



**GPS USER EQUIPMENT
INTERFACE SPECIFICATION
FOR
DEFENSE ADVANCED GPS RECEIVER (DAGR)
UNIQUE INTERFACE CHARACTERISTICS**

23 July 2007

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GPS USER EQUIPMENT

INTERFACE SPECIFICATION

FOR

DEFENSE ADVANCED GPS RECEIVER (DAGR)
UNIQUE INTERFACE CHARACTERISTICS

Approved by:



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Global Positioning Systems Wing

23 July 07
DATE

REVISIONS

LTR	DESCRIPTION
	Baseline

Preface

Changes to this Interface Specification (IS) must be coordinated with the Global Positioning System (GPS) Wing (GPSW), the Interface Control Contractor (ICC), and the GPS contractors as required.

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1.0 SCOPE

1.1 Introduction.

This document identifies and defines the external physical characteristics of the Defense Advanced GPS Receiver (AN/PSN-13 and AN/PSN-13A). Reference to DAGR within the text of this document refers to both the AN/PSN-13 and AN/PSN-13A unless noted otherwise. In addition, it identifies and defines the physical connectors and cables associated with the Single-Channel Ground and Airborne Radio System (SINCGARS), Cryptographic Key Loading, HAVE QUICK, RS-232, RS-422, Pulse Per Second (PPS), external antenna and external power interfaces as they are incorporated in the DAGR. This document also identifies and defines the external physical and electrical characteristics of the DAGR's accessories: external antennas, installation mount, mount adapters, submil GLS, and external battery pack. Additionally, this document describes the physical and electrical characteristics, as applicable, of the Anti-Jam Accessory (AJA) and its associated cables. Figure 1 is a block diagram of the DAGR and its external electrical interfaces.

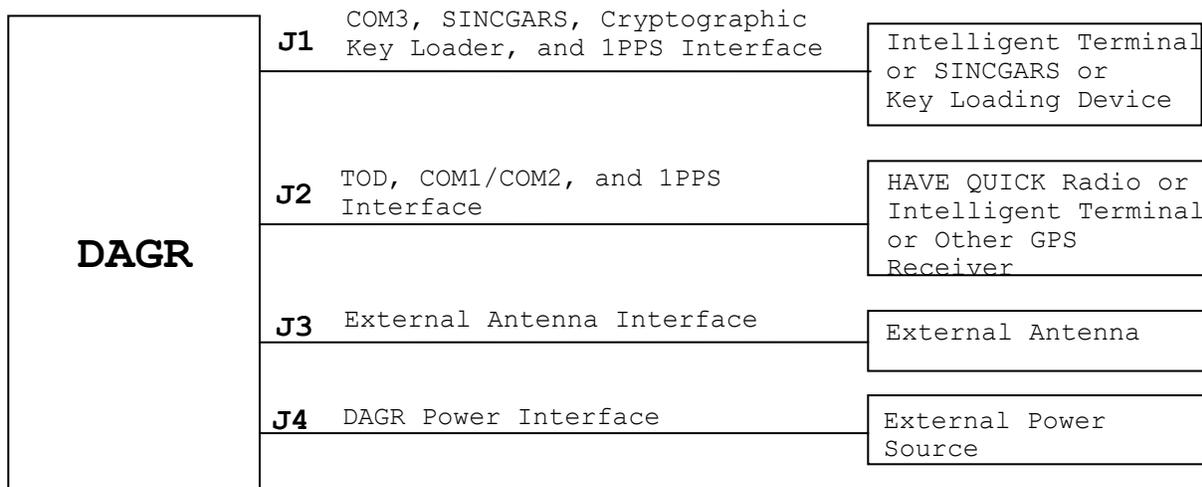


Figure 1. DAGR Interface Block Diagram

1.2 Purpose.

This document provides information for developers of future GPS user equipment (UE) to maintain physical and electrical compatibility with existing DAGR integrations.

1.3 Item Description.

1.3.1 DAGR, Satellite Signals Navigation Set.

The DAGR is a self-contained, hand-held, twelve-channel receiver that: 1) processes GPS signals and provides position, velocity, and time information, 2) includes an antenna, receiver processor unit, controls for user input and function selection, displays, and a power source, and 3) can be operated as a hand-held device or can be installed in various facilities and vehicles.

1.4 Agencies/Contractors.

All agencies involved in the development of this IS are identified below.

1.4.1 GPS Wing (GPSW) .

The GPSW in the Space and Missile Systems Center of the Air Force Space Command is responsible for the development, configuration control, and life-cycle support of the GPS UE. The point of contact for the GPS UE Interface Control Working Group is:

GPSW/ENR
483 North Aviation Blvd
Los Angeles AFB
El Segundo, CA 90245-2808
Phone (310) 653-3771
DSN 653-3771
Fax (310) 653-3676
E-mail gpsicd.request@losangeles.af.mil

1.4.2 Interface Control Contractor (ICC) .

ARINC is the GPS UE Interface Control Contractor and is responsible for maintaining the technical validity of this IS. The ICC point of contact is:

ARINC Engineering Services, LLC
4055 Hancock Street, Suite 100
San Diego, CA 92110-5152
Phone (619) 222-7447
Fax (619) 225-1750

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents.

The following documents form a part of the GPS UE standards as specified herein. Refer to the document revision that is applicable to the receiver being used.

ON199168D 22 Sep 83	KOI-18 Interface Specification
ON199159G 22 Sep 83	KYK-13 Interface Specification
EKMS 603 ON477312B28 Oct 98	Interoperability Standards for Electronic Key Management Systems, AN/CYZ-10(V)3 Data Transfer Device, Interface Specification
IS-GPS-153D 12 Jul 2007	GPS User Equipment Interface Control Document for the GPS Standard Serial Interface Protocol (GSSIP) of DoD Standard GPS UE Radio Receivers
MIL-PRF-39012E 27 Apr 05	Connectors, Coaxial, Radio Frequency, General Specification for
TM 11-5820-1172-13	Operator and Maintenance Manual, Defense Advanced GPS Receiver (DAGR) Satellite Signals Navigation Set, AN/PSN-13 NSN 5825-01-516-8038, AN/PSN-13A NSN 5825-01-526-4783
USA CECOM DWG A3191133 10 Mar 94	Specification - Interface for Mode 2 and Mode 3 Fill

2.2 Non-Government Documents.

The following documents form a part of the GPS UE standards as specified herein. Refer to the document revision that is applicable to the receiver being used.

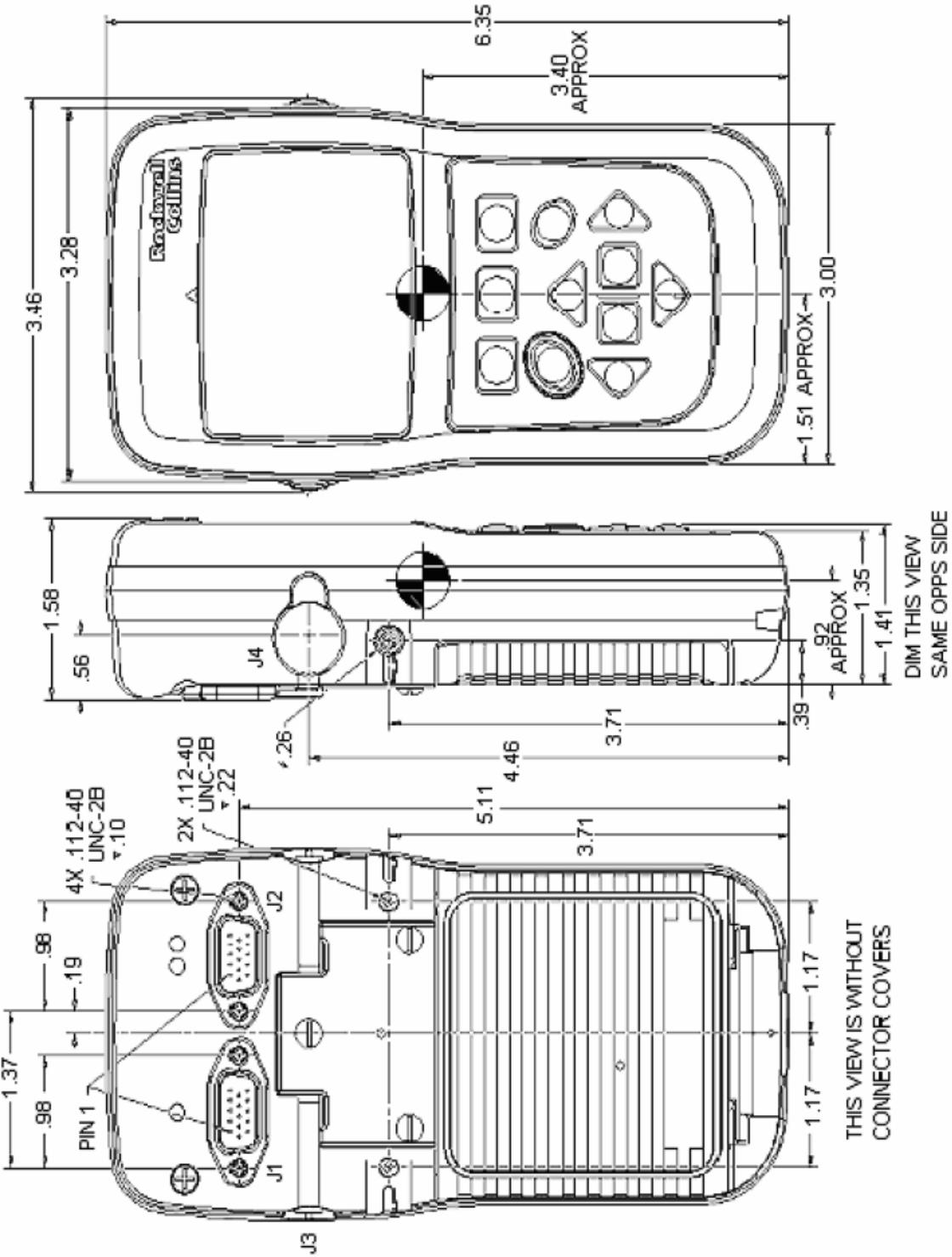
TIA/EIA-232F Oct 1997	Interface Between Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange
TIA/EIA-422B 27 Jan 2000	Electrical Characteristics of Balanced Voltage Digital Interface Circuits

3.0 INTERFACES

3.1 DAGR Hardware Definition.

3.1.1 DAGR Physical Dimensions.

The DAGR dimensions and connector locations are provided in Figure 2. Four electrical connectors mounted on the external surfaces of the DAGR allow connection to interfacing equipment. These connectors are identified by designator, function, and mating connector part number in Table 1. Sections 3.2, 3.3, 3.4, 3.5, and 3.7 of this document contain additional information about the cables and interfaces which use these external connections.



DIM ARE IN INCHES: TOL ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = ± 0.02 , .XXX = ± 0.010
 Center of gravity includes the DAGR, memory battery and empty four cell battery pack

Figure 2. DAGR Dimensions and Connector Locations

Table 1. Receiver Connectors and Mates

Reference Designator	Interface/Function	Mating Connector
J1	Data/Timing/ Cryptographic/ SINCGARS	Available from Multiple Vendors M24308/2-11 or equivalent
J2	Data/Timing	Available from Multiple Vendors M24308/2-11 or equivalent
J3	Remote Antenna	M39012/55-3112 or equivalent (SMA plug IAW MIL-PRF-39012)
J4	External Power	Turck Part Number PKG 3M or equivalent

3.1.2 Cables.

Several cables are available for the DAGR and may be found in current integrations. These cables are identified in Table 2.

Table 2. Cables

Connector	Cable Description	National Stock Number (NSN)	Length
J1	DAGR to SINCGARS Cable	5995-01-521-3182	118" ± 3.0"
J1	PLGR Cable Adapter-SINCGARS	5995-01-521-3185	10" ± 0.5"
J1	AJA Data Cable	5995-01-542-8574	397"± 3.0"
J1	Crypto Keyfill Cable	5995-01-521-3185	13" ± 0.5"
J2	DAGR to HAVE QUICK Cable	5995-01-521-2680	118" ± 3.0"
J2	DAGR to PC Cable	5995-01-521-3198	118" ± 3.0"
J2	DAGR to DAGR / PLGR Cable	5995-01-521-2713	39" ± 1.5"
J2	PLGR Cable Adapter-Serial	5995-01-521-3071	13" ± 0.5"
J2	RS-422 to USB Adapter	5995-01-531-5118	60" ± 1.0"
J3	DAGR to Remote Antenna 1 Cable	5995-01-504-1762	197" ± 2.0"
J3	DAGR to Remote Antenna 1 Cable	5995-01-521-4244	394" ± 3.0"
J3	DAGR to Remote Antenna 2 Cable	5995-01-521-2941	394" ± 3.0"
J3	DAGR to Helmet Antenna Cable	5995-01-521-6753	58.75" ± 2.5"
J3	PLGR Cable Adapter-Remote Antenna	5995-01-521-3120	8" ± 0.5"
N/A	AJA Power Cable	6150-01-542-6459	397"± 3.0"
J4	AC (alternating current) Power Adapter	6130-01-521-3157	118" ± 2.0"
J4	DAGR External Power Cable	6150-01-521-6755	79" ± 2.0"
J4	DAGR External Power Cable	6150-01-521-6757	197" ± 3.0"
J4	PLGR Cable Adapter-External Power	6150-01-521-3510	8" ± 0.5"
J4	DAGR Cigarette Lighter Power Adapter	6150-01-521-2548	79" Min
J4	DAGR to External (cold weather) Battery Pack Cable	5995-01-533-3421	79" ± 2.0"

3.1.3 DAGR Accessories.

Additional accessories are available for the DAGR. These additional accessories are listed in Table 3. Characteristics of the accessories are specified in sections 3.6 through 3.7.

Table 3. DAGR Accessories

Accessories	NSN
Installation Mount	5975-01-521-3063
PLGR Installation Mount Adapter	5340-01-521-4394
Remote Antenna 1	5985-01-502-6692
Remote Antenna 2	5985-01-521-1775
Anti-Jam Accessory	5985-01-547-3652
External (cold weather) Battery Pack	6130-01-530-4652
Keyfill Cable Adapter Bracket Kit	5935-01-521-3067
Submil GLS Kit	5985-01-521-2625

3.2 J1 Connector

The J1 connector provides data, timing, SINGARS and cryptographic keyfill interfaces.

3.2.1 Physical Interface.

The J1 connector and its mate are identified in Table 1. Refer to Figure 3 for J1 contact locations. Cables used to connect the DAGR to keyfill devices and SINGARS radios are identified in Table 2.

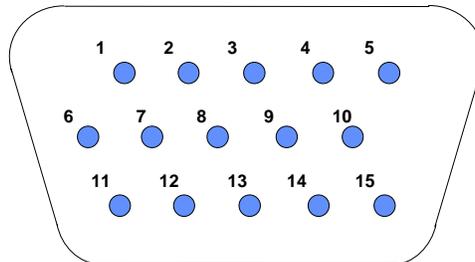


Figure 3. DAGR J1 Contact Locations

3.2.2 SINGARS.

The SINGARS interface transfers SINGARS Time Fill data from the DAGR into the SINGARS radio via J1. The SINGARS interface uses pins 2, 3, 4, 11, 12, 14 and 15. Refer to Figure 3 for J1 contact locations. The pins associated with the SINGARS and COM 3 interfaces are shared and cannot be used simultaneously.

3.2.3 Cryptographic Fill Interface.

Cryptographic keys are loaded through the DAGR's J1 connector (refer to Figure 3). The cryptographic fill interface uses pins 3, 7, 8, 9, 10 and 13. The keys are loaded from a KYK-13, KOI-18, or AN/CYZ-10 COMSEC fill device.

3.2.4 COM 3.

COM 3 is a bidirectional TIA/EIA-232 interface. The COM 3 fill interface uses pins 2, 3, 4, 11, 14 and 15. Refer to Figure 3 for J1 contact locations. Pins 2 and 4 are non-functional and reserved for future growth. The pins associated with the SINGARS and COM 3 interfaces are shared and cannot be used simultaneously.

3.2.5 PPS Interface.

The J1 PPS interface inputs and outputs time data via the DAGR's J1 connector. Refer to Figure 3 for J1 contact locations. The J1 PPS uses pins 1, 3, and 6. The J1 PPS input and J2 PPS input cannot be used simultaneously.

3.2.6 Electrical Interface.

Table 4 identifies the COM 3, J1 PPS, SINGARS, and cryptographic key loading interface electrical characteristics. The DAGR keyfill interface must be configured properly prior to loading the DAGR with keys. Refer to Table 5 for a listing of devices supported by the DAGR keyfill modes.

Table 4. DAGR Connector J1 Electrical Characteristics

Pin	SIGNAL	I/O ¹	ELECTRICAL CHARACTERISTICS
1 ²	1PPS In (active high)	I	Input impedance: 50 Ω nominal Pulse width: 15 μ s to 30 μ s Voltage with respect to (WRT) Ground: Logic 1: +2.5 to +5.5 VDC Logic 0: 0.0 to +0.8 VDC
2 ³	SINGGARS MUX override pin F COM3 RTS ⁷	O O	Mode 3 Mux override (time fill) IAW CECOM Drawing A3191133 COM 3 Mode per TIA-232
3	Signal Reference	N/A	Ground
4 ³	COM3 versus SINGGARS Mode Control	I	Leave open/floating to enable SINGGARS Mode on pins 2, 11, 14, and 15. Ground ($\leq 100 \Omega$) to enable COM 3 Mode
5	Reserved	N/A	Reserved.
6	PPS Out J1 ⁶ (Applicable to AN/PSN-13) COM3 PPS Out ⁶ (pulse drives line high) (applicable to AN/PSN-13A)	O	Load: 50 Ω nominal Pulse width: 20 μ s \pm 20% Voltage WRT Ground: Logic 1: +3 to +5.5 VDC Logic 0: 0 to +0.5 VDC Rise time: 50 ns max Fall time: 1 μ s max
7 ⁴	DS-101 Transmit DS-102 pin D ⁵	O I	DS-101 (RS-232 mode) Receive Data IAW EKMS 603/ON477312B Note: This signal is Receive Data to the KFD and Transmit Data from the DAGR <u>DS-102 Mode</u> Per DS-102 Common Fill Device Interface(CFDI)
8 ⁴	DS-101 Flow Control Input (FCI) DS-102 pin E ⁵	I I	DS-101 (RS-232 mode) Flow Control Output (FCO) IAW EKMS 603/ON477312B Note: This signal is FCO from the KFD and FCI to the DAGR <u>DS-102 Mode</u> Per DS-102 (CFDI)
9 ⁴	DS-101 Flow Control Out DS-102 pin B ⁵	O I	DS-101 (RS-232 mode) FCI IAW EKMS 603/ON477312B Note: This signal is FCI to the KFD and FCO from the DAGR <u>DS-102 Mode</u> Per DS-102 (CFDI)

Table 4. DAGR Connector J1 Electrical Characteristics (continued)

Pin	SIGNAL	I/O ¹	ELECTRICAL CHARACTERISTICS
10	DS-101/DS-102 pin A ⁵	N/A	Ground
11 ³	COM3 CTS ⁷ SINGARS Clock pin E	I IO	COM 3 Mode Per TIA-232 SINGARS Mode 3 Fill Information Available/Clock (time fill) IAW CECOM Drawing A3191133
12	SINGARS Command Control Data (CCD) pin B	IO	Mode 3 CCD (time fill) IAW CECOM Drawing A3191133
13 ⁴	DS-101 Receive DS-102 pin C ⁵	I O	DS-101 (RS-232 mode) Transmit Data IAW EKMS 603/ON477312B Note: This signal is Transmit Data from the KFD and Receive Data to the DAGR KYK-13/KOI-18 Data IAW ON199159G/ON199168D
14 ³	SINGARS Info pin D COM3 Transmit	O O	Mode 3 Fill Info (time fill) IAW CECOM Drawing A3191133 COM 3 Mode Per TIA-232
15 ³	SINGARS Request pin C COM3 Receive	I I	Mode 3 Fill REQ-N (time fill) IAW CECOM Drawing A3191133 COM 3 Mode Per TIA-232

Notes:

1. Input and output are with respect to the GPS Receiver.
2. The 1PPS input on the J1 and J2 connectors are the same input signal to the DAGR and both cannot be used simultaneously.
3. Pins 2, 4, 11, 14, and 15 are shared between SINGARS and COM 3 interfaces. Their behavior is determined by the setting of pin 4.
4. Pins 7, 8, 9, and 13 are shared between DS-101 and DS-102 interfaces. Their behavior is determined by the setting of CV Loading Interface on the Crypto Fill page of the DAGR control/display.
5. Pin Designation refer to those found on standard key fill device.
6. For optimum time accuracy performance, DAGR integrations should account for the time delay associated with the antenna cable and data cable. The DAGR has accounted for the time delay associated with external antenna.
7. The COM 3 RTS and CTS pins are non-functional and reserved for future growth.

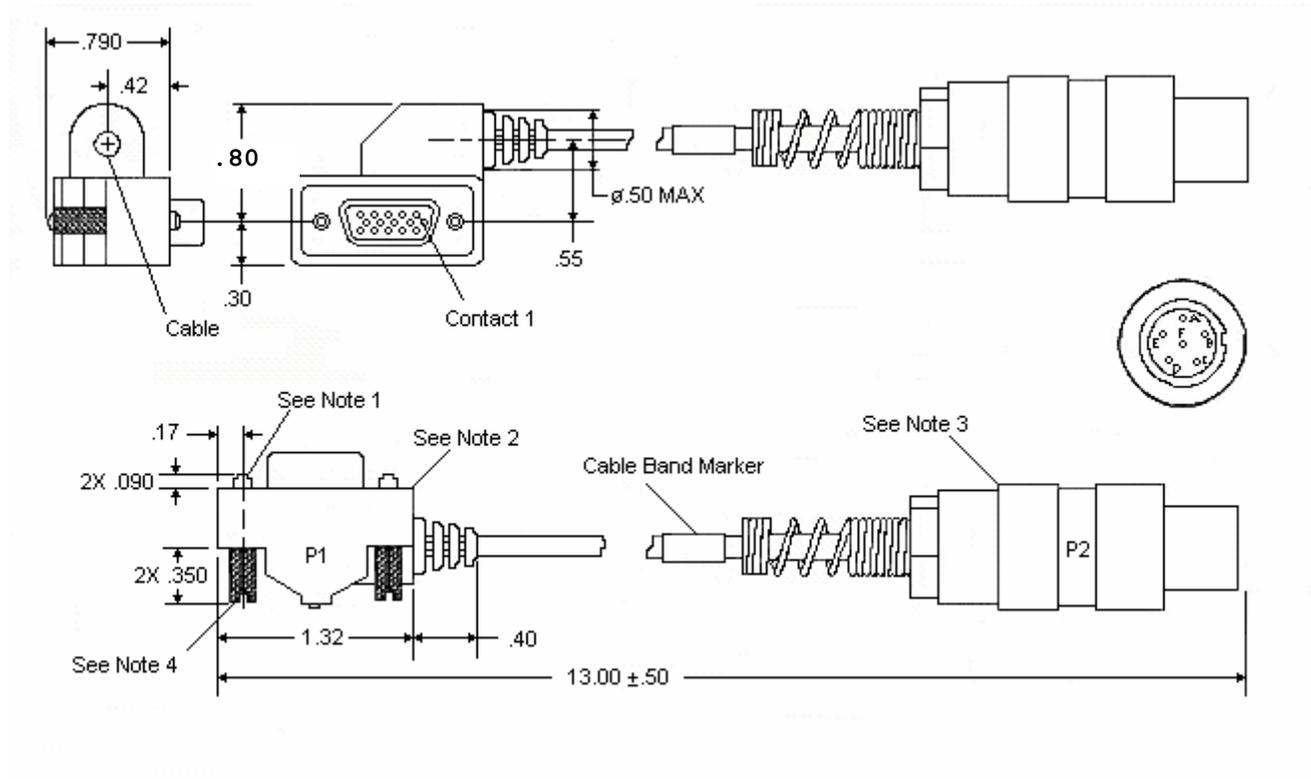
3.2.7 Cables and Adapters.

3.2.7.1 Crypto Fill Cable.

The Crypto Fill Cable provides for the connection between the DAGR and the KYK-13, KOI-18, and AN/CYZ-10. Table 5 contains the wiring list for the Crypto Fill Cable. Figure 4 illustrates the Crypto Fill cable dimensions. The DAGR J1 connector mate is identified in Table 1. Refer to the KYK-13/KOI-18 Interface Specifications identified in Section 2.0.

Table 5. Crypto Fill Cable Wiring List

Wire Number	Wire/Cable Description	From	To
1	Wire (22 to 28 gauge is acceptable)	P1-10	P2-A
2	Wire (22 to 28 gauge is acceptable)	P1-9	P2-B
3	Wire (22 to 28 gauge is acceptable)	P1-13	P2-C
4	Wire (22 to 28 gauge is acceptable)	P1-7	P2-D
5	Wire (22 to 28 gauge is acceptable)	P1-8	P2-E
6	Wire (22 to 28 gauge is acceptable)	P1-3	P1-4
Shield		P1 Housing	P2 Housing



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS .112-40 UNC-2A.
2. THE CONNECTOR FLANGE IS .030 ABOVE TO .015 BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF .230 DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. MIL-CON PART NUMBER MC328CG2 OR EQUIVALENT.
4. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR A FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED.

CAUTION: The visual difference between the AN/PSN-11 SINGARS cable adapter and the DAGR Crypto Fill Cable are:

- (1) the length, 10 inches and 13 inches, respectively.
- (2) the Crypto Fill cable band marker is marked "CRYPTO FILL CABLE" and the PLGR Cable Adapter-SINGARS cable band marker is marked "PLGR CABLE ADAPTER-SINGARS";
- (3) the supplier part number is molded into the P1 plug.

Though visually similar, these two cables are constructed differently and are not interchangeable.

THE NSN IS NOT ALWAYS PRESENT

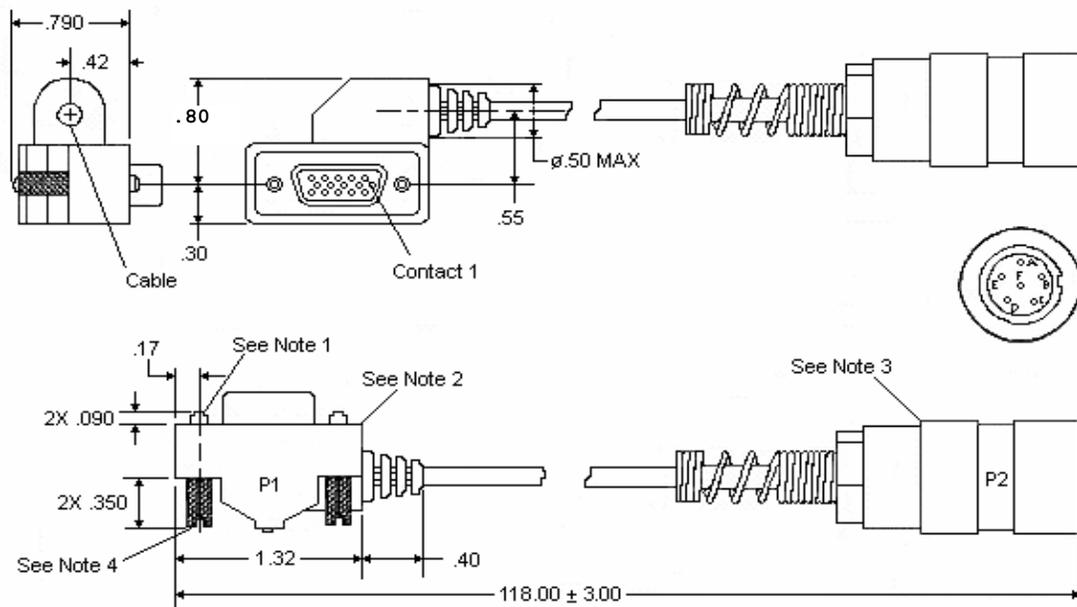
Figure 4. DAGR Crypto Fill Cable

3.2.7.2 DAGR-to-SINGARS Cable.

The DAGR-to-SINGARS Cable provides for the connection between the DAGR and the SINGARS Radio. Table 6 contains the wiring list for the DAGR-to-SINGARS Cable. Figure 5 illustrates the DAGR-to-SINGARS cable dimensions. The DAGR J1 connector mate is identified in Table 1.

Table 6. DAGR to SINGARS Cable Wiring List

Wire Number	Wire/Cable Description	From	To
1	Wire (22 to 28 gauge is acceptable)	P1-3	P2-A
2	Wire (22 to 28 gauge is acceptable)	P1-12	P2-B
3	Wire (22 to 28 gauge is acceptable)	P1-15	P2-C
4	Wire (22 to 28 gauge is acceptable)	P1-14	P2-D
5	Wire (22 to 28 gauge is acceptable)	P1-11	P2-E
6	Wire (22 to 28 gauge is acceptable)	P1-2	P2-F
Shield		P1 Housing	P2 Housing



UNLESS OTHERWISE SPECIFIED ALL DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS .112-40 UNC-2A.
2. THE CONNECTOR FLANGE IS .030 ABOVE TO .015 BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF .230 DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. MIL-CON PART NUMBER MC328CG2 OR EQUIVALENT.
4. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR A FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED.

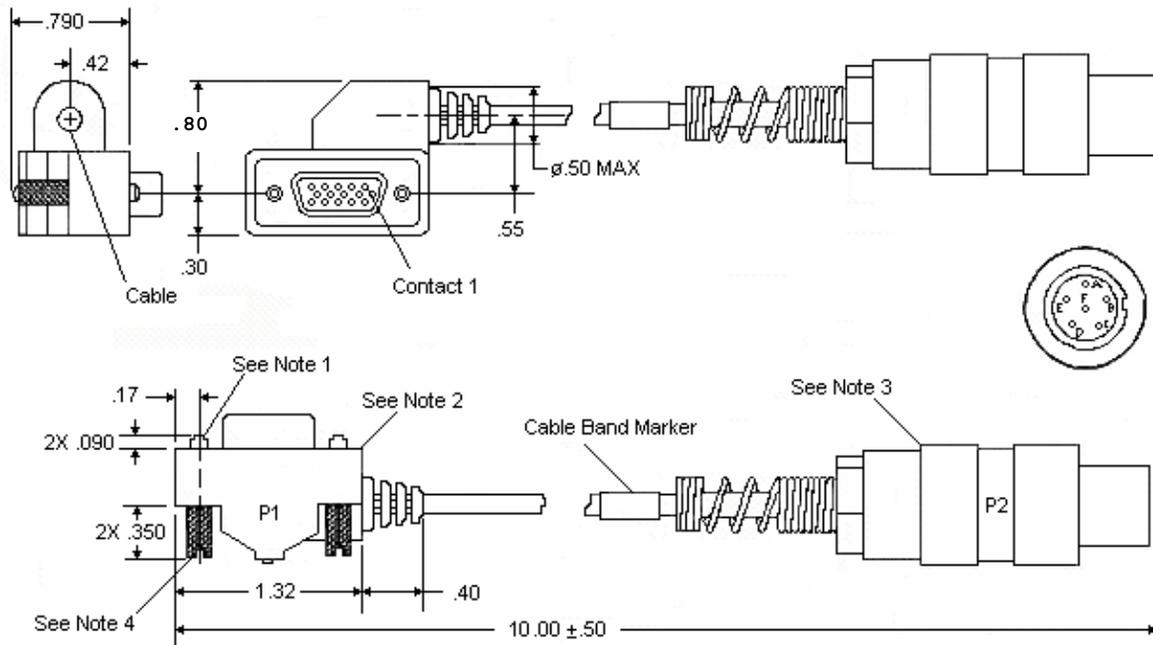
Figure 5. DAGR to SINGARS Cable

3.2.7.2 PLGR Cable Adapter-SINGARS.

The PLGR Cable Adapter-SINGARS Cable provides for the connection between the DAGR and a PLGR SINGARS Cable (NSN 6150-01-375-8666). Table 7 contains the wiring list for the PLGR Cable Adapter-SINGARS Cable. Figure 6 illustrates the PLGR Cable Adapter - SINGARS cable dimensions. The DAGR J1 connector mate is identified in Table 1.

Table 7. PLGR Cable Adapter-SINGARS Wiring List

Wire Number	Wire/Cable Description	From	To
1	Wire (22 to 28 gauge is acceptable)	P1-3	P2-A
2	Wire (22 to 28 gauge is acceptable)	P1-12	P2-B
3	Wire (22 to 28 gauge is acceptable)	P1-15	P2-C
4	Wire (22 to 28 gauge is acceptable)	P1-14	P2-D
5	Wire (22 to 28 gauge is acceptable)	P1-11	P2-E
6	Wire (22 to 28 gauge is acceptable)	P1-2	P2-F
Shield		P1 Housing	P2 Housing



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS .112-40 UNC-2A.
2. THE CONNECTOR FLANGE IS .030 ABOVE TO .015 BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF .230 DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. MIL-CON PART NUMBER MC328CG2 OR EQUIVALENT.
4. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR A FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED.

CAUTION: The visual difference between the AN/PSN-11 SINGARS cable adapter and the DAGR Crypto Fill Cable are:

- (1) the length, 10 inches and 13 inches, respectively.
- (2) the Crypto Fill cable band marker is marked "CRYPTO FILL CABLE" and the PLGR Cable Adapter-SINGARS cable band marker is marked "PLGR CABLE ADAPTER-SINGARS";
- (3) the supplier part number is molded into the P1 plug.

Though visually similar, these two cables are constructed differently and are not interchangeable.

THE NSN IS NOT ALWAYS PRESENT

Figure 6. PLGR Cable Adapter-SINGARS

3.3 J2 Connector.

The J2 connector provides data, timing, HAVEQUICK, and Remote On interfaces.

3.3.1 J2 Physical Interface.

The J2 connector and its mate are identified in Table 1. Refer to Figure 7 for J2 contact locations. Cables used to connect the DAGR to another DAGR or PLGR, PC and HAVE QUICK radios are identified in Table 2.

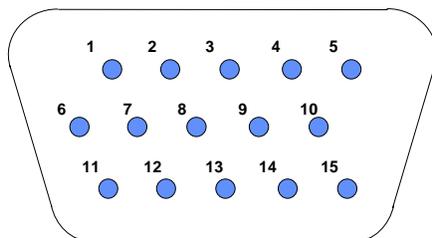


Figure 7. DAGR J2 Contact Locations

3.3.2 Electrical Interface.

Electrical characteristics are provided in Table 9.

3.3.3 Serial Data Interface #1 (COM 1) Interface.

The COM 1 interface transfers bi-directional data via J2. The COM 1 interface uses pins 3, 14, and 15. Refer to Figure 7 for contact information.

3.3.4 Serial Data Interface #2 (COM 2) Interface.

The COM 2 interface transfers bi-directional data via J2. The COM 2 interface uses pins 3, 4, 5, 9, and 10. Refer to Figure 7 for contact information.

3.3.5 PPS Interface.

The 1PPS interface inputs and outputs time data via J2. The J2 1PPS uses pins 1, 2, 6, 11, and 12. Refer to Figure 7 for contact locations. The J1 1PPS input and J2 1PPS input cannot be used simultaneously.

3.3.6 HAVE QUICK Time of Day (TOD) Interface.

The HAVE QUICK TOD interface outputs Time of Day information to Have Quick radio. The HAVE QUICK TOD interface uses pins 3, and 7. Refer to Figure 7 for contact locations.

The TOD interface of the DAGR is intended to reflect the actual operation of the AN/PSN-11, and is provided to ensure interoperability with HAVE QUICK radios that have previously used the AN/PSN-11 as a source of time synchronization. This interface is not guaranteed to be interoperable with all radios implementing the HAVE QUICK frequency hopping algorithm. Refer to IS-GPS-154 for a description of the AN/PSN-11 TOD interface implemented in the DAGR.

3.3.7 Remote On Interface.

The Remote On interface electrical characteristics are described in Table 9.

3.3.8 Electrical Interface

Table 8 identifies the COM 1, COM 2, J2 1PPS, HAVE QUICK, and Remote On electrical characteristics.

Table 8. DAGR Connector J2 Electrical Characteristics

Pin	SIGNAL	I/O ¹	ELECTRICAL CHARACTERISTICS
1 ²	1PPS In (active high)	I	Input impedance: 50 Ω nominal Pulse width: 15 μ s to 30 μ s Voltage with respect to (WRT) Ground: Logic 1: +2.5 to +5.5 VDC Logic 0: 0.0 to +0.8 VDC
2 ⁷	1PPS In Return	N/A	Ground
3 ⁷	Signal Reference	N/A	Ground
4/5	COM2 Data Out A/B TIA/EIA-422	O	Voltage (A WRT B): Logic 1: +2 to +6 VDC Logic 0: -2 to -6 VDC Load: \geq 100 Ω Baud rate tolerance: \pm 1%
6	PPS OUT J2 ^{3,5} COM1 PPS Out ^{3,6} (pulse drives line high)	O	Load: 50 Ω nominal Pulse width: 20 μ s \pm 20% Voltage WRT Ground: Logic 1: +3 to +5.5 VDC Logic 0: 0 to +0.5 VDC Rise time: 50 ns max Fall time: 1 μ s max
7	HAVE QUICK	O	Voltage WRT Ground: Logic 1: 300 μ s at +4.5 to +5.5 VDC followed by 300 μ s at 0 to +0.5 VDC Logic 0: 300 μ s at 0 to +0.5 VDC followed by 300 μ s at +4.5 to +5.5 VDC Sink/source: \leq 0.5 mA Data Period: 600 μ s \pm 2 μ s
8	Remote ON ⁴	I	Power On: Sw closure to GND (\leq 100 Ω) Power Off: Open Circuit (\geq 50 k Ω) Falling Edge: \leq 50ns
9/10	COM2 Data In A/B TIA/EIA-422	I	Voltage (A WRT B): Logic 1: +0.2 to +6 VDC Logic 0: -0.2 to -6 VDC Input impedance: \geq 200 Ω Baud rate tolerance: \pm 1.7%
11 ⁷	1PPS Out Return	N/A	Signal Reference
12 ^{5,8}	Reserved ⁵	N/A	N/A
12 ^{6,8}	COM2 PPS Out ^{3,6} (pulse drives line high)	O	Load: 50 Ω nominal Pulse width: 20 μ s \pm 20% Voltage WRT Ground: Logic 1: +3 to +5.5 VDC Logic 0: 0 to +0.5 VDC Rise time: 50 ns max Fall time: 1 μ s max
13	Reserved	N/A	N/A
14	COM1 Data Out TIA/EIA-232	O	Voltage (WRT GND): Logic 1: -5 to -14 VDC Logic 0: +5 to +14 VDC Load: \geq 3 k Ω in parallel with \leq 2500 pF Slew rate: 30 volts/ μ s max Baud rate tolerance: \pm 1%

Table 8. DAGR Connector J2 Electrical Characteristics (continued)

Pin	SIGNAL	I/O*	ELECTRICAL CHARACTERISTICS
15	COM1 Data In TIA/EIA-232	I	Voltage (WRT GND): Logic 1: -3 to -25 VDC Logic 0: +3 to +25 VDC Load: $\geq 3 \text{ k}\Omega$ Slew rate: 30 volts/ μs max Baud rate tolerance: $\pm 1.7\%$

Notes:

1. Input and output are with respect to the GPS Receiver.
2. The 1PPS input on the J1 and J2 connectors are connected together and cannot be used simultaneously.
3. For optimum time accuracy performance, DAGR integrations should account for the time delay associated with the antenna cable and data cable. The DAGR has accounted for the time delay associated with the external antenna.
4. Upon receipt of a Remote On discrete command to power down the DAGR, the DAGR will start its power-down sequence (which lasts for 30 seconds). During this time, the DAGR will not recognize any further Remote On discrete activity.
5. Applicable to AN/PSN-13.
6. Applicable to AN/PSN-13A
7. Pins 2, 3, and 11 are connected together inside the DAGR
8. Tolerant of application of $12 \pm 0.5 \text{ VDC}$ without damage to the receiver

3.3.9 J2 Cables and Adapters

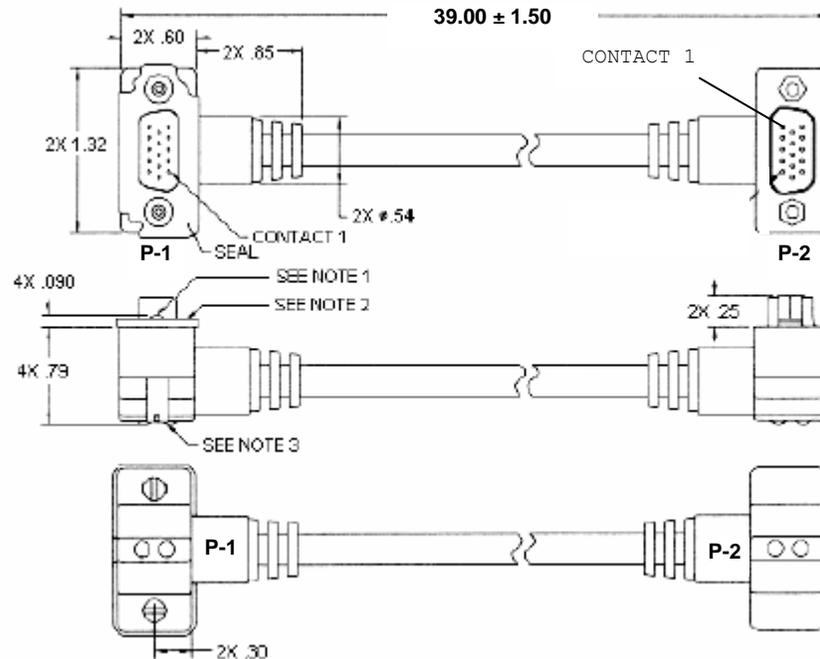
3.3.9.1 DAGR-to-DAGR/PLGR Cable

The DAGR-to-DAGR/PLGR Cable provides for connection between two DAGRs or between a DAGR and a PLGR (AN/PSN-11). Table 9 contains the wiring list for the DAGR-to-DAGR/PLGR Cable. Figure 8 illustrates the DAGR-to-DAGR/PLGR Cable dimensions. The DAGR J2 connector mates are identified in Table 1.

Table 9. DAGR to DAGR/PLGR Cable Wiring List

Wire No.	Wire/Cable Description	From	To
1	50 ohm shielded cable	P1-1	P2-6
	Shield terminated to P1-2 and P2-11	P1-2	P2-11
2	50 ohm shielded cable	P1-6	P2-1
	Shield terminated to P1-11 and P2-2	P1-11	P2-2
3	Wire (22 to 28 gauge is acceptable)	P1-14	P2-15
4	Wire (22 to 28 gauge is acceptable)	P1-15	P2-14
5*	Wire (22 to 28 gauge is acceptable)	P1-3	P1-13
6*	Wire (22 to 28 gauge is acceptable)	P2-3	P2-13
N/A	Outershield	†	†

- * Jumper required to establish DAGR to PLGR communications.
 † Outershield is soldered to both connector housings.



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Notes :

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS .112-40 UNC-2A.
2. THE CONNECTOR FLANGE IS .030 ABOVE TO .015 BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF .230 DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR A FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED

Figure 8. DAGR-to-DAGR/PLGR Cable

3.3.9.2 DAGR-to-PC Cable

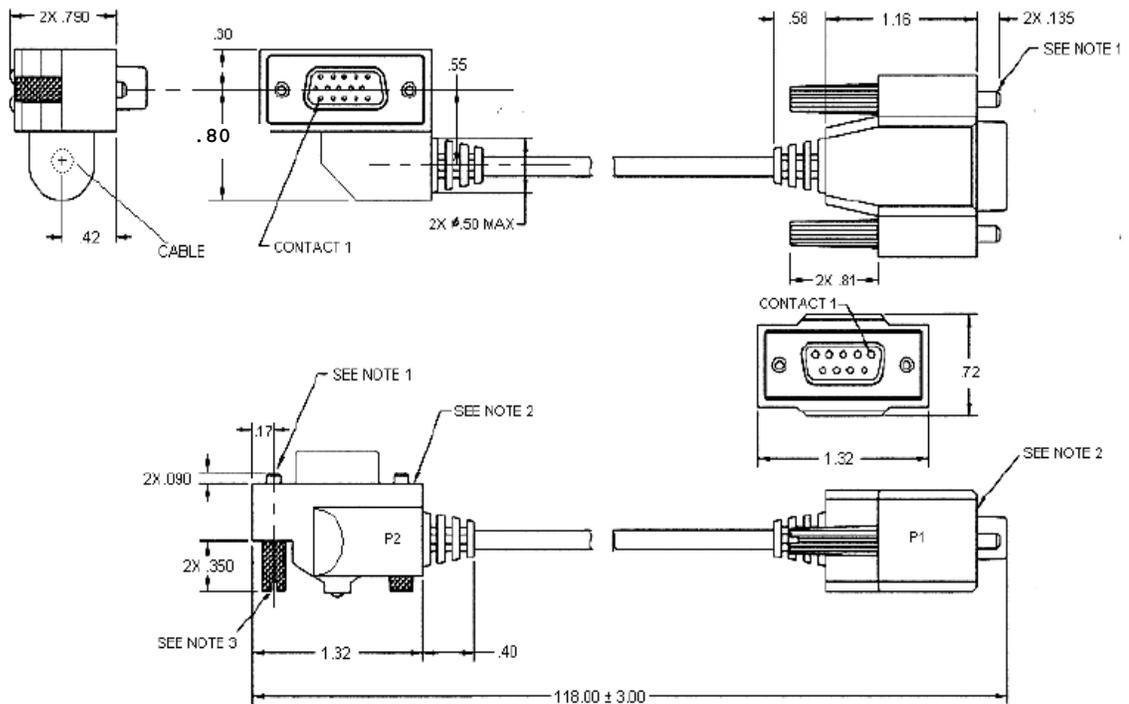
The DAGR-to-PC Cable provides for connection between a DAGRs and a PC. Table 10 contains the wiring list for the DAGR-to-PC Cable. Figure 9 illustrates the DAGR-to-PC Cable dimensions. The DAGR J2 connector mate is identified in Table 1.

Table 10. DAGR-to-PC Cable Wiring List

Wire No.	Wire/Cable Description	From	To
1	Wire (22 to 28 gauge is acceptable) ¹	P1-2	P2-14
2	Wire (22 to 28 gauge is acceptable) ²	P1-3	P2-15
3	Wire (22 to 28 gauge is acceptable)	P2-13	P2-3
4	Wire (22 to 28 gauge is acceptable)	P1-4	P1-1
5	Wire (22 to 28 gauge is acceptable)	P1-6	P1-1
6	Wire (22 to 28 gauge is acceptable)	P1-8	P1-1
7	Wire (22 to 28 gauge is acceptable)	P1-5	P2-2
Shield	Soldered to both P1 and P2 connector housing	P1-Housing	P2-Housing

Notes:

1. Total sum capacitance between wire 1 and all other conductors, wires, and shields in this cable assembly shall be less than 700pF
2. Total sum capacitance between wire 2 and all other conductors, wires, and shields in this cable assembly shall be less than 700pF



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS .112-40 UNC-2A.
2. THE CONNECTOR FLANGE IS .030 ABOVE TO .015 BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF .230 DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED.

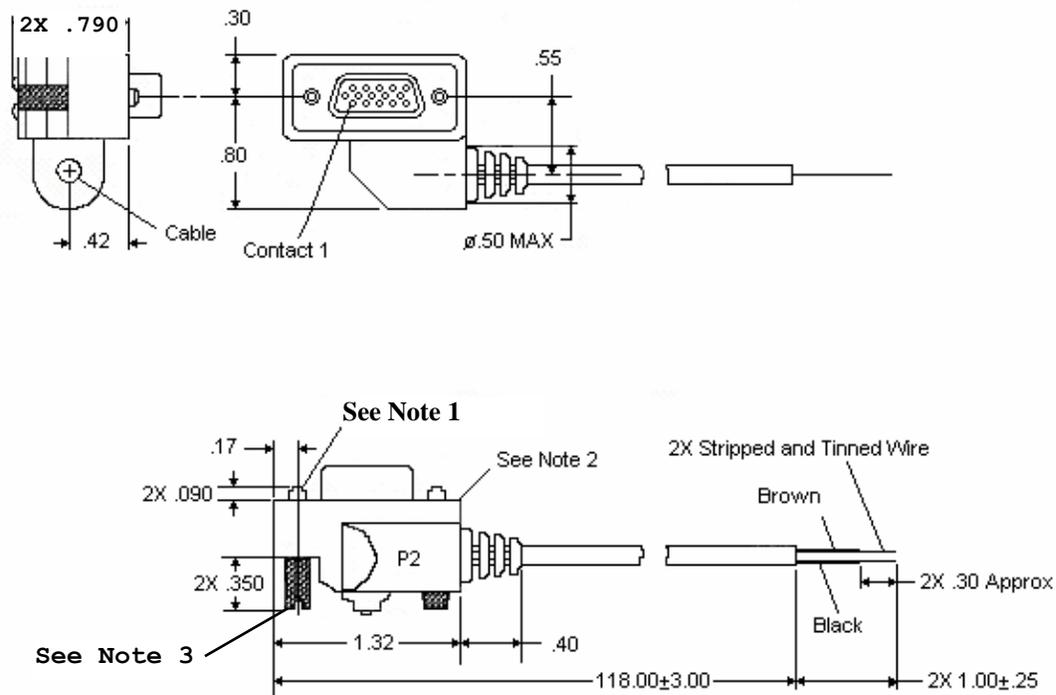
Figure 9. DAGR to PC Cable

3.3.9.3 DAGR-to-HAVE QUICK Cable

The DAGR-to-HAVE QUICK Cable provides for a connection between DAGR and HAVE QUICK radio. Table 11 contains the wiring list for the DAGR-to-HAVE QUICK Cable. Figure 10 illustrates the DAGR-to-HAVE QUICK Cable dimensions. The DAGR J2 connector mate is identified in Table 1.

Table 11. DAGR-to-HAVE QUICK Cable Wiring List

Wire No.	Wire/Cable Description	From	To
1	Wire (22 to 28 gauge is acceptable)	P1-3	n/c (Black)
2	Wire (22 to 28 gauge is acceptable)	P1-7	n/c (Brown)
Shield	Soldered to P2 connector housing	P2-Housing	



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: $.XX = \pm .02$, $.XXX = \pm .010$

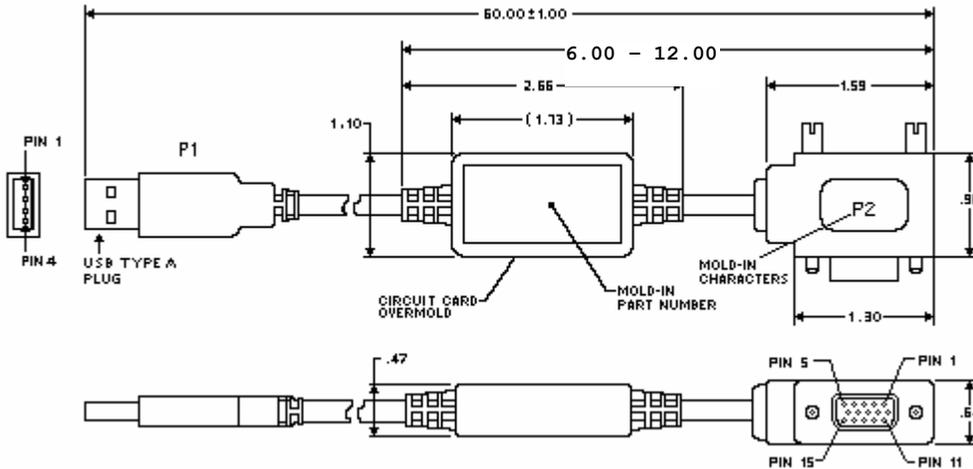
NOTES:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS $.112-40 \text{ UNC}-2A$.
2. THE CONNECTOR FLANGE IS $.030$ ABOVE TO $.015$ BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF $.230$ DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED.

Figure 10. DAGR to HAVE QUICK Cable

3.3.9.4 RS-422-to-USB Cable

The RS-422-to-USB Cable provides for connection between a DAGR and a PC. Figure 11 illustrates the RS-422-to-USB cable dimensions. The DAGR J2 connector mate is identified in Table 1.



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Notes:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE.
2. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR A FLAT BLADE SCREWDRIVER.
3. A SOFTWARE STARTUP COMPACT DISC (CD) IS PACKAGED WITH THE RS-422-TO-USB CABLE IN ONE (1) CONTAINER.

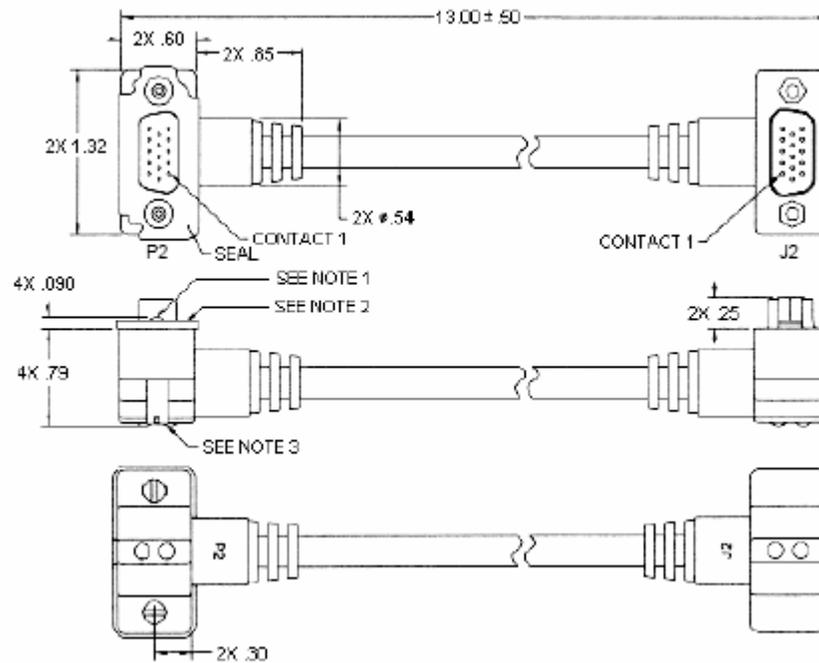
Figure 11. RS-422-to-USB Cable

3.3.9.5 PLGR Adapter Cable - Serial

The PLGR Adapter Cable-Serial provides an extension to the DAGR J2 connector. Table 12 contains the wiring list for the PLGR Adapter Cable-Serial. Figure 12 illustrates the PLGR Adapter Cable-Serial dimensions. The DAGR J2 connector mate is identified in Table 1.

Table 12. PLGR Adapter Cable-Serial Wiring List

Wire No.	Wire/Cable Description	From	To
1	50 Ω shielded coax cable with shield terminated to P2-2 and J2-2	P2-1	J2-1
2	50 Ω shielded coax cable with shield terminated to P2-11 and J2-11	P2-6	J2-6
3	Wire (22 to 28 gauge is acceptable)	P2-3	J2-3
4	Wire (22 to 28 gauge is acceptable)	P2-7	J2-7
5	Wire (22 to 28 gauge is acceptable)	P2-4	J2-4
6	Wire (22 to 28 gauge is acceptable)	P2-5	J2-5
7	Wire (22 to 28 gauge is acceptable)	P2-8	J2-8
8	Wire (22 to 28 gauge is acceptable)	P2-9	J2-9
9	Wire (22 to 28 gauge is acceptable)	P2-10	J2-10
10	Wire (22 to 28 gauge is acceptable)	P2-12	J2-12
11	Wire (22 to 28 gauge is acceptable)	P2-13	J2-13
12	Wire (22 to 28 gauge is acceptable)	P2-14	J2-14
13	Wire (22 to 28 gauge is acceptable)	P2-15	J2-15
Shield		P2-Housing	J2-Housing



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

1. THE JACKSCREW IS CAPTIVE TO THE CONNECTOR AND HAS THE CAPABILITY TO RETRACT (BY SLIDING) SUCH THAT THE TIP OF THE MALE THREAD IS FLUSH OR BELOW THE CONNECTOR FLANGE. THE JACKSCREW IS .112-40 UNC-2A
2. THE CONNECTOR FLANGE IS .030 ABOVE TO .015 BELOW THE BACK SHELL MOLD MATERIAL. AN AREA OF .230 DIAMETER MINIMUM AROUND CONNECTOR MOUNTING HOLES IS FREE OF MOLD MATERIAL (FOR JACKSCREW RECEPTACLE CLEARANCE).
3. THE JACKSCREW CAN BE OPERATED WITH THE FINGERTIPS OR A FLAT BLADE SCREWDRIVER. THE JACKSCREW DOES NOT PROTRUDE BEYOND THE BACKSIDE OF THE BACK SHELL WHEN THE JACKSCREW IS FULLY ENGAGED.

Figure 12. PLGR Adapter Cable-Serial

14. For purposes of this document, it is assumed that the antenna consists of one or more antenna elements with an associated self-contained ground plane, an appropriate enclosure (radome), filtering and amplification as needed to meet the RF characteristics, and a single coaxial remote antenna-to-receiver interface cable. Antenna gain is measured in dBic, i.e., decibels referenced to the gain of an ideal, Right Hand Circularly Polarized (RHCP) isotropic antenna.

Table 14. Antenna Performance Characteristics

Characteristic	Performance Value
Antenna polarization	RHCP
Antenna element radiation pattern ¹	-3.0 dBic minimum at L1 and L2
Input noise figure	2.5 dB maximum
Gain ²	+20 dB minimum, +30 dB maximum
Operating Bandwidth L1 L2	1575.42 ± 10.23 MHz minimum 1227.60 ± 10.23 MHz minimum
Amplitude ripple over operating bandwidth	2dB peak-to-peak maximum
Output Impedance	50 Ω nominal
Output VSWR	2:1 Maximum (relative to 50 Ω) at center frequency of L1 and L2
DC power connection	+2.5 to +5.5 VDC
DC Input Voltage	50 mV peak-to-peak max
DC Operating Current	9mA to 60 mA
Out-of-Band Rejection: The antenna must show no signs of discernible, repeated compression while exposed to a 50 volt per meter (V/m) electric field in the frequency range from 2 MHz to 18 GHz, excluding L1 ± 100 MHz, and L2 ± 100 MHz.	
Burnout: The antenna must not suffer any permanent degradation as a result of being exposed to a 200 V/m electric field with 500 μs pulse width, 1 kHz repetition rate, in the frequency from 2 MHz to 18 GHz.	
Environmental Considerations: These characteristics apply over a range of environmental considerations that are consistent with the users operating environment.	

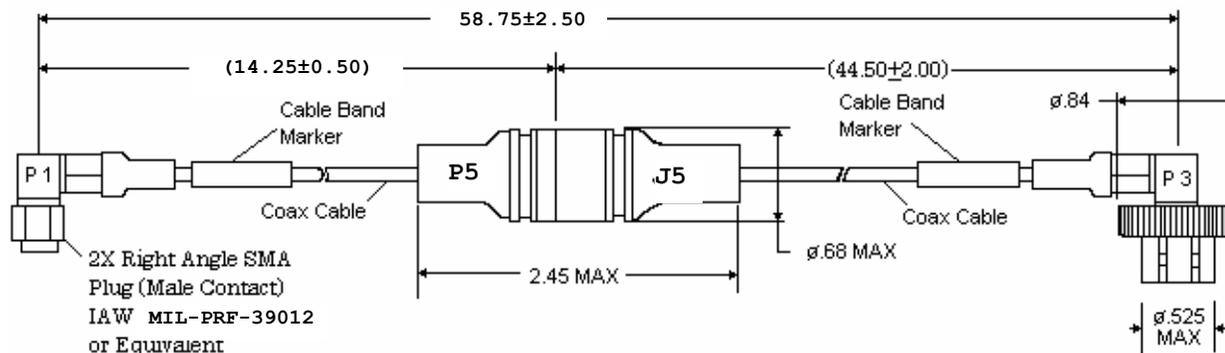
Notes:

1. Antenna element radiation pattern applies for all azimuth and elevation angles with elevation greater than 10 degrees.
2. Net gain of antenna and interface cable, not including the gain associated with the antenna element.

3.4.4 Antennas, Cables and Adapters.

3.4.4.1 DAGR-to-Helmet Antenna (HA) Cable (1.5 meter).

The DAGR-to-HA Cable (1.5 Meter) provides for connection between the DAGR and the HA. Figure 14 illustrates the DAGR-to-HA Cable dimensions. The DAGR J3 connector mate is identified in Table 1. The DAGR-to-HA Cable non-destructively separates at the P5/J5 interfaces at a force load between 7 and 16 pounds. The DAGR-to-HA Cable time delay is 6.5 ns typical.

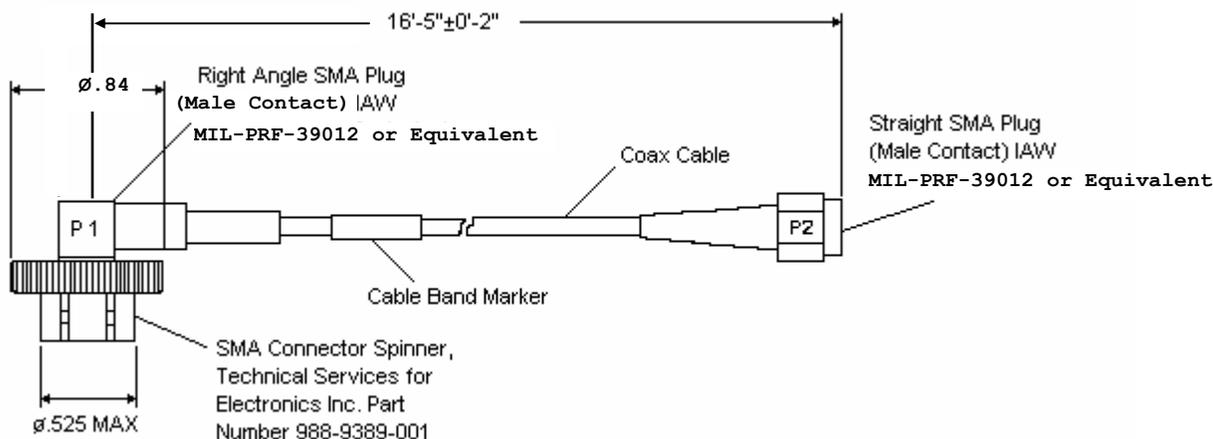


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: XX = ± 0.02 , .XXX = ± 0.010

Figure 14. DAGR to Helmet Antenna Cable (1.5 meter)

3.4.4.2 DAGR-to-Remote Antenna 1 (RA-1) Cable (5 meter).

The DAGR-to-RA-1 Cable (5 Meter) provides for connection between the DAGR and a RA-1. Figure 15 illustrates the DAGR-to-RA-1 Cable (5 Meter) dimensions. The DAGR J3 connector mate is identified in Table 1. The DAGR-to-RA-1 (5 Meter) time delay is 24 ns typical.

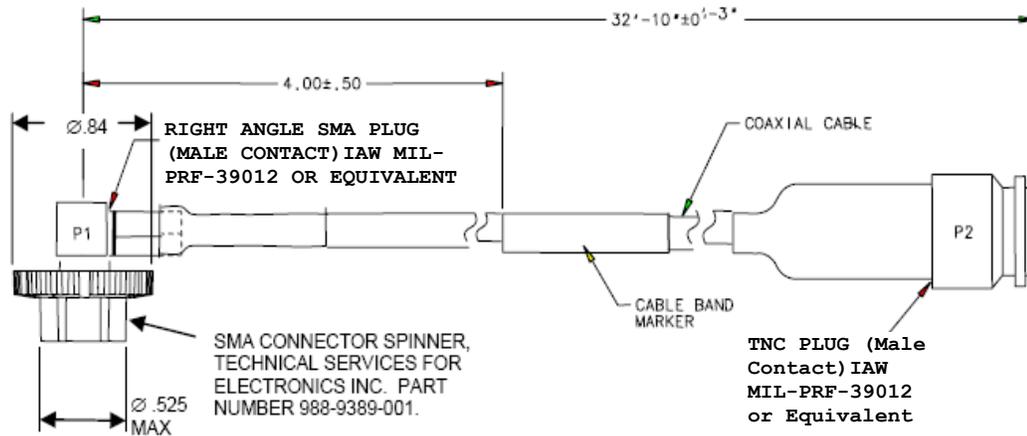


UNLESS OTHERWISE SPECIFIED DIM ARE
 IN INCHES: TOL ON: ANGLES: $\pm 2.0^\circ$
 DECIMALS: .XX = ± 0.02 , .XXX = ± 0.010

Figure 15. DAGR to Remote Antenna 1 Cable (5 meter)

3.4.4.3 DAGR-to-Remote Antenna 1 (RA-1) Cable (10 meter).

The DAGR-to-RA-1 Cable (10 Meter) provides for connection between the DAGR or an AJA and a RA-1. Figure 16 illustrates the DAGR-to-RA-1 Cable (10 Meter) dimensions. The DAGR J3 connector mate is identified in Table 1. The DAGR-to-RA-1 Cable (10 Meter) time delay is 43 ns typical.

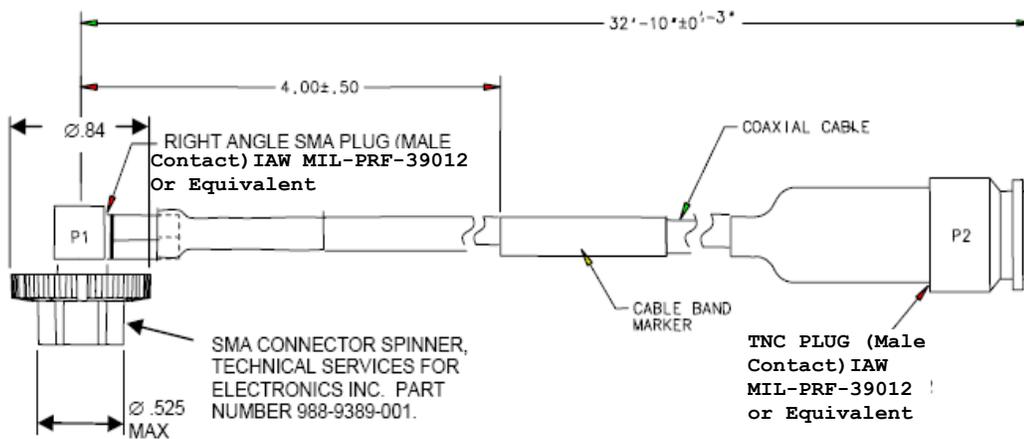


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = ± 0.02 , .XXX = ± 0.010

Figure 16. DAGR to Remote Antenna 1 Cable (10 meter)

3.4.4.4 DAGR-to-Remote Antenna 2 (RA-2) Cable (10 meter).

The DAGR-to-RA-2 Cable provides for connection between the DAGR and a RA-2. Figure 17 illustrates the DAGR-to-RA-2 Cable dimensions. The DAGR J3 connector mate is identified in Table 1. The DAGR-to-RA-2 Cable (10 Meter) time delay is 43 ns typical.

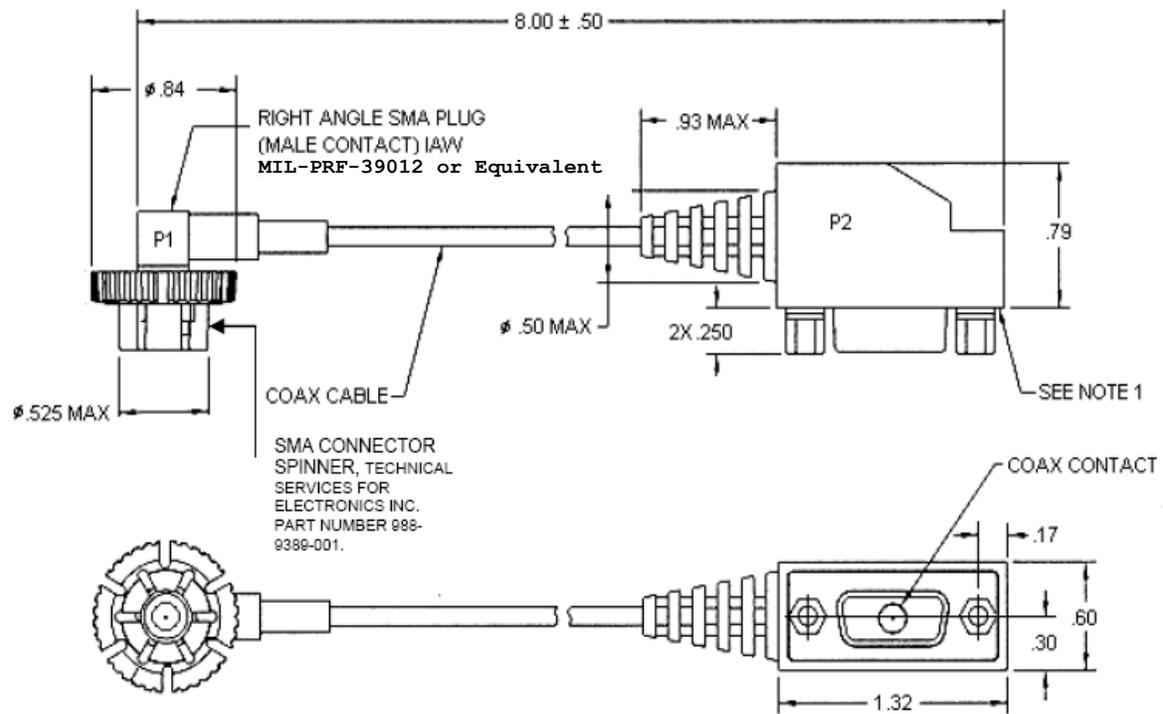


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = ± 0.02 , .XXX = ± 0.010

Figure 17. DAGR to Remote Antenna 2 Cable (10 meter)

3.4.4.5 PLGR Cable Adapter - Remote Antenna.

The PLGR Cable Adapter - Remote Antenna provides for connection between the DAGR and a PLGR RA Cable (NSN 5985-01-375-4660 and NSN 5985-01-391-2947). Figure 18 illustrates the PLGR Cable Adapter- Remote Antenna dimensions. The DAGR J3 connector mate is identified in Table 1. The PLGR Cable Adapter time delay is 1 ns typical.



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Note:

1. The connector flange is $.030$ above to $.015$ below the back shell mold material.

Figure 18. PLGR Cable Adapter-Remote Antenna

3.5 J4 Connector

3.5.1 J4 Physical Interface.

The J4 connector and its mate are identified in Table 1. The external power interface uses pins 1 and 3. Refer to Figure 19 for J4 contact locations. Accessories and cables used to connect the DAGR to an external power source are identified in Table 2 and Table 3.

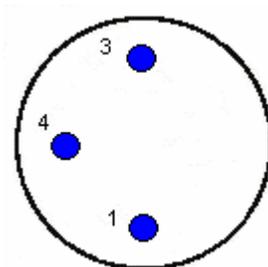


Figure 19. DAGR J4 Contact Locations

3.5.2 J4 Electrical Interface.

Table 15 identifies the characteristics of the external power interface.

Table 15. DAGR J4 Connector Signals

Pin	Signal	I/O ¹	Electrical Characteristics
1	External Power Return	N/A	Isolated power return
3	External Power In	I	Voltage: +9 to +32 VDC Operational power consumption: 3 W max OFF mode consumption: 0.5 W max
4	Reserved	N/A	N/A

Notes:

1. Input and output are with respect to the GPS Receiver.

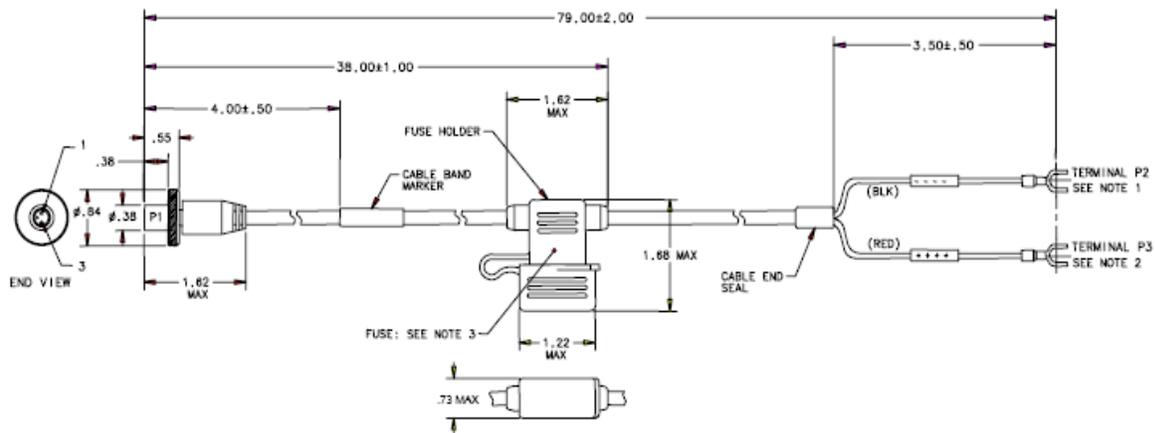
3.5.3 J4 Cables and Adapters.

3.5.3.1 DAGR-to-External Power Cable (2 Meter).

The DAGR-to-External Power Cable (2 Meter) provides for connection between a DAGR and an external power source. Table 16 contains the wiring list for the DAGR-to-External Power Cable (2 Meter). Figure 20 illustrates the DAGR-to-External Power Cable (2 Meter) dimensions. The DAGR J4 connector mate is identified in Table 1.

Table 16. DAGR-to-External Power Cable (2 Meter)

Wire No.	Wire/Cable Description	From	To	In-Line Fuse
1	Wire (20 gauge)	P1-1	P2	No
2	Wire (20 gauge)	P1-3	P3	Yes



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

1. K.S. TERMINALS PART NUMBER SNYS1-3.7 BLACK OR EQUIVALENT.
2. K.S. TERMINALS PART NUMBER SNYS1-3.7 RED OR EQUIVALENT.
3. FUSE TYPE: 32 VDC, 2 AMP, NSN 5920-01-433-3097

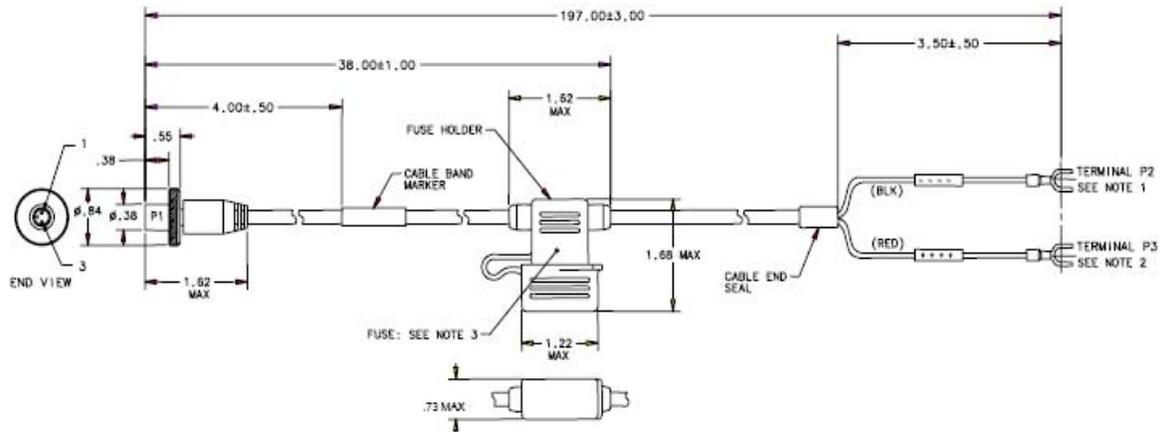
Figure 20. DAGR-to-External Power Cable (2 meter)

3.5.3.2 DAGR-to-External Power Cable (5 Meter).

The DAGR-to-External Power Cable (5 Meter) provides for connection between a DAGR and an external power source. Table 17 contains the wiring list for the DAGR-to-External Power Cable (5 Meter). Figure 21 illustrates the DAGR-to-External Power Cable (5 Meter) dimensions. The DAGR J4 connector mate is identified in Table 1.

Table 17. DAGR-to-External Power Cable (5 meter)

Wire No.	Wire/Cable Description	From	To	In-Line Fuse
1	Wire (20 gauge)	P1-1	P2	No
2	Wire (20 gauge)	P1-3	P3	Yes



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .03$, .XXX = $\pm .010$

NOTES:

4. K.S. TERMINALS PART NUMBER SNYS1-3.7 BLACK OR EQUIVALENT.
5. K.S. TERMINALS PART NUMBER SNYS1-3.7 RED OR EQUIVALENT.
6. FUSE TYPE: 32 VDC, 2 AMP, NSN 5920-01-433-3097

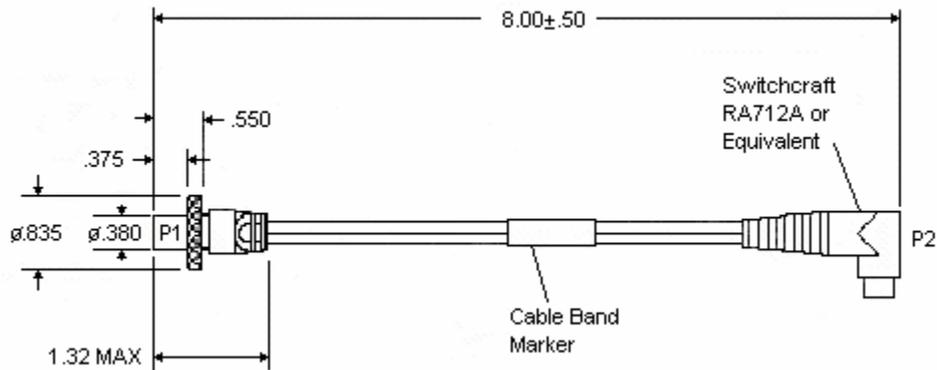
Figure 21. DAGR-to-External Power Cable (5 meter)

3.5.3.3 PLGR Cable Adapter - External Power.

The PLGR Cable Adapter - External Power provides for connection between a DAGR and a PLGR external power cable (NSN 6150-01-375-8661). Table 18 contains the wiring list for the PLGR Cable Adapter - External Power. Figure 22 illustrates the PLGR Cable Adapter - External Power dimensions. The DAGR J4 connector mate is identified in Table 1.

Table 18. PLGR Cable Adapter - External Power

Wire No.	Wire/Cable Description	From	To
1	Wire (20 gauge)	P1-3	P2 - Center Conductor
2	Wire (20 gauge)	P1-1	P2 - Outer Conductor

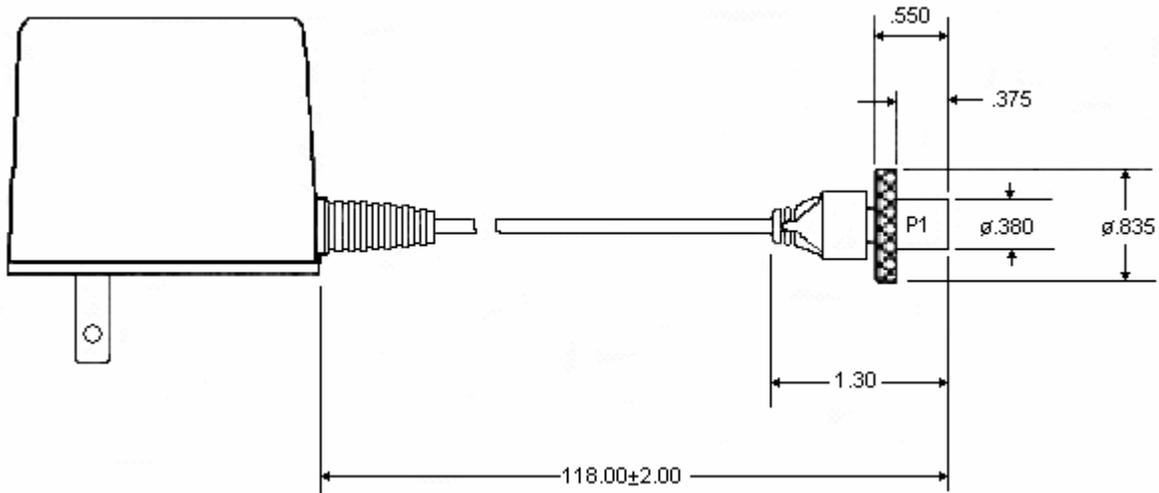


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Figure 22. PLGR Cable Adapter - External Power

3.5.3.4 AC Power Adapter.

The AC Power Adapter provides for connection between a DAGR and an AC power source that supplies 110/220 VAC $\pm 10\%$ 50/60 Hz. Figure 23 illustrates the AC Power Adapter dimensions. The DAGR J4 connector mate is identified in Table 1.



UNLESS OTHERWISE SPECIFIED DIM ARE
 IN INCHES: TOL ON: ANGLES: $\pm 2.0^\circ$
 DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

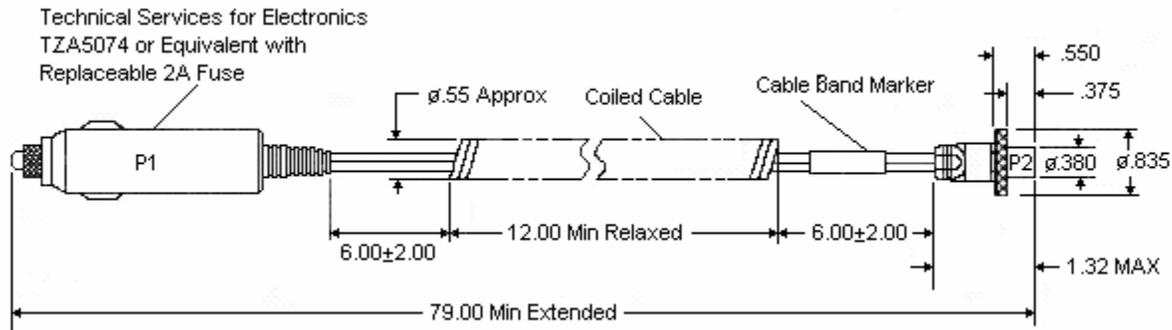
Figure 23. AC Power Adapter

3.5.3.5 Cigarette Lighter Power Adapter.

The Cigarette Lighter Power Adapter provides for connection between a DAGR and a cigarette lighter. Table 19 contains the wiring list for the Cigarette Lighter Power Adapter. Figure 24 illustrates the Cigarette Lighter Power Adapter dimensions. The DAGR J4 connector mate is identified in Table 1.

Table 19. Cigarette Lighter Power Adapter

Wire No.	Wire/Cable Description	From	To
1	Wire (20 gauge)	P2-3	P1 - Center Conductor
2	Wire (20 gauge)	P2-1	P1 - Outer Conductor



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = ± 0.02 , .XXX = ± 0.010

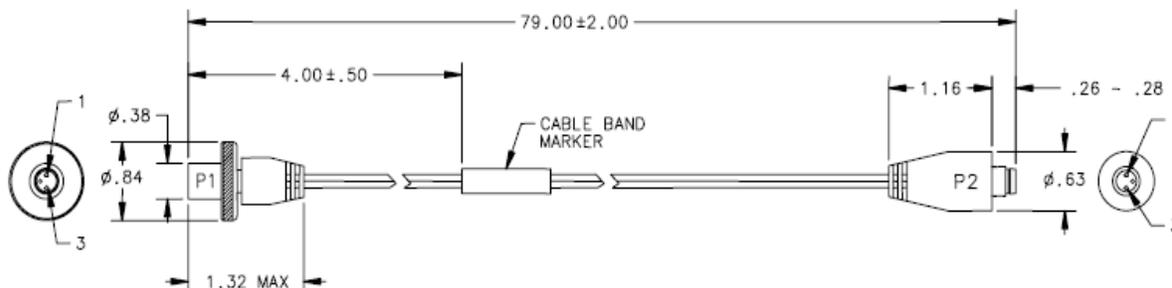
Figure 24. Cigarette Lighter Power Cable

3.5.3.6 DAGR-to-External (Cold Weather) Battery Pack Cable.

The DAGR-to-External (Cold Weather) Battery Pack Cable provides for connection between a DAGR and an External (Cold Weather) Battery Pack. Table 20 contains the wiring list for the DAGR-to-External (Cold Weather) Battery Pack Cable. Figure 25 illustrates the DAGR-to-External (Cold Weather) Battery Pack Cable dimensions. The DAGR J4 connector mate is identified in Table 1.

Table 20. DAGR-to-External (Cold Weather) Battery Pack Cable

Wire No.	Wire/Cable Description	From	To
1	Wire (20 gauge)	P1-1	P2-1
2	Wire (20 gauge)	P1-3	P2-3



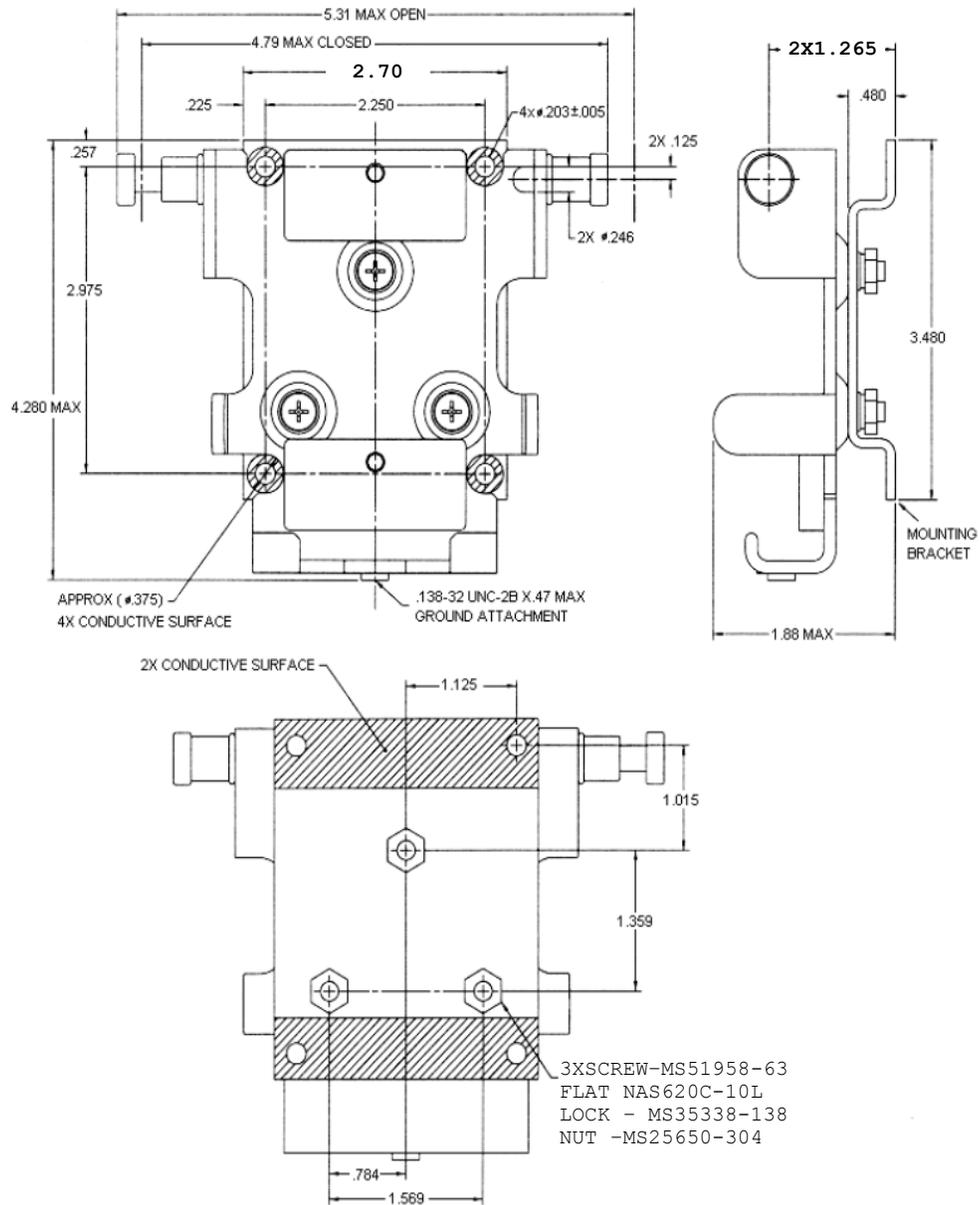
UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES: TOL ON: ANGLES: $\pm 2.0^\circ$
 DECIMALS: .XX = ± 0.02 , .XXX = ± 0.010

Figure 25. DAGR-to-External (Cold Weather) Battery Pack Cable

3.6 DAGR MOUNTS

3.6.1 DAGR Installation Mount and Mounting Points.

The Installation Mount dimensions and mounting points are shown in Figure 26.

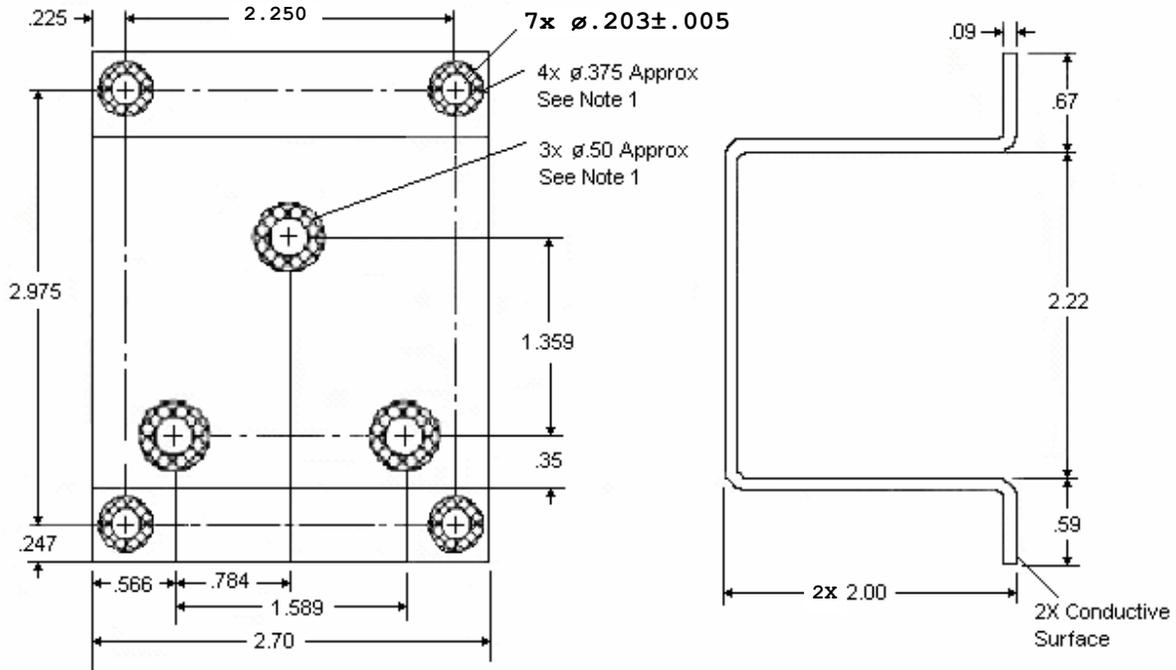


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOL ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Figure 26. DAGR Installation Mount

3.6.2 PLGR Installation Mount Adapter and Mounting Points.

The PLGR Installation Mount Adapter dimensions and mounting points are shown in Figure 27. The PLGR Installation Mount Adapter replaces the mounting bracket of the Installation Mount.

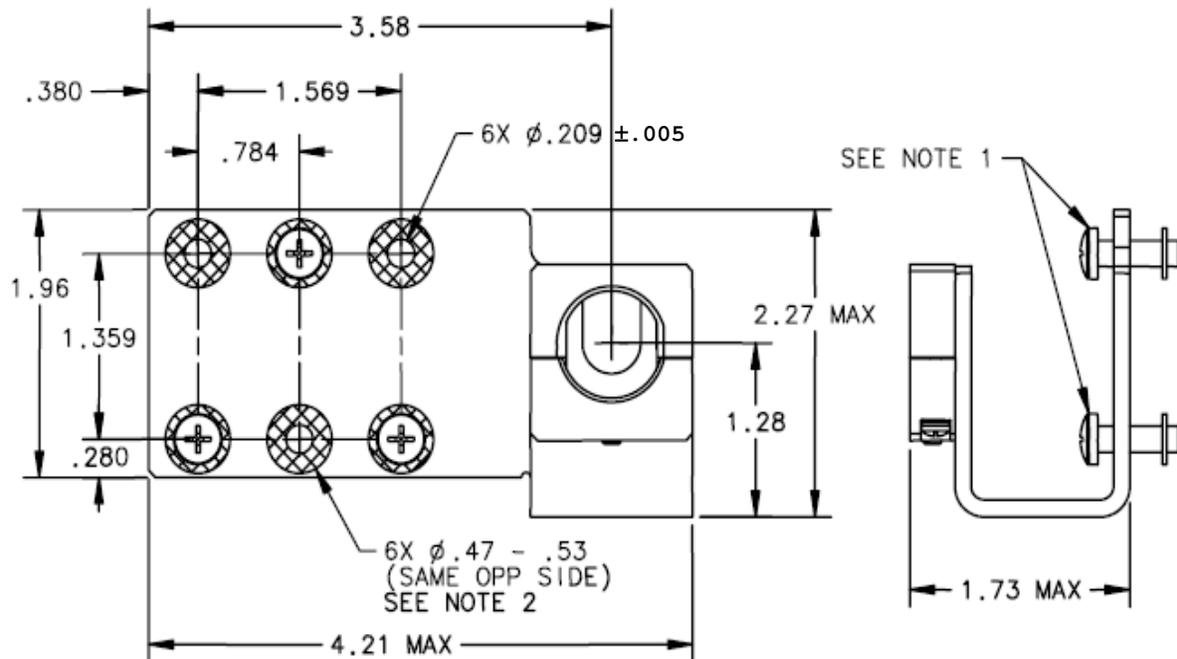


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$
NOTE 1: Conductive Surfaces

Figure 27. PLGR Installation Mount Adapter

3.6.3 Front Keyfill Cable Adapter Bracket Kit.

The Keyfill Cable Adapter Bracket Kit attaches to the Installation Mount and the P2 connector on the Crypto Fill Cable to securely hold and position P2 for mating connector engagement. Figure 28 illustrates the Keyfill Cable Adapter Bracket dimensions.



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:

TOL ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

NOTES:

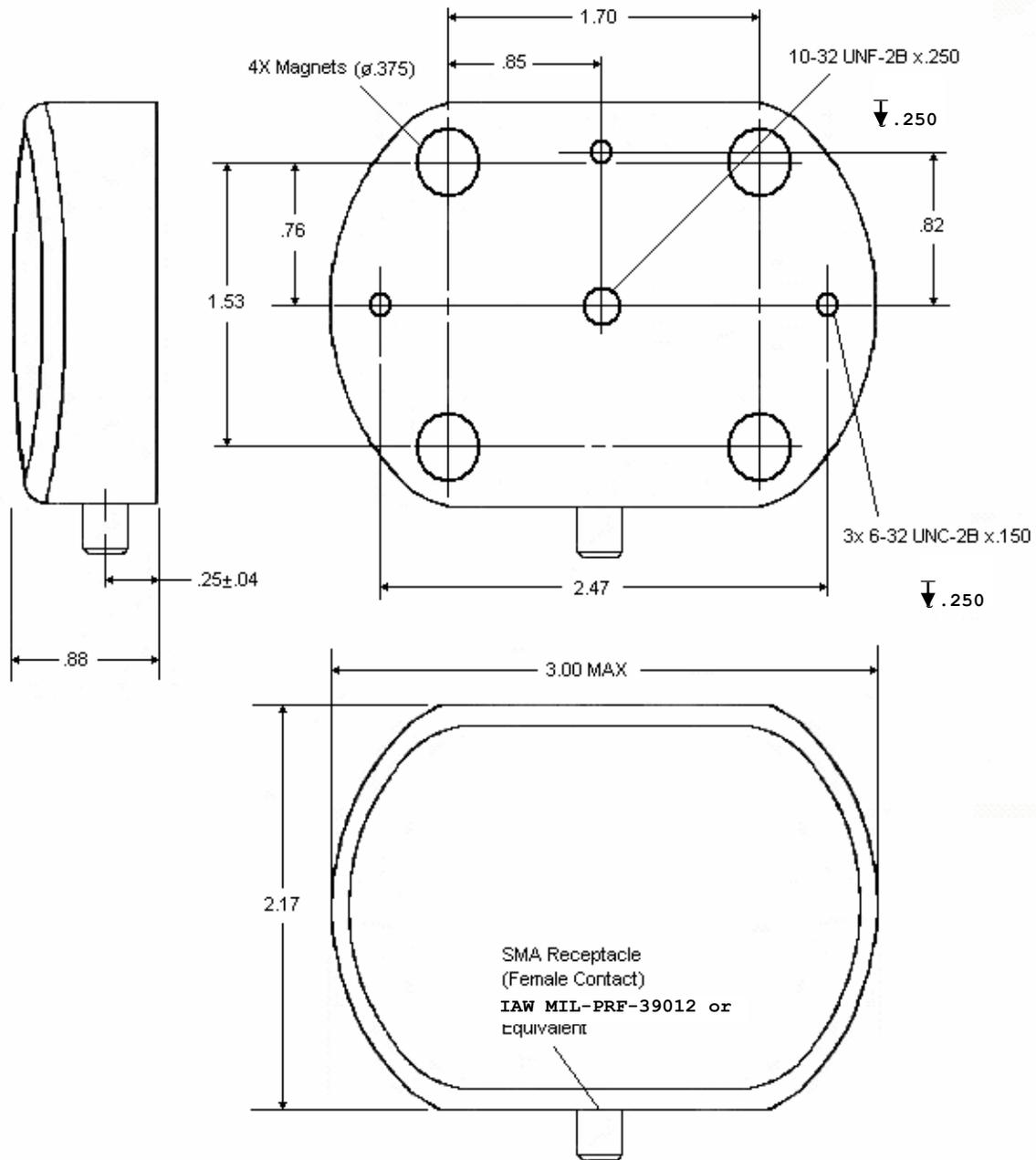
1. Hardware provided in kit includes: machine screw MS51958-64 (quantity 3) and flat washer NAS620C10L (quantity 3).
2. Conductive surface

Figure 28. Front Keyfill Cable Adapter Bracket Kit

3.7 DAGR ACCESSORIES.

3.7.1 Remote Antenna 1 (RA-1).

Refer to Figure 29 for illustrations of the Remote Antenna 1 dimensions.

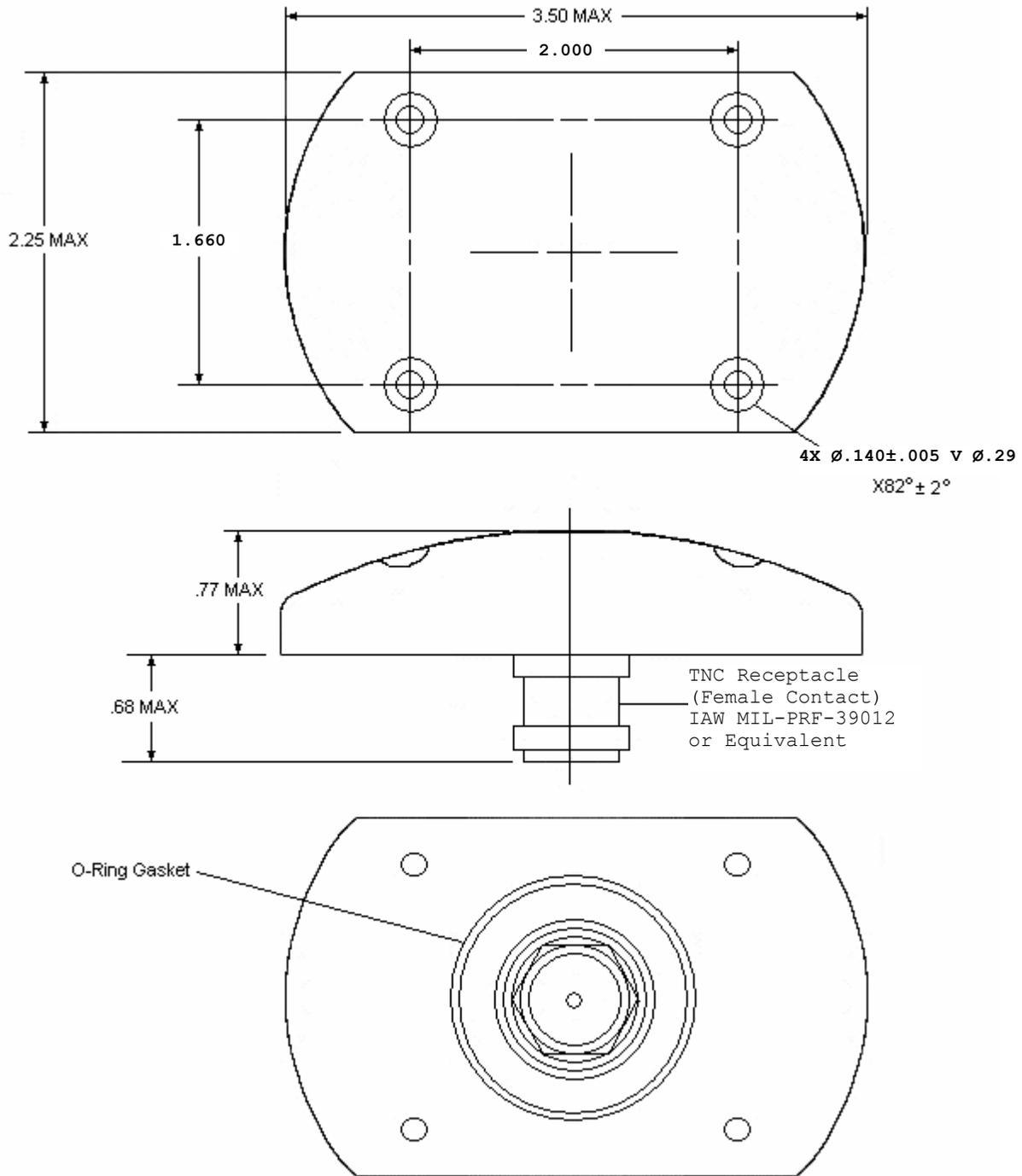


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Figure 29. Remote Antenna 1 (RA-1)

3.7.2 Remote Antenna 2 (RA-2).

Refer to Figure 30 for illustrations of the Remote Antenna 2 dimensions.



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

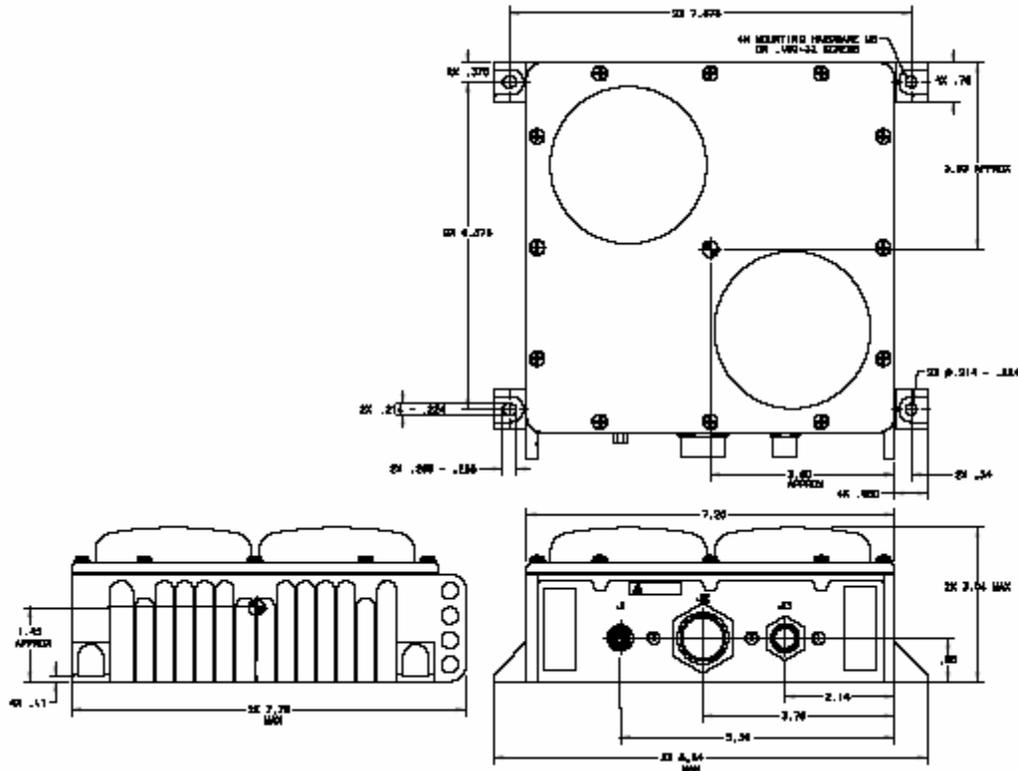
Figure 30. Remote Antenna 2 (RA-2)

3.7.3 Anti-Jam Accessory (AJA).

The Anti-Jam Accessory is a remote antenna system that enhances the ability of the DAGR to operate while in a jamming environment. The AJA uses advanced digital signal processing techniques to reduce the effects of CW, partial-band, and broad-band GPS jammers. The AJA is intended for use with the DAGR.

3.7.3.1 AJA Physical Dimensions.

The AJA dimensions are provided in Figure 31.



Unless otherwise specified, dimensions are in inches.
 Tolerance on: angles $\pm 2.0^\circ$, decimals: .XX = $\pm .02$, .XXX = $\pm .010$

Figure 31. Anti-Jam Accessory

3.7.3.2 External Conectors.

The AJA has three connectors that allow for integration to the DAGR and the host system. The AJA's connector reference designation, function and mating connector part numbers are identified in Table 21.

Table 21. AJA Interfaces and Connectors

AJA Reference Designator	Function	Mating Connector
J1	RF Output	M39012/55-3129 or equivalent
J2	Data	MS3116E14-19S with backshell, Glenair part number 390DS008B1403A3
J3	External Power	MS3116J8-4S

Cables used to integrate the AJA and the associated AJA connector are defined in Table 2 and Table 22.

Table 22. AJA Cables

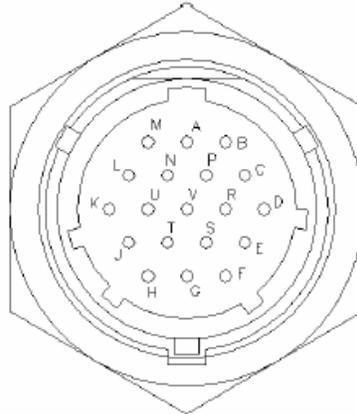


Figure 33. AJA J2 Digital I/O Contact Location

3.7.3.2.2.2 J2 Electrical Interface.

Table 24 identifies the characteristics of AJA Digital I/O interface.

Table 24. AJA J2 Connector Signals

Pin	Name	Description	I/O [†]	Characteristics
B, D, F, H, L	Chassis Ground	Chassis Ground	N/A	Ground
A, C, E, G, K, V	Digital Gnd	Digital Ground	SR	Signal Return
N	SP XMT	RS-232 Transmit to DAGR	O	Per EIA-232
T	SP RCV	RS-232 Receive from DAGR	I	Per EIA-232

NOTES:

1. Input and output are with respect to the AJA.
2. All pins not listed are spare or reserved.

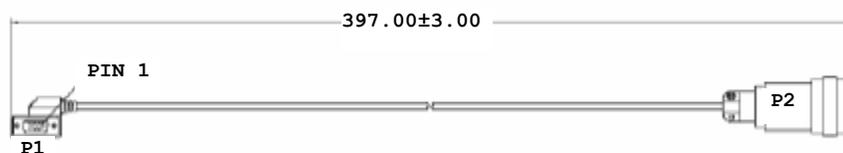
3.7.3.2.2.3 AJA J2 Data Cable.

The AJA Data Cable provides for connection between the AJA and DAGR COM 3. Figure 34 illustrates the AJA Data Cable dimensions. Table 25 identifies the AJA Data Cable signals. The AJA Data Cable NSN is identified in Table 23.

CAUTION: In addition to the AJA data cable, the AJA to DAGR interface also includes vendor proprietary data messages which the AJA requires to function.

Table 25. AJA Data Cable Signals

Wire Number	Wire/Cable Description	From	To
1	22 to 24 AWG is acceptable	P1-3	P2-V
2	22 to 24 AWG is acceptable	P1-4	P1-3
3	22 to 24 AWG is acceptable	P1-14	P2-T
4	22 to 24 AWG is acceptable	P1-15	P2-N
Shield		P1-Housing	P2-Backshell



Unless otherwise specified, dimensions are in inches

Figure 34. AJA Data Cable

3.7.3.3 AJA J3 External Power Connector.

The J3 power connector accepts external power from the host system.

3.7.3.3.1 J3 Physical Interface.

Refer to Figure 35 for J3 contact locations.

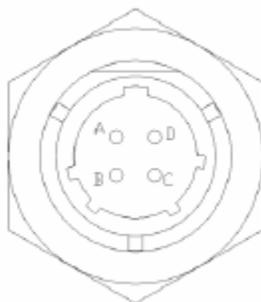


Figure 35. AJA J3 External Power Connector

3.7.3.3.2 J3 Electrical Interface.

Table 26

identifies the electrical characteristics of AJA external power interface.

Table 26. AJA J3 External Power Connector Signals

Pin	Name	Description	I/O ¹	Characteristics
B	EXT PWR IN	28VDC	I	Voltage: +9VDC to +32VDC Power Consumption: 19 W max 16 W Typical
C	EXT PWR RTN	28 VDC Return	SR	Power Return

NOTES:

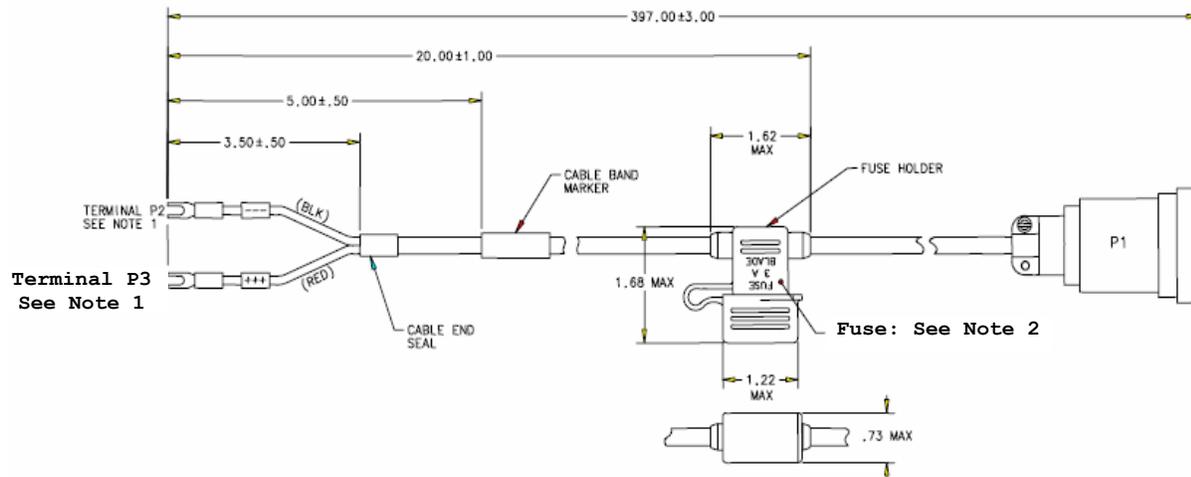
1. Input and output are with respect to the AJA.
2. All pins not listed are spare or reserved

3.7.3.3.3 AJA J3 Power Cable.

The AJA Power Cable provides for connection between the AJA and an external power source. Figure 36 illustrates the AJA Power Cable dimensions. Table 27 identifies the AJA Power Cable signals. The AJA Power Cable NSN is identified in Table 23.

Table 27. AJA Power Cable Signals

Wire Number	Wire/Cable Description	From	To	In-Line Fuse
1	16 AWG	P2	P1-C	No
2	16 AWG	P3	P1-B	Yes



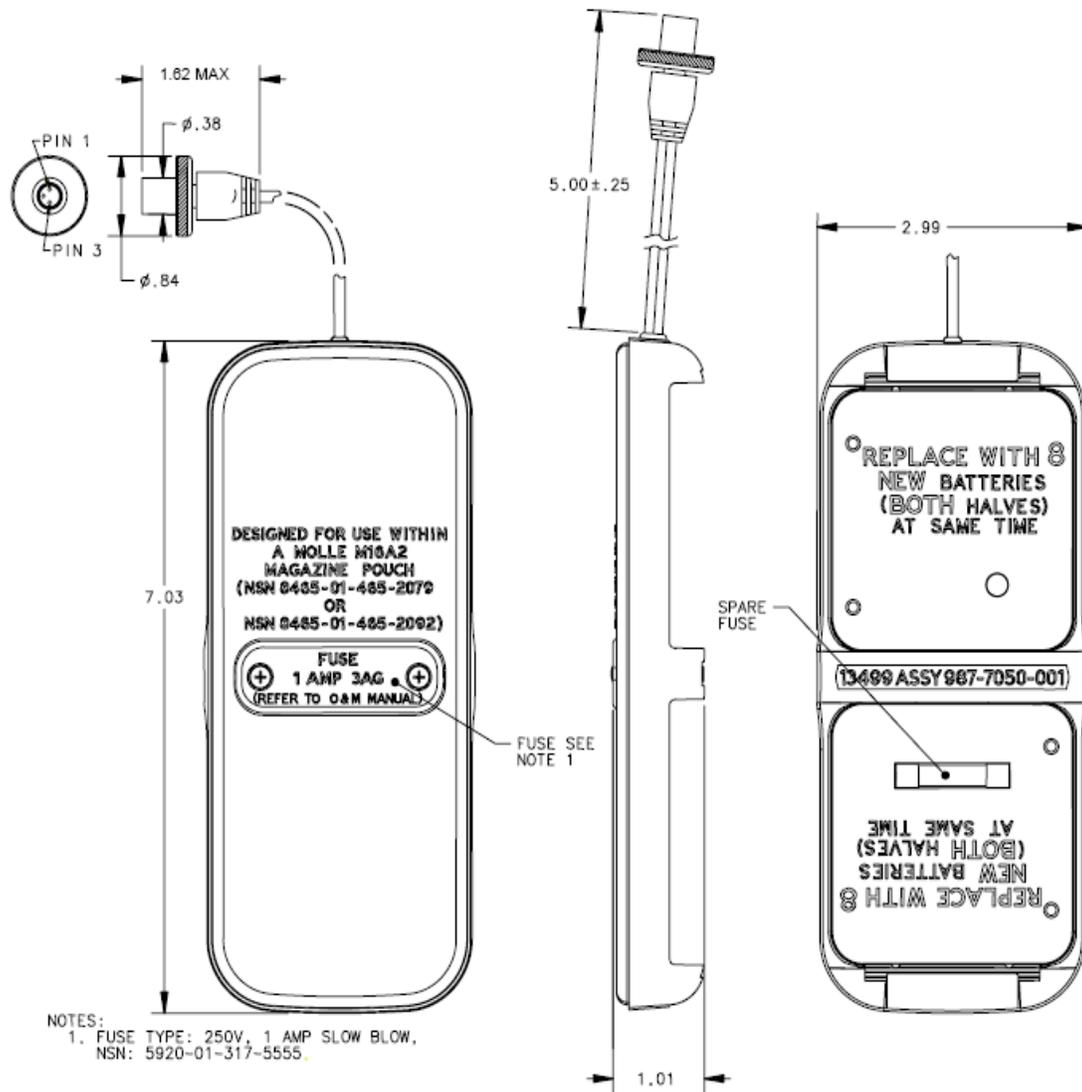
Unless otherwise specified, dimensions are in inches.
 Tolerance on: angles $\pm 2.0^\circ$, decimals: .XX = $\pm .02$.XXX = $\pm .010$
 Notes:

1. Thomas and Betts part number RBS14-6FLX or equivalent.
2. Fuse type: 32 VDC, 3 AMP, NSN 5920-01-123-5210

Figure 36. AJA Power Cable

3.7.4 External (Cold Weather) Battery Pack.

The external (Cold Weather) Battery Pack is an external power source designed for extended use with the DAGR when batteries are the only practical means of power. The Battery pack interfaces with two DAGR Prime Power Battery Magazines for a total capacity of eight AA sized battery cells. The Battery Pack interfaces with the DAGR using the DAGR-to-External (Cold Weather) Battery Pack cable described in Table 21, and illustrated in Figure 25. The External (Cold Weather) Battery Pack is designed to utilize ammunition pouches NSN: 8465-01-465-2079, 8465-01-465-2092, or equivalent to attach to the operator and be carried/worn inside cold weather clothing. The Battery Pack is illustrated in Figure 37.

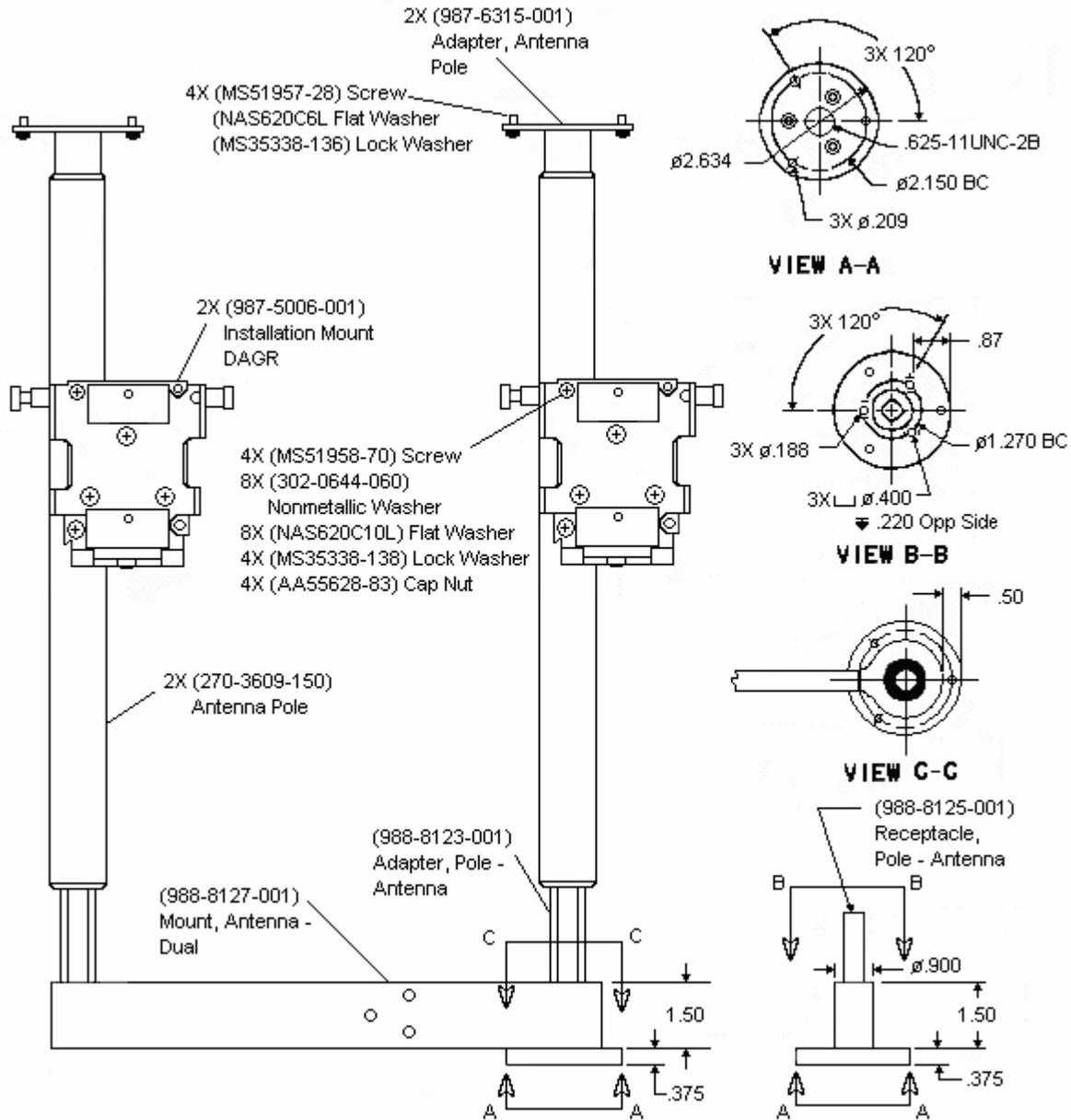


UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: ±2.0° DECIMALS: .XX = ±.02, .XXX = ±.010

Figure 37. DAGR External Battery Pack

3.7.5 Sub-Mil Gun Laying System Kit Interface Definition.

The components of the Sub-Mil GLS Kit and the interfaces external to the DAGR Sub-Mil GLS system are shown in Figure 38.



UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES:
 TOLERANCES ON: ANGLES: $\pm 2.0^\circ$ DECIMALS: .XX = $\pm .02$, .XXX = $\pm .010$

Figure 38. DAGR Sub-Mil GLS Kit and Mounting Points

4.0 ACRONYMS AND ABBREVIATIONS

Ø	diameter
Ω	ohm
μs	microsecond
1PPS	one pulse per second
AC	alternating current
AFB	Air Force base
AJA	Anti-Jam Accessory
amp	ampere
ANCD	automated net control device
AWG	American wire gauge
BCD	Binary Coded Decimal
CCD	command control data
CECOM	Communication-Electronics Command
CFDI	Common Fill Device Interface
coax	coaxial cable
COM	Communications Port
COMSEC	communication security
CW	Continuous Wave
DAGR	Defense Advanced GPS Receiver
dB	decibel
dBic	isotropic antenna
DC	direct current
DIA	diameter
DIM	dimensions
DoD	Department of Defense
DSN	Defense Switched Network
DWG	drawing
EIA	Electronics Industries Association
EPROM	erasable programmable read-only memory
FCI	Flow Control Input

FCO	Flow Control Output
GLS	Gun Laying System
GND	ground
GPS	Global Positioning System
GPSW	Global Positioning System Wing
HA	Helmet Antenna
HV	host vehicle
Hz	hertz
I	input
ICC	interface control contractor
ICD	interface control document
INFO	information
IS	interface specification
I/O	input/output
KFD	Keyfill Device
L	length
M	million
mA	milliampere
Max	maximum
MHz	megahertz
Min	minimum
MUX	multiplex
mV	millivolt
N/A	not applicable
NF	noise figure
NMEA	National Marine Electronics Association
NO	number
NSN	National Stock Number
O	output

DOC. NO. IS-GPS-164
DATE 23 July 2007

p-p	peak-to-peak
PC	personal computer
pF	pico farad
PLGR	Precision Lightweight GPS Receiver
PPS	Pulse Per Second
RA	Remote Antenna
REF	reference
RCPN	Rockwell Collins Part Number
REQ	request
RF	radio frequency
RHCP	right-hand circularly polarized
SINGARS	Single-Channel Ground and Airborne Radio Set
Sub-Mil	Sub millimeter
Sw	switch
TM	technical manual
TFOM	Time Figure of Merit
TOD	Time of Day
TOL	tolerance
UE	user equipment
USA	United States Army
UTC	Coordinated Universal Time
VAC	volts alternating current
VDC	volts direct current
VSWR	voltage standing wave ratio
w/	with
WRT	with respect to