, when in the TEST mode and switching through the ranges, the test pattern position will be altered on the screen.

(6) Change the range to 2 miles. The test pattern will be beyond the area being scanned. Increase the range, one step at a time and observe that the test pattern appears in the correct ranges. Observe that the proper range marks appear in the display.

(7) Rotate the Function Select Switch on the Radar Control Panel to the STBY position, then taxi the aircraft to a clear-ahead area where metal buildings, aircraft, etc., are not in the line-of-sight. Observe the warning at the beginning of paragraph 2.7.

(8) Rotate the Function Select Switch on the Radar Control Panel to the ON position. Use WOW override if WOW is installed. The display will automatically be in the WX mode.

(9) Adjust the TILT control up (+ degrees) in small increments until a clear picture develops of any local weather. Close-in ground targets may also appear in the display. A +15°, no ground target should appear on the display.

(10) Repeat TILT control adjustment to check remaining ranges.

(11) Sequentially change the modes through SR1, SR2 and SR3. Observe that for each mode selected, SRCHl, SRCH2, or SRCH3 appears in the mode field on the MFD display, and for each mode the fault field remains off. Example: if in SR1 mode, the display should show "SRCHl".

(12) Set the mode to SR1 and the range to 20. Observe that the four range marks are identified. Index range selector to 20, 10, 5, 2, 1, and .5 NM and note that the range marks are identified properly in each range.

Note

☞ The RT-1601 Receiver Transmitter has a special feature. In SRI or SR2 mode, at 2 NM range or less, a 500-foot-wide red band will appear, with the outer edge at the 500-foot point in the display.

(13) Set the mode to BCN and the range to 20. Observe that the characters "BCN" appear in the mode field on the MFD display. The fault field should be off and the display should be free of all noise and ground clutter. If a beacon station of 9310 MHz is within range, a beacon reply may be observed on the screen.

(14) Proceed as follows to check the DO-172 6-pulse beacon format.

(a) With the indicator in the BCN mode, press and release the BCN button until the word A1 appears on the display. This selects the 6-pulse beacon format.

(b) Press the PUSH CODE button and observe that the beacon code displayed in the lower left corner changes sequentially from A1 to A15, then changes to A1, and then repeats the sequence.

(c) Observe the display for any 6-pulse beacon replies. The 6-pulse beacon transponder reply will be displayed by two frame marks with either 1,2,3, or 4 other closely spaced marks between the two frame marks.

Note

☞ The marks between the frame marks represent the beacon code number in 4-bit binary format, with each mark a logic 1 and the closest mark to the origin being the least significant bit.

(d) If a beacon reply is observed, repeatedly press the PUSH CODE button until a beacon code (e.g. A12) appears in the display between the frame marks.

Note

☞ The selected range must be set for 2,5,10,20, or 40 miles to identify the DO-172 beacon reply.

(e) Observe the beacon code number selected and the beacon code number displayed by the beacon marks are the same number.

(f) Press the BCN button until the beacon-selected character changes from A to B. Only the two-pulse beacon replies will now be identified.

(15) Proceed as follows to check the two-pulse beacon format.

(a) Press and hold the PUSH CODE button and observe that the beacon code displayed in the lower left corner changes sequentially from Bl to B9, and then repeats the sequence.

(b) Observe the display for any 2-pulse beacon replies.

(c) If a 2-pulse beacon reply is observed, repeatedly press the PUSH CODE button until a beacon code (e.g. B3) appears in the display between the "hash marks".

Note

☞ The selected range must be set for 2,5, 10,20,40, or 80 mile range to identify 2-pulse beacon replies.

(d) Observe the beacon code number selected and the beacon code number displayed by the beacon marks are the same number.

(e) Rotate the Function Select Switch on the Radar Control Panel to the TEST position.

2.8.1.2 Multiple Displays

Repeat paragraph 2.8.1-1 for display number 2.

2.8.2 Flight Check procedure

Note

☞ Vertical gyro precession may be experienced during take-off or during prolonged aircraft maneuvers. Antenna stabilization may therefore suffer a 3° to 5° error for as long as five minutes after the maneuver.

2.8.2.1 Check Test Pattern

Rotate the Function Select Switch on the Radar Control Panel to the TEST position. Set the range to 80 miles. Adjust the brightness (BRT) control on the MFD display as necessary to evaluate the test pattern. Basically, check that update is occurring and that the five colored bands are correct.

2.8.2.2 Check And Adjust Antenna Stabilization

Note

☞ The pitch and roll output levels from the vertical gyro are governed by the 115 volt, 400 Hz excitation, the linearity of the gyro, plus the ability of the gyro to follow the motion of the aircraft. The accuracy contributed by the antenna is its ability to respond to the gyro outputs. As a result of these factors, the stabilization system accuracy can vary up to ±10% of the pitch or roll angle of the aircraft. This accuracy can be tested in flight by performing the following procedure.

(1) Fly to a convenient altitude above 10,000 feet.

(2) Select a range of 80 nautical miles, or 40-mile range for 12-inch antennas. Set the mode to SRCH 3.

(3) Pull the PULL STAB OFF switch (on tilt control pot) out on the Radar Control Panel to remove antenna stabilization.

(4) While flying level (0° pitch, 0° roll), adjust the TILT control on the Radar Control Panel to obtain the video pattern shown in Figure 2.9-1, then note TILT control setting. The terrain band should be displayed about the third range mark.

If the inner ring of video is not parallel to the range mark, the error is caused by mechanical displacement of the antenna about the roll axis of the aircraft. Use TILT control to determine exact error. Correction on the ground, if necessary, must be performed prior to further in-flight calibration.

(5) Push the PULL STAB OFF switch (on tilt control pot) in on the Radar Control Panel to restore antenna stabilization.

(6) The pattern observed in step (4) should not change. If the pattern shifts as in Figure 2.9-2 or Figure 2.9-3, it will be necessary to ground-check leveling of the gyro and accuracy of the Horizon Situation Indicator. Use TILT control to find exact error.

(7) Roll the aircraft 20° right. For perfect stabilization, the terrain band shown in Figure 2.9-1 should not shift.

(8) In step (7), if the terrain band shifts as shown in Figure 2.9-2, increase the tilt angle, by means of the TILT control on the Radar Control Panel, until the pattern is similar to Figure 2.9-1.

Note

☞ Note the new position of the TILT control. It should not be more than two degrees above that noted in step (4).

(9) In step (7), if the terrain band shifts as shown decrease the tilt angle (using the TILT control) is similar to Figure 2.9-1. Note the new position control. It should not be more than two degrees in step (4).

(10) If the differences between steps (8) and (4) or steps (9) and (4) are greater than two degrees, recalibrate the roll stabilization circuitry to the gyro using the following procedure:

(a) Reset the TILT control under the flight conditions of step (4) with stab on. Then roll the aircraft 20° right.

(b) If the pattern shifts per Figure 2.9-2, slowly adjust the ROLL TRIM potentiometer on the Radar Control Panel (recessed pot below SRCH button) until the terrain band display is as shown in Figure 2.9-1. Usually a clockwise adjustment is required.

(c) If the pattern shifts per Figure 2.9-3, slowly adjust the ROLL TRIM potentiometer on the Radar Control Panel (recessed pot below SRCH button) until the terrain band display is as shown in Figure 2.9-1. Usually a counterclockwise adjustment is required.

(11) If the pattern shifts per Figure 2.9-4, there is no roll stabilization and the system should be ground-checked per the post-installation tests of this manual, Paragraph 2.7.3, "Antenna Stabilization Check".

2.8.2.3 Check Weather Alert Mode

(1) Rotate the Function Select Switch on the Radar Control Panel to the ON position, and adjust the TILT control to obtain a strong red level ground return.

(2) Select the WXA mode by pressing the WXA button on the Radar Control Panel.

(3) Observe that the red area flashes on and off approximately once per second (the red areas will flash if the MFD display has the ability to perform this function).

(4) Return the tilt control to the normal position.

2.8.2.4 Check Target Alert

(1) Select the WXA mode by pressing the WXA button on the Radar Control Panel.

(2) Locate a distant red level storm or adjust the TILT control down until a red level ground return appears near the outer edge.

(3) Reduce the range until the red level return is off the screen, but not more than 25 miles beyond the selected range.

(4) Observe that the word TGT ALRT flashes on the MFD display.

(5) Return the TILT control to the normal position.

2.8.2.5 Testing Completed

This completes the flight check procedures; however, refer to the RDR-1600 Pilot's Guide (TM106101) for additional details relating to operation of the RDR-1600 Weather Radar System.

2.9 ILLUSTRATIONS AND DRAWINGS

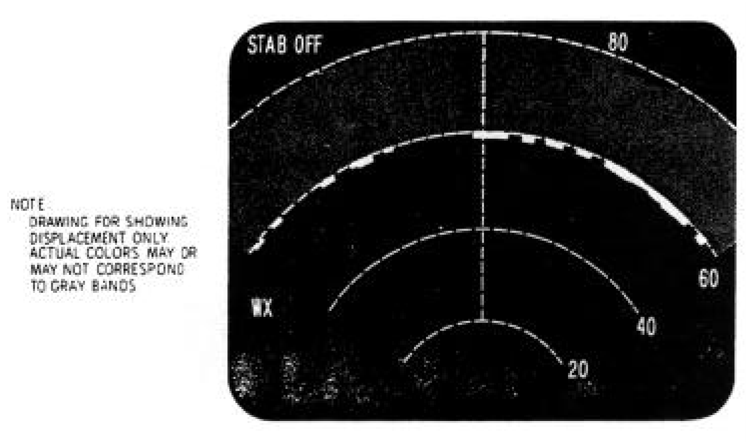


Figure 2.9-1. Video Pattern, Level Flight

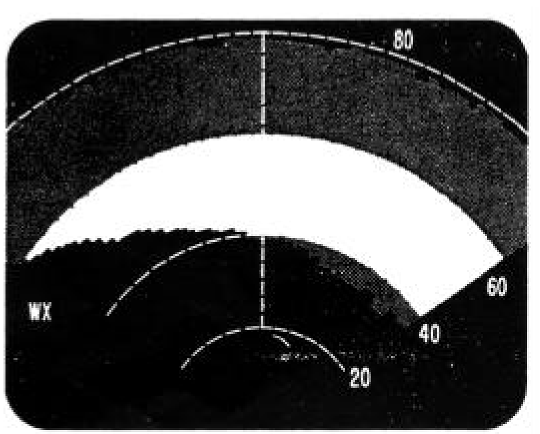


Figure 2.9-2. Video Pattern With Stab Error

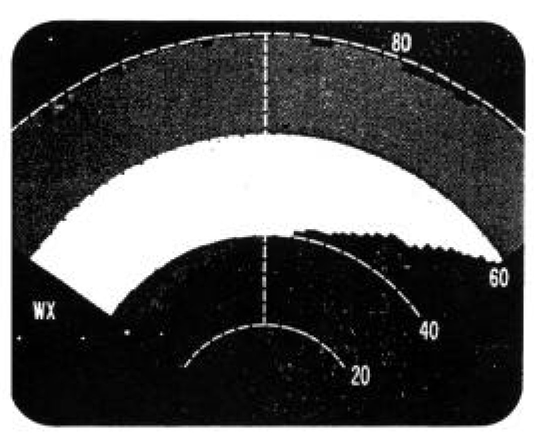


Figure 2.9-3. Video Pattern With Stab Error

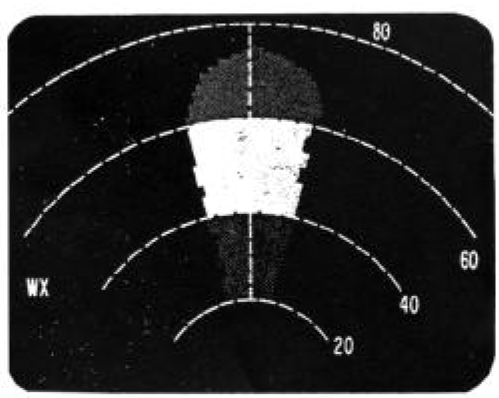


Figure 2.9-4. Video Pattern, No Stabilization

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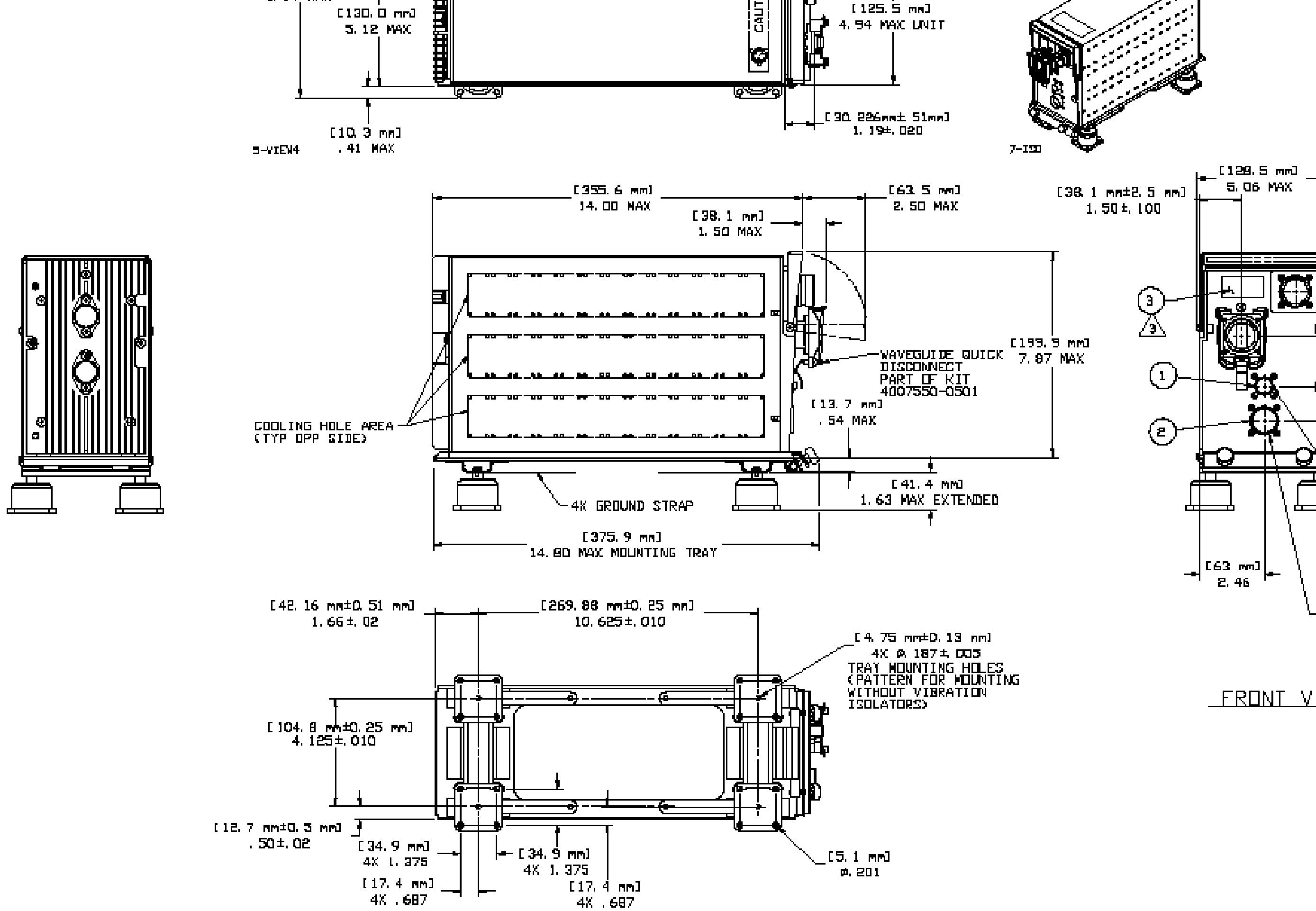


TM106601_(7/01)

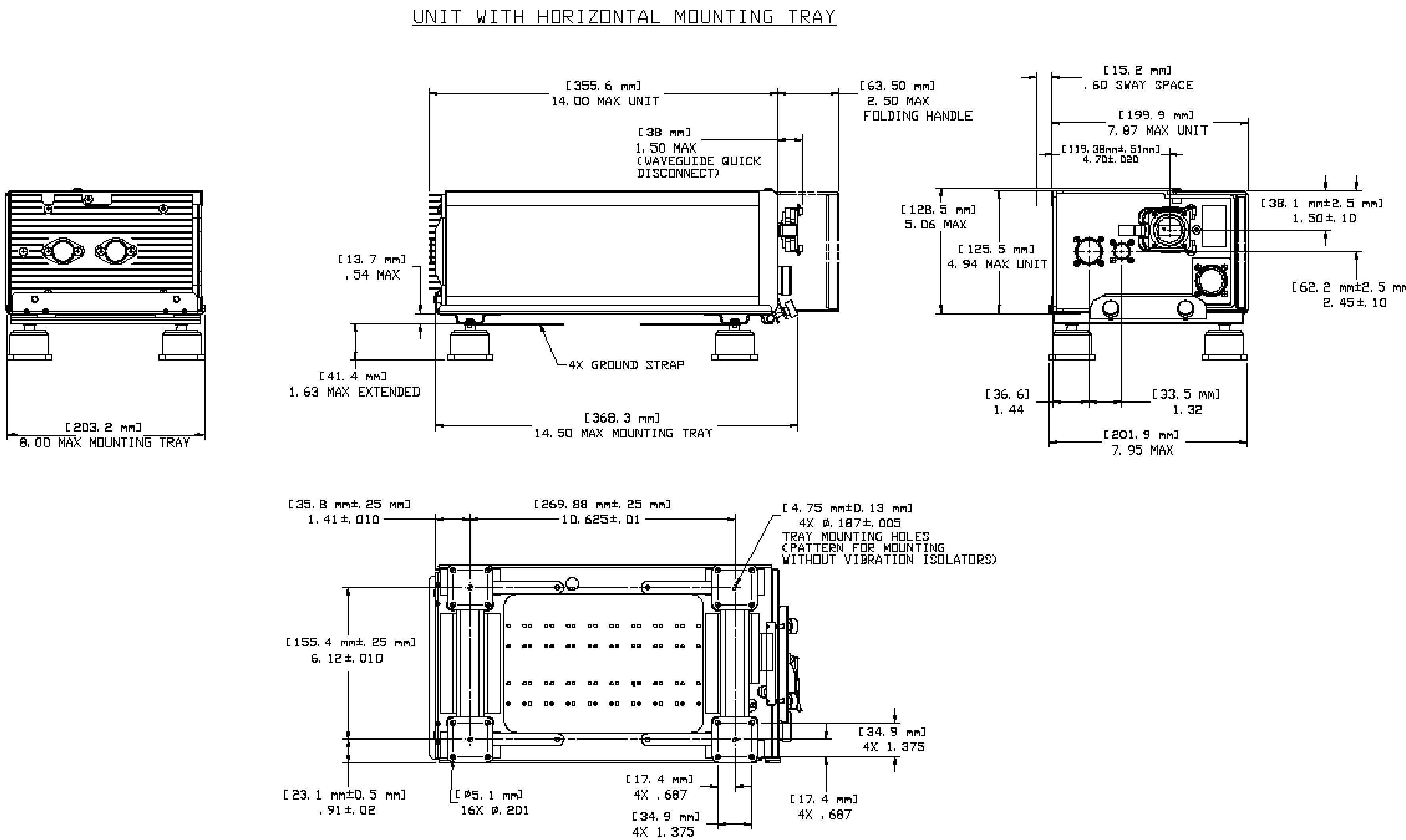


Figure 2.9-5. RT-1601 Receiver Transmitter Outline Drawing (Drawing No. 379-2011-001) (Sheet 2 of 2)

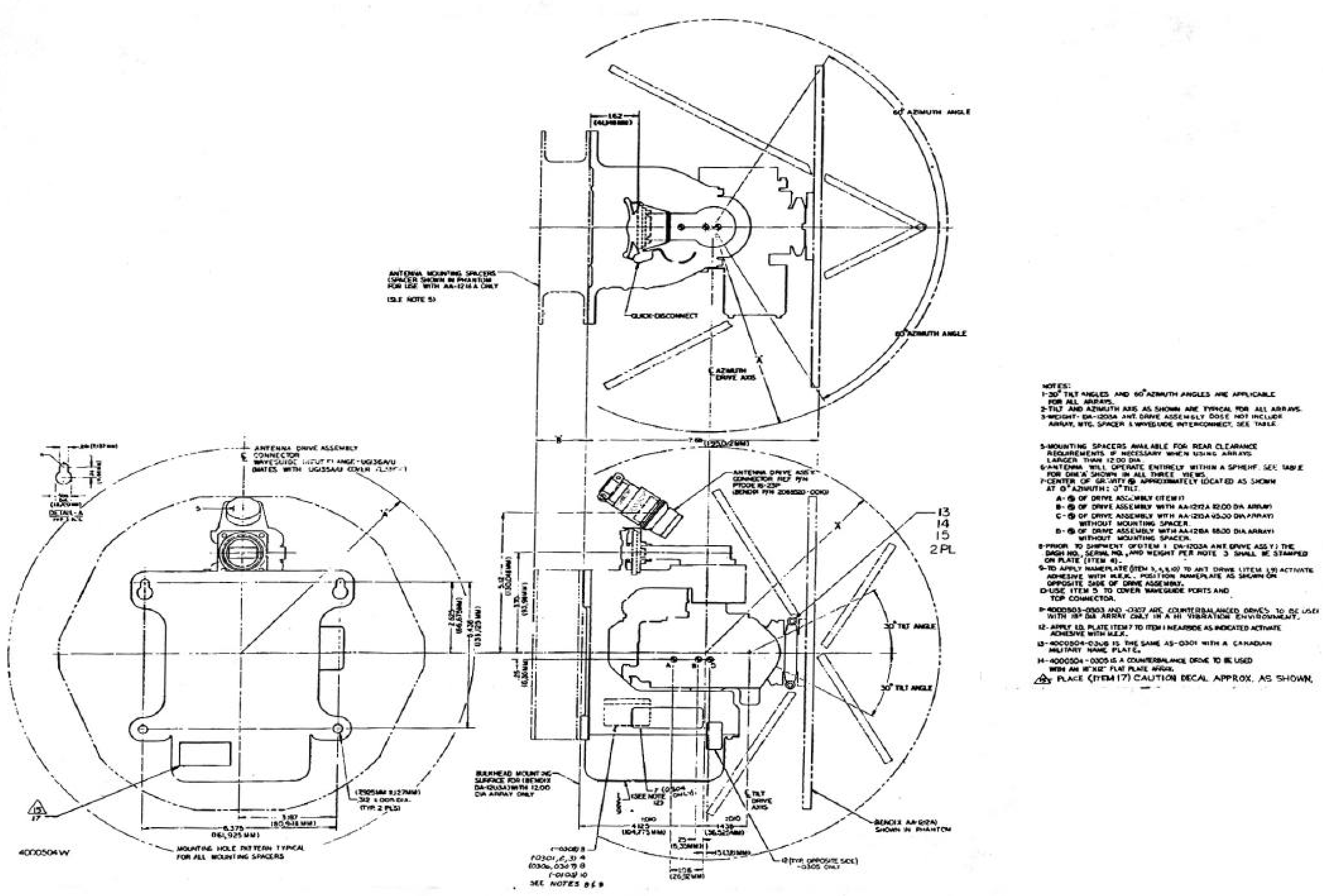
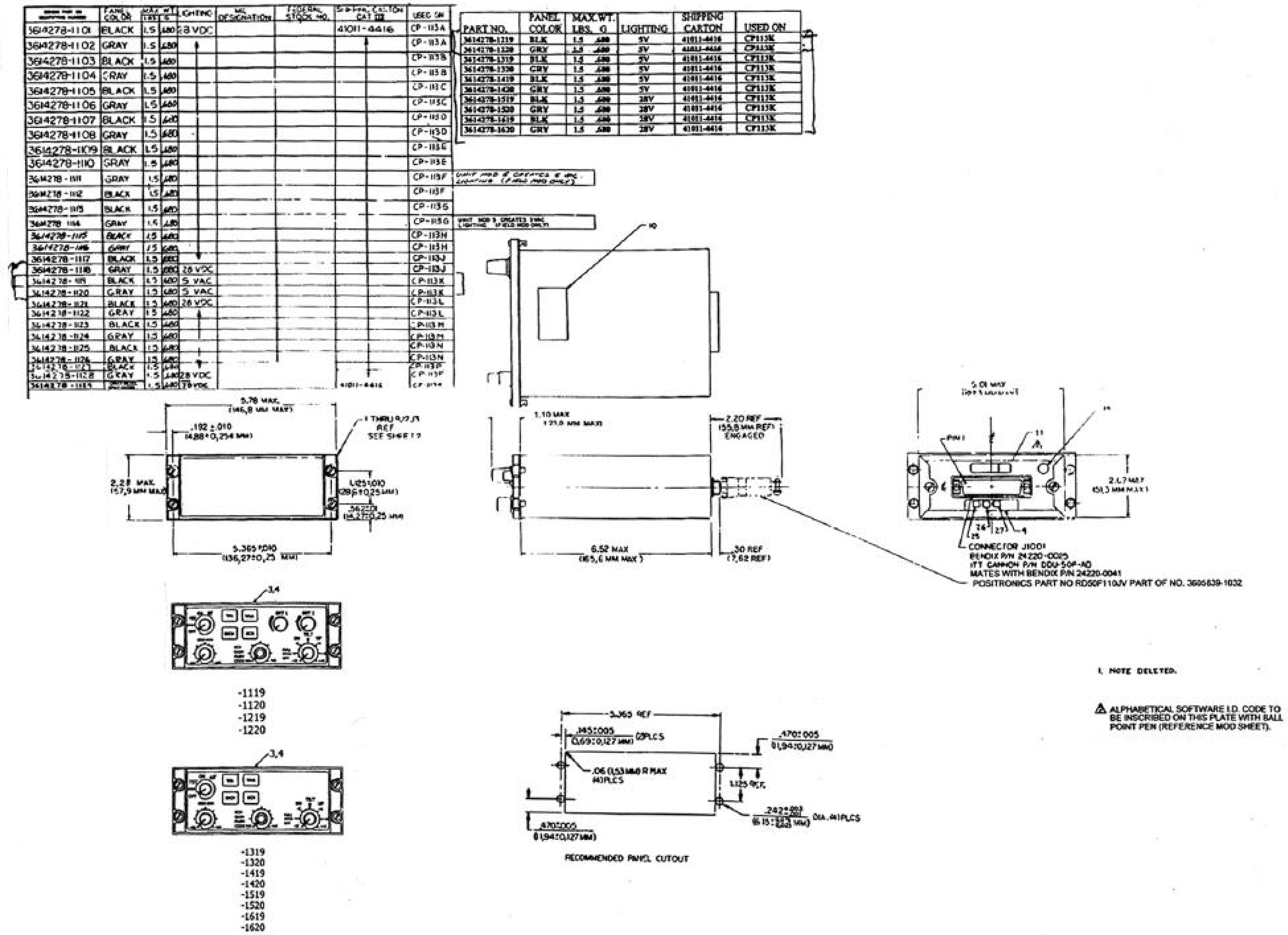


Figure 2.9-6. DA-1203A Antenna Drive Outline Drawing (Drawing No. 4000504)



PART NO.	PANEL COLOR	MAX WT. LBS	MAX WT. G	LIGHTING	MIL DESIGNATION	FEDERAL STOCK NO.	SHIPPING CARTON CAT III	USED ON
3614278-1101	BLACK	1.5	.680	28 VDC			41011-4416	CP-113A
3614278-1102	GRAY	1.5	.680					CP-113A
3614278-1103	BLACK	1.5	.680					CP-113B
3614278-1104	GRAY	1.5	.680					CP-113B
3614278-1105	BLACK	1.5	.680					CP-113C
3614278-1106	GRAY	1.5	.680					CP-113C
3614278-1107	BLACK	1.5	.680					CP-113D
3614278-1108	GRAY	1.5	.680					CP-113D
3614278-1109	BLACK	1.5	.680					CP-113E
3614278-1110	GRAY	1.5	.680					CP-113E
3614278-1111	GRAY	1.5	.680					CP-113F
3614278-1112	BLACK	1.5	.680					CP-113F
3614278-1113	BLACK	1.5	.680					CP-113G
3614278-1114	GRAY	1.5	.680					CP-113G
3614278-1115	BLACK	1.5	.680					CP-113H
3614278-1116	GRAY	1.5	.680					CP-113H
3614278-1117	BLACK	1.5	.680					CP-113J
3614278-1118	GRAY	1.5	.680	28 VDC				CP-113J
3614278-1119	BLACK	1.5	.680	5 VAC				CP-113K
3614278-1120	GRAY	1.5	.680	5 VAC				CP-113K
3614278-1121	BLACK	1.5	.680	28 VDC				CP-113L
3614278-1122	GRAY	1.5	.680					CP-113L
3614278-1123	BLACK	1.5	.680					CP-113M
3614278-1124	GRAY	1.5	.680					CP-113M
3614278-1125	BLACK	1.5	.680					CP-113N
3614278-1126	GRAY	1.5	.680					CP-113N
3614278-1127	BLACK	1.5	.680					CP-113P
3614278-1128	GRAY	1.5	.680	28 VDC				CP-113P
3614278-[illegible]	[illegible]	1.5	.680	28 VDC			41011-4416	[illegible]

PART NO.	PANEL COLOR	MAX.WT. LBS.	MAX.WT. G	LIGHTING	SHIPPING CARTON	USED ON
3614278-1219	BLK	1.5	.680	5V	41011-4416	CP113K
3614278-1220	GRY	1.5	.680	5V	41011-4416	CP113K
3614278-1319	BLK	1.5	.680	5V	41011-4416	CP113K
3614278-1320	GRY	1.5	.680	5V	41011-4416	CP113K
3614278-1419	BLK	1.5	.680	5V	41011-4416	CP113K
3614278-1420	GRY	1.5	.680	5V	41011-4416	CP113K
3614278-1519	BLK	1.5	.680	28V	41011-4416	CP113K
3614278-1520	GRY	1.5	.680	28V	41011-4416	CP113K
3614278-1619	BLK	1.5	.680	28V	41011-4416	CP113K
3614278-1620	GRY	1.5	.680	28V	41011-4416	CP113K

Figure 2.9-7. CP-113 Radar Control Panel Outline Drawing (Drawing No. 3614278)

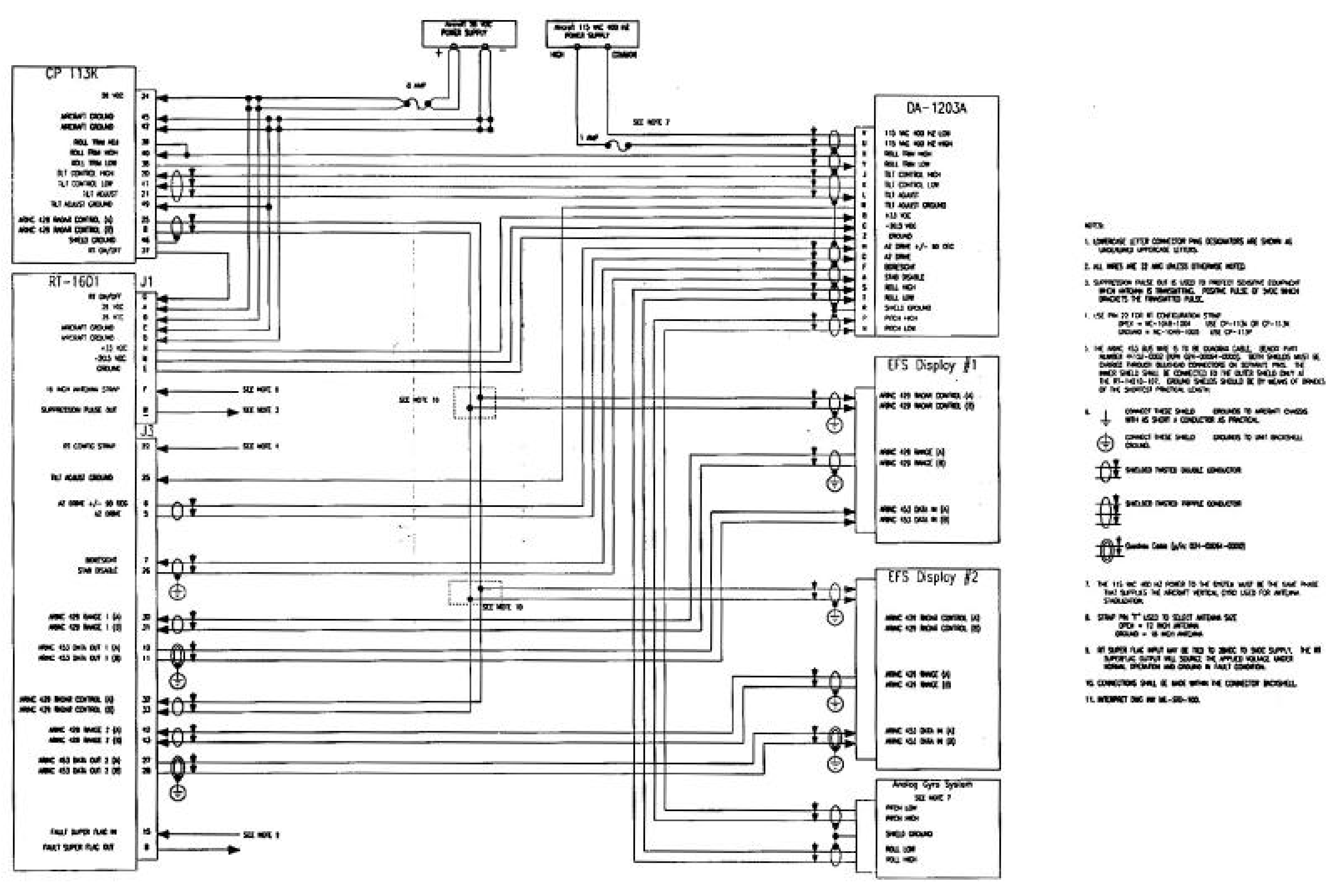
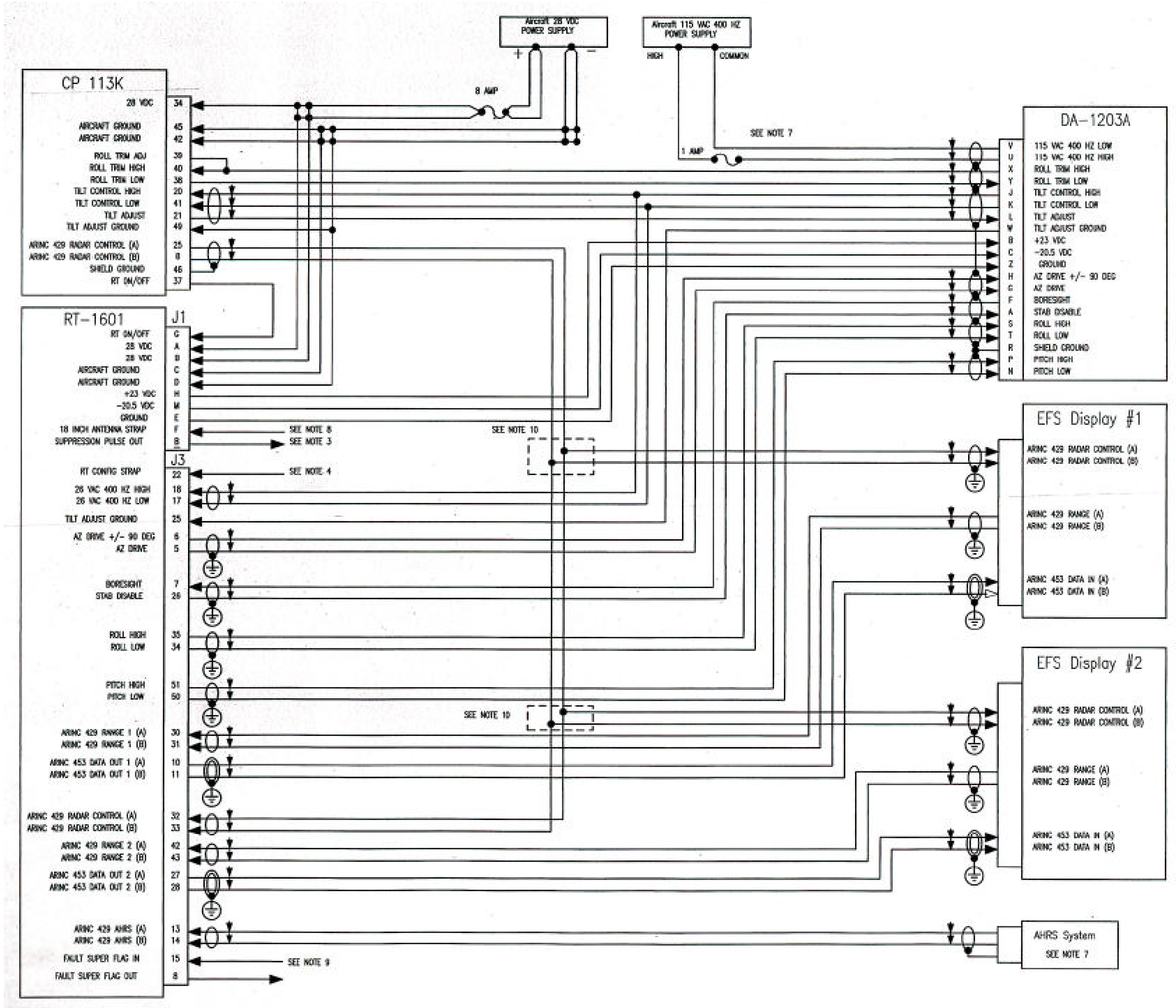


Figure 2.9-8. RDR-1600 System Wiring Diagram With Analog Gyros (Drawing No. WD379-2015-001)



NOTES:

1. LOWERCASE LETTER CONNECTOR PINS DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
2. ALL WIRES ARE 22 AWG UNLESS OTHERWISE NOTED.
3. SUPPRESSION PULSE OUT IS USED TO PROTECT SENSITIVE EQUIPMENT WHEN ANTENNA IS TRANSMITTING. POSITIVE PULSE OF 5VDC WHICH BRACKETS THE TRANSMITTED PULSE.
4. USE PIN 22 FOR RT CONFIGURATION STRAP
   OPEN = MC-104B-1004 USE CP-113A OR CP-113K
   GROUND = MC-104B-1005 USE CP-113P
5. THE ARINC 453 BUS WIRE IS TO BE QUADRAX CABLE. BENDIX PART NUMBER 44152-0002 (KPN 024-00064-0000). BOTH SHIELDS MUST BE CARRIED THROUGH BULKHEAD CONNECTORS ON SEPARATE PINS. THE INNER SHIELD SHALL BE CONNECTED TO THE OUTER SHIELD ONLY AT THE RT-1401B-107. GROUND SHIELDS SHOULD BE BY MEANS OF BRAIDS OF THE SHORTEST PRACTICAL LENGTH.
6. CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.
   CONNECT THESE SHIELD GROUNDS TO UNIT BACKSHELL GROUND.
   SHIELDED TWISTED DOUBLE CONDUCTOR
   SHIELDED TWISTED TRIPPLE CONDUCTOR
   Quadrax Cable (p/n: 024-00064-0000)
7. THE 115 VAC 400 HZ POWER TO THE SYSTEM MUST BE THE SAME PHASE THAT SUPPLIES THE AIRCRAFT VERTICAL GYRO USED FOR ANTENNA STABILIZATION.
8. STRAP PIN "F" USED TO SELECT ANTENNA SIZE.
   OPEN = 12 INCH ANTENNA
   GROUND = 18 INCH ANTENNA
9. RT SUPER FLAG INPUT MAY BE TIED TO 28VDC TO 5VDC SUPPLY. THE RT SUPERFLAG OUTPUT WILL SOURCE THE APPLIED VOLTAGE UNDER NORMAL OPERATION AND GROUND IN FAULT CONDITION.
10. CONNECTIONS SHALL BE MADE WITHIN THE CONNECTOR BACKSHELL.
11. INTERPRET DWG IAW MIL-STD-100.

Figure 2.9-9. RDR-1600 System Wiring Diagram With AHRS System (Drawing No. WD379-2016-001)

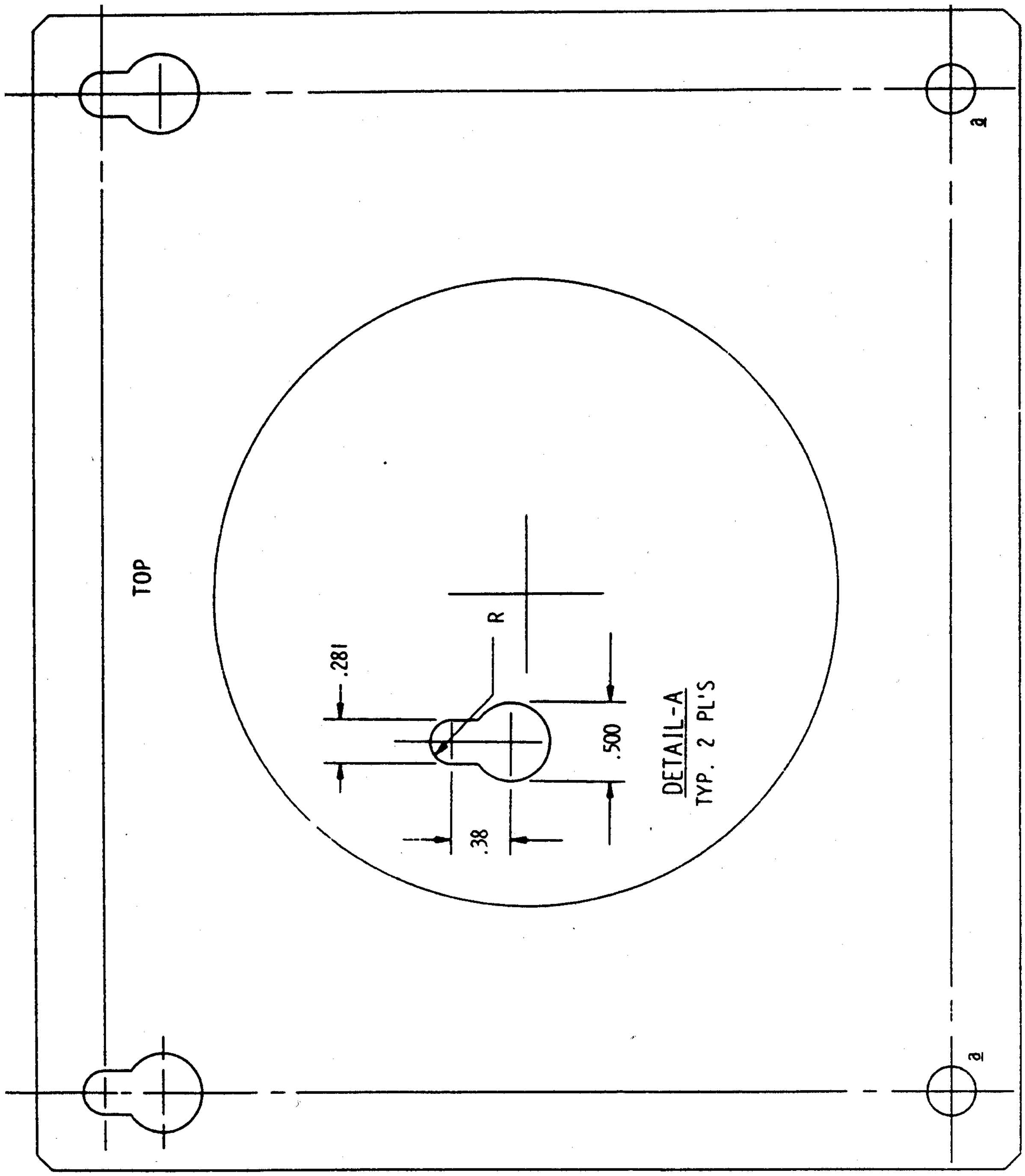


Figure 2.9-10. DA-1203A Antenna Mount Hole Pattern

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

First Class Mail, Permit No. 7083427, Farmingdale, NY

POSTAGE WILL BE PAID BY THE ADDRESSEE

Telephonics Corporation
Command Systems Division
815 Broad Hollow Road
Farmingdale, NY 11735-3940 USA

Att: Product Support Department

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