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System Installation Manual

KTR 2280A Multi-Mode Digital Radio

Part Number	CAGE
069-01039-0101	22373

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TRANSMITTAL INFORMATION

THIS IS AN INITIAL RELEASE OF KTR 2280A MULTI-MODE DIGITAL RADIO SIM PUBLICATION No. D201610000049 ISSUED FOR USE IN SUPPORT OF THE FOLLOWING:

Table TI-1 shows the applicable components.

Table TI-1. Applicable Components

Component PN	Nomenclature
069-01039-0101	KTR 2280A Multi-Mode Digital Radio

Revision History

Table TI-2 shows the revision history of this SIM.

Table TI-2. Revision History

Revision Number	Revision Date
0	15 May 2017

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RECORD OF REVISIONS

For each revision, write the revision number, revision date, date put in the manual, and your initials in the applicable column.

NOTE: Refer to the Revision History in the TRANSMITTAL INFORMATION section for revision data.

Revision Number	Revision Date	Date Put In Manual	By	Revision Number	Revision Date	Date Put In Manual	By

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Definition of Status column: A TR may be active, incorporated, or deleted. “Active” is entered by the holder of the manual. “Incorporated” means a TR has been incorporated into the manual and includes the revision number of the manual when the TR was incorporated. “Deleted” means a TR has been replaced by another TR, a TR number will not be issued, or a TR has been deleted.

Temporary Revision Number	Status	Page Number	Issue Date	Date Put in Manual	By	Date Removed From Manual	By

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LIST OF EFFECTIVE PAGES

* indicates a changed or added page.
F indicates a foldout page.

* indicates a changed or added page.
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INTRODUCTION

1. How to Use This Manual

A. General

(1) This publication gives maintenance instructions for the equipment shown on the Title page.

(2) Standard maintenance procedures that technicians must know are not given in this manual.

(3) This publication is written in agreement with the ATA Specification.

(4) Warnings, cautions, and notes in this manual give the data that follows:

- A WARNING gives a condition or tells personnel what part of an operation or maintenance procedure, which if not obeyed, can cause injury or death
- A CAUTION gives a condition or tells personnel what part of an operation or maintenance procedure, which if not obeyed, can cause damage to the equipment
- A NOTE gives data, not commands. The NOTE helps personnel when they do the related instruction.

(5) Warnings and cautions go before the applicable paragraph or step. Notes follow the applicable paragraph or step.

B. Observance of Manual Instructions

(1) Make sure that you carefully obey all safety, quality, operation, and shop procedures for the unit.

(2) All personnel who operate equipment and do maintenance specified in this manual must know and obey the safety precautions.

C. Symbols

(1) The symbols and special characters are in agreement with IEEE Publication 260 and IEC Publication 27. Special characters in text are spelled out.

(2) The signal mnemonics, unit control designators, and test designators are shown in capital letters.

(3) The signal names followed by an “*” show an active low signal.

(4) The symbols in Figure INTRO-1 show ESDS and moisture sensitive devices.

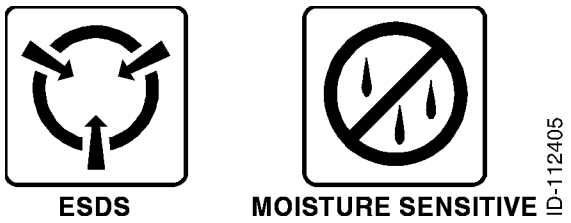

Figure INTRO-1. (Sheet 1 of 1) Symbols

D. Units of Measure

(1) Measurements, weights, temperatures, dimensions, and other values are expressed in the USMS followed by the appropriate SI metric units in parentheses. Some standard tools or parts such as drills, taps, bolts, nuts, etc. do not have an equivalent.

E. Standard Practices Manual

(1) Not applicable.

F. Electrostatic Discharge

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3. References

A. Honeywell/Vendor Publications

(1) Honeywell publications related to the content of this manual are shown in the list that follows:

- Not applicable.

B. Other Publications

(1) These publications are standard references. Check for latest version of publication.

- The United States GPO Style Manual 2000 (aavailable at http://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/content-detail.html)
- IEEE Std 260, Standard Letter Symbols for Units of Measurement (available from the American National Standards Institute at http://www.ansi.org)

- ASME Y14.38, Abbreviations for Use on Drawings and in Text (available from the American National Standards Institute at http://www.ansi.org)
- ANSI/IEEE Std 91, Graphic Symbols for Logic Functions (available from the American National Standards Institute at http://www.ansi.org)
- CAGE codes and manufacturers' addresses are available at https://cage.dla.mil
- IEEE 315/ANSI Y32.2, Graphic Symbols for Electrical and Electronics Diagrams (available from the American National Standards Institute at http://www.ansi.org)
- MIL-HDBK-263, Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric) (available from any military standards database)
- MIL-STD-1686, Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric) (available from any military standards database).

4. Acronyms and Abbreviations

A. General

(1) The abbreviations are used in agreement with ASME Y14.38.

(2) Acronyms and non-standard abbreviations used in this publication are as follows.

List of Acronyms and Abbreviations

Term	Full Term
ACARS	aircraft communications addressing and reporting system
ADF	automatic direction finder
AM	amplitude modulation
ANSI	American National Standards Institute
ANT	antenna
AOA	angle of attack
APM	aircraft personality module
ARINC	Aeronautical Radio, Incorporated
ASME	American Society of Mechanical Engineers
ATA	Air Transport Association
ATN	aeronautical telecommunication network
AVLC	aviation link control
BFO	beat frequency oscillator
BIT	built-in test
CAGE	commercial and government entity

List of Acronyms and Abbreviations (Cont)

Term	Full Term
CPDLC	controller/pilot data link communications
CFR	Code of Federal Regulations
CMC	central maintenance computer
CMF	communications management function
CMM	component maintenance manual
COM	communication
dB	decibel
dBm	decibel (referenced to one milliwatt)
DEG	degree
DME	distance measuring equipment
EB	engineering bulletin
ECCN	export control classification number
ELT	emergency locator transmitter
ESDS	electrostatic discharge sensitive
ETSO	European Technical Standard Order
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
GMT	Greenwich mean time
GND	ground
GPO	Government Printing Office
GRY	grey
GS	glidescope
HIRF	high intensity radiated fields
Hz	hertz
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ILS	instrument landing system
kHz	kilohertz
KTR	king transceiver radio
LOC	localizer
LRU	line replaceable unit
mA	milliampere

List of Acronyms and Abbreviations (Cont)

Term	Full Term
MHz	megahertz
MIC	microphone
MIL	military
MMDF	multi-mode digital function
MMDR	multi-mode digital receiver
MMDS	multi-mode digital sensor
MNT	mount
MOPS	minimum operational performance standards
NAV	navigation
NDB	non-directional beacon
No.	number
PGM	program
PN	part number
POA	plain old aircraft communications addressing and reporting system
PTT	push-to-talk
PWR	power
QE	quadrantal error
REV	revision
RF	radio frequency
RTCA	Radio Technical Commission for Aeronautics
RX	receiver
SIM	system installation manual
SNR	signal-to-noise ratio
STC	supplemental type certificate
TC	type certificate
TSO	technical standard order
TX	transmiter
UTC	universal time coordinated
VAC	volts alternating current
VDC	volt direct current
VHF	very high frequency
VOR	very high frequency omnidirectional range

List of Acronyms and Abbreviations (Cont)

Term	Full Term
VSWR	voltage standing wave ratio
W	watt

SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information relative to the physical, mechanical, and electrical characteristics of the Honeywell KTR 2280A MMDR. Installation and check out procedures are also included. Information relative to the maintenance, alignment, and procurement of the replacement parts may be found in this KTR 2280A CMM, Publication No. D201610000050. Final design of the installation and airworthiness approval is incumbent upon the installer and their respective certification authority.

1.2 EQUIPMENT DESCRIPTION

The KTR 2280A MMDR Transceiver is a blind panel mounted integrated transceiver containing one transmitter and six receivers. Depending on system configuration, all six receivers can be simultaneously active. The KTR 2280A will operate from a normal voltaqe of 27.5 VDC. The KTR 2280A is designed with ARINC 429 interfaces which is intended for use in the aircraft. It is also designed with RS-422 capabilities that will be used primarily for development and testing in the engineering lab. The KTR 2280A is controlled by other LRUs which will send control information to the KTR 2280A through ARINC 429 data. Some outputs from the KTR 2280A are in digital formats and sent to other LRUs through ARINC 429. Other outputs are more traditional analog outputs.

The six receivers and their modes of operation are as follows, The NAV receiver operates in one of three modes as dynamically controlled by the system interface. These three modes are VOR, LOC, and VDB. The GS operates in the Glideslope mode only. The ADF operates in the direction finding and AM modes. There are three COM receivers. The first COM is a traditional AM mode receiver with either 25 or 8.33 kHz channel spacing. The second AM COM receiver functions as a Guard channel receiver with either 25 or 8.33 kHz channel spacing. The third COM receiver is capable of receiving either VDL Mode 2 (D8PSK) or VDL Mode A (MSK) signals. The COM transmitter is capable of AM, VDL Mode 2, or VDL Mode A modes.

The KTR 2280A contains BIT equipment so that the operational health of the unit is constantly monitored. When a critical fault is detected, the unit notifies the host system. The unit stores detected failures in non-volatile memory for later review. The unit also has a temperature sensor and a timer so that faults can be time stamped and temperature data can be collected and stored.

1.3 TECHNICAL CHARACTERISTICS

1.3.1 KTR 2280A Technical Characteristics

Table 1-1 KTR 2280A Technical Characteristics

SPECIFICATION	CHARACTERISTIC
TSO COMPLIANCE:	
COM TRANSMIT	TSO-C169a, ETSO-2C169a, DO-186B, ED-23C for transmitter Class 3 and 5
COM RECEIVE	TSO-169a, ETSO-2C169a, DO-186B for receiver Classes C, D, E, and ED-23C for receiver Classes C, D, E and H2
VOR	TSO-C40c, ETSO- 2C40c, DO-196, and ED-22B
LOC	TSO-C36e, ETSO-2C36f, DO-195 for receiver Class B, and ED-46B for automatic landing.
GS	TSO-C34e, ETSO-2C34f, DO-192, and ED-47B
ADF	TSO-C41d, ETSO-2C41d, DO-179 for Class A, and ED-51
STUCK MICROPHONE	TSO-128a, ETSO-2C128, DO-207, and ED-67
VDB	TSO-C162a and DO-253C
VDL MODE 2 TRANSCEIVER	TSO-C160a, DO-281B, and ED-92B for Class YF7
TSO/ETSO DEVIATIONS	Refer to APPENDIX B
NON-TSO FUNCTIONS TRANSCEIVER (ACARS)	Mode A
SOFTWARE QUALIFICATION	DO-178B Level B
HARDWARE QUALIFICATION	DO-254 Level B
ENVIRONMENTAL CATEGORIES	Refer to APPENDIX A
PHYSICAL DIMENSIONS	Refer to Figure 2-21 KTR 2280A Installation Drawing
WEIGHT	Refer to Figure 2-21 KTR 2280A Installation Drawing
MOUNTING	Remote rack mounted
TEMPERATURE	Refer to APPENDIX A
ALTITUDE	Refer to APPENDIX A
COOLING	Internal fan and external rack mounted fan
POWER INPUT	16 to 33 VDC (Nominal voltage 27.5 VDC)
POWER REQUIREMENTS (Note: 100% transmit is specified for short-term operation only)	

RECEIVE (NOMINAL)	19 Watt (0.7 A at 27.5 V)
RECEIVE (NOMINAL) W/10% TRANSMIT	33 Watt (1.19 A at 27.5 V)
RECEIVE (NOMINAL) W/100% TRANSMIT	154 Watt (5.6 A at 27.5 V)
RECEIVE (MAXIMUM)	28 Watt (1.02 A at 27.5 V)
RECEIVE (MAXIMUM) W/10% TRANSMIT	43 Watt (1.57 A at 27.5 V)
RECEIVE (MAXIMUM) W/100% TRANSMIT	179 Watt (6.5 A at 27.5 V)

1.3.2 KA 44B Technical Characteristics

Table 1-2 KA 44B Technical Characteristics

SPECIFICATION	CHARACTERISTIC
TSO COMPLIANCE	Refer to APPENDIX A
ENVIRONMENTAL SPECIFICATIONS	Refer to APPENDIX A
PHYSICAL DIMENSIONS	Refer to Figure 2-22 and Figure 2-23 for Outline and Mounting Drawing
WEIGHT:	Refer to Figure 2-22 and Figure 2-23 for Outline and Mounting Drawing
POWER REQUIREMENTS	8.5 ±0.5 VDC at 100 mA max (supplied by KTR 2280A)

1.4 UNITS AND ACCESSORIES SUPPLIED

1.4.1 KTR 2280A Installation Kit

NOTE: The following installation kit information is presented at the revision existing at the time of this publication. Future revisions to these kits can occur. Use the latest revision of the kit as provided by Honeywell.

The KTR 2280A installation kit, PN 050-03721-0010, contains the following parts:

PN	DESCRIPTION	REV
050-03721-0010	INSTALL KIT KTR 2280A	A

SYM-BOL	PART NO.	FIND NO.	DESCRIPTION	UM	-QTY
P1	030-03296-0000		HI DENSITY SUBD44P	EA	1.00

SYM-BOL	PART NO.	FIND NO.	DESCRIPTION	UM	-QTY
P101	030-00101-0002		PANEL MOUNT PLUG	EA	1.00
P102	030-00101-0002		PANEL MOUNT PLUG	EA	1.00
P103	030-00101-0002		PANEL MOUNT PLUG	EA	1.00
P104	030-00101-0002		PANEL MOUNT PLUG	EA	1.00
J501	57000525-002		FAN, 25 X 25 X 10 mm, 3.5 CFM, TEFLON	EA	1.00
	001-01299-0000		INSTRUCTION FOR HARNESS ASSEMBLY PARTS	RF	.00
	030-01458-0000		CONTACT, SOCKET, SIZE 22	EA	44.00
	030-01466-0003		CONN, D-SUB, CONT, FEM, #22 W/ 20 AWG CRMP BARREL	EA	6.00
	047-11179-0004		STAIN RELIEF CLAMP, .220	EA	1.00
	047-11310-0004		RACK, W/FINISH	EA	1.00
	057-05944-0085		KTR 2280A KIT TSO LABEL	EA	1.00
	073-01140-0003		BACKPLATE W/HARDWARE	EA	1.00
	073-01141-0002		CONNECTOR HOOD SUB D 25 90 DEG W/FINISH	EA	1.00
	073-01142-0002		CONN HOOD COVER W/FINISH	EA	1.00
	076-03189-0001		SCREW 100DEG FHP 2-56 X 3/8 SPECIAL	EA	5.00
	088-03559-0001		FAN GUARD	EA	1.00
	089-05874-0011		SCR PHP 2-56 X 11/16	EA	3.00
	089-05878-0005		SCR PHP 4-40 X 5/16	EA	1.00
	089-05903-0004		SCR PHP 4-40 X 1/4	EA	3.00
	089-06008-0004		SCR FHP 4-40 X 1/4	EA	2.00
	089-08252-0030		WASHER	EA	8.00
	090-00019-0007		RING RTNR .438	EA	4.00
	091-00464-0002		CABLE TIE, 5.62 INCH	EA	1.00
	150-00128-0009		TBG HT SHRNK WHT	IN	2.00
	155-03009-0001		CABLE ASSY, POWER, KTR 2280A FAN	EA	1.00
	155-06081-0000		INSTALL DRAWING MMDR KTR 2280A	RF	.00
	200-10452-0001		BAR CLAMP ASSEMBLY -15	EA	1.00

Shield braids must be clamped to the connector backshell using bar clamp assembly, PN 200-10452-0001, which contains the following parts. Refer to Figure 2-12 Typical Taylor Backshell Instructions and Figure 2-21 KTR 2280A Installation Drawing for additional information.

PN	DESCRIPTION	REV
200-10452-0001	BAR CLAMP ASSEMBLY -15	-

SYM-BOL	PART NO.	FIND NO.	DESCRIPTION	UM	-0001
REF1	-0000		BAR CLAMP ASSEMBLY KMC 2220	RF	.00
	047-11178-0002		BACKSHELL BAR CLAMP MED	EA	1.00
	076-03190-0001		SCREW PHP 4-40 X 7/16 SPECIAL	EA	2.00
	187-01943-0002		BACKSHELL GASKET MEDIUM	EA	1.00

The KA 44B antenna installation kit Honeywell PN 050-01756-0020 contains the following parts

PN	DESCRIPTION	REV
050-01756-0020	INSTALL KIT 48 FT MMDR KA 44B DO-160D	C

SYM-BOL	PART NO.	FIND NO.	DESCRIPTION	UM	-0020
	030-00101-0000		PANEL MNT PLUG	EA	1.00
	057-02259-0000		ANT MTG TEMPLATE	EA	1.00
	057-05944-0074		KA 44B KIT TSO LABEL	EA	1.00
	076-01042-0001		FERRULE W/F	EA	1.00
	090-00019-0007		RING RTNR .438	EA	1.00
	091-00031-0005		NY CA CLAMP .312	EA	1.00
	155-05334-0000		INST DWG KA44B	RF	0.00
	200-02586-0020		ANT CBL ASSY 48FT KA 44B DO-160D	EA	1.00

The KA 44B antenna cable assembly Honeywell PN 200-02586-0020 contains the following parts

PN	DESCRIPTION	REV
200-02586-0020	ANT CBL ASSY 48FT KA 44B DO-160D	G

SYM-BOL	PART NO.	FIND NO.	DESCRIPTION	UM	-0020
	025-00001-0000		WIRE, HOOKUP, PTFE, 26 (7/34)AWG SPC, BLK	IN	3.90
	025-05120-0000		WIRE, TIN PLTD CU SHLD, 5-24 (19/36)AWG TPC COND	IN	578.00
	026-00029-0000		WIRE, CU, 22AWG, TINNED	IN	3.00
	030-01157-0011		SOCKET CRMP 20G	EA	9.00
	030-01171-0000		CONN SUB-D HSG 9S (FEMALE PINS)	EA	1.00

SYM-BOL	PART NO.	FIND NO.	DESCRIPTION	UM	-0020
	030-02351-0000		HOOD/LVR ASSY ST E	EA	1.00
	150-00024-0010		TUBING SHRINK 10G	IN	2.00
	150-00049-0010		SHRINK TUBING WHT	IN	0.75
	350-00052-0010		SHRINK TUBING WHT	IN	4.5
	300-02586-0020		ANTENNA CABLE INTERCONNECT KA 44B DO-160D	RF	.00
	53001150-1		50 OHM QUADRAXIAL CABLE	FT	48.17
	025-00003-0008		WIRE 22 GRY	IN	4.30
	710-H4TS		HEAT SHRINK, 1/4, PRNTABLELABL	EA	1

1.5 ACCESSORIES REQUIRED, BUT NOT SUPPLIED

A. Broadband communications antenna (50 ohms)
B. VHF NAV antenna (50 ohms)
C. Glideslope antenna
D. Antenna splitter(s)
E. ADF Antenna (representative type KA 44B)
   The KA 44B, PN 071-1234-00/01, is a low profile ADF Antenna which contains both loop and sense antennas, preamplifiers, and modulators which combine the antenna signals into a single RF signal which is output to the KTR 2280A through a quadaxial cable of non-critical length. The KA 44B is supplied with a backing plate (Refer to Figure 2-22 KA 44B Outline and Mounting Drawing for PN 155-05334-0000 and the KA 44B, PN 155-05334-0010 is supplied with a grounding ring (Ref to Figure 2-23 KA 44B Outline and Mounting Drawing for PN 155-05334-0010).
F. Consumables:
   (1) RTV No. 3145 (PN 016-01082-0000).
   (2) Alumiprep No 33 (PN 016-01127-0000).
   (3) Alodine No 1001 (PN 016-00128-0000).
   (4) Dow Corning DC-4 or equivalent.

1.6 LICENSING REQUIREMENTS

The KTR 2280A meets CFR Title 47, Part 2, 15 and 87 (FCC Approvals) for all radio equipment. For non-US registered aircraft, follow applicable licensing requirements as required.

This device complies with Industry Canada’s license-exempt RSSs. Operation is subject to the following two conditions:

- This device cannot cause interference: and
- This device must accept any interference, including interference that can cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- l'appareil ne doit pas produire de brouillage, et

- l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

1.7 CONTINUED AIRWORTHINESS INSTRUCTIONS

1.7.1 Equipment

The instructions for continued airworthiness given in the TC or STC approvals for this product supplements or supersedes the instructions for continued airworthiness in this manual.

The KTR 2280A is designed and manufactured to allow "on-condition maintenance". On condition maintenance is described as follows; There are no periodic service requirements necessary to maintain continued airworthiness. No maintenance is required until the equipment does not properly perform its intended function. When service is required, a complete performance test must be accomplished following any repair action. Consult the KTR 2280A CMM, Pub. No. D201610000050, for complete performance test information. All maintenance must be performed by a Honeywell approved repair center

14 CFR Part 23.1529 and 25.1529, Instructions for Continued Airworthiness is met per the following instructions:

The removal of the equipment is on the condition of failure. There is no required periodic maintenance for the KTR 2280A.

NOTE: Upon completion of maintenance or repair, the post-installation checkout procedures must be performed. Refer to 2.4 POST-INSTALLATION CHECKS for the procedures.

1.7.2 Wires and Coaxial Cables

During on-condition or regularly scheduled maintenance, inspect the wires and coax cables following the guidelines listed in AC 43.13-1B Chapter 11, 12 as necessary.

1.8 ANTENNA RF EXPOSURE

WARNING: TO MINIMIZE RF EXPOSURE TO PERSONNEL, INSTALL THE ANTENNA GENERALLY AWAY FROM AREAS WHERE PEOPLE ARE LOCATED. IN SITUATIONS WHERE A PERSON WOULD BE DIRECTLY EXPOSED TO ANTENNA RADIATION, SUCH AS IN A COMPOSITE AIRCRAFT, A MINIMUM SEPARATION OF 1.97 FT (60 CM) IS GENERALLY REQUIRED BETWEEN ANY PART OF THE ANTENNA AND ANY LOCATION WHERE A PERSON MAY BE PERMANENTLY SEATED IN THE AIRCRAFT. LESSER SEPARATION IS ACCEPTABLE IN AN AIRCRAFT WHERE METAL SKIN SHIELDS THE OCCUPANTS FROM THE ANTENNA

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SECTION 2

INSTALLATION

2.1 GENERAL INFORMATION

This section contains general suggestions and information to consider before installation of the KTR 2280A. Close adherence to these suggestions will assure optimum performance from the equipment.

NOTE: The conditions and test required for the TSO/ETSO approval of this article are minimum performance standards. Those installing this article, on or within a specific type or class of aircraft, are responsible for determining that the aircraft installation conditions are suitable for the TSO/ETSO article. TSO/ETSO articles must have separate approval for installation in an aircraft. The article can be installed only if performed under article 14 CFR part 43 or the applicable airworthiness requirements.

NOTE: Per AC 23.1309-1E, the probability of total loss of navigation and communication (a Hazardous failure) must be less than 1E-7 (Part 23 Class III or Class IV) per flight hour and only dual installation of KTR 2280A can support this probability requirement without the installation of additional navigation or communication equipment. Additionally, other installation considerations must be analyzed (e.g. electrical wiring and interconnect, power distribution, RF cabling and antennas) to determine the acceptability.

2.2 UNPACKING and INSPECTING EQUIPMENT

Exercise extreme care when unpacking the equipment. Make a visual inspection of the unit for evidence of damage during shipment. If a claim for damage is to be made, save the shipping container to substantiate the claim. The claim must be promptly filed with the transportation company. It would be advisable to retain the container and packing material after all equipment has been removed, in the event that equipment storage or reshipment must become necessary.

2.3 EQUIPMENT INSTALLATION

2.3.1 Avionics Cooling Requirements

The unit is cooled by a fan internal to the unit and an external fan attached to the rear rack assembly plate, the latter being a part of the installation (Refer to Figure 2-21 KTR 2280A Installation Drawing). During installation, do not block any holes in the unit cover(s) which would restrict air flow.

2.3.2 Equipment Location

The following paragraphs contain information pertaining to the initial installation of the KTR 2280A MMDR, including instructions concerning the location and mounting of the supporting antenna(s).

The equipment must be installed in the aircraft in a manner consistent with acceptable workmanship and engineering practices and in accordance with the instructions set forth in this publication. To ensure that the system has been properly and safely installed in the aircraft, the installer make a thorough visual inspection and conduct an overall operational check of the system on the ground prior to flight.

The installation must be in accordance with standards established by the customer's installing agency and existing conditions as to unit location and type of installation; however, the following must be considered before installing the system in order to assure a more satisfactory performance from the equipment.

NOTE: The TSO identifies the minimum performance standards, tests, and other conditions applicable for issuance of design and production approval of the article. The TSO applicant is responsible for documenting all limitations and conditions suitable for installation of the article. An applicant requesting approval for installation of the article within a specific type or class of product is responsible for determining environmental and functional compatibility.

Care must be exercised to avoid mounting components near equipment operating with high pulse current or high rf power outputs such as radar and satellite communications equipment. In general, the equipment must be installed in a location convenient for operation, inspection, and maintenance, and in an area consistent with the TSO environmental limits. Determine the mounting location for system components following the guidelines below

2.3.2.1 Mounting Tray Location(s)

The KTR 2280A MMDR mounting tray can be installed in any convenient location.

2.3.2.2 Antenna(s)

The antenna(s) must be well removed from other antenna projections, the engine(s), and propeller(s). It must also be well removed from landing gear doors, access doors, or other openings which will break the ground plane for the antenna(s). On metal skinned aircraft, the antenna(s) must be bonded to the surface of the aircraft in a fore to aft location that provides the flattest ground plane. On composite aircraft, the antenna(s) must be located at the center of a conductive ground plane, contoured to the shape of the aircraft, having dimensions of at least 2 feet by 2 feet. The antenna penetration must be designed such that the structural integrity of the fuselage is not compromised. The antenna(s) need to be within 5 degrees of the centerline.

Where practical, plan the antenna location(s) to keep cable lengths as short as possible and avoid sharp bends in the cable to minimize the VSWR. Avoid running other cables or wires near the antenna cable(s).

On pressurized aircraft, the antenna(s) must be sealed using an approved sealant, such as RTV No. 3145 (PN 016-01082-0000) or equivalent, around the connector and mounting hardware.

The antenna edge and mounting hardware recesses must be sealed from the outside for moisture protection using RTV or equivalent.

Mount the antenna(s) in as clean as environment as possible, away from exhaust gases and oils. The antenna(s) must be kept clean. If left dirty (oil covered), the antenna performance can be affected.

2.3.3 KTR 2280A Mechanical Installation

The mounting tray for the MMDR must be mounted using the dimensions specified in the outline and mounting drawing, Figure 2-21 (KTR 2280A Installation Drawing). Install the unit as follows:

(1) Slide the MMDR into the tray until the locking rod engages the nut on the back of the rack.

IMPORTANT:The locking rod is located close to one side of the KTR 2280A. As the locking rod is tightened, use the opposite hand to press the opposite side of the KTR 2280A into the installation rack. This will ensure that the KTR 2280A is fully inserted within the mounting rack.

The KTR 2280A must use the internal fans or a part of the mounting rack for air cooling. The mounting racks and other objects will be installed as per the instructions in the installations in the installation drawing to allow air flow through the chassis.

CAUTION: DO NOT OVERTIGHTEN THE LOCKING ROD.

(2) Using a 3/32 inch allen wrench, turn the locking rod clockwise until it has drawn the unit into the rack and mating connectors and is tight.

CAUTION: DO NOT USE BALL END ALLEN WRENCHES.

To remove the unit, turn the securing rod counter clockwise until it disengages from the mounting tray. Then, pull the unit out of the mounting rack.

The KTR 2280A can be installed in any orientation. For additional KTR 2280A installation information, refer to Figure 2-21 (KTR 2280A Installation Drawing).

2.3.4 Antenna Mechanical Installation

2.3.4.1 VHF COM Antennas

The VHF COM antenna must be mounted as far away as possible (8 feet, minimum) from other similar antennas and the vertical stabilizer. Mounting the COM antenna as far away as possible from the navigation antenna will help reduce COM to NAV interference. The COM antenna must also be mounted as far away as possible from an ELT antenna to prevent distortion of the radiated pattern and to prevent radiated broadband noise from the ELT when excited by the COM transmissions. Radiated broadband noise from an ELT is a common cause of COM-to-COM and COM-to-NAV interference. Mounting one antenna on top of the fuselage at the highest location to ensure a good radiation pattern and the other on the bottom of the fuselage offers good separation with a minimum of interaction.

It is recommended that one COM transceiver be connected to the top antenna for good ground communication and that the other COM transceiver be connected to the bottom antenna to provide good airborne communications. If mounting antennas on the same side of the aircraft is unavoidable, maintain the minimum allowable separation (8 feet).

The antenna must be mounted on a section of the aircraft that is horizontal during cruise flight. The base of the antenna must be well bonded to the metal aircraft skin. Remove any paint from around the mounting holes to ensure a good connection between the antenna and the skin. The metal aircraft skin at the base of the antenna must extend a minimum of twenty-four inches in every direction. This provides the ground plane required for the antenna. Any less metallized area will result in reduced communication range at some bearings around the aircraft and can increase interference to and from other systems.

The COM transceiver performance depends heavily on the integrity of the electrical bonding to the airframe and also the electrical integrity of the aircraft structure. If the electrical resistance between an antenna and the aircraft or between adjacent skin panels change intermittently, noisy communications can result.

Connect the antenna to the COM unit with 50 ohm coaxial cable, keeping the cable length to a minimum and avoiding sharp bends in the cable. Keep the COM antenna cable as far away from other antenna cables as possible and do not bundle several cables together. Prepare the cable to the BNC connector as shown in Figure 2-18 Right Angle Connector Instruction Sheet

Use Dow-Corning DC-4, or equivalent, on both inside and outside of the connector and its mate as an effective barrier against moisture and to prevent corrosion.

2.3.4.2 NAV Antennas

LIMITATIONS: If radio is used for VDB installation, the total minimum installation loss must be 5 dB in NAV antenna RF path. Installation loss includes the antenna gain and implementation loss from antenna to MMDR.

The NAV antenna must be well removed from other antennas, projections, engines or propellers. It must have a clear line of sight area if possible. The antenna must be mounted symmetrically with the center line of the aircraft. Avoid running other coaxial cables and wires near the NAV antenna cable.

The VOR/LOC antenna with Glideslope is a two piece dipole with one part mounted on each side of the vertical stabilizer. It must be installed on the upper section of the vertical stabilizer of single finned aircraft and be at least 28 inches (measured vertically) from the horizontal stabilizer.

On dual VOR/ILS installations, it is recommended that a splitter be used to divide signals from a single VOR/LOC antenna into two or more receivers. Use double shielded cables to reduce interference to the receivers. Prepare the cable to the BNC connector as shown in Figure 2-18 Right Angle Connector Instruction Sheet

2.3.4.3 ADF Antennas

The antenna installation will determine, to a large extent, whether the ADF will give optimum performance as required. The KA 44B ADF Antenna contains both the loop and sense antennas. The following considerations must be taken into account before selecting a location for the antenna:

CAUTION KEEP THE ANTENNA AT LEAST 4 FEET AWAY FROM DME OR TRANSPONDER ANTENNAS TO MINIMIZE L-BAND INTERFERENCE. THE ANTENNA MUST BE MOUNTED WELL CLEAR OF THE AIRCRAFT GENERATOR/ALTERNATOR AND WELL CLEAR OF ANY GENERATOR/ALTERNATOR CABLES.

CAUTION: DO NOT ROUTE THE CABLES ALONG WITH HIGH POWER LEVEL TRANSMITTING CABLES. DO NOT ROUTE THE CABLES WITH OR NEAR ALTERNATOR OR 400HZ CABLES. MAKE SURE THAT THE CABLES DO NOT INTERFERE WITH ANY OF THE AIRCRAFT CONTROL CABLES.

- Mount the antenna on the center line of the aircraft fuselage. Failure to do so can result in excessive Q.E. error.
- If the antenna is to be top mounted, select a location where shadowing from the wings, etc., is minimized.
- The antenna must be well removed from any projections such as engines and propellers, as well as landing gear doors, access doors or other openings which will break the ground plane for the antenna.

- Use the template included in the installation kit to mark the mounting holes on the aircraft fuselage.
- Drill and/or punch the required holes.
- Use a piece of fine sandpaper or emery cloth to sand the area on the fuselage skin on which the backup plate is to be mounted.
- Apply Alumiprep No. 33, PN 016-01127-0000, to both the inside area of the fuselage and the back of the doubler plate, following the directions on the container to cleanse the metal of any residue.
- Apply Alodine No. 1001, PN 016-00128-0000, to both locations following the directions on the container. This is used to ensure good bonding and prevent oxidation.
- Refer to the installation manual and mount the antenna as shown. First rivet the doubler plate in place. It is imperative that the doubler plate make a good ground plane contact with the inside of the aircraft skin.
- Prepare the ADF RF cable as shown in Figure 2-1 thru Figure 2-11 Quadraxial Cable Preparation. Note that the cable provided can be cut to length as required for the installation.

2.3.5 KTR 2280A Wiring and Cable Installation

2.3.5.1 KTR 2280A Interconnection and Cable Harness Fabrication

The KTR 2280A MMDR receives primary power from the aircraft power source. A typical interface is shown in Figure 2-24 KTR 2280A Interconnect Diagram. Aircraft specific interfaces with more details are provided in separate EB or Installation Drawings.

The length of the wires to parallel pins must be approximately the same length, so that the best distribution of current can be effected. Honeywell recommends that all wires, including spares, as provided with the interconnect definition information be included in the fabrication of the wiring harness. However; if full wiring is not desired, the installer must ensure that the minimum wiring requirements for the features and functions to be used have been incorporated.

When cables are installed in the aircraft, they must be supported firmly enough to prevent movement and must be carefully protected against chafing. Additional protection must also be provided in all locations where the cable can be subjected to chafing.

In wire bundles, the cabling must not be tied tightly together as this tends to increase the possibility of noise pickup and similar interference. When routing cables through the aircraft the cables must cross high level RF lines at right angles.

Prior to installing any equipment, make a continuity check of all wires and cables associated with the system. Then apply power and check for proper voltages at system connectors, and then remove power before completing the installation.

The following guidelines are recommended:

(1) The installing facility will supply and fabricate all external cables. The required connectors are supplied as part of the installation kit (Refer to 1.4.1 KTR 2280A Installation Kit).

(2) The unit must be kept a minimum of three feet from the antenna. Additionally, the antenna coax cable must not be bundled with the other wiring harnesses to the unit.

(3) The length and routing of the external cables must be carefully planned before attempting the actual installation. Avoid sharp bends or locating the cable near aircraft control cables. The cables must be of a length to allow for a “maintenance loop”. That is, the length must be adequate to access and extend the connectors aft of the panel for future maintenance purposes. Excess cabling must be secured and stowed by tie-wrapping until such maintenance is required.

(4) The cables must be supported firmly enough to prevent movement. They must be carefully protected wherever one can chafe against another or against some other object. Extra protection must be provided in all locations where the cables can be subject to chafe. Shields on shielded wires must be grounded in accordance with the system interconnection information.

(5) Shields must be carried through any obstruction through a thru-bulkhead connector. If shielding cannot be carried through by use of a bulkhead/connector pin, precautions must be taken to ensure each segment of the shielded lead be grounded at only one point. A ground connection of not more than two inches in length must be used. The preceding discussion does not apply to coaxial and quadraxial cable.

(6) Avoid routing cables near high noise and high power sources.

Quadraxial Cable Preparation

(1) Remove the outer installation 0.900 inch (22.88 mm) from the end of cable, to expose the outer layer as shown in Figure 2-1.

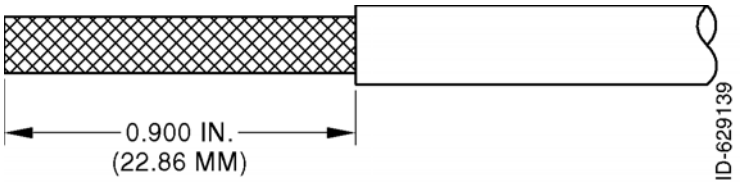


Figure 2-1 (Sheet 1 of 1) Quadraxial Cable Preparation

(2) Push the braid back as far as possible as shown in Figure 2-2. This will be pulled back up later and soldered to the connector body.

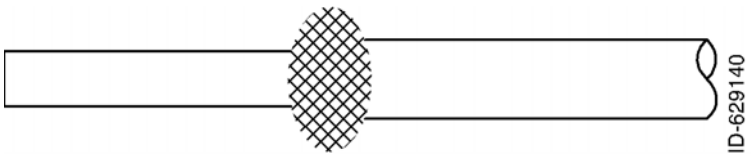


Figure 2-2 (Sheet 1 of 1) Quadraxial Cable Preparation

(3) Measure back 0.700 inch (17.78 mm) and remove the outer insulation from the middle shield as shown in Figure 2-3.

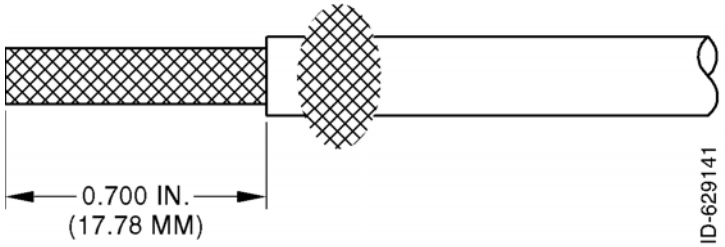


Figure 2-3 (Sheet 1 of 1) Quadraxial Cable Preparation

(4) Tin the exposed shield of the middle coax. With a cutting tool, score the tinned shield around the entire circumference as shown in Figure 2-4.

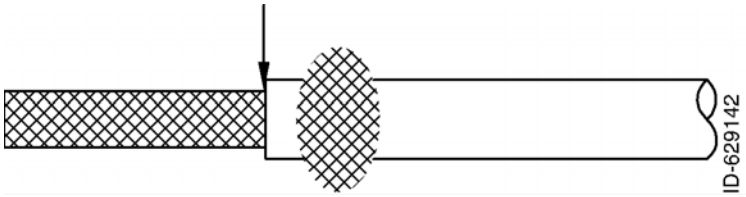


Figure 2-4 (Sheet 1 of 1) Quadraxial Cable Preparation

(5) Carefully break loose the tinned middle coax shield and slide it off. This will expose the center coax insulation as shown in Figure 2-5.

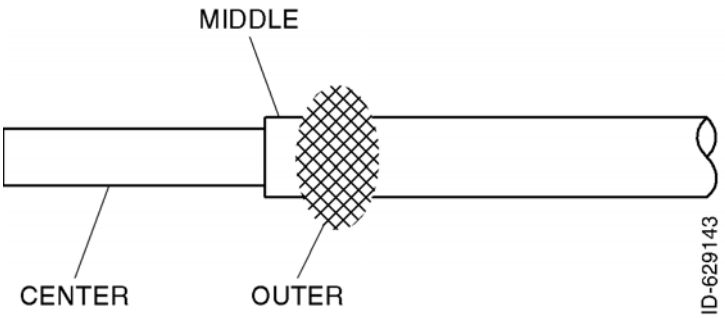


Figure 2-5 (Sheet 1 of 1) Quadraxial Cable Preparation

(6) Measure back 0.500 inch (12.70 mm) and remove the insulation from the center shield as shown in Figure 2-6.

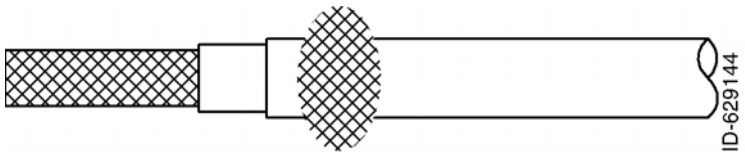


Figure 2-6 (Sheet 1 of 1) Quadraxial Cable Preparation

(7) Tin the shield for the center coax as shown in Figure 2-7.

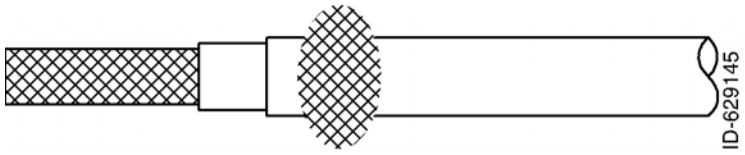


Figure 2-7 (Sheet 1 of 1) Quadraxial Cable Preparation

(8) Measure back from the end of the cable 0.30 inch (7.6 mm) and score the center shield with a cutting tool around the full circumference as shown in Figure 2-8.

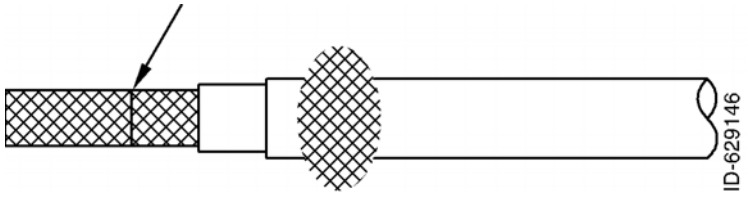


Figure 2-8 (Sheet 1 of 1) Quadraxial Cable Preparation

(9) Carefully break the shield loose. Strip off the insulation from the center conductor as shown in Figure 2-9.

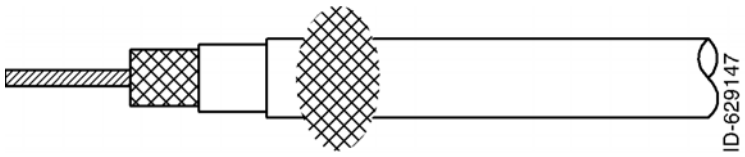


Figure 2-9 (Sheet 1 of 1) Quadraxial Cable Preparation

(10) Install 0.25 inch (6.35 mm) length of shrink tubing over the middle shield stub to prevent possible shorts to the outer shield as shown in Figure 10.

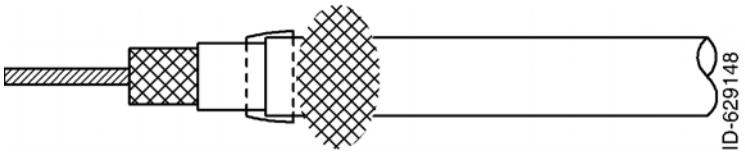


Figure 2-10 (Sheet 1 of 1) Quadraxial Cable Preparation

(11) Connector Assembly

- Install the ferrule over the center shield and solder.
- Slip the cable into the connector housing as shown in Figure 2-11.
- Solder the center conductor to the center terminal.
- Pull up the outer shield and solder to the bottom stem.
- Install shrink tubing over the entire assembly to the bottom of the connector housing as shown in Figure 2-11.
- Install the horse shoe shaped insert for a 50 ohm impedance match.

- Install the rear cover cap and solder to barrel lip in two places.

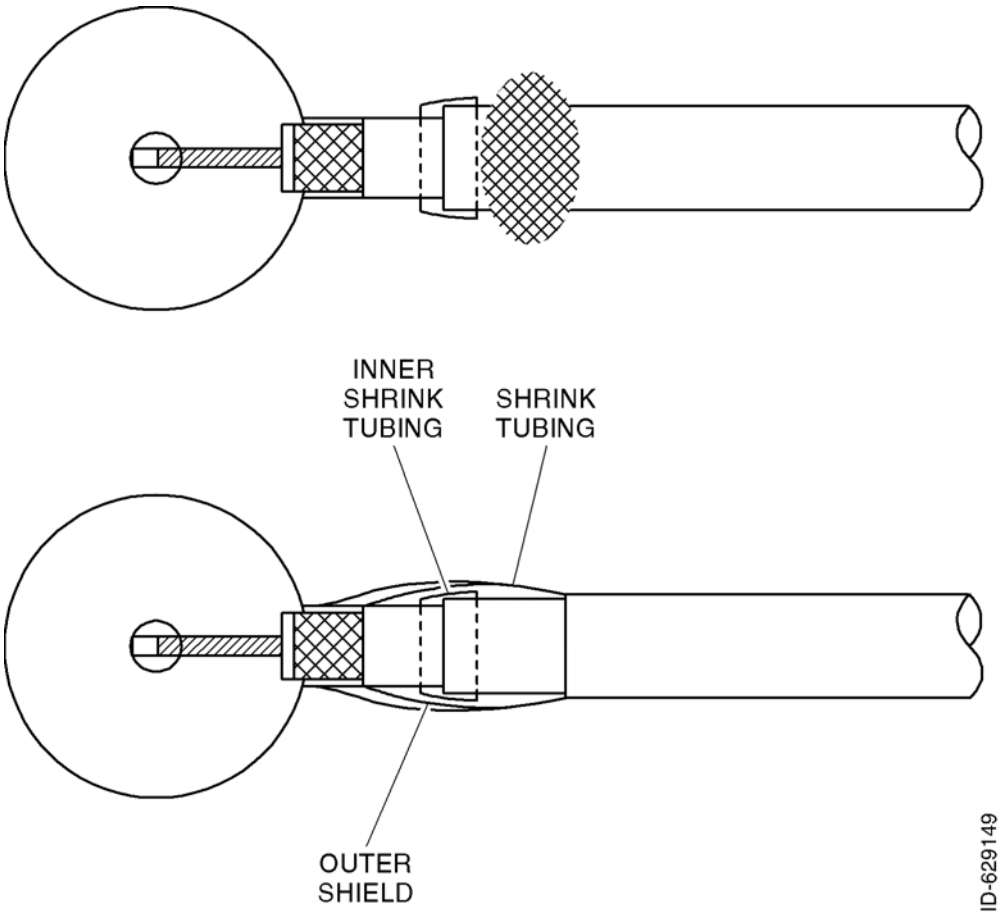


Figure 2-11 (Sheet 1 of 1) Connector Assembly

2.3.5.2 Taylor Backshell Instructions

A. General Information

(1) Taylor Backshells are a proprietary Honeywell design developed to expedite cable harness fabrication while ensuring that HIRF and lightning performance goals are met. A typical backshell is shown in Figure 2-12 Typical Taylor Backshell. Figure 2-13 Backshell Assembly Exploded View provides an exploded view of the backshell. Table 2-1 KTR 2280A Backshell Hardware describes the connector type used for the KTR 2280A.

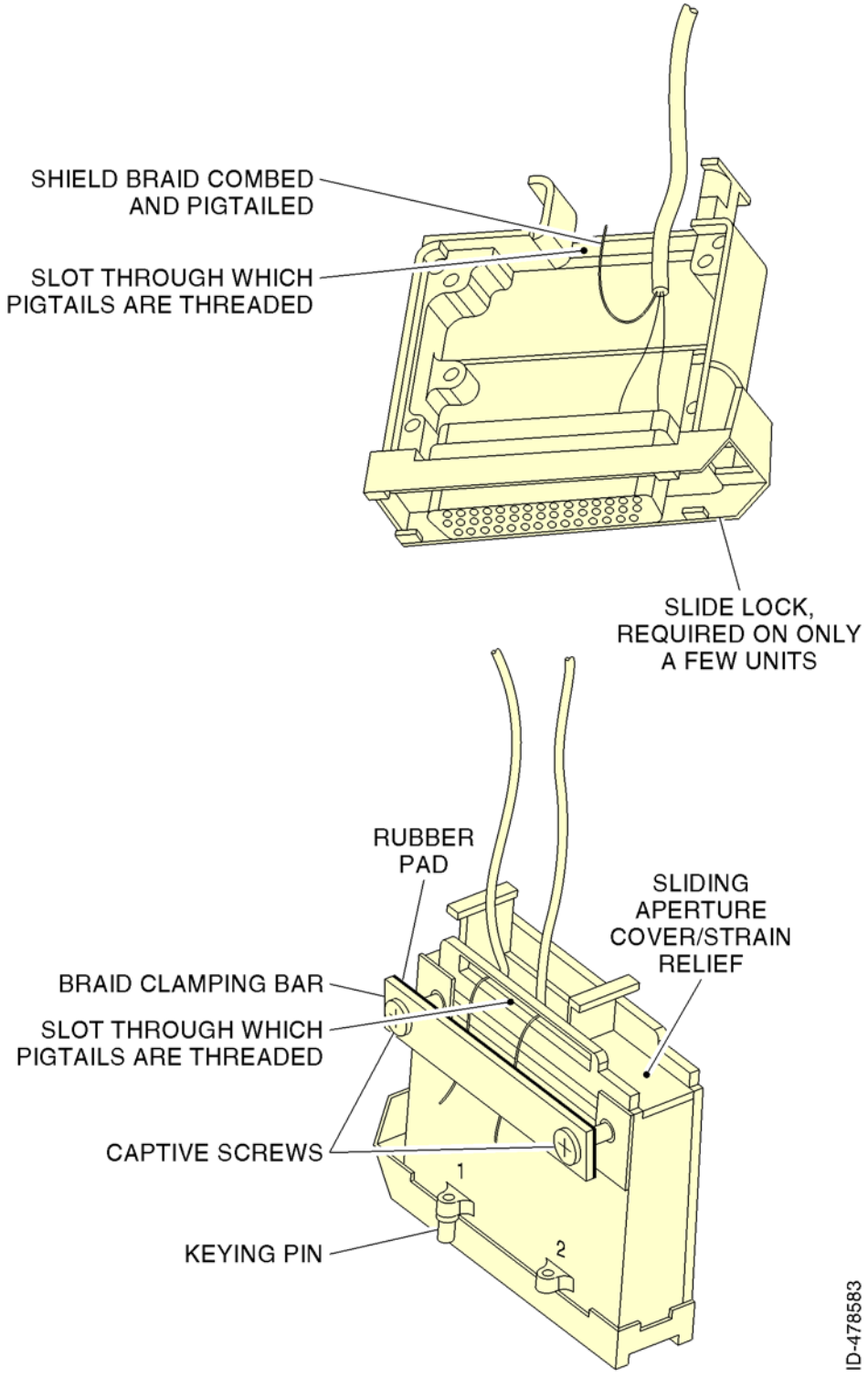


Figure 2-12 (Sheet 1 of 1) Typical Taylor Backshell Instructions

Table 2-1 KTR 2280A Backshell Hardware

Connector Type	PN				
	Backshell	Cover	Cover Screws	Bar Clamp Assy	Strain Relief Clamp
44 pin right-angle custom	073-01141 -0002	073-01142 -0002	076-03189 -0001	200-10452 -0001	047-11179 -0004

(2) Apply Loctite 425 or equivalent to all screw threads when assembling components.

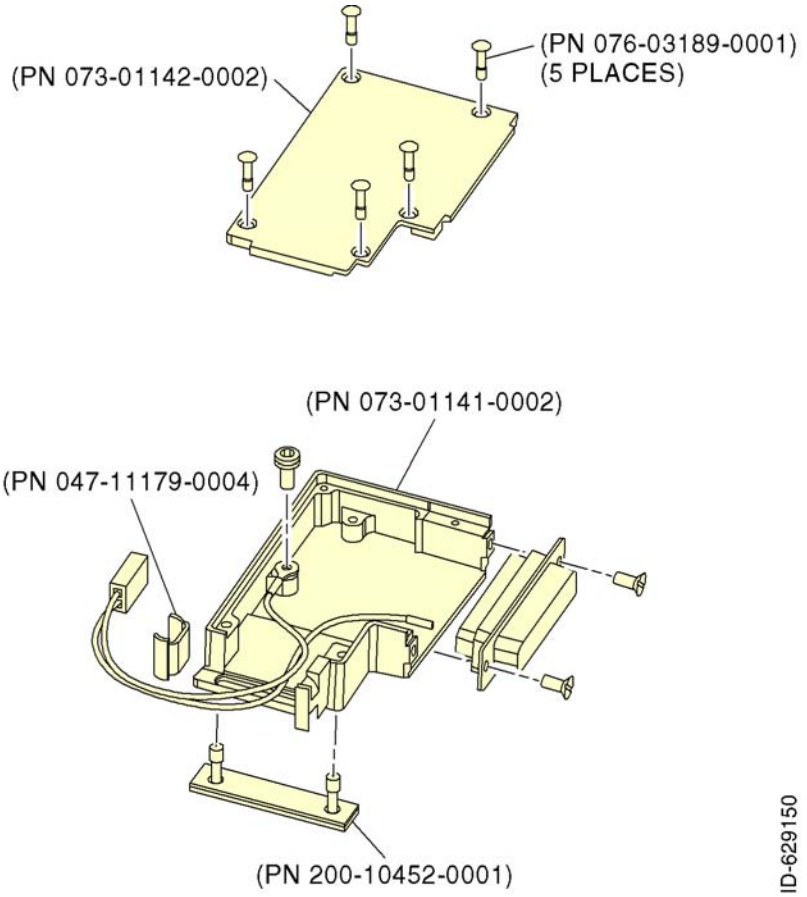
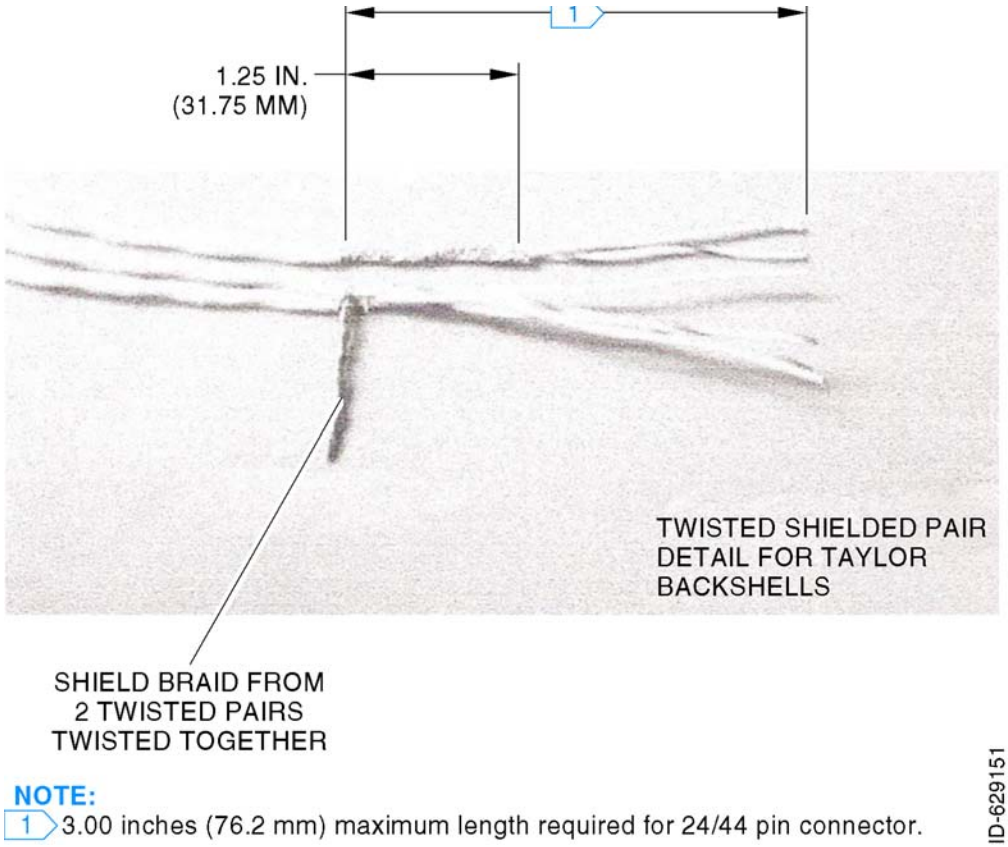


Figure 2-13 (Sheet 1 of 1) Backshell Assembly Exploded View

(B) Backshell Wiring

(1) Strip the outer jacket of the twisted pair as shown in Figure 2-14 Assembly Details. Trim the shield braid to 1.25 inch (31.75 mm) length and then comb out

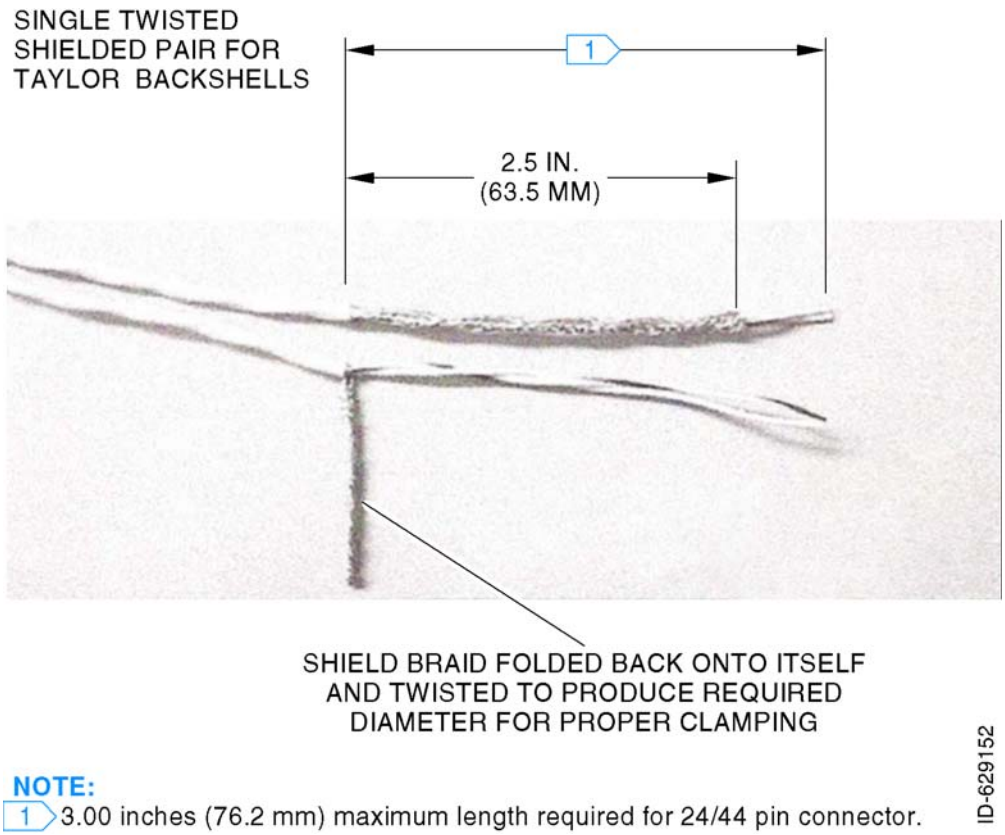
the braid. The braids from two twisted pairs can be twisted together to maintain the proper diameter for the twisted braid.



NOTE:
1 3.00 inches (76.2 mm) maximum length required for 24/44 pin connector.

Figure 2-14 (Sheet 1 of 1) Assembly Details

(2) If installing a single twisted pair, the combed braid must be folded back on itself and twisted to form the proper diameter bundle. Refer to Figure 2-15 Assembly Details.



NOTE:
1 3.00 inches (76.2 mm) maximum length required for 24/44 pin connector.

Figure 2-15 (Sheet 1 of 1) Assembly Details

(3) Crimp pins or sockets onto the wires.

(4) Insert the pins or sockets into the connector. When using oversized power and ground contacts, ensure heat shrink tubing is used to cover exposed ends of contacts.

(5) Place the backshell over the wire bundle.

(6) Attach the connector to the backshell.

(7) Insert the shield braid into the slot in the backshell cover

(8) Attach the backshell cover to the backshell with the screws provided.

(9) Dress the twisted shields as shown in Figure 2-16 Shield Braid Routing and Clamping Bar Details. Do not allow twisted shields to cross over each other. Tighten the clamping bar to secure the braids and provide a reliable electrical ground.

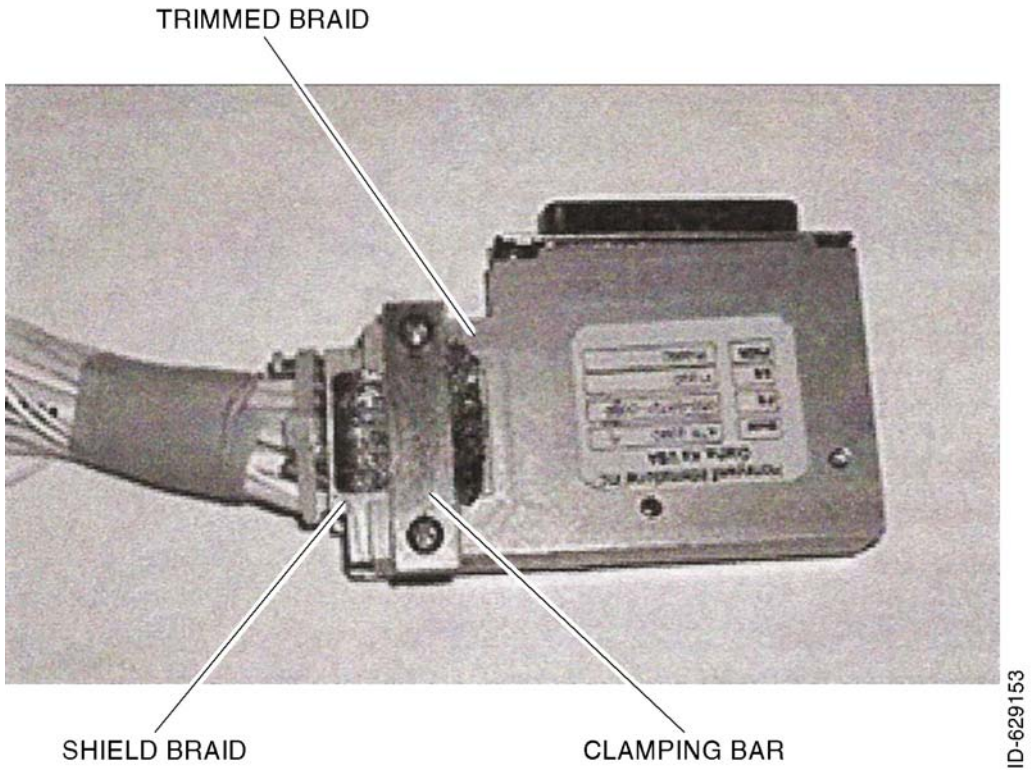


Figure 2-16 (Sheet 1 of 1) Shield Braid Routing and Clamping Bar Details

(11) When the clamping bar is tight, the exposed braids must be trimmed as shown in Figure 2-16 Shield Braid Routing and Clamping Bar Details.

(12) Insert the strain relief and secure with a tie wrap as shown in Figure 2-17 Securing Strain Relief Clamp.

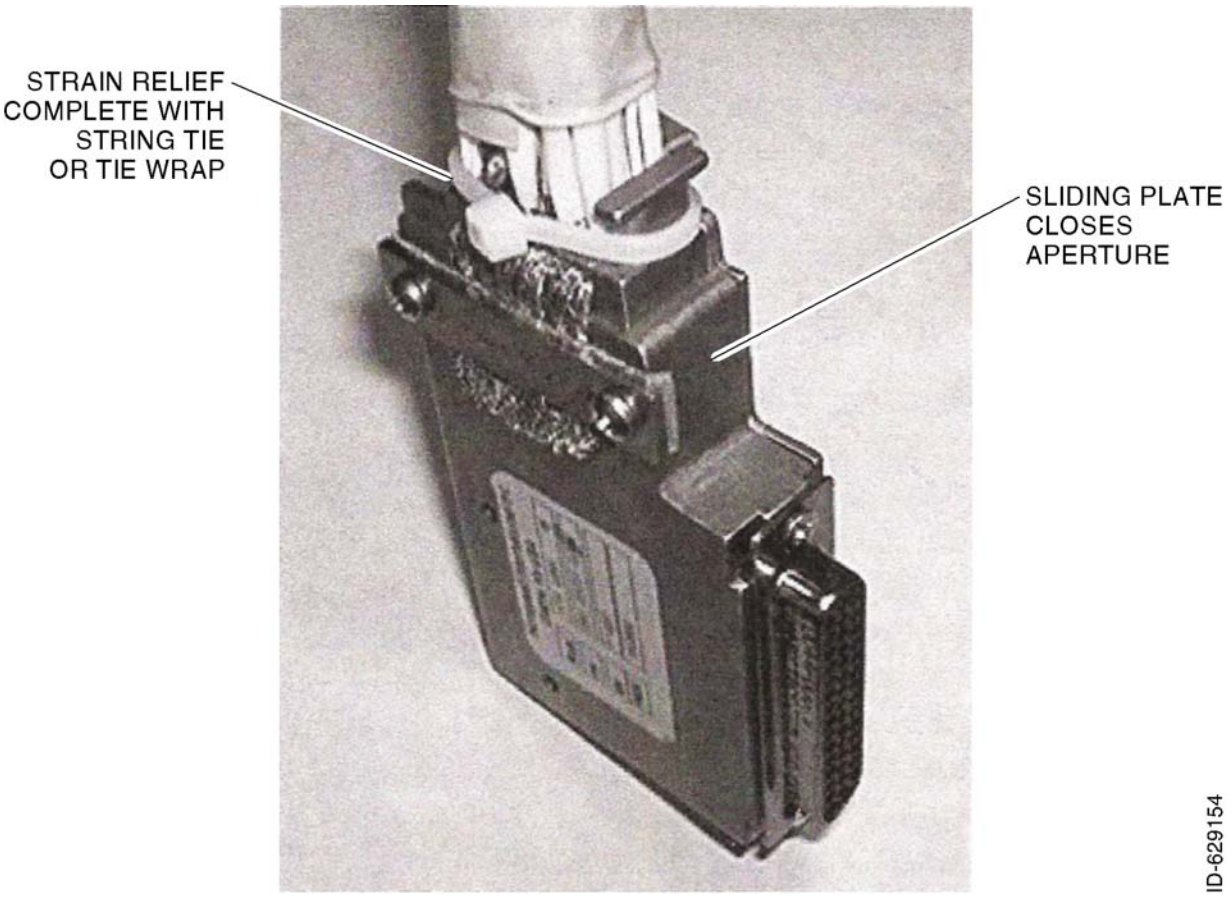


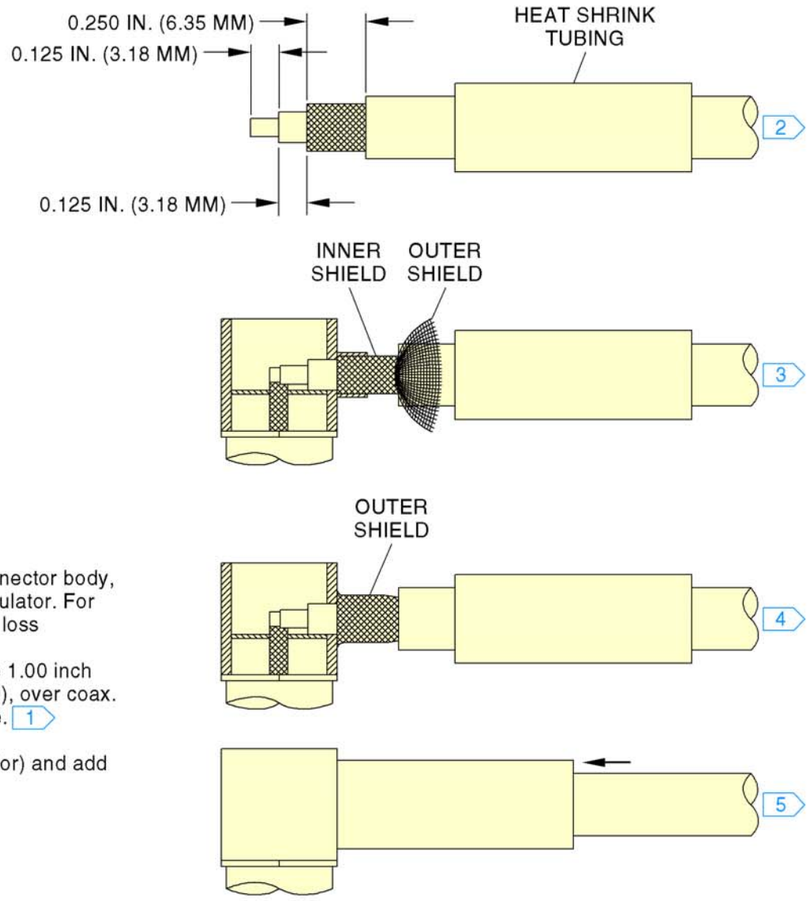
Figure 2-17 (Sheet 1 of 1) Securing Strain Relief Clamp

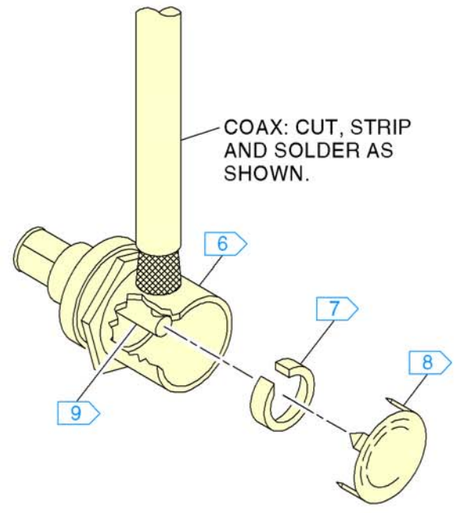
(c) Installation Considerations

(1) Determining Wire Length: The length of wire from the point at which the shield is split off to the terminations in the connector must be as short as possible to allow the wire to lay in the backshell without straining the wires.

(2) Grounding: Taylor Backshells have an external tapped hole that can be used to attach a ground strap. This can be used at the installer's discretion.

(3) Shell Aperture: When the strain relief is tightened against the wire bundle ensure that there are no large openings in the shell back and that the wires are held securely. A different size strain relief can be required if the wire bundle is too small. Wrapping wires in the connector throat is acceptable to bring the bundle diameter up to a size that can be properly clamped.





ID-629155

NOTES:

1. When soldering, avoid applying excess heat to connector body, heat sink spring contacts, and center conductor insulator. For normal applications use RG142 or RG400. For low loss applications use RG393.
2. Strip RG-142B/U, (PN 024-00002-0000), and place 1.00 inch (25.4 mm) heat shrink tubing, (PN 150-00025-0010), over coax.
3. Solder center contact and solder inner shield inside. 1
4. Solder outer shield outside. 1
5. Slide heat shrink tubing forward (flush with connector) and add heat to shrink the tubing.
6. (PN 030-00101-0002).
7. Install 50 ohm match.
8. After installing cap, tack solder, (2 places).
9. Avoid excess solder on center conductor.

Figure 2-18 (Sheet 1 of 1) Right Angle Connector Instruction Sheet

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2.3.5.3 Primary Power and Circuit Breaker Requirements

The KTR 2280A MMDR receives primary power from the aircraft power circuit breakers. Power connections, wire sizes, and circuit breaker requirements can be found in the system installation manual and/or EB for a specific installation.

2.3.5.4 Connectors

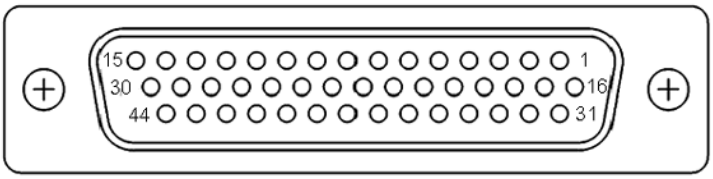

Figure 2-19 (Sheet 1 of 1) KTR 2280A Mating Connector Front View

Table 2-2 J1 Pin Functions

Pin No.	Pin Name	Description
1	O	A429 Out1 A
2	O	ADF Loop Enable OUT
3	I	Test
4	I	Unit Pos PGM 1*
5	I	Unit Pos PGM 2*
6	I	COM TX Interlock* IN
7	I	COM MIC Key* IN
8	O	RS-422 RX A
9	O	RS-422 RX B
10	I	RS-422 TX A
11	I	RS-422 TX B
12	I	COM MIC GND
13	I	A429 IN3 A
14	O	ADF Audio LO OUT
15	O	ADF Audio HI OUT
16	O	A429 Out1 B
17	O	ADF MOD 0 OUT
18	O	A429 Out2 A

Pin No.	Pin Name	Description
19	I	Unit Pos Parity*
20	I	A429 IN1 A
21	O	A429 OUT3 A
22	I	A429 IN2 A
23	I	ADF ANT PWR Return
24	I	DC Return 1
25	I	DC Power 2 IN
26	I	Emergency Channel*
27	I	COM MIC Audio IN
28	I	A429 IN3 B
29	O	NAV Audio LO OUT
30	O	NAV Audio HI OUT
31	O	ADF MOD 90 OUT
32	O	A429 Out2 B
33	O	MMDS FAN 5V OUT
34	I	A429 IN1 B
35	O	A429 OUT3 B
36	I	A429 IN2 B
37	I	Pgm Pin Common
38	O	ADF ANT PWR OUT
39	I	DC Power 1 IN
40	I	DC Return 2
41	I	Download*
42	I/O	VDL Interlock IN OUT*
43	O	COM Audio/Sidetone LO OUT
44	O	COM Audio/Sidetone HI OUT

Table 2-3 Antenna Connector Functions

Connector	Pin	I/O	Description
J101	1	I/O	COM RF
J102	1	I	ADF RF IN
J103	1	I	NAV RF IN
J104	1	I	Glideslope RF IN

Note: * indicates the Pin is active GND.

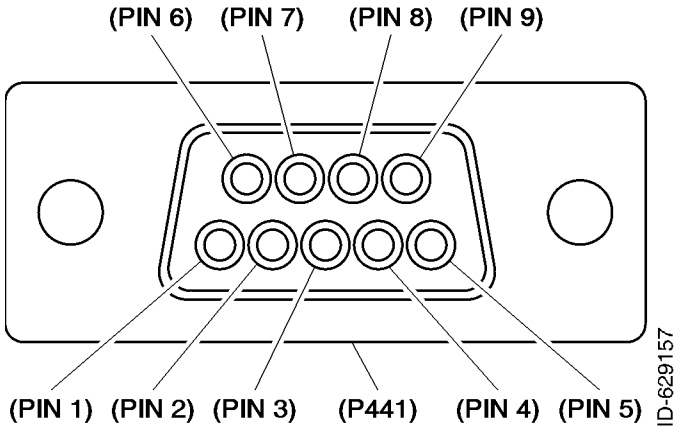

Figure 2-20 (Sheet 1 of 1) KA 44B Mating Connector Front View (Part of Antenna Cable Assembly, PN 200-02586-0020)

Table 2-4 KA 44B Pin Functions

PIN	I/O	SIGNAL NAME
1	I	ANTENNA POWER
2	I	LOOP ENABLE
3	O	RF INPUT
4	I	ADF MOD 90 Out
5	I	ADF MOD 0 Out
6		NO CONNECTION
7		GROUND
8		INNER SHIELD
9		MIDDLE/OUTER SHIELD

2.3.5.5 Crimp Tool Information

Table 2-5 Crimp Tools and Accessories

Crimp Tool	Honeywell PN 005-02012-0021, Positronic 9507 or equivalent
Positioner	Positronic 9502-3 or equivalent
Insertion/Extraction Tool	Positronic 4811-2-0-0 or equivalent

NOTES:

1. Deleted.
2. Shield braids are to be combed/twisted, threaded through the slots in (PN 073-01141-0002) and clamped to backshells using PN 200-10452-0001 bar clamp assemblies.
3. Center of gravity (CG) locations are approximate and do not include mating cables.
4. Deleted.
5. If a ground bond of 2.5 milliohm maximum impendence cannot be achieved through the mounting surfaces the installer can use a bond strap from the connector housing(s) to the airframe.
6. Secure rack with six stainless steel flathead 100 degrees, No. 6-32 screws, such as PN MS24693-CXX (not included).
7. Remove protective covers from connectors and locking rod before installation.
8. Weight (tolerance ±12%): MMDR with install kit 5.45 lbs (2.5 Kg); Install kit 0.85 lbs (0.4 Kg).
9. Connector housing can be installed with wires exiting from top or bottom. Allow 1.50 inches (38.1 mm) of clearance from top or bottom of the unit for proper wire bend radius.
10. Notch in front of unit can be used for removal of unit from rack. A screwdriver or similar tool can be inserted into the slot to assist with the removal without damaging the unit.
11. Heat shrink to be used on 20 AWG power and ground pins only (4 places). Heat shrink tubing to be placed on the wire above the crimp. After the contact is locked into the connector insert, the shrink tubing must cover the exposed portion of the contact and 0.15 inch (3.8 mm) minimum of the wire. After shrinking, the tubing must seal the joint where the wire meets the contact.

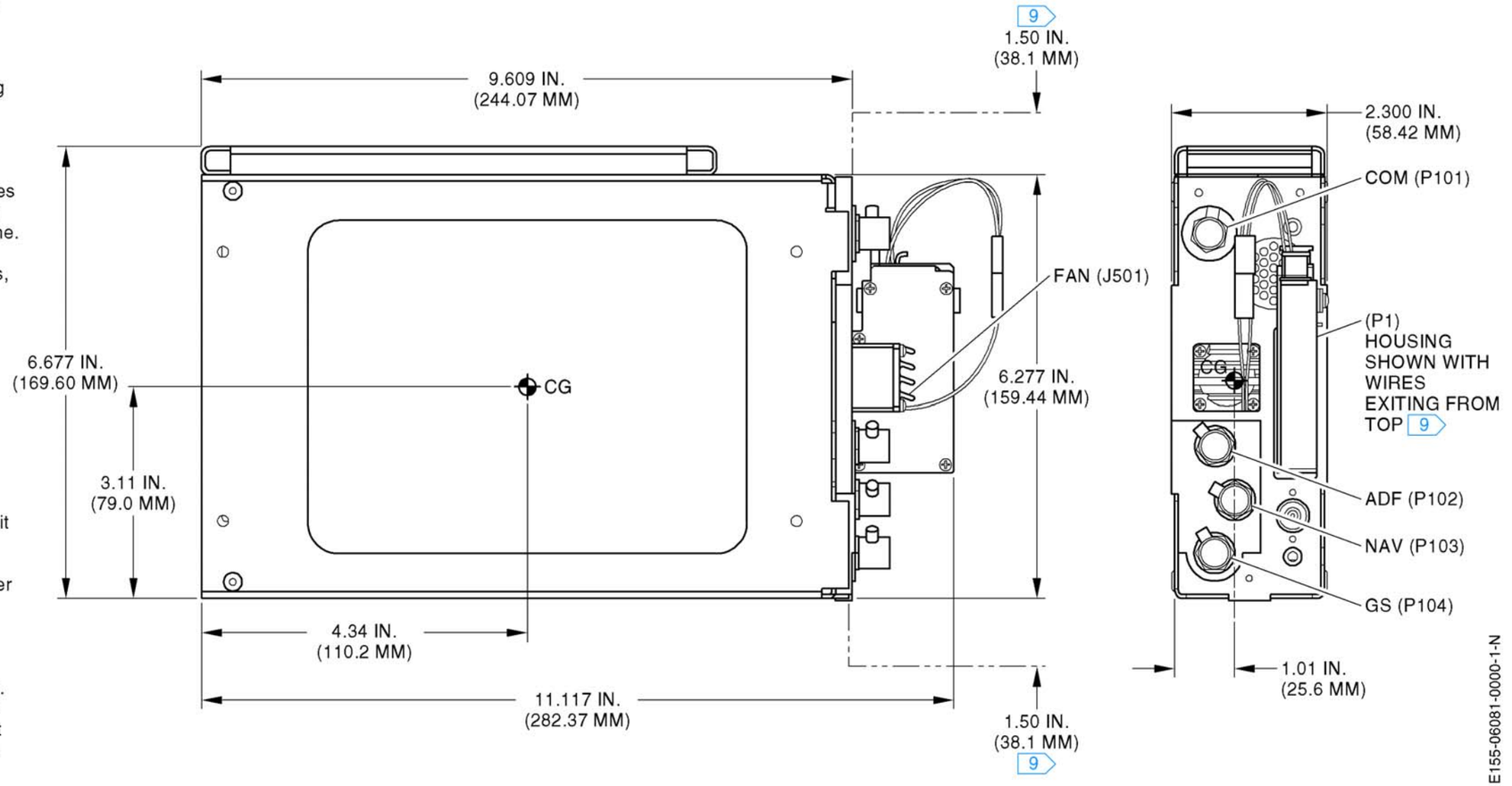

Figure 2-21 (Sheet 1 of 4) KTR 2280A Installation Drawing (Dwg No 155-06081-0000 Rev N)

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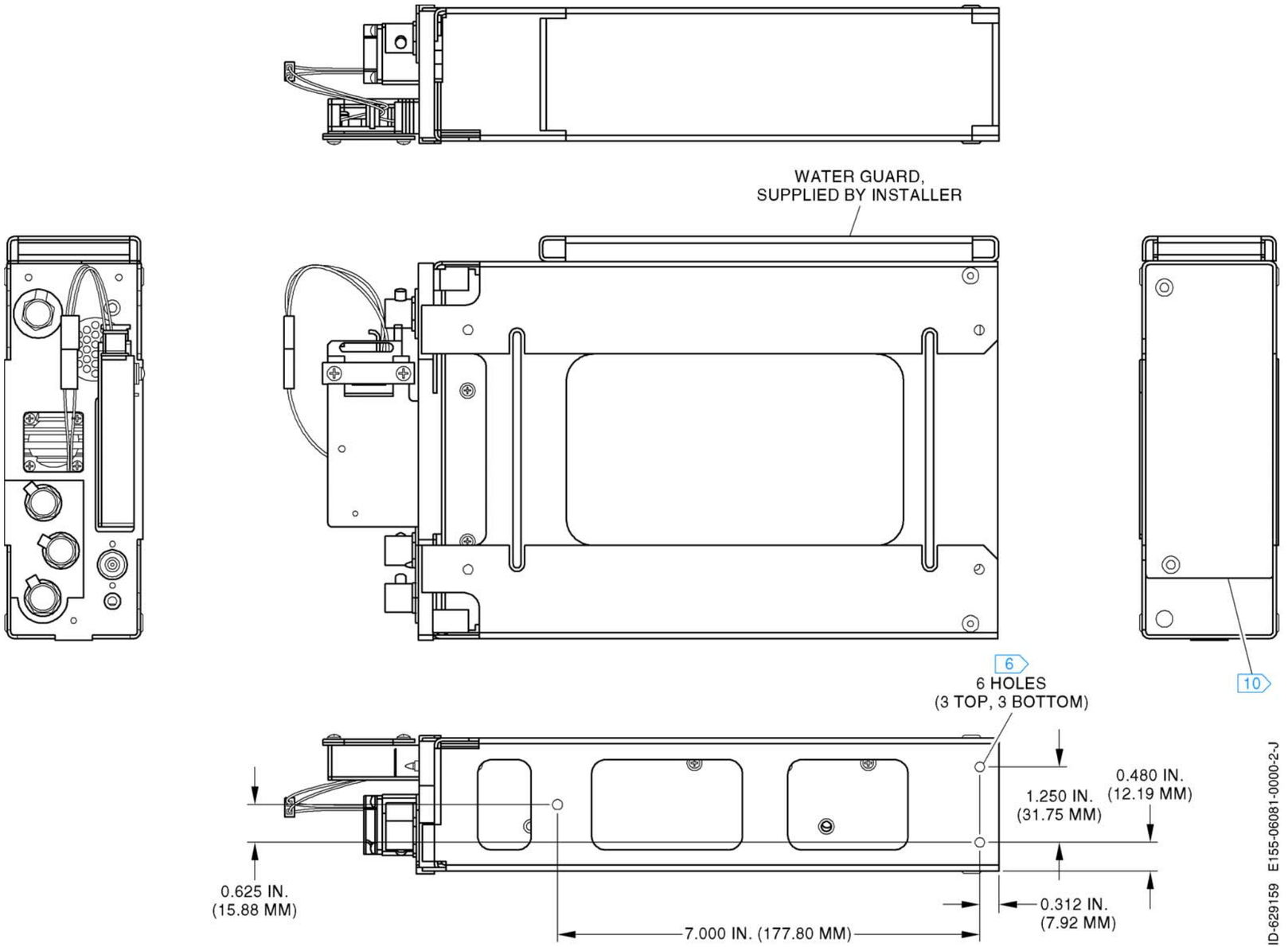

Figure 2-21 (Sheet 2 of 4) KTR 2280A Installation Drawing (Dwg No 155-06081-0000 Rev N)

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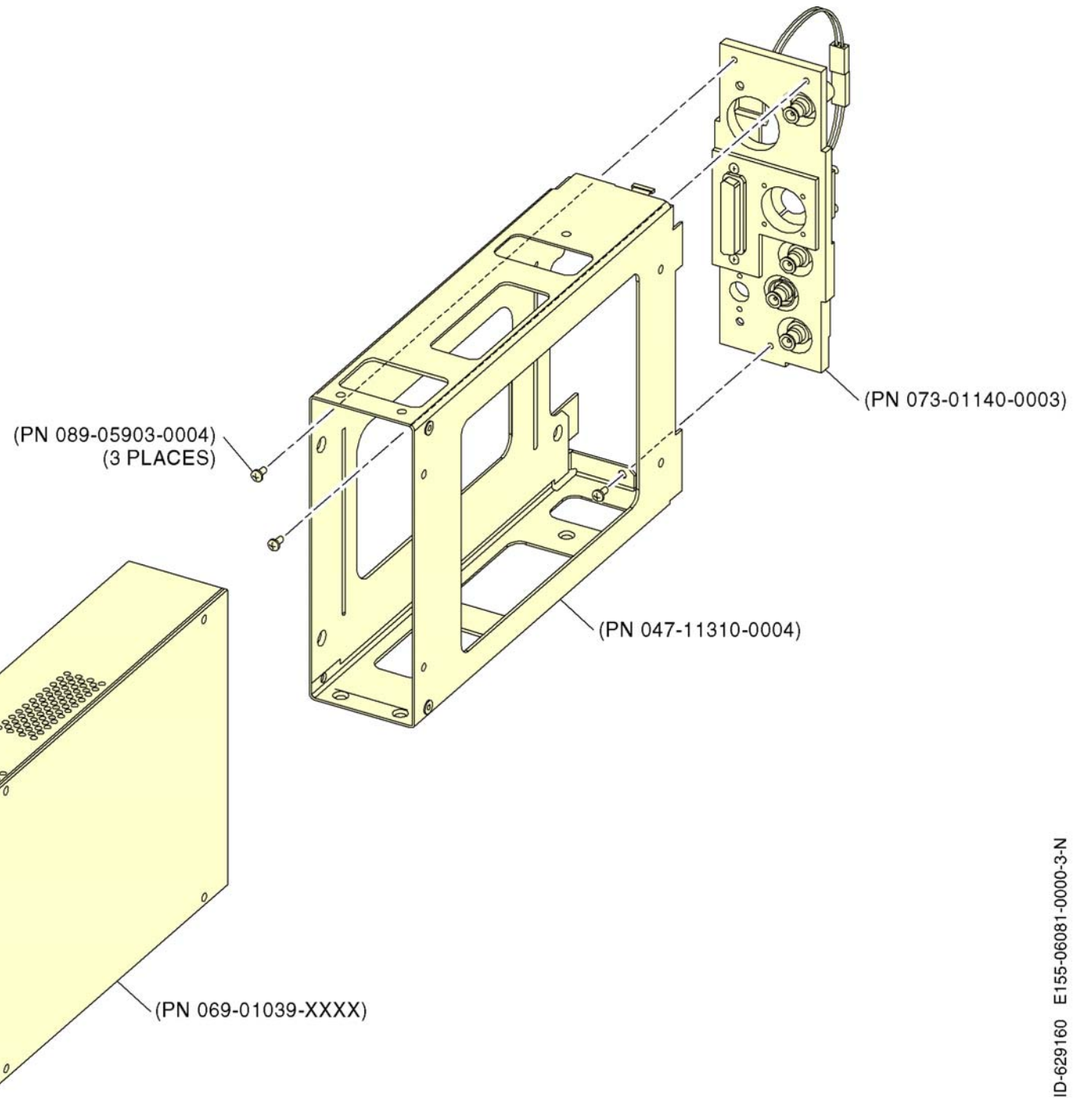

ID-629160 E155-06081-0000-3-N

Figure 2-21 (Sheet 3 of 4) KTR 2280A Installation Drawing (Dwg No 155-06081-0000 Rev N)

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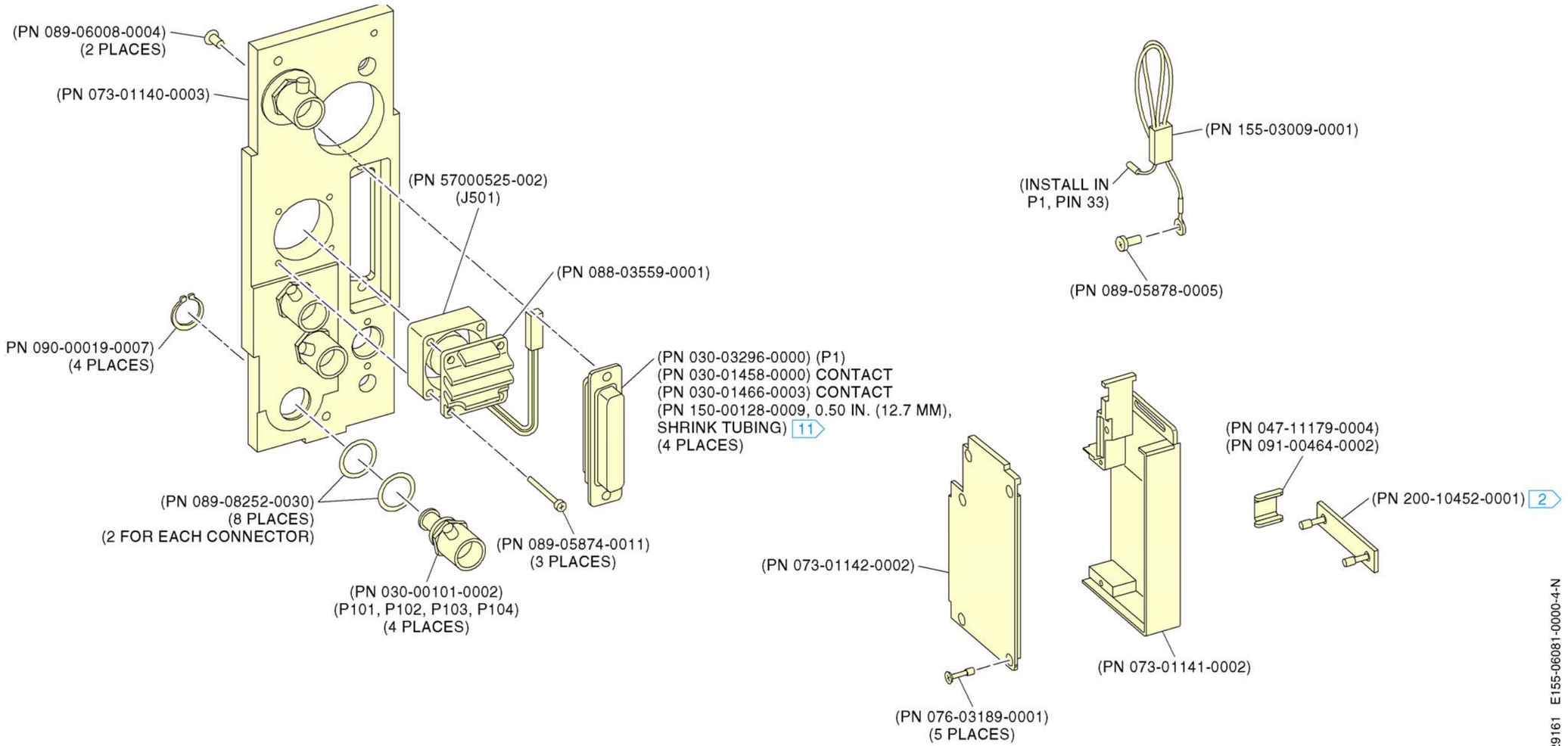

HARNESS - BACKPLATE ASSEMBLY

Figure 2-21 (Sheet 4 of 4) KTR 2280A Installation Drawing (Dwg No 155-06081-0000 Rev N)

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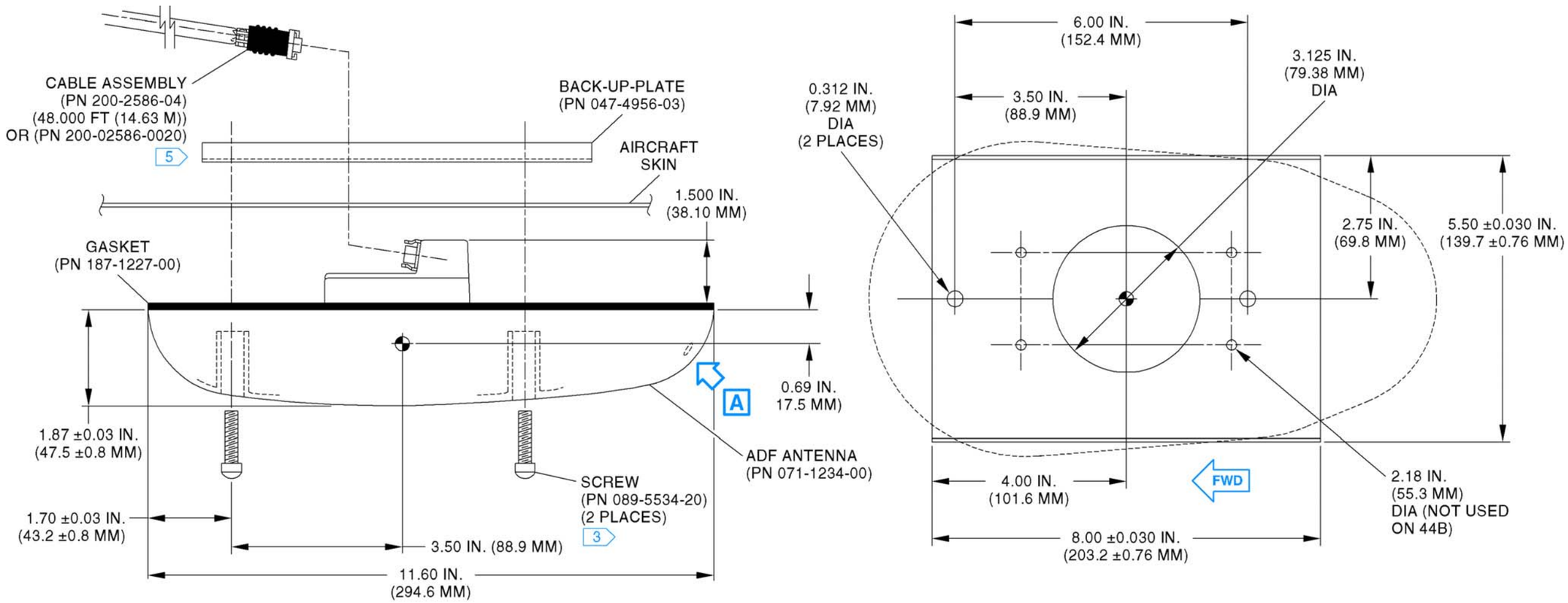

-WARNING-

1. KA44B, SN 8799 and below:
   Drain hole, located at rear of antenna, must be plugged with a caulking compound or sealant RTV 3116 (PN 016-1021-00).
2. KA44B, SN 8800 and above:
   Drain hole has been eliminated. No action is required.

A

NOTES:

1. Deleted.
2. Nominal weight: 4.2 LBS. (1.89 Kg).
3. Two screws, (PN 089-05534-0036) are supplied with antenna for installations that require longer mounting screws.
4. Mounting screw holes must be filled with sealant RTV 3116 (PN 016-01021-0000) if antenna is top mounted.
5. KTR 2280 ADF installations must use only (PN 200-02586-0020) cable and (PN 050-01756-0020) kit.

ID-629162 E155-05334-0000-1-AC

Figure 2-22 (Sheet 1 of 1) KA 44B Outline and Mounting Drawing (Dwg No 155-05334-0000 Rev AC)

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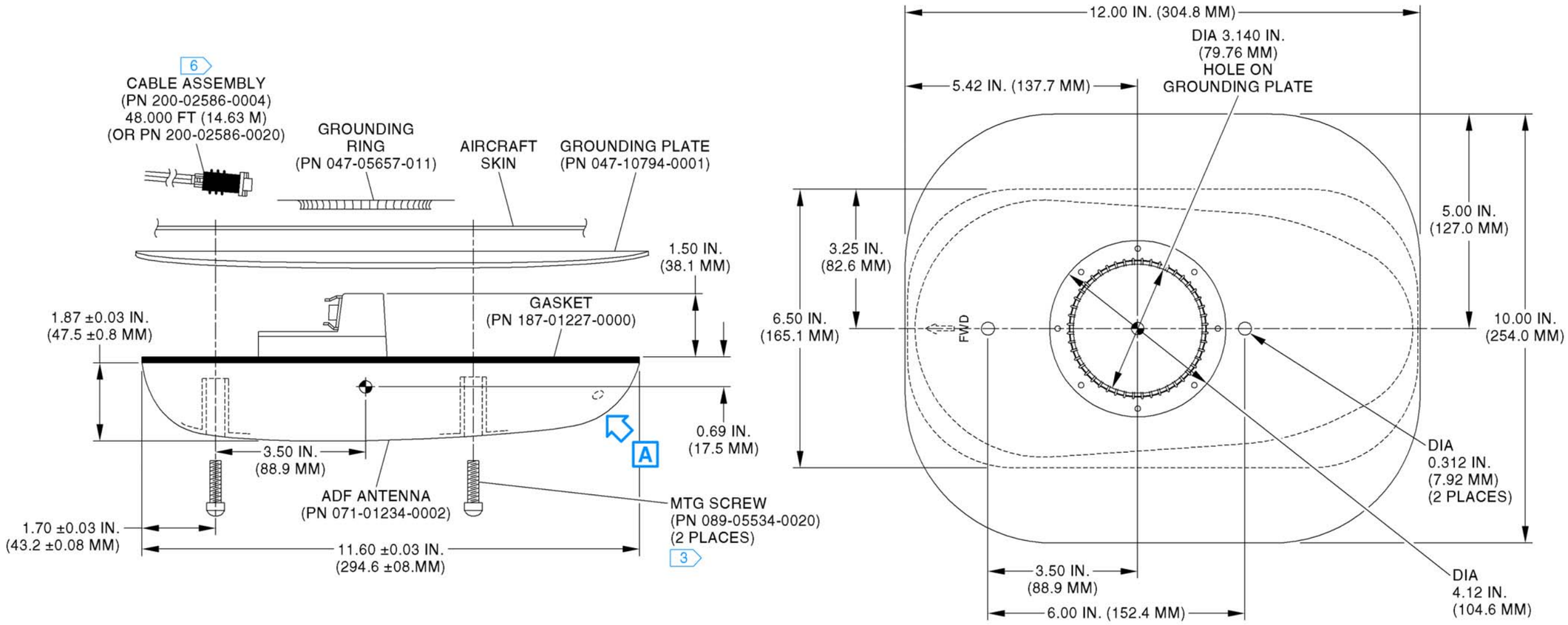

-WARNING-

1. KA44B, SN 8799 and below:
   Drain hole, located at rear of antenna, must be plugged with a good caulking compound or sealant such as RTV 3116.
2. KA44B, SN 8800 and above:
   Drain hole has been eliminated. No action is required.

A

NOTES:

1. Deleted.
2. Nominal weight: 4.2 lbs. (1.89 kg).
3. Screws (PN 089-05534-0038) (2 places) are also supplied with antenna for installations that require longer mounting screws.
4. Mounting screw holes must be filled with sealant such as RTV 3116 if antenna is top mounted.
5. Grounding ring (PN 047-05657-0011) and adapter plate (PN 047-10794-0001) are installed to aircraft skin using rivets. Suggested rivets are MS 2426 AD.
6. KTR 2280 ADF installations must use only (PN 200-02586-0020) and (PN 050-01756-0020) kit.

ID-631692 E155-05334-0010-1-AD

Figure 2-23 (Sheet 1 of 1) KA 44B Outline and Mounting Drawing (Dwg No 155-05334-0010 Rev AD)

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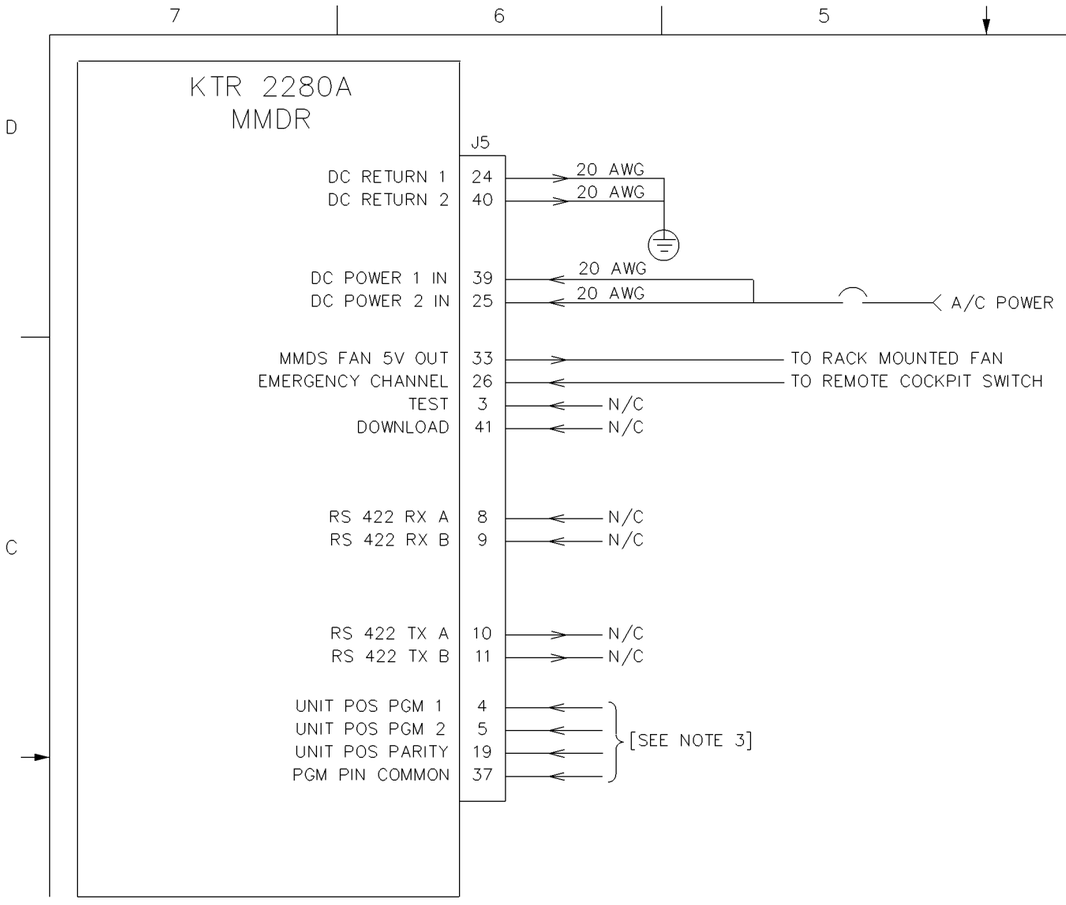

NOTES:

1. CONNECT THE SHIELD/PIN TO AIRCRAFT GROUND WITH AS SHORT A CONDUCTOR AS PRACTICAL.
2. ALL STRANDED WIRE SHALL CONFORM TO SAE AS 22759/16 SPEC OR EQUIVALENT. ALL SHIELDED WIRE SHALL CONFORM TO NEMA WC 27500 SPEC OR EQUIVALENT. ALL WIRES ARE 22 GAUGE UNLESS OTHERWISE NOTED.
3. PER THE FOLLOWING UNIT SELECTION TABLE, 0 = STRAP TO PIN 37, 1 = OPEN (N/C).

PIN 4	PIN 5	PIN 19	SELECT UNIT
0	0	1	KTR 2280A #1
0	0	0	N.A.
1	0	0	KTR 2280A #2
1	0	1	N.A.
0	1	0	KTR 2280A #3
0	1	1	N.A.
1	1	1	N.A.
1	1	0	N.A.

4. REFER TO FAA ADVISORY CIRCULAR AC 43.13-1B CHG 1, CHAPTER 11 FOR INFORMATION ON BREAKER SIZING AND WIRE RUN LENGTH. SEE THE KTR 2280A INSTALLATION MANUAL FOR KTR 2280A CURRENT REQUIREMENTS.

SCHEMATIC DIAGRAM SHEET NO. 1 OF 5

ID-631684 E155-01835-0000-1

Figure 2-24 (Sheet 1 of 5) KTR 2280A Interconnect Diagram (Dwg No 155-01835-0000 Rev -)

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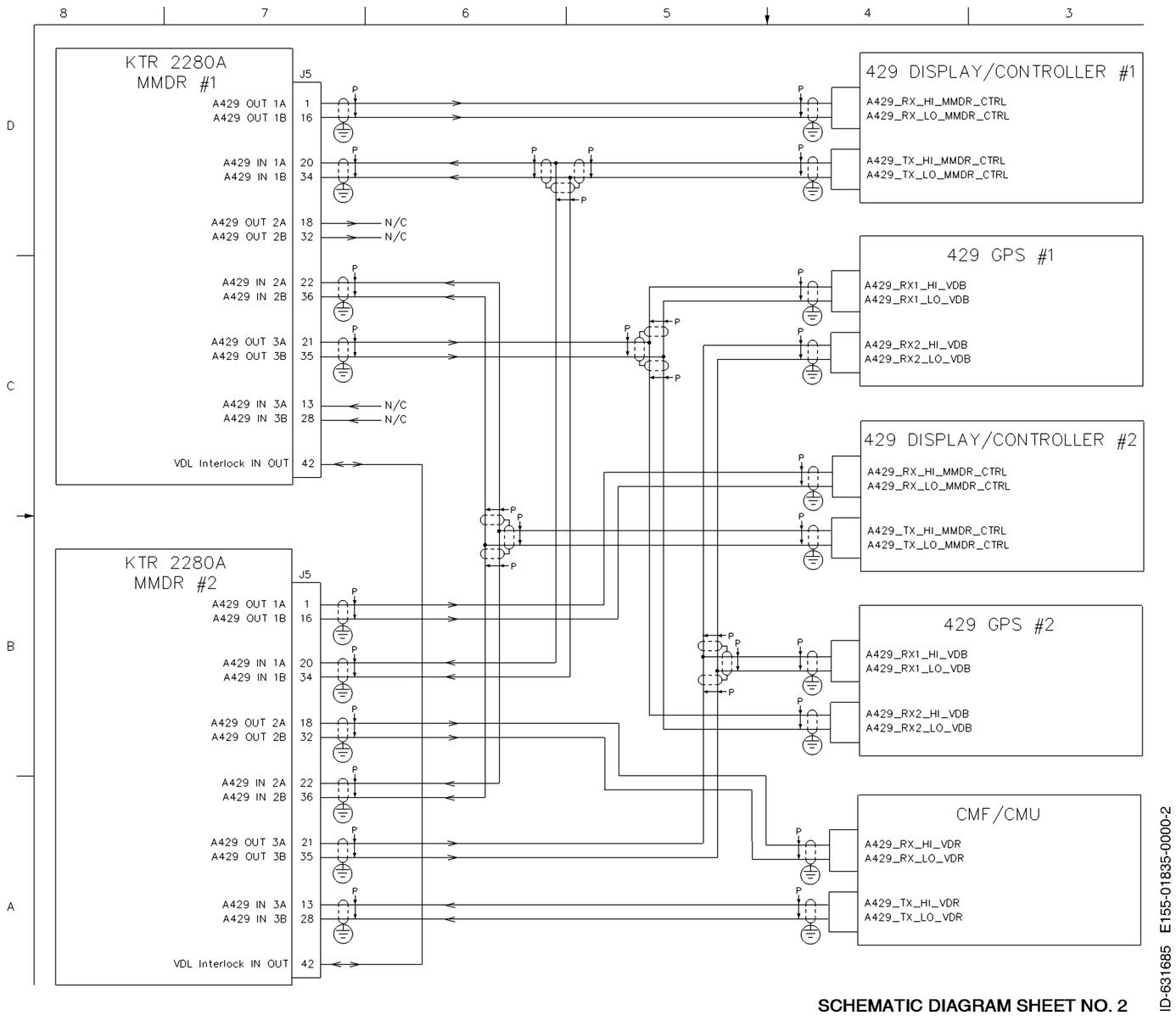

Figure 2-24 (Sheet 2 of 5) KTR 2280A Interconnect Diagram (Dwg No 155-01835-0000 Rev -)

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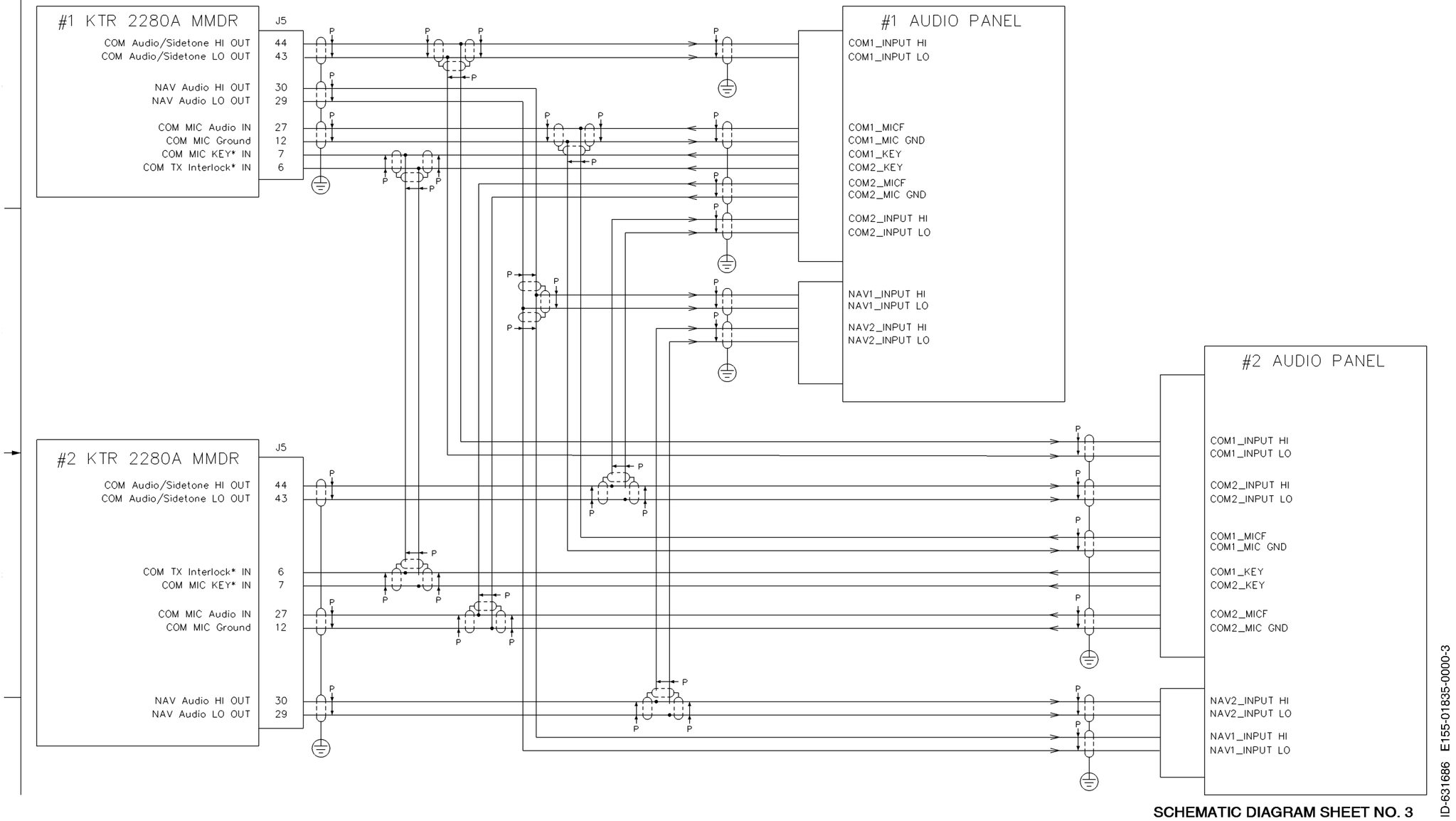

Figure 2-24 (Sheet 3 of 5) KTR 2280A Interconnect Diagram (Dwg No 155-01835-0000 Rev -)

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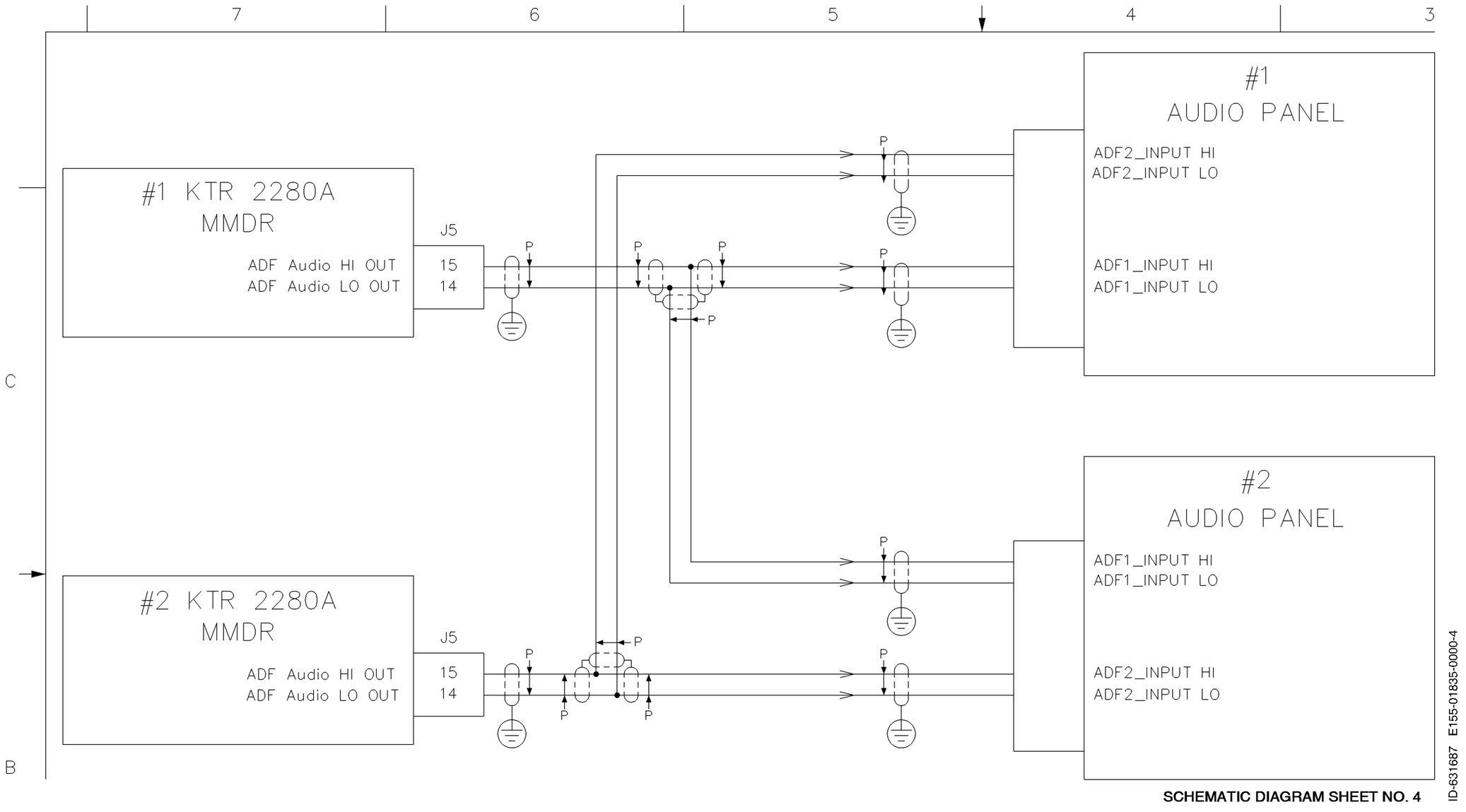

Figure 2-24 (Sheet 4 of 5) KTR 2280A Interconnect Diagram
(Dwg No 155-01835-0000 Rev -)

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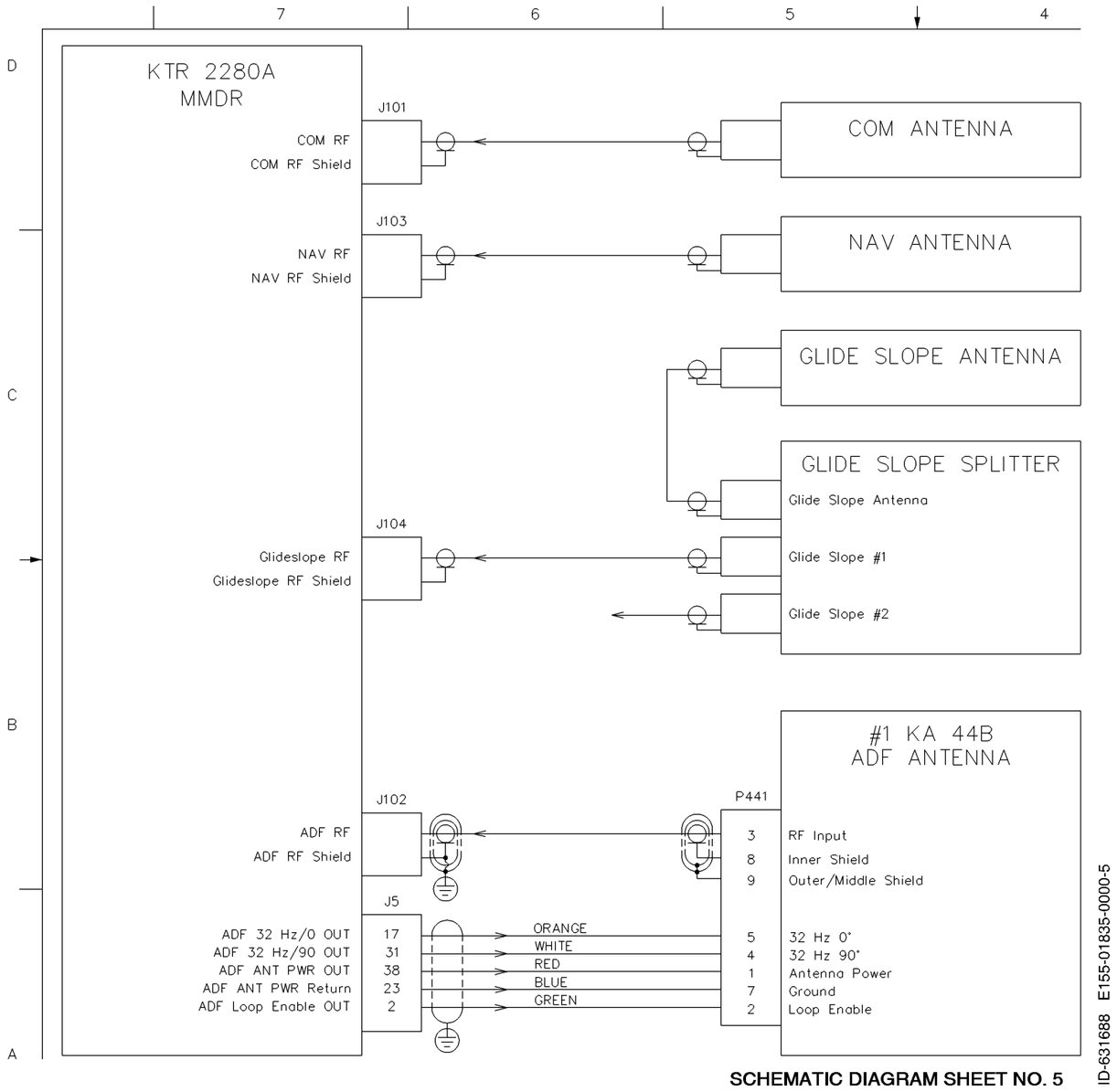

Figure 2-24 (Sheet 5 of 5) KTR 2280A Interconnect Diagram (Dwg No 155-01835-0000 Rev -)

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2.4 POST-INSTALLATION CHECKS

2.4.1 KTR 2280A MMDR Post-Installation Inspection and Ground Test

2.4.1.1 INSPECTION

Table 2-6 Inspection/Check Procedure is a visual inspection/check procedure that must be performed after system installation as part of a system checkout. A post-installation test per paragraph 2.4.1.2 Ground Tests must be performed. In addition, the procedure must be used as a periodic maintenance inspection check.

Table 2-6 Inspection/Check Procedure

EQUIPMENT	INSPECTION/CHECK PROCEDURE
KTR 2280A MMDR	A. Inspect external surface for damage.
	B. Check that the unit is securely installed and that retaining mechanism is securely tightened.
	C. Ensure that all connections in the mounting tray are properly mounted and secure.
Antennas	A. Inspect external surfaces for damage.
	B. Check that antenna is properly mounted and mounting screws are tight.
	C. Ensure that antenna coaxial cable connectors are properly mated and secure.

(1) Perform the following inspections on the overall system:

(a) Check that cables do not interfere with aircraft controls or other equipment.
(b) Check cabling for proper routing and check security of tie-down points. Inspect and adjust cable runs to ensure that cables are not strained, kinked, or severely twisted and are not exposed to rough or sharp surfaces.

(2) System Interwiring Check

To check the aircraft and MMDR system interconnections proceed as follows:

(a) Check that all cables and interwiring are installed in accordance with the interwiring and cable harness fabrication instructions (refer to paragraph 2.3.5.1 KTR 2280A Interconnection and Cable Harness Fabrication).
(b) Using the applicable interconnection information, check wiring for proper destinations, opens and shorts.
(c) Check RF cables for insertion loss and VSWR.

(3) Visual Inspection

In conjunction with system installation, perform the inspection/check procedure. Refer to Table 2-6 Inspection/Check Procedure.

2.4.1.2 Ground Tests

(1) Post-Installation Test (NAV/COM Functionality)

Perform a ground check of the installation before the flight test. Using a local frequency, confirm that the COM function can receive and transmit a modulated signal. Using a ramp tester, confirm that VOR, LOC, and GS needle deflections move in the correct direction, the To/From flag is the proper sense, and that the warning flags are functioning properly. Check all aircraft control movements to be sure no electrical cables interfere with their operation.

CAUTION: AS AN ADDED PRECAUTION BEFORE ANY FLIGHT TESTS, CHECK THE ANTENNA. VSWR MUST BE CHECKED WITH AN IN-LINE TYPE WATTMETER INSERTED IN THE COAXIAL TRANSMISSION LINE BETWEEN THE TRANSCEIVER AND THE ANTENNA. ANY PROBLEM WITH THE ANTENNA INSTALLATION WILL MOST LIKELY BE SEEN AS A HIGH REFLECTED POWER.

NOTE: Installed system transmitter power may show considerably less that the manufacturer's rating of 16 W (minimum). There are several reasons for this:

1. It is not uncommon for an installation to have up to as much as 1 dB of RF transmission line cable loss. This would reduce a 16 W transmitter output to 12.7 W.
2. RF power meter test equipment that has an accuracy of ± 0.3 dB would cause power reading variations as high as ± 1 W.
3. The effect of antenna VSWR in a given installation will affect the output power. The VSWR is a function of the antenna design itself, aircraft skin properties and proximate metallic features of the airframe, and the size of the metallic surface the antenna is bonded to. Note that the committees that wrote the Minimum Operation Performance Standards to which the VHF COM system is TSO'd are aware of this characteristic. They have established that transmitter power for a 16 W (minimum) transmitter must not drop below 8.0 W into a 2:1 VSWR and 6.4 W into a 3:1 VSWR (Refer to RTCA-DO-186B and Eurocae ED-23C).

(2) Post-Installation Test (ADF Functionality)

A quick preliminary check can be made by tuning to a local AM broadcast station or a strong NDB station. Check for satisfactory audio (this must be done where clear reception is possible, preferably outside of the hangar).

(a) Quadrantal Error Adjustments

The system has been factory adjusted to compensate for a typical airframe. Therefore, little or no compensation must be required. Nonetheless, the KTR 2280A provides software adjustment of Quadrantal Error (the average amount of quadrantal error (QE) that exists due to the shape of the airframe). The values for these alignments are stored within the aircraft system maintenance computer and downloaded to the KTR 2280A on power up. If this download does not occur the KTR 2280A uses the last values that were loaded.

The KA 44B ADF antenna, like most modern ADF antennas, can have inherent errors at the quadrantal (45°, 135°, 225° and 315°) bearings relative to the antenna's boresite. The following procedure details the process for setting a KTR 2280A configuration parameter to allow the radio to automatically compensate for these inherent errors. It is very important that this procedure be followed exactly as stated to ensure these quadrantal bearings are properly compensated.

This procedure can be carried out at any location, however care must be exercised to ensure that the chosen location is magnetically "clean". Usually an airfield's compass

rose location is a good choice since magnetically “clean” is one of the criteria for establishing compass rose location.

NOTE: Ensure that QE = 0 is the value being fed or the last value that was fed to the KTR 2280A before performing this procedure.

1. Point the nose of the aircraft directly at the emitter (NDB or AM broadcast radio station) being used for this purpose. Confirm this orientation by verifying the ADF indicator’s bearing pointer is pointing directly to the lubber line (aircraft nose reference).
2. Record the magnetic heading of the aircraft using the aircraft directional gyro or magnetic compass.
3. Using the aircraft’s directional gyro or magnetic compass as a guide, rotate the aircraft 45° to the left such that the aircraft magnetic heading is now 45° less that the value found in Step 2.
4. Record the number of degrees by which the ADF bearing has moved relative to the ADF indicator’s lubber line. (This number must be a positive number and must be approximately 45°.) Log this number as Bearing_45.
5. Using the aircraft’s directional gyro or magnetic compass as a guide, rotate the aircraft another 45° to the left so that the aircraft magnetic heading is now 90° less than the value found in Step 2.
6. Record the number of degrees by which the ADF bearing indication has moved relative to the ADF indicator’s lubber line. (This number must be a positive number and must be approximately 90°.)
7. Confirm that the value in Step 6 is within ±5° of 90°. If not, the aircraft has a magnetic anomaly that precludes the ability to calculate an acceptable QE adjustment The QE alignment process must terminate at this point and not resume until any aircraft related anomalies have been corrected. (Note: Problems with this step could also be due to the airfield location where the QE alignment procedure is being performed if that location is not magnetically “clean”.)
8. Using the aircraft’s directional gyro or magnetic compass as a guide, rotate the aircraft another 45° to the left so that the magnetic heading is now 135° less than the value found in Step 2.
9. Record the number of degrees by which the ADF bearing indication has moved relative to the ADF indicator’s lubber line. (This number must be a positive number and must be approximately 135°.) Log this number as Bearing_135.
10. Using the aircraft’s directional gyro or magnetic compass as a guide, rotate the aircraft another 45° to the left so that the aircraft magnetic heading is now 180° less than the value found in Step 2.
11. Record the number of degrees by which the ADF bearing indication has moved relative to the ADF indicator’s lubber line. (This number must be a positive number and must be approximately 180°.)
12. Confirm the value recorded in Step 11 is within ±5° of 180°. If not, the aircraft has a magnetic anomaly the precludes the ability to calculate an acceptable QE adjustment. The QE alignment process must terminate at this point and not resume until the aircraft related anomalies have been corrected. (Note: Problems with this step could also be due to the airfield location where the QE alignment procedure is being performed if that location is not magnetically “clean”.)
13. Using the aircraft’s directional gyro or magnetic compass as a guide, rotate the aircraft another 45° to the left so the aircraft magnetic heading is now 225° less than the value found in Step 2.
14. Record the number of degrees by which the ADF bearing indication has moved relative to the ADF indicator’s lubber line.

    (This number must be a positive number and must be approximately 225°.) Log this number as Bearing_225.
15. Using the aircraft’s directional gyro or magnetic compass as a guide, rotate the aircraft another 45° to the left so that the aircraft magnetic heading is now 270° less than the value found in Step 2.

16. Record the number of degrees by which the ADF bearing indicator has moved relative the ADF indicator's lubber line (This number must be a positive number and must be approximately 270°.)
17. Confirm the value recorded in Step 16 is within ± 5° of 270°. If not, the aircraft has a magnetic anomaly that precludes the ability to calculate an acceptable QE adjustment. The QE alignment process must terminate at this point and not resume until the aircraft related magnetic anomalies have been corrected. (Note: Problems with this step could also be due to the airfield location where the QE alignment procedure is being performed if that location is not magnetically "clean".)
18. Using the aircraft's directional gyro or magnetic compass as a guide, rotate the aircraft another 45° to the left so that the aircraft magnetic heading is now 315° less than the value found in Step 2.
19. Record the number of degrees by which the ADF bearing indicator has moved relative to the ADF indicator's lubber line. (This number must be a positive number and must be approximately 315°.) Log this number as Bearing_315.
20. Using the following formulas, calculate the QE offset:

    QE_45 = 45 - Bearing_45 (This could be a negative number if Bearing_45 is > 45)

    QE_135 = Bearing_135 - 135 (This could be a negative number if Bearing_135 is < 135)

    QE_225 = 225 - Bearing_225 (This could be a negative number if Bearing_225 is > 225)

    QE_315 = Bearing_315 - 315 (This could be a negative number if Bearing_315 is < 315)

    QE = ((QE_45) + (QE_135) + (QE_225) + (QE_315)) / (4)
21. Enter the value calculated in Step 20 into the KTR 2280A Parameter table per 2.5 KTR 2280A INSTALLATION PARAMETER MODIFICATIONS.
22. Recheck the relative bearings abd readjust the QE compensation as necessary to split the error at the quadrantal points (45°, 135°, 225° and 315°) to obtain the lowest possible error.

(b) Operational Checks

The following operational checks are to verify proper operation of the ADF function of the KTR 2280A and can be made with the aircraft in the parking area.

1. Place the ADF in the ANT mode and tune in several known stations. Verify that audio reception is satisfactory and that volume control operation is normal. Verify that the ADF indicator needle is parked at the 90 degree position relative to the noise of the aircraft. Place the unit in the ADF mode and verify that the needle points to the station.
2. Select the BFO function to enter the BFO mode and verify that the BFO tone is present in the receiver audio (if a keyed CW station is used the tone heard will be the coded identifier).

2.4.2 KTR 2280A Post-Installation Flight Tests

2.4.2.1 COM TRANSCEIVER FLIGHT TEST

To check the COM transceiver, maintain altitude of at least 1500 feet and contact a ground station facility at a range of at least fifty nautical miles. Contact a ground station close in. Disable the automatic squelch and listen for any unusual electrical noise which would reduce the COM receiver sensitivity by increasing the squelch threshold. If possible, verify the communications capability on both the high and low end of the VHF COM band. Ensure that the COM mode selector is capable of individually selecting all three modes (one mode at a time).

2.4.2.2 NAV RECEIVER FLIGHT TEST

To check the VOR/ILS system, select a VOR frequency within a forty nautical mile range. Listen to the VOR audio and ensure that no electrical interference such as magneto noise is present. Check the tone

identifier filter operation. Fly inbound and outbound on a selected VOR radial and check for proper LEFT-RIGHT and TO-FROM indications. Check the VOR accuracy.

NOTE: VOR ground station scalloping may be present.

To check the localizer and glideslope functions, select an appropriate ILS frequency and fly an approach to the proper runway. Check for proper LEFT-RIGHT and UP-DOWN indications.

2.4.2.3 ADF RECEIVER FLIGHT TEST

Confirm that bearing indications to several local NDB facilities appear reasonable. Listen to the ADF audio and ensure that no unusual electrical interference is present.

2.5 KTR 2280A INSTALLATION PARAMETER MODIFICATIONS

The KTR 2280A has several parameters that can be adjusted during installation in order to conform the unit to a given installation. Parameter modifications must only be performed
by a qualified avionics technician. Table 2-7 Unit Parameters, lists the KTR 2280A adjustments accessible by the technician to facilitate the unit installation.

NOTE: KTR 2280A units sent to the factory for repair will be returned to service with their factory defaults reset as shown in Table 2-7 Unit Parameters.

The method for setting these parameters is a function of the specific installed system and the user interface used for personality module settings. Refer to the appropriate STC Installation Manual for specific instructions. The KTR 2280A responds to installed system personality module settings through high speed ARINC 429 labels 300, 301, 302, and 303. These labels occur periodically at a 1 Hz rate.

Table 2-7 Unit Parameters

Parameter	MMDR Factory Default	Minimum Setting	Maximum Setting	Resolution
COM Carrier Squelch (-dBm)	88	85	100	1
COM Emergency Freq. (MHz)	121.500	118.000	136.990	*
COM Emergency Volume (dB) [1]	20	0	72	1
COM Sidetone Level (dB)[1]	52	0	72	1
COM Squelch (SNR dB)	12	3	20	1
COM Microphone Gain[2]	21	0	31	**
QE Offset (degrees)	0	-20	+20	0.1
* 8.33 kHz channel spacing ** Each resolution increment is equivalent to 1.5 dB. Total range is -31.5 dB to 15.0 dB				

NOTE: 1: This setting represents attenuation (in dB) relative to rated audio output level.

NOTE: 2: This setting is a relative number only. Each numeric value represents a change of 1.5 dB. Nominal setting, which represents the level provided by typical microphones, is the default

numeric value of 21. This control provides amplification (for unusually weak microphones) of up to 15 dB (setting of 31) or attentuation (for extra sensitive microphones) of up to 31.5 dB (setting of 0) relative to the default.

2.6 ARINC 429 INTERFACE

The KTR 2280A has three high speed ARINC 429 transmitters and three high speed ARINC 429 receivers. All labels are transmitted on both transmit channels. The same data is transmitted over both channels

Table 2-8 ARINC 429 Output Labels

Function	Label	Parameter	Interval (ms)
NAV	034	VOR/ILS Frequency	200
	053	VOR/ILS Standby (Preset) Frequency	200
	173	Localizer Deviation	100
	174	Glideslope Deviation	100
	222	VOR Bearing	100
	242	VOR/ILS Station Ident (Characters 1-2)	200
	244	VOR/ILS Station Ident (Characters 3-4)	200
	265	VOR/ILS Volume	200
COM	030	VHF COM Frequency	200
	047	VHF Aux/Guard COM Frequency	200
	052	VHF COM Standby (Preset) Frequency	200
	263	VHF Aux/Guard COM Frequency	200
	266	VHF COM Volume	200
	267	VHF COM Status	200
ADF	032	ADF Frequency	200
	162	ADF Bearing	100
	262	ADF Volume	200
CMC	350	Member System Status	1000
	352	MMDF System Fault Report	1000
	377	Member System Identification	1000
VDL	172	System Address Label (SAL)	1000
	270	VDR Status Word	1000

Function	Label	Parameter	Interval (ms)
VDL	304	Williamsburg BOP	Burst
	377	VDR Equipment ID	1000
VDB	033	Landing Mode/Frequency	200
	045	Message Block Start	Burst
	046	Message Block Data	Burst
* MMDR hardware fault (BIT 19 in Label 352) is set when the unit detects a hardware fault and/or malfunction of the hardware that can result in incorrect data.			

Table 2-9 ARINC 429 Input Labels

Function	Label	Parameter	Interval (ms)
NAV	034	Set VOR/ILS Frequency	200
	053	Set VOR/ILS Standby (Preset) Frequency	200
	265	Set VOR/ILS Volume	200
COM	030	Set VHF COM Frequency	200
	047	Set VHF Aux/Guard COM Frequency	200
	052	Set VHF/COM Standby (Preset) Frequency	200
	263	Set VHF Aux/Guard COM Volume	200
	266	Set VHF COM Volume	200
ADF	032	Set ADF Frequency	200
	262	Set ADF Volume	200
CLOCK	150	GMT (UTC)	1000
	260	Date	1000
FLIGHT	151	Flight Leg	1000
APM	300	MMDR Configuration Options #1	1000
	301	MMDR Configuration Options #2	1000
	302	MMDR Configuration Options #3	1000
	303	MMDR Configuration Options #4	1000
	304	MMDR Configuration Options #5	1000
	305	MMDR Configuration Options #6	1000

Function	Label	Parameter	Interval (ms)
CMC	227	CMC Command and Control	1000
VDB	033	Landing Mode/Frequency	200
VDL	172	System Address label	1000
	214	Aircraft ICAO Address #1	1000
	216	Aircraft ICAO Address #2	1000
	251	Williamsburg BOP VDR #1	Burst
	252	Williamsburg BOP VDR #2	Burst
	253	Williamsburg BOP VDR #3	Burst
	270	Apex CMU Status Word 1	1000
	276	Apex CMU Status Word 2	1000
	276	VDR Mode Command	500

SECTION 3
OPERATION

3.1 GENERAL

The KTR 2280A is a remote mounted radio. As such, the user interface is defined by controllers and displays unique to the particular system configuration. Refer to the appropriate pilot's guide or flight manual supplement for complete operating instructions.

The paragraphs below provide an overview of the controls and displays that are typically available in systems that provide full KTR 2280A functionality.

3.1.1 VHF COM Controls and Displays

A. Frequency Selectors: An active frequency (channel) and a standby frequency (channel) selector. A "swap" or "flip-flop" button may be available for swapping the active and standby frequencies. The KTR 2280A responds to high speed ARINC 429 labels 030 and 052 for the active and standby selections respectively. These labels appear only when a frequency (channel) change is made.

B. Volume Control: A rotational knob or up/down pushbutton to adjust the volume of the COM audio output. The KTR 2280A responds to high speed ARINC 429 label 266 for the COM volume control setting. This label appears only when a volume change is made.

C. RX/TX Annunciators: Some display means indicate when the radio is transmitting (TX Annunciator) and when the radio is receiving (RX Annunciator). This is keyed by the squelch status. The KTR 2280A outputs the RX status and TX status on the high speed ARINC 429 label 267, having a 5 Hz update rate.

D. Squelch Disable Control: Normally a pushbutton that cycles between Squelch Disable and Squelch Enable. The RX annunciator will be displayed during Squelch Disable. The KTR 2280A responds to high speed ARINC 429 label 266 for COM squelch disable (override). This label appears only when a status change is made.

E. Stuck Microphone Annunciator: Some display means to indicate when the Push-to-Talk (PTT) button has been held down beyond the 30 second transmitter time-out period. The KTR 2280A outputs the stuck microphone alert on high speed ARINC 429 label 267, having a 5 Hz update rate.

F. Emergency COM Control: Some means to channel the KTR 2280A transmitter and receiver to a pre-defined emergency frequency (channel) in the event of display and/or control failure. Pin 26 on main connector J1 (Refer to Figure 2-24 KTR 2280A Interconnect Diagram) is the discrete control for this function. Grounding this normally open pin places the unit into Emergency COM Mode.

G. AUX COM channel and volume controls are typically not available. These parameters can be adjusted through APM settings.

3.1.2 VHF NAV Controls and Displays

A. Frequency Selectors: An active frequency (channel) and a standby frequency (channel) selector. A “swap” or “flip-flop” button may be available for swapping the active and standby frequencies. The KTR 2280A responds to high speed ARINC 429 labels 034 and 053 for the active and standby selections respectively. These labels appear only when a frequency (channel) change is made.

B. Volume Control: A rotational knob or up/down pushbutton to adjust the volume of the NAV audio output. The KTR 2280A responds to high speed ARINC 429 label 265 for the volume control setting. This label appears only when a volume change is made.

C. Ident Tone Control: A means to defeat the Ident Tone notch filter in the NAV audio so the 1020 Hz Ident Tone can be heard. The KTR 2280A responds to high speed ARINC 429 label 265 for ident filter control. This label only occurs when a status change is made.

D. The NAV Station Ident is Output on Label 242 and 244.

E. KTR 2280A responds to high speed ARINC 429 label 033 for VDB mode selection. This label only occurs when a mode change is made.

3.1.3 ADF Controls and Displays

A. Frequency Selectors: An active frequency (channel) and a standby frequency (channel) selector. A “swap” or “flip-flop” button may be available for swapping the active and standby frequencies. The KTR 2280A responds to high speed ARINC 429 label 032 for frequency selection. This label only occurs when a frequency (channel) change is made.

B. Volume Control: A rotational knob or up/down pushbutton to adjust the volume of the ADF audio output. The KTR 2280A responds to high speed ARINC 429 label 262 for volume setting. This label only occurs when a change is made.

C. Mode Control: A means to select the following ADF operating modes:

ADF Mode - The normal ADF operating mode.

ANT Mode - The mode in which ADF bearing information is defeated and receiver sensitivity and bandwidth are optimized for audio reception only.
BFO Mode - The mode required in order to use first generation NDB facilities that used on/off carrier keying for identification.

The KTR 2280A responds to high speed ARINC 429 label 032 for mode selection. This label only occurs when a change is made.

3.1.4 VDL Mode A and VDL Mode 2

A. VDL Mode A

Mode A allows the KTR 2280A to exchange downlink and uplink POA data messages with a CMF through a transmit/receive pair of 100 Kbps ARINC 429 digital interfaces.

The downlink message data bits transferred to the KTR 2280A modulate the RF carrier at a rate of 2,400 bps using the DSB-AM MSK modulation scheme.

The KTR 2280A also controls when to access the channel to transmit data. The data link channel selection is still controlled by the CMF, but channel selection messages are exchanged through the same high-speed ARINC 429 interface used to exchange AOA messages which simplifies wiring.

B VDL Mode 2

VDL Mode 2 is the term used to describe a suite of air/ground protocols that increases the data rate of the air/ground link to 31,500 bps.

VDL Mode 2 allows the transition from character-oriented ACARS protocols for end-to-end delivery of messages to one that uses bit-oriented ATN protocols using the same VHF ground and aircraft radios. The KTR 2280A Mode 2 capability supports the transmission and reception of standard ACARS messages using a protocol referred to as AOA.

The KTR 2280A Mode 2 capability also supports the transmission and reception of bit-oriented ATN application messages such as CPDLC. The set of VDL Mode 2 protocols consist of the physical layer protocol, channel access protocol, data link service and management protocol, and Mode 2 network access protocol. The physical layer protocol includes the modulation, data rate, and forward error correction techniques used to transmit data over the air/ground link.

The channel access protocol is the method that allows multiple aircraft to communicate with the ground stations on the same frequency. The data link service and management protocol includes procedures to establish, maintain and hand-off an air/ground link, and ensure error-free delivery of messages. The network access protocol is the interface between users and the Mode 2 air/ground link service providers. As in Mode A, only the physical layer and channel access protocols are performed by the KTR 2280A while the data link service and management, and the network access protocols are performed by the CMF.

The VDL Mode 2 physical layer protocol employs a bit transmission rate of 31,500 bps over the air/ground link on a single 25-kHz channel. The increased utilization of the 25-kHz channel is achieved by use of a bandwidth modulation scheme known as D8PSK. A D8PSK transmitter transmits a carrier whose phase is modulated by the data. The phase can be 0, 45, 90, 135, 180, 225, 270, or 315 degrees. The rate at which the carrier phase is changed is the modulation rate.

The phase difference or D8PSK symbol between successive phase changes can be equal to 0, 45, 90, 135, 180, 225, 270, or 315 degrees. Since there are eight possible phase differences, each phase change (D8PSK symbol) represents three bits of information: 000, 001, 011, 010, 110, 111, 101, or 100.

For example, if the phase changes at a 10.5-kHz rate, the bit transmission rate is equal to 31.5 Kbps. The VDL Mode 2 D8PSK modulator uses the bits in the message, three at a time, to select the carrier phase change at a rate of 10,500 D8PSK symbols each second. A 10.5-kHz D8PSK phase modulation rate corresponds to a D8PSK bit transmission rate of 31.5 Kbps.

The VDL Mode 2 channel access protocol is CSMA modified to let all terminals to have equal chances to access the channel when multiple terminals have data to transmit. The ability to

optimize the CSMA protocol is included in the VDL Mode 2 channel access protocol specification.

As in Mode A, the Mode 2 data link channel selection is controlled by the CMF through the same high-speed ARINC 429 interface used to exchange downlink and uplink AOA or ATN messages. The CMF also dynamically controls the switching between Mode A and Mode 2 operation subject to available coverage. Since the VDL Mode 2 data rate and modulation scheme differ from those used in Mode A, separate VHF frequencies and ground-based VHF equipment must be used to give POA and AOA/ATN service coverage. As a result, the availability of high-speed AOA service depends on the availability of ground stations.

APPENDIX A

KTR 2280A MMDR TRANSCEIVER

ENVIRONMENTAL QUALIFICATION FORMS

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KTR 2280A MMDR TRANSCEIVER

QUALIFICATION ENVIRONMENTAL FORM

Prepared by: Nelson X. Cortes (ETS-Qual)
Engineer II

Approved by: Sudarsana Amuru
Project Lead

Approved by: Todd Sorensen
Technical Manager Software

Approved by: Kathy Cochran
PDQA Representative

Approved by: Sal Navidi
Product Certification, Qual

REVISION HISTORY

Rev.	ECO No.	Description	Date
-	0314690	Initial release	10-May-2017

RTCA DO-160G and EUROCAE ED-14G ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE:	KTR 2280A MMDR
UNIT PART NUMBER:	069-01039-0101
INSTALLATION KIT PART NUMBER:	050-03721-0010
TSO/ ETSO NUMBERS:	TSO-C34e, ETSO-2C34f TSO-C36e, ETSO-2C36f TSO-C40c, ETSO-2C40c TSO-C41d, ETSO-2C41d TSO-C128a, ETSO-2C128 TSO-C160a TSO-C162a TSO-C169a, ETSO-2C169a
MANUFACTURER'S SPECIFICATION:	MPS57000251-001
MANUFACTURER:	Honeywell International Inc.
ADDRESS:	23500 W 105th St, Olathe, KS 66061

Table 1 DO-160G/ED-14G Environmental Test Categories

DO-160G/ED-14G Section	Title	Category	Description
4	Temperature and Altitude	A1F1	
4.5.1	Ground Survival Low Short Term Operating Low		Equipment tested at +55 degree C Equipment tested at -40 degree C
4.5.2	Operating Low Temp (1)		-40C
4.5.3	Ground Survival High Short Term Operating High		Equipment tested at +85 degree C Equipment tested at +70 degree C
4.5.4	Operating High Temp		Equipment tested at +55degree C
4.5.5	In-Flight Loss of Cooling	X	Not Required
4.6.1	Altitude Test	F1	55k
4.6.2	Decompression Test	A1	8k to 55k
4.6.3	Overpressure Test	A1	-15,000 ft, 170kPa
5	Temperature Variation	B	5 deg/ minute
6	Humidity	A	
7	Shock and Crash Safety	B	
8	Vibration	Fixed S Fixed H	Zone 2 Curve B & M Zone 2 Curve R
9	Explosive Atmosphere	X	Not Required
10	Waterproofness	X	Not Required
11	Fluids Susceptibility	X	Not Required
12	Sand and Dust	X	Not Required
13	Fungus Resistance	X	Not Required
14	Salt Spray	X	Not Required
15	Magnetic Effect	Z	<.3 m
16	Power Input	BXI	Momentary power interruptions (DC) tested to >50mS with radio reset allowed. Momentary power interruptions (DC) tested to <=50 ms with no radio reset allowed. Emergency voltage will be 16.0 V instead of 18.0 V.
17	Voltage Spike	A	
18	Audio Frequency Conducted Susceptibility- Power Inputs	BZ	
19	Induced Signal Susceptibility	ZC	
20	Radio Frequency Susceptibility.	RR	
21	Emission of Radio Frequency Energy	M	
22	Lightning Induced Transient Susceptibility	A3J3L3	
23	Lightning Direct Effects	X	Not Required
24	Icing	X	Not Required
25	Electrostatic Discharge (ESD)	A	
26	Flammability	C	

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Olathe, KS

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Revision: -
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NOTES:

1) Operating Low Temperature will be -40 instead of A1's -15 or F1's -20.

2) All tests were conducted at Honeywell, Deer Valley, Phoenix AZ except for Crash Safety Sustained & Impulse, was conducted in Honeywell Aerospace, Redmond, WA and Flammability was conducted in Element Materials Technology, Duarte CA.

KA 44B ENVIRONMENTAL PERFORMANCE

The KA 44B ADF Antenna (Honeywell PN 071-1234-00) is certified to TSO C41c with RTCA DO-160A environmentals per B2D2/A/LJY/XXXXXX/ABABA.

Recent "not-for-certification-credit" testing has been performed on this antenna to determine expected performance in selected DO-160D environmental conditions.

DO-160D Section 20 (RF Susceptibility) Tests

A KA 44B production test sample was subjected to Category TT fields as defined in the test environment called out in RTCA DO-160D Section 20 (Change No. 1). This unit was tested in conjunction with the KTR 2280 Multi-Mode Digital Radio. All conducted and radiated susceptibility performance requirements were passed except for radiated susceptibility in the band of interference frequencies between 277 MHz and 339 MHz. Within this band the KA 44B could not tolerate interference levels greater than 0.8 V/m (for acceptable audio signal-to-noise) or greater than 1.1 V/m (for acceptable bearing error).

A KA 44B production test sample was subjected to the 100 V/M (and greater) HIRF levels expected for aircraft system level certification. This test was done in a manner consistent with aircraft system level HIRF certification testing. No permanent damage was noted during the HIRF exposure and the unit returned immediately to normal operation after the HIRF event terminated.

DO-160D Section 22 (Lightning Induced Transient Susceptibility) Tests

A KA 44B production test sample was subjected to Category A3J33 as defined and in the test environment called out in RTCA DO-160D Section 22 (Change No. 3). The KA 44B passed all requirements.

DO-160D Section 23 (Lightning Direct Effects) Tests

A KA 44B production test sample was subjected to Category 2A as defined in the test environment called out in RTCA DO-160D Section 23. The KA 44B passed all requirements.

Other DO-160D based test data has been collected and is available on request from Honeywell.

APPENDIX B

DEVIATIONS

Appendix B – Deviations

B.1 Deviation, RTCA DO-179 Paragraph 2.2.13 (TSO-C41d)

Honeywell Int'l has requested a deviation specified below for TSO-C41d to RTCA DO-179 Paragraph 2.2.13 in Honeywell Letter TSO-13-1746R1 and has received approval in FAA memorandum from AIR-130 Dated September 11, 2013.

(a) 80 dB when the receiver is tuned anywhere in the frequency range of 190-850 kHz with the exception of the three discrete frequencies of $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ the tuned frequency where the rejection specification is reduced to 40 dB.

(b) 60 dB when the receiver is tuned above 850 kHz with the exception of the two discrete frequencies of $\frac{1}{2}$ and $\frac{1}{3}$ the tuned frequency where the rejection specification is reduced to 40 dB.

B.2 Deviation, RTCA DO-253C Paragraph 2.2.7 (TSO-C162a)

Honeywell Int'l has requested a deviation specified below for TSO-C162a to RTCA DO-253C Paragraph 2.2.7 in Honeywell Letter TSO-16-1783 and has received approval in FAA memorandum from AIR-130 Dated December 14, 2016.

Requirement:

The VDB receiver subsystem shall [LAAS-052] meet the requirements specified in Section 2.2.5 in the presence of an undesired co-channel VDB signal that is either:

a. […]

b. assigned different time slot(s) and whose power is up to +15 dBm at the receiver input.

Request:

Honeywell requests that an alternate performance requirement for TSO-C162a Standard RTCA/DO-253C Paragraph 2.2.7.1b be allowed.

Honeywell would show compliance to the Co-Channel rejection of undesired VDB signal in a different slot using the following criteria for Class A receivers prescribed in paragraph 2.2.7.1.1 in upcoming revision of RTCA/DO-253. The VDB receiver subsystem shall [LAAS-052] meet the requirements specified in Section 2.2.5 in the presence of an undesired co-channel VDB signal that is either:

b) assigned different time slot(s) and whose power is up to Smax at the receiver input and no more than 79 dB above the desired VDB signal power level; or

c) assigned different time slot(s) and whose power is no more than 79 dB above the minimum desired VDB signal Smin.

ID-631665

Note: Per paragraph 2.2.5.1 in draft RTCA/DO-253D for Class A receivers Smax is -1 dBm and Smin is -87 dBm.

B.3 Deviation, RTCA DO-253C Paragraph 2.2.9.2.1 (TSO-C162a)

Honeywell Int'l has requested a deviation specified below for TSO-C162a to RTCA DO-253C Paragraph 2.2.9.2.1 in Honeywell Letter TSO-17-1799 and has received approval in FAA memorandum from AIR-130 Dated March 22, 2017.

Requirement:

The VDB receiver subsystem shall [LAAS-269] meet the requirements of Section 2.2.5 in the presence of VHF FM broadcast signals with signal levels shown in Table 2-3 and Table 2-4.

Request:

Honeywell requests a deviation to reduce the maximum level of out-of-band interferers by up to 3dB. Honeywell will show compliance to the DO-253C para 2.2.9.2.1 FM Immunity Desensitization with the reduced level of out-of-band interferer.

B.4 Deviation for the Environmental Qualification.

Honeywell Int'l will use the superseded version of RTCA/DO-160 i.e RTCA/DO-160G for the environmental qualification instead of using the obsolete versions mentioned in the TSO's. Below table summarizes the obsolete versions of RTCA/DO-160 for the TSO's for which deviations were requested and approved by the FAA.

Table B-1 KTR 2280A TSO Deviations for RTCA/DO-160 Obsolete Standards

Document Number	Recommended DO-160 version in TSO for Environmental Qualification	DO-160 version will be used for the KTR 2280A Environmental Qualification
TSO-169a	RTCA/DO-160E	RTCA/DO-160G
TSO-C160a	RTCA/DO-160D	RTCA/DO-160G
TSO-C40c	RTCA/DO-160B	RTCA/DO-160G
TSO-C36e	RTCA/DO-160B	RTCA/DO-160G
TSO-C34e	RTCA/DO-160B	RTCA/DO-160G
TSO-C41d	RTCA/DO-160A	RTCA/DO-160G
TSO-C128a	RTCA/DO-160E	RTCA/DO-160G
TSO-162a	RTCA/DO-160D	RTCA/DO-160G

B.5 Deviation for the Software Qualification

ID-631666

Honeywell Int'l will use the superseded version of RTCA/DO-178 i.e RTCA/DO-178B for the software qualification instead of using the obsolete versions mentioned in the TSO's. Below table summarizes the obsolete versions of RTCA/DO-178 for the TSO's for which deviations were requested and approved by the FAA.

Table B-2 KTR 2280A TSO Deviations for RTCA/DO-178 Obsolete Standards

Document Number	Recommended DO-178 version in TSO for Software Qualification	DO-178 version will be used for the KTR 2280A Software Qualification
TSO-C40c	RTCA/DO-178A	RTCA/DO-178B
TSO-C36e	RTCA/DO-178A	RTCA/DO-178B
TSO-C34e	RTCA/DO-178A	RTCA/DO-178B
TSO-C41d	RTCA/DO-178	RTCA/DO-178B

B.6 ETSO Deviation Requests

Honeywell has submitted three TSO deviation requests for the KTR 2280A. Deviation specified below in section B.6.1 for ETSO 2C41d (refer section B.1 for TSO deviation request) addresses a non-harmonized TSO/ETSO. The other two deviation requests (refer sections B.2, B.3) are fully harmonized deviations as defined by the current bi-lateral TSO/ETSO agreements between the FAA and EASA.

B.6.1 Deviation, EUROCAE ED-51 Paragraph 3.10 (ETSO-2C41d)

Honeywell Int'l has requested a deviation specified below for ETSO-2C41d to EUROCAE ED-51 Paragraph 3.10 in Honeywell Letter TSO-17-1805.

Request:

80 dB when the receiver is tuned anywhere in the frequency range of 190-850 kHz with the exception of the three discrete frequencies of $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ the tuned frequency where the rejection specification is reduced to 40 dB.

ID-631800