



Submarine Rescue System

SRS-RCS

Rescue Capable System

**Control Van
Navigation System
2A5A9**

Maintenance Manual

2A5A9-NAV-MM-D-2

Submarine Rescue System – Rescue Capable System

Control Van (CV) Navigation System (NAV) 2A5A9

Maintenance Manual

GOVERNMENT PURPOSE RIGHTS – TECHNICAL DATA

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1.1 Purpose

This manual provides specific maintenance procedures for the Control Van (CV) Navigation System (NAV).

The information is intended to be used as a general reference and to assist with system understanding for training and maintenance purposes.

1.2 Scope

This manual applies only to the CV Navigation System and its interface to directly related subsystems.

1.3 Drawing References

Table 1 lists drawings referenced in this manual.

Table 1 Drawing References

NAVSEA #	OceanWorks #	Drawing Title
7531488	569-270-A63000	Acoustic positioning interface bracket (2A11A7)
7533024	569-620-A38196	APS motion sensor installation details
7533045	569-620-A38032	CV navigation system assembly
7533046	569-620-A38154	CV navigation system cable routing
7533047	569-620-S38032	CV navigation system schematic
7533048	569-620-S38199	Navigation tray wiring diagram
7533099	569-620-A38189	Navigation tray assembly
7533101	569-620-A38190	INS computer assembly
7533105	569-620-A38144	APS C/D module installation details
7533106	569-620-A38178	Gyro sensor module installation details
7533107	569-630-A38252	VOO heading RS-232 data cable assembly
7533152	569-620-A38192	Video converter tray assembly
7533177	569-630-A38204	GPS antenna interior cable assembly
7533180	569-630-A38203	GPS antenna exterior cable assembly
7533184	569-640-A38201	APS transducer interior cable assembly
7533187	569-630-A38253	Gyro control unit RS-232 data cable assembly
7533189	569-630-A38255	GPS time code data cable assembly
7533194	569-640-A38200	APS transducer exterior cable assembly

7533196	569-620-A38263	Gyro control unit power cable assembly
7533197	569-610-A38233	P-Code GPS power cable assembly
7533198	569-620-A38258	Generic 75-ohm BNC to BNC video cable assembly
7533203	569-130-A38195	GPS antenna installation details
7533426	569-610-A38423	DGPS unit power cable assembly
7533428	569-620-A38425	DGPS antenna exterior cable assembly
7533429	569-630-A38426	VOO heading RS-422 data cable assembly
7533444	569-630-A38434	DGPS antenna interior cable assembly
7533446	569-620-S38436	APS wiring diagram
7533459	569-630-A38453	APS motion sensor repeater cable assembly

1.4 Document References

Table 2 lists documents referenced in this manual.

Table 2 Document References

Document Type	Document #	Document Title
COTS Manuals	This manual does not reference COTS Manuals.	
SRS-RCS Documents	2A5A2-ELEC-MM	CV Electrical Power System Maintenance Manual
	2A5A5-CCD-MM	CV Command, Control and Data System Maintenance Manual
	2A5A9-NAV-OM	CV Navigation System Operating Manual
	2A5A10-VIDEO-MM	CV Video and Data Display System Maintenance Manual
Other Documents	This manual does not reference other documents.	

1.5 Abbreviations and Acronyms

See the Glossary at the end of this manual for acronyms, abbreviations, and special term descriptions.

1.6 Danger, Warning, Caution, and Note

This manual uses the following safety and information related notations:

DANGER! Danger indicates a location, equipment, or system where imminent hazard exists that may result in personnel injury or death, or threaten the primary SRS-RCS mission.

WARNING! Warning indicates a location, equipment, or system where a potential hazard exists that may injure maintainers or operators if the approved procedures are not followed.

CAUTION! Caution indicates a hazard that could damage equipment, a system, or the SRS-RCS, causing loss of mission capability if the approved procedures are not followed.

Note: Notes call attention to supplemental information that may enhance a user's understanding and performance of the procedure.

The Control Van Navigation System consists of the following components:

- One (1) INS computer
- One (1) Navigation tray
- One (1) APS C/D module
- One (1) APS transducer
- One (1) APS dynamic motion sensor
- One (1) APS dynamic motion sensor repeater
- Two (2) RS-232 – RS-422 converters
- One (1) VGA splitter
- One (1) DGPS receiver
- One (1) DGPS antenna
- One (1) Gyro sensor module
- One (1) Gyro control unit
- One (1) GPS antenna
- One (1) P-code GPS (not installed)

See the *CV Navigation System Operating Manual (2A5A9-NAV-OM)* for a description of the system and its functions.

3

Preventive Maintenance

3.1 Preventive Maintenance Schedule and Index

Table 3 provides an index and schedule for preventive maintenance required for the Control Van Navigation System.

Table 3 Preventive Maintenance Schedule and Index

Section #	Procedure	Monthly	6 Months	Yearly	5-year Overhaul	Other
3.2	Testing Cables				X	

3.2 Testing Cables

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533180	GPS antenna exterior cable assembly
7533194	APS transducer exterior cable assembly
7533428	DGPS antenna exterior cable assembly

Special Tools

None

Spare Parts

7533180	GPS antenna exterior cable assembly
7533194	APS transducer exterior cable assembly
7533428	DGPS antenna exterior cable assembly

Preconditions

To confirm functionality of the APS cable, this procedure must be performed in operational mode with the PRM and acoustic positioning interface bracket submerged.

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.

2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the unit connected to the faulty unit:
 - GPS cable: Turn off the P-code GPS unit.
 - DGPS cable: Turn off the DGPS control unit.
 - APS cable: Turn off the APS C/D module.
4. Disconnect cable at both ends.
5. Test the cable (see Section 6.4, Electrical Cables Testing).
6. Replace cable if necessary.
7. Reconnect cable at both ends.
8. Turn on the unit connected to the faulty unit:
 - GPS cable: Turn on the P-code GPS unit.
 - DGPS cable: Turn on the DGPS control unit.
 - APS cable: Turn on the APS C/D module.
9. Perform a functionality test on the system.
10. Return valves and electrical switches to the state that they were in before this procedure was performed.
11. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
12. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4

Corrective Maintenance

4.1 Corrective Maintenance Index

Table 4 provides an index to procedures for correcting malfunctions of the CV Navigation System. See Chapter 5, Troubleshooting, for assistance in selecting an appropriate procedure.

Table 4 Corrective Maintenance Index

Section #	Procedure
4.2	Replacing a Cable
4.3	Replacing the INS Computer
4.4	Replacing the VGA Splitter
4.5	Replacing the RS-232 – RS-422 Converter
4.6	Replacing the Breakout Board
4.7	Replacing the APS C/D Module
4.8	Replacing the APS Transducer
4.9	Replacing the APS Motion Sensor Repeater
4.10	Replacing the APS Motion Sensor
4.11	Replacing the Gyro Sensor Module
4.12	Replacing the Gyro Control Unit
4.13	Replacing the DGPS Antenna
4.14	Replacing the DGPS Receiver
4.15	Replacing the P-code GPS
4.16	Replacing the GPS Antenna

4.2 Replacing a Cable

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533107	VOO heading RS-232 data cable assembly
7533177	GPS antenna interior cable assembly
7533180	GPS antenna exterior cable assembly
7533184	APS transducer interior cable assembly
7533187	Gyro control unit RS-232 data cable assembly
7533189	GPS time code data cable assembly
7533194	APS transducer exterior cable assembly
7533196	Gyro control unit power cable assembly
7533197	P-code GPS power cable assembly
7533198	Generic 75-ohm BNC to BNC video cable assembly
7533426	DGPS unit power cable assembly
7533428	DGPS antenna exterior cable assembly
7533429	VOO heading RS-422 data cable assembly
7533444	DGPS antenna interior cable assembly
7533459	APS motion sensor repeater cable assembly

Special Tools

None

Spare Parts

See Table 5 for cable part numbers.

Preconditions

To confirm functionality of APS cables 2A5A9-CBL-CC16, 2A5A9-CBL-CC03, and 2A5A9-COAX-CC02, this procedure must be performed in operational mode with the PRM and acoustic positioning interface bracket submerged.

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Following Table 5 for reference, turn off the unit connected to the faulty cable.
4. Disconnect cable at both ends.
5. Connect the replacement cable. See Table 5 for replacement cable part numbers.
6. Following Table 5 for reference, turn on the unit connected to the replacement cable.
7. Restore power to the unit connected to the replacement cable and confirm functionality.
8. Return valves and electrical switches to the state that they were in before this procedure was performed.
9. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
10. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

Table 5 CV Navigation Cables

Part Number	Cable ID	Cable Description	Turn Off and Test
7533459	2A5A9-CBL-CC01	APS sensor	APS C/D module APS motion sensor repeater
600727C	2A5A9-CBL-CC02	APS motion sensor	APS C/D module APS motion sensor repeater
7533184	2A5A9-CBL-CC03	APS transducer	APS C/D module
7533107	2A5A9-CBL-CC04	VOO heading RS-232 data	APS C/D module
1120-35C	2A5A9-CBL-CC05-1	DGPS RS-232 data	INS computer
1120-35C	2A5A9-CBL-CC05-2	DGPS NTP RS-232 data	INS computer
1120-35C	2A5A9-CBL-CC05-3	GPS RS-232 data	INS computer
1120-35C	2A5A9-CBL-CC05-4	APS RS-232 data	INS computer
EVNPS07-0035-MF	2A5A9-CBL-CC06	APS VGA out	APS C/D module
7533187	2A5A9-CBL-CC09	VOO heading RS-422 data	SCC #1
7533189	2A5A9-CBL-CC11	GPS time code data	TDT generator #1
BC00200	2A5A9-CBL-CC14	PRM depth	SCC #1
32-0623-30	2A5A9-CBL-CC15	Gyro sensor	Gyro control unit
7533194	2A5A9-CBL-CC16	APS transducer exterior cable assembly	APS C/D module
EVNPS07-0010-MM	2A5A9-CBL-CC20	INS VGA/5VDC	INS computer
EVNPS07-0003-MM	2A5A9-CBL-CC21	INS VGA out	INS computer
7533429	2A5A9-CBL-CC22	VOO heading RS-422 data	INS computer
EYN257T-0006-MF	2A5A9-CBL-CC27	Null modem	SCC #1 and INS computer
generic	2A5A9-CBL-EP01	120VAC UPS #1	INS computer
7533196	2A5A9-CBL-EP02	Gyro 12 to 32VDC	Gyro control unit
generic	2A5A9-CBL-EP03	120VAC UPS #1	APS C/D module
7533197	2A5A9-CBL-EP04	P-Code GPS power	P-code GPS
SPC11678	2A5A9-CBL-EP05	120VAC UPS #1	RS-232 – RS-422 converter
STA 5724AT	2A5A9-CBL-EP06	120VAC to 24VDC	APS C/D module
7533426	2A5A9-CBL-EP07	DGPS unit 12VDC	DGPS receiver
generic	2A5A9-CBL-EP09	120VAC UPS #1	INS computer
7533177	2A5A9-COAX-CC01	GPS antenna interior	P-code GPS
7533198	2A5A9-COAX-CC02	Responder trigger	APS C/D module
7533444	2A5A9-COAX-CC03	DGPS antenna	DGPS receiver
7533180	2A5A9-COAX-CC04	GPS antenna exterior	P-code GPS
7533428	2A5A9-COAX-CC07	DGPS antenna exterior	DGPS receiver

4.3 Replacing the INS Computer

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533101	INS computer assembly

Special Tools

None

Spare Parts

7533101	INS computer assembly c/w power and keyboard Y cable – ISE
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the INS computer.
4. Disconnect the power cable.
5. Disconnect all data cables connected to the computer.
6. At the front of the unit, remove four (4) screws.
7. Pull the INS computer assembly out of the video console.
8. Insert the replacement computer into the video console.
9. Secure the computer with four (4) screws.
10. Reconnect data cables to the INS computer.
11. Reconnect the power cable.
12. Restore power to the INS computer and confirm functionality.
13. Return valves and electrical switches to the state that they were in before this procedure was performed.
14. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
15. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.4 Replacing the VGA Splitter

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533152	Video converter tray assembly

Special Tools

None

Spare Parts

60-506-01	VGA Splitter Model P/2 DA2xi
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. At the video console, remove four (4) screws securing the video converter tray assembly.
4. Pull out the video converter tray assembly.
5. Disconnect cable 2A5A9-CBL-CC20 from the VGA splitter.
6. Disconnect two (2) VGA cables from the VGA splitter.
7. Remove four (4) screws and the faulty VGA splitter.
8. Install the replacement VGA splitter and secure it with four (4) screws.
9. Connect two (2) VGA cables.
10. Connect cable 2A5A9-CBL-CC20 at the VGA splitter.
11. Reinsert the video converter tray and secure it with four (4) screws.
12. Test functionality by displaying the INS computer on a screen.
13. Return valves and electrical switches to the state that they were in before this procedure was performed.
14. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
15. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.5 Replacing the RS-232 – RS-422 Converter

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533048	Navigation tray wiring diagram
7533099	Navigation tray assembly

Special Tools

None

Spare Parts

8323	RS-232 to RS-422 Converter – Telebyte
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Disconnect power cable 2A5A9-CBL-EP05 from power bar 2A5A2-PB-EP02-1.
4. Remove four (4) screws securing the navigation tray to the control/power console.
5. Pull out the navigation tray.
6. Disconnect all wires connected to the RS-232 – RS-422 converter.
7. Remove the faulty RS-232 – RS-422 converter from the DIN rail.
8. Install the replacement RS-232 – RS-422 converter on the DIN rail.
9. Connect all wires to the RS-232 – RS-422 converter.
10. Reinsert the navigation tray in the control/power console.
11. Secure the navigation tray with four (4) screws.
12. Reconnect power cable 2A5A9-CBL-EP05 to power bar 2A5A2-PB-EP02-1.
13. Confirm functionality of the RS-232 – RS-422 converter.
14. Return valves and electrical switches to the state that they were in before this procedure was performed.
15. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
16. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.6 Replacing the Breakout Board

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533048	Navigation tray wiring diagram
7533099	Navigation tray assembly

Special Tools

None

Spare Parts

22 81 59 7	Breakout Board – Phoenix Contact
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Remove four (4) screws securing the navigation tray to the control/power console.
4. Pull out the navigation tray.
5. Disconnect power cable 2A5A9-CBL-EP04 from the breakout board.
6. Disconnect two (2) data cables.
7. Remove the faulty breakout board from the DIN rail.
8. Install the replacement breakout board on the DIN rail.
9. Connect two (2) data cables to the breakout board.
10. Connect power cable power cable 2A5A9-CBL-EP04 to the breakout board.
11. Secure the navigation tray with four (4) screws.
12. Confirm functionality of the breakout board.
13. Return valves and electrical switches to the state that they were in before this procedure was performed.
14. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
15. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.7 Replacing the APS C/D Module

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533105	APS C/D module installation details
7533446	APS wiring diagram

Special Tools

None

Spare Parts

4410D-01	APS C/D module c/w power cable – ORE Trackpoint 2 plus
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Preconditions

This procedure is performed by two (2) maintenance workers.

To confirm functionality, this procedure must be performed in operational mode with the PRM and acoustic positioning interface bracket submerged.

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. At the back of the unit, disconnect the power cable.
4. Disconnect all data cables.
5. Remove four (4) screws securing the APS C/D module to the control/power console.
6. Pull out the APS C/D module.
7. Have a second maintenance worker hold the APS C/D module. Remove six (6) screws securing the APS C/D module to the slides, and remove the faulty module.
8. Install the replacement APS C/D module to the slides with six (6) screws.
9. Reinsert the APS C/D module in the control/power console.
10. Secure the APS C/D module to the control/power console with four (4) screws.
11. Connect all data cables and the power cable.
12. Turn on the APS C/D module and confirm functionality.
13. Return valves and electrical switches to the state that they were in before this procedure was performed.
14. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.

15. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.8 Replacing the APS Transducer

Drawing References

7531488	Acoustic positioning interface bracket (2A11A7)
7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)

Special Tools

None

Spare Parts

4610B	APS Transducer – ORE Trackpoint 2 Plus
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Preconditions

To confirm functionality, this procedure must be performed in operational mode with the PRM and acoustic positioning interface bracket submerged.

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the APS C/D module.
4. Remove four (4) bolts securing the APS transducer to the acoustic positioning interface bracket.
5. Disconnect the cable from the APS transducer.
6. Connect the cable to the replacement APS transducer (see Section 6.3, Electrical Cables Connection)
7. Install the replacement APS transducer to the acoustic positioning interface bracket and secure with four (4) bolts.
8. Restore power to the APS C/D module and confirm functionality.
9. Return valves and electrical switches to the state that they were in before this procedure was performed.
10. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
11. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.9 Replacing the APS Motion Sensor Repeater

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533048	Navigation tray wiring diagram
7533099	Navigation tray assembly

Special Tools

None

Spare Parts

4413A	APS Motion Sensor Repeater – TSS
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Remove four (4) screws securing the navigation tray to the control/power console.
4. Pull out the navigation tray.
5. Disconnect the power cable 2A5A9-CBL-EP06 from the APS motion sensor repeater.
6. Disconnect three (3) data cables from the APS motion sensor repeater.
7. Remove four (4) screws securing the APS motion sensor repeater to the navigation tray and remove the faulty repeater.
8. Install the replacement APS motion sensor repeater and secure with four (4) screws.
9. Connect three (3) data cables to the APS motion sensor repeater.
10. Connect power cable 2A5A9-CBL-EP06 to the APS motion sensor repeater.
11. Reinsert the navigation tray in the control/power console and secure with four (4) screws.
12. Confirm functionality of the unit.
13. Return valves and electrical switches to the state that they were in before this procedure was performed.
14. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
15. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.10 Replacing the APS Motion Sensor

Drawing References

7533024	APS motion sensor installation details
7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)

Special Tools

None

Spare Parts

44148	APS dynamic motion sensor – TSS
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Disconnect power cable 2A5A9-CBL-EP06 from power bar 2A5A2-PB-EP02-1.
4. Disconnect the cable from the APS motion sensor.
5. Remove four (4) bolts securing the APS motion sensor and remove the faulty unit.
6. Install the replacement APS motion sensor and secure with four (4) bolts.
7. Connect the cable at the APS motion sensor.
8. Connect power cable 2A5A9-CBL-EP06 to power bar 2A5A2-PB-EP02-1.
9. Confirm functionality of the APS motion sensor.
10. Return valves and electrical switches to the state that they were in before this procedure was performed.
11. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
12. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.11 Replacing the Gyro Sensor Module

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533047	CV navigation system schematic (2A5A9)
7533106	Gyro sensor module installation details

Special Tools

None

Spare Parts

01-0226-03	Gyro sensor module C/W cable – KVH Industries
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the gyro control unit.
4. Disconnect the cable from gyro sensor module.
5. Remove the faulty gyro sensor module from the vertical mounting bracket.
6. Install the replacement gyro sensor module on the vertical mounting bracket.
7. Connect the cable at the gyro sensor module.
8. Turn on the gyro control unit and confirm functionality.
9. Return valves and electrical switches to the state that they were in before this procedure was performed.
10. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
11. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.12 Replacing the Gyro Control Unit

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533099	Navigation tray assembly

Special Tools

None

Spare Parts

02-0961	Gyro control unit – KVH Gyrotrac
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the Gyro control unit.
4. Remove four (4) screws securing the navigation tray to the control/power console.
5. Pull out the navigation tray.
6. Disconnect the power cable 2A5A9-CBL-EP02 from the gyro control unit.
7. Disconnect data cables from the gyro control unit.
8. Remove the faulty gyro control unit from the navigation tray.
9. Install the replacement gyro control unit in the navigation tray.
10. Connect data cables to the gyro control unit.
11. Connect the power cable 2A5A9-CBL-EP02 to the gyro control unit.
12. Reinsert the navigation tray in the control/power console and secure with four (4) screws.
13. Turn on the gyro control unit and confirm functionality.
14. Return valves and electrical switches to the state that they were in before this procedure was performed.
15. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
16. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.13 Replacing the DGPS Antenna

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing

Special Tools

None

Spare Parts

49086-D0	DGPS antenna DSM-132 – Trimble
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the DGPS receiver.
4. Disconnect coaxial cable from the antenna.
5. Remove the faulty DGPS antenna from the mast assembly.
6. Install the replacement DGPS antenna on the mast assembly.
7. Connect the coaxial cable to the DGPS antenna.
8. Turn on the DGPS receiver and confirm functionality of the antenna.
9. Return valves and electrical switches to the state that they were in before this procedure was performed.
10. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
11. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.14 Replacing the DGPS Receiver

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533099	Navigation tray assembly

Special Tools

None

Spare Parts

49086-00	DGPS receiver DSM-132
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Preconditions

None

Procedure

1. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, torque specifications, inspection of mounting hardware, and use of Nylok® nuts, as applicable.
2. Perform the following steps in accordance with local requirements for SOC and tag in/out, as applicable.
3. Turn off the DGPS receiver.
4. Remove four (4) screws securing the navigation tray to the control/power console.
5. Pull out the navigation tray.
6. Disconnect power cable 2A5A9-CBL-EP07 from the DGPS receiver.
7. Disconnect all data cables at the DGPS receiver.
8. Remove four (4) screws securing the DGPS receiver to the navigation tray and remove the faulty unit.
9. Install the replacement DGPS on the navigation tray and secure with four (4) screws.
10. Connect all data cables to the DGPS receiver.
11. Connect power cable 2A5A9-CBL-EP07 to the DGPS receiver.
12. Reinsert the navigation tray in the control/power console.
13. Secure the navigation tray with four (4) screws.
14. Turn on the DGPS receiver and confirm functionality.
15. Return valves and electrical switches to the state that they were in before this procedure was performed.
16. Inspect and determine disposition of any parts removed. If applicable, dispose of removed parts and/or fluids in accordance with local requirements.
17. Ensure the preceding steps were performed in accordance with local requirements for SOC and tag in/out, as applicable.

4.15 Replacing the P-code GPS

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533099	Navigation tray assembly

Special Tools

None

Spare Parts

41205-00	P-code GPS – Trimble Force 22
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Preconditions

None

Procedure

1. Equipment and maintenance procedure to be provided by NAVSEA.

4.16 Replacing the GPS Antenna

Drawing References

7533045	CV navigation system assembly
7533046	CV navigation system cable routing
7533203	GPS antenna installation details

Special Tools

None

Spare Parts

41175	GPS antenna – Trimble Navigation
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Preconditions

None

Procedure

1. Equipment and maintenance procedure to be provided by NAVSEA.

5.1 Overview

DANGER!

The decision trees provided in this Chapter are a guide, not a step by step procedure. Follow tag in/out and other safety procedures as set out in the corrective and preventive maintenance procedures in this manual.

This Chapter provides troubleshooting decision trees for identifying malfunctioning components of the CV Navigation System.

Each decision tree addresses one malfunction and points to corrective procedures in Chapter 4, Corrective Maintenance, or other decision trees, as applicable.

In all cases, test the parts replaced (see the specific corrective and preventive maintenance procedures).

See schematic 7533047 and 7533048 when using the troubleshooting decision trees.

5.2 Troubleshooting Subroutine — General Power Check

Device	Cable	Power bar
INS computer	2A5A9-CBL-EP01	2A5A2-PB-EP02-8
APS C/D module	2A5A9-CBL-EP03	2A5A2-PB-EP02-1
VGA splitter	2A5A9-CBL-EP09	2A5A2-PB-EP02-2
RS-232 – RS-422 converter 1	2A5A9-CBL-EP05	2A5A2-PB-EP02-1
RS-232 – RS-422 converter 2	2A5A9-CBL-EP08	2A5A2-PB-EP02-5 (cable)
APS motion sensor repeater	2A5A9-CBL-EP06	2A5A2-PB-EP02-1

Procedure

1. Follow the troubleshooting steps in Figure 1.

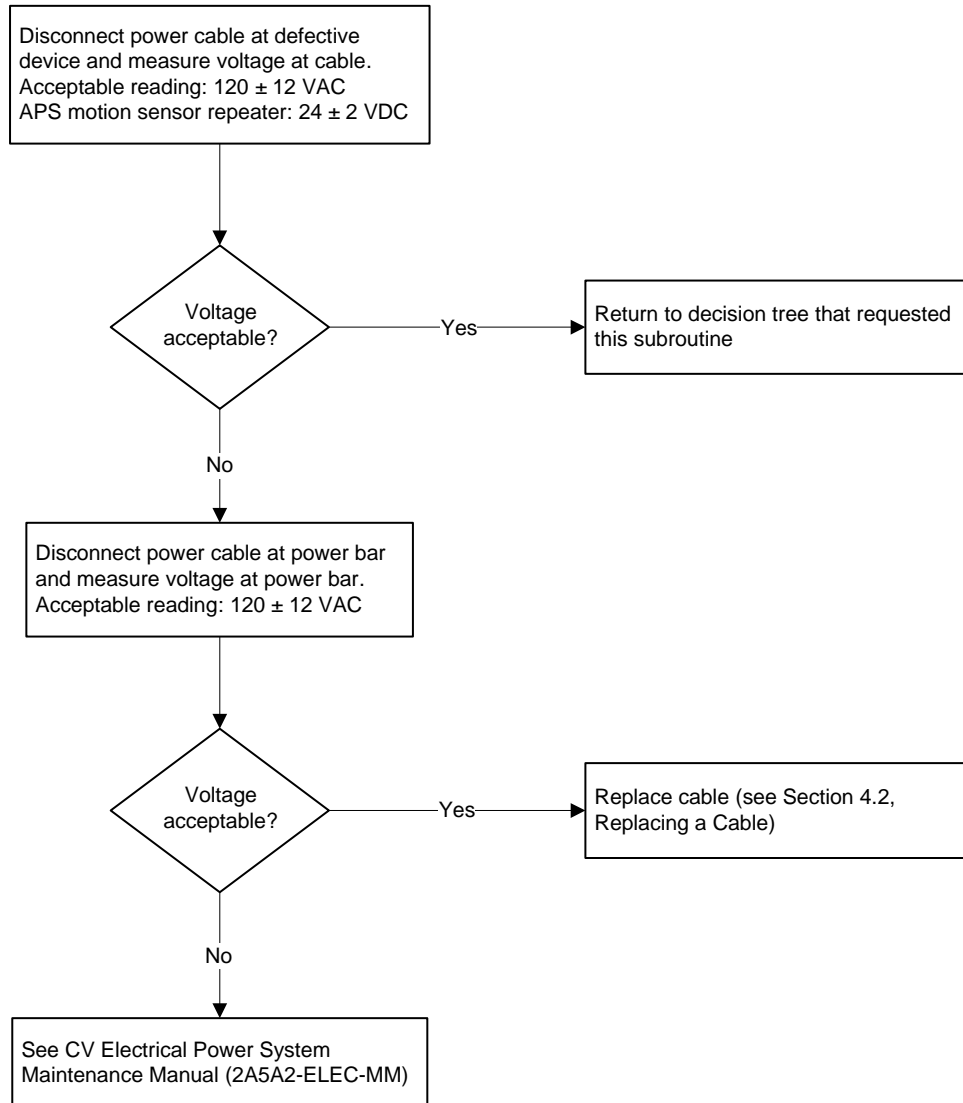


Figure 1 Troubleshooting Subroutine – General Power Check

5.3 INS Computer Doesn't Display Image

Symptoms

The INS computer does not display an image on any LCD or video projector.

Procedure

1. Follow the troubleshooting steps in Figure 2 and Figure 3.

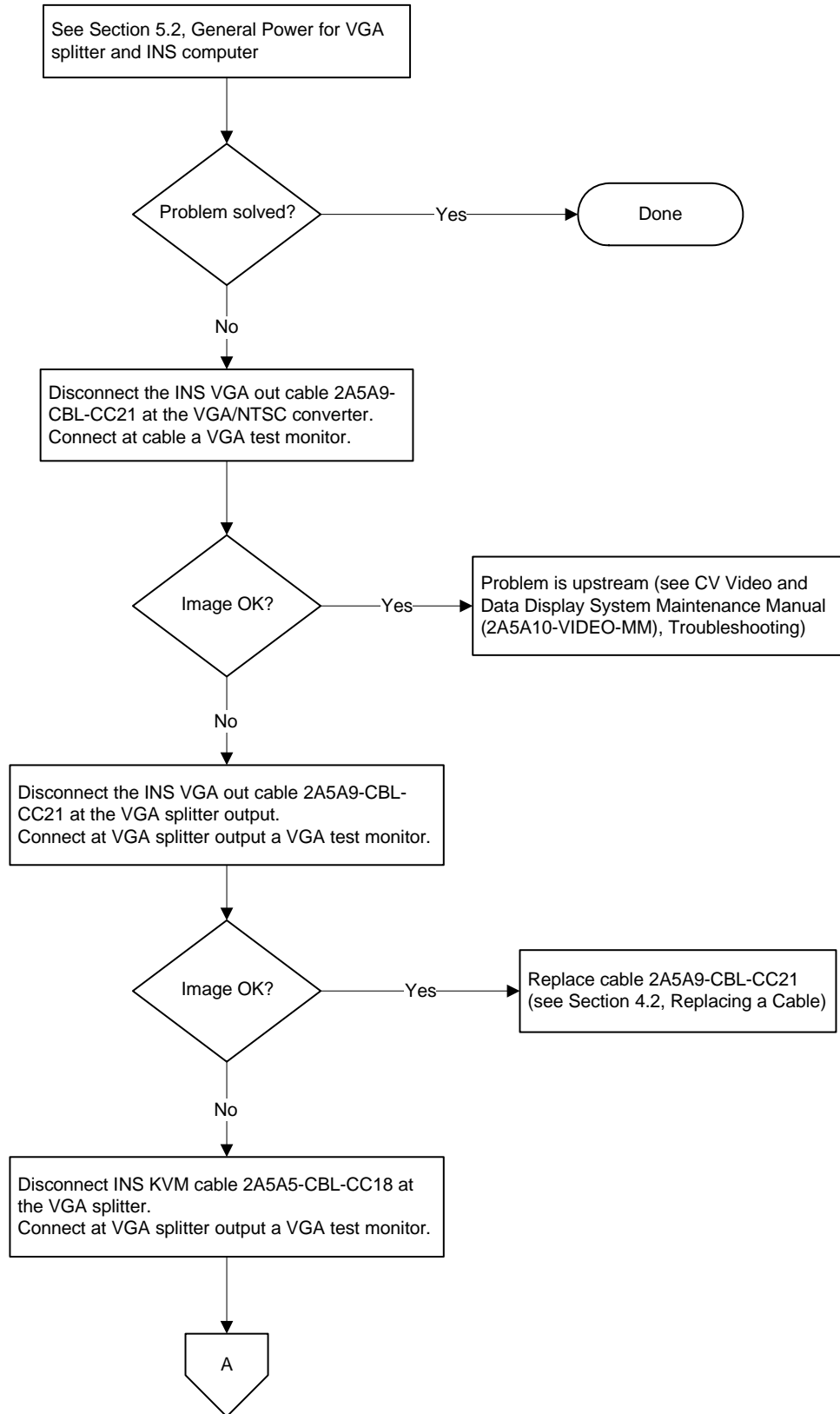


Figure 2 Troubleshooting – INS Computer Doesn't Display Image – Sheet 1

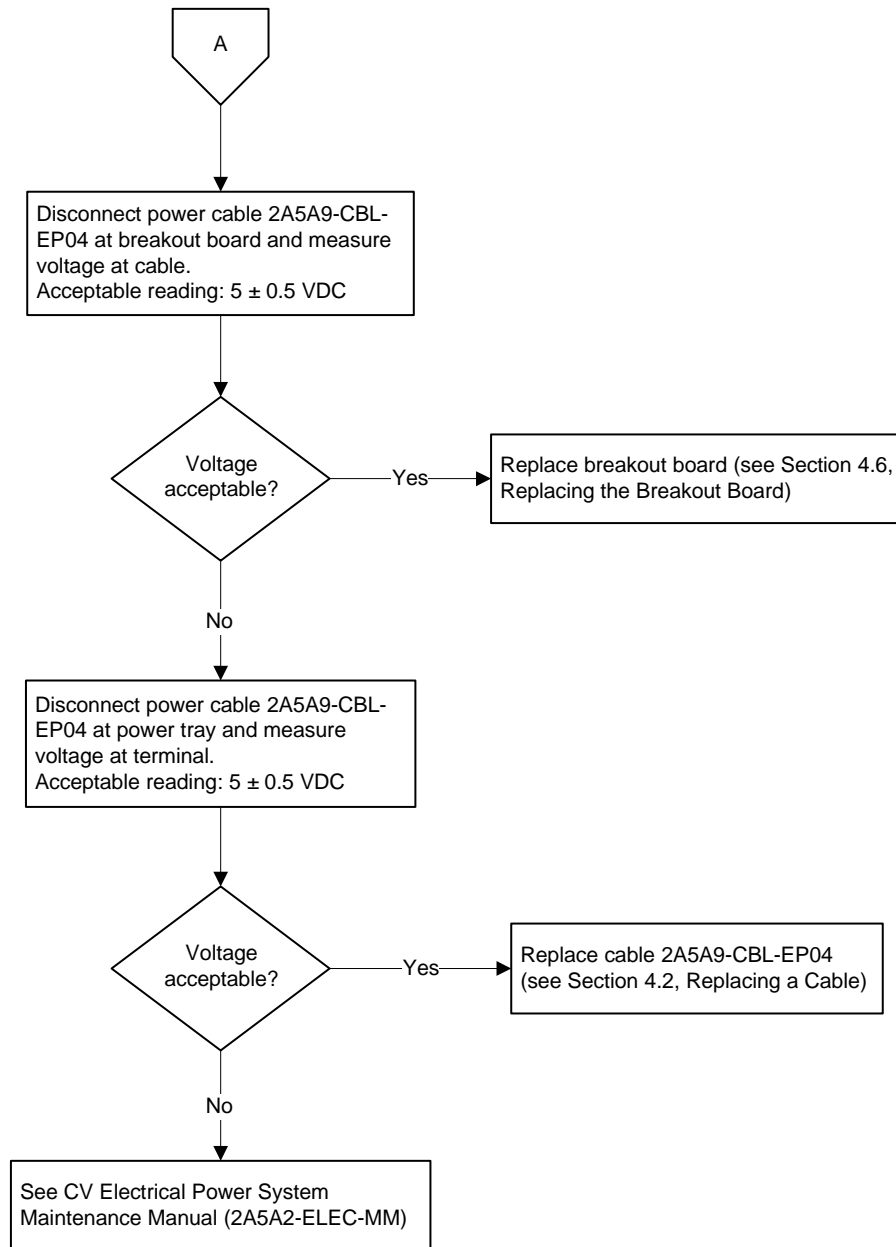


Figure 3 Troubleshooting – INS Computer Doesn't Display Image – Sheet 2

5.4 INS Computer is not Communicating with DGPS Receiver

Symptoms

The INS computer is not receiving data from the DGPS receiver.

Procedure

- Follow the troubleshooting steps in Figure 4 and Figure 5.

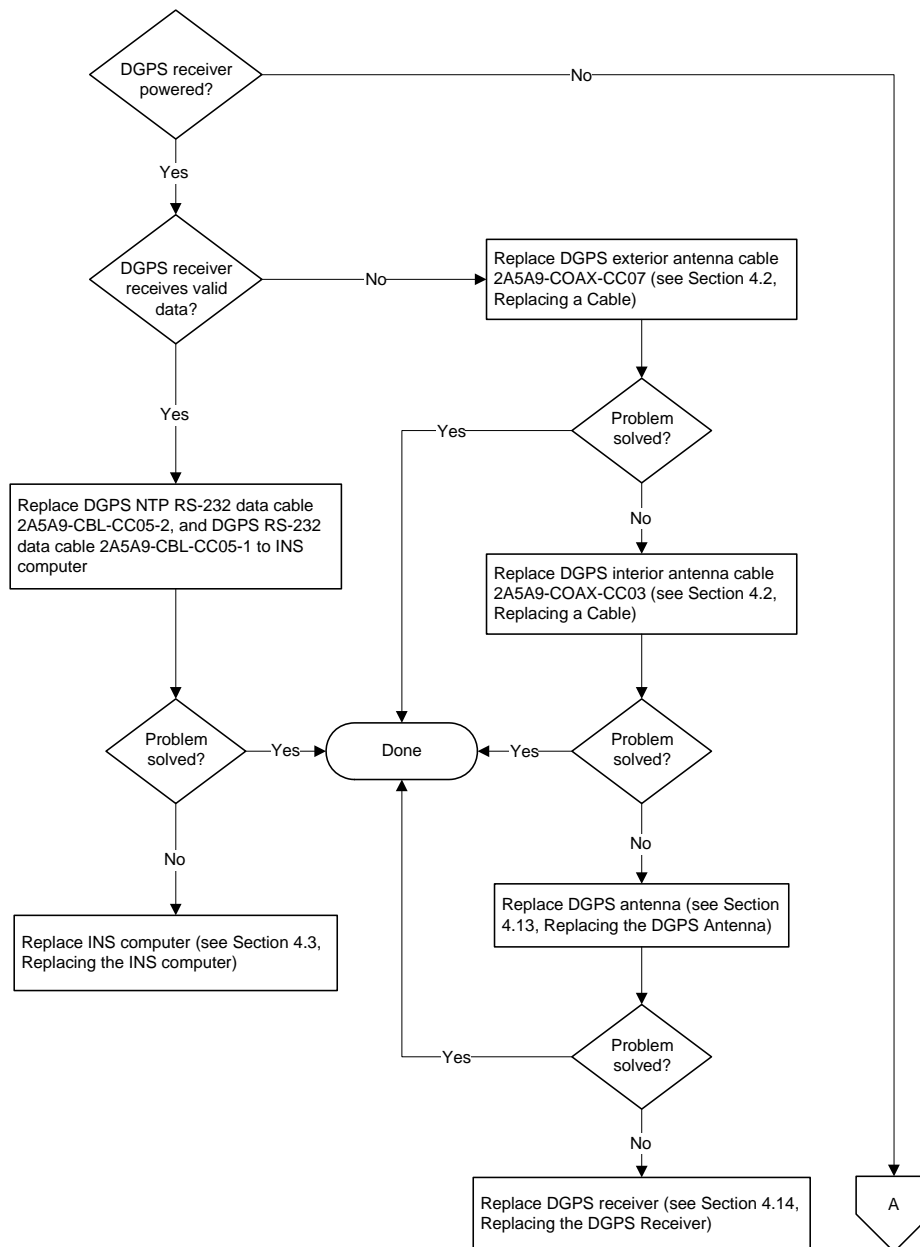


Figure 4 Troubleshooting – INS Computer is not Communicating with DGPS Receiver – Sheet 1

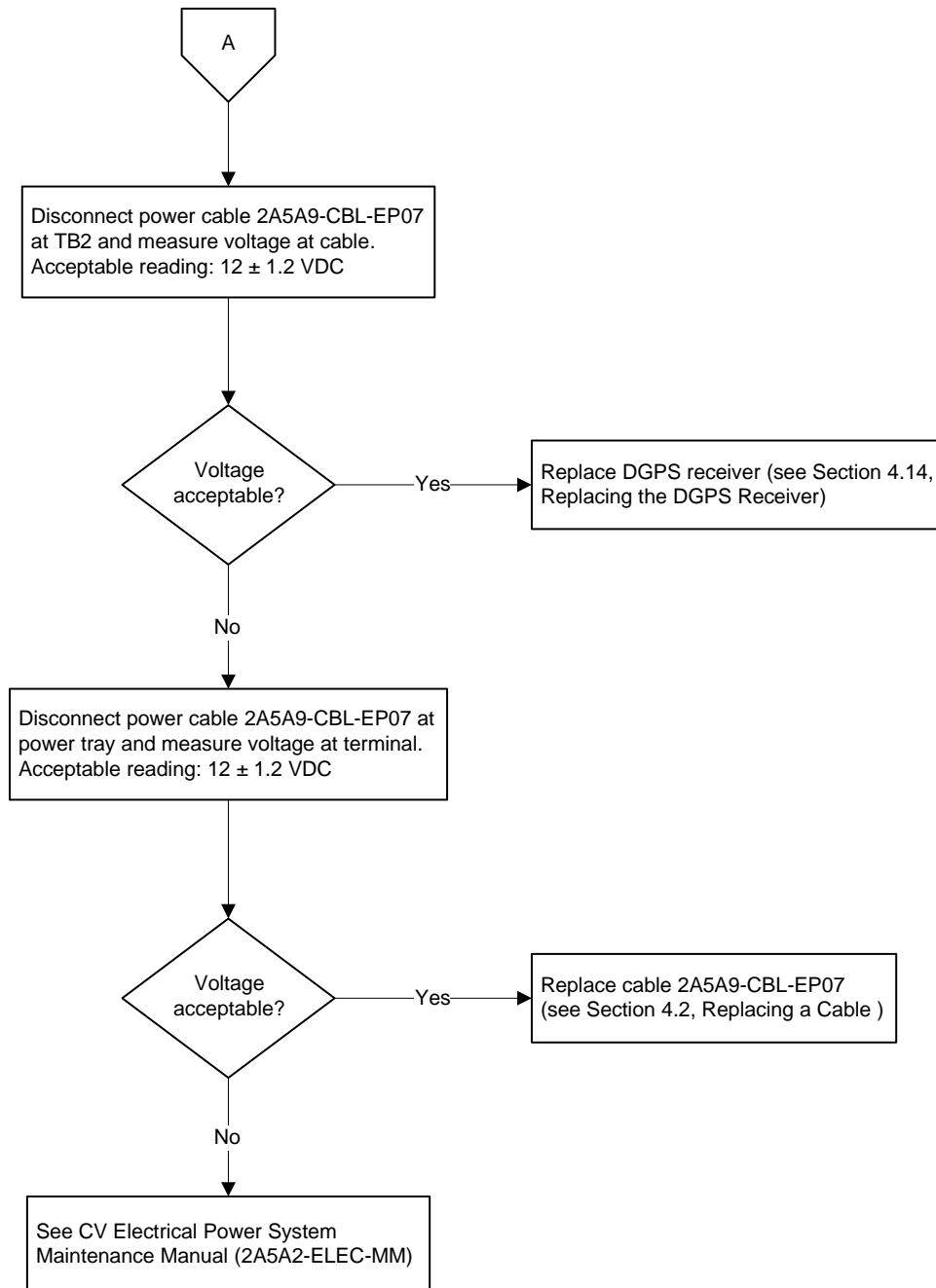


Figure 5 Troubleshooting – INS Computer is not Communicating with DGPS Receiver – Sheet 2

5.5 INS Computer is not Communicating with P-code GPS

Symptoms

The INS computer is not receiving information from the P-code GPS.

Procedure

1. Follow the troubleshooting steps in Figure 6 and Figure 7.

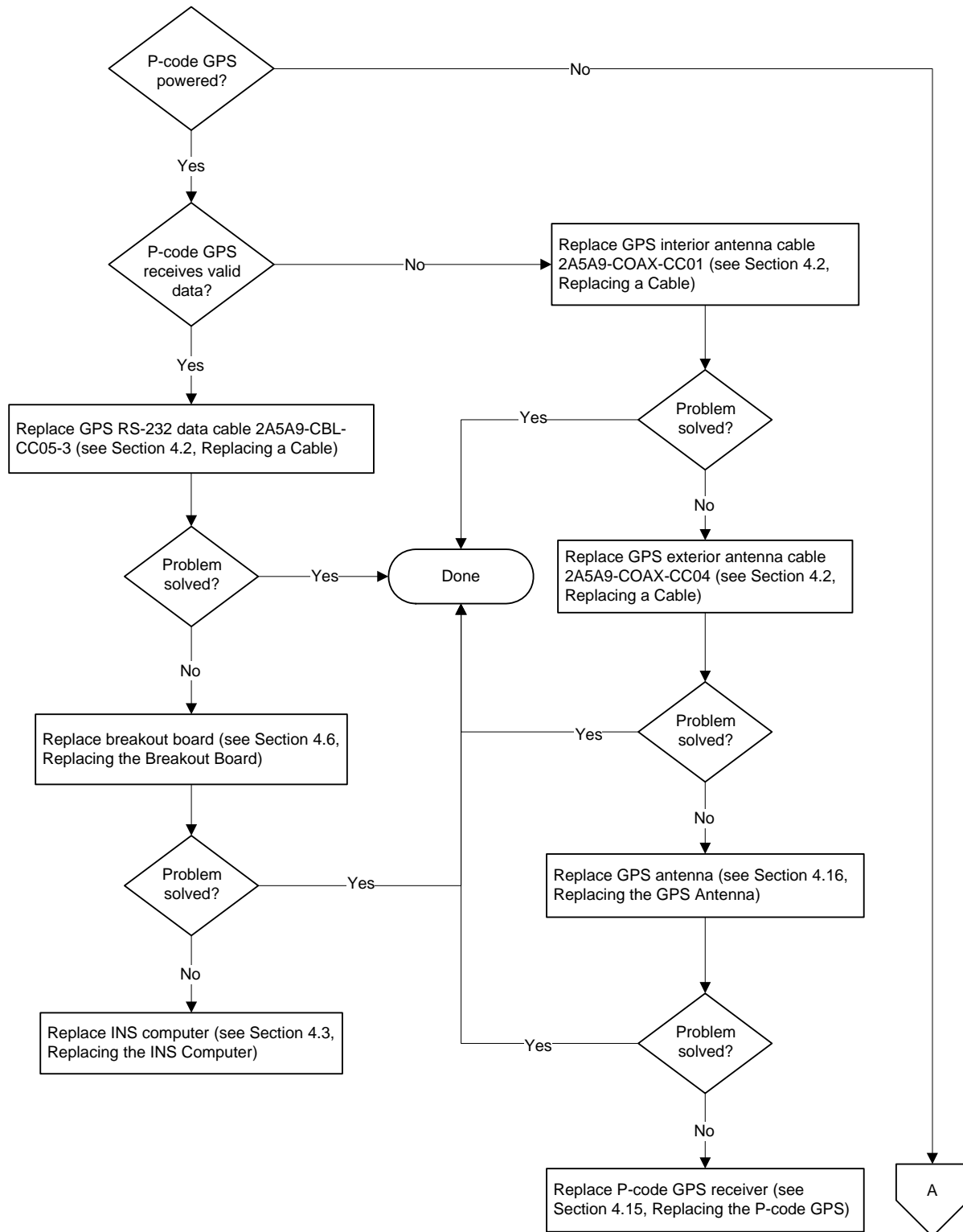


Figure 6 Troubleshooting – INS Computer is not Communicating with P-code GPS – Sheet 1

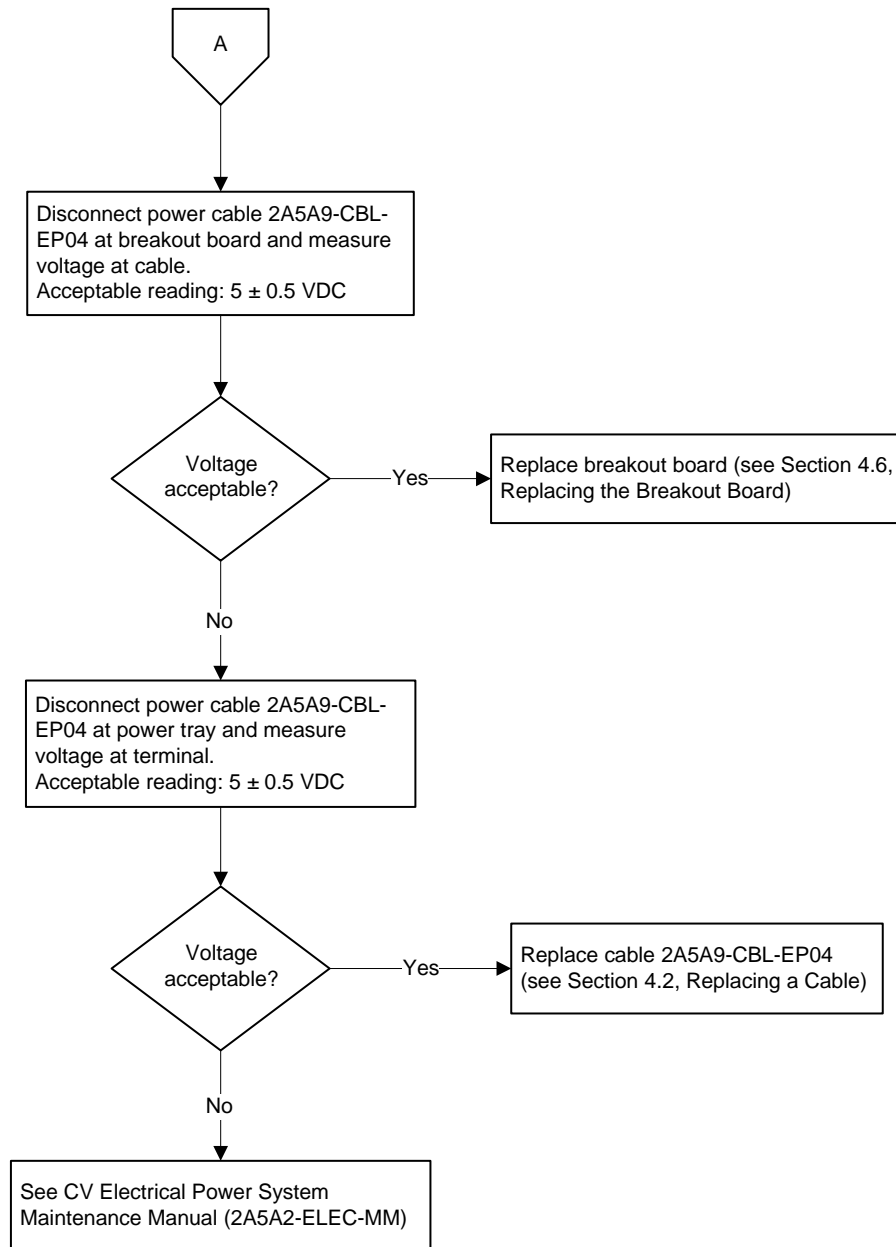


Figure 7 Troubleshooting – INS Computer is not Communicating with P-code GPS – Sheet 2

5.6 INS Computer is not Communicating with Gyro Control Unit

Symptoms

The INS computer is not receiving data from the gyro control unit.

Procedure

- Follow the troubleshooting steps in Figure 8 and Figure 9.

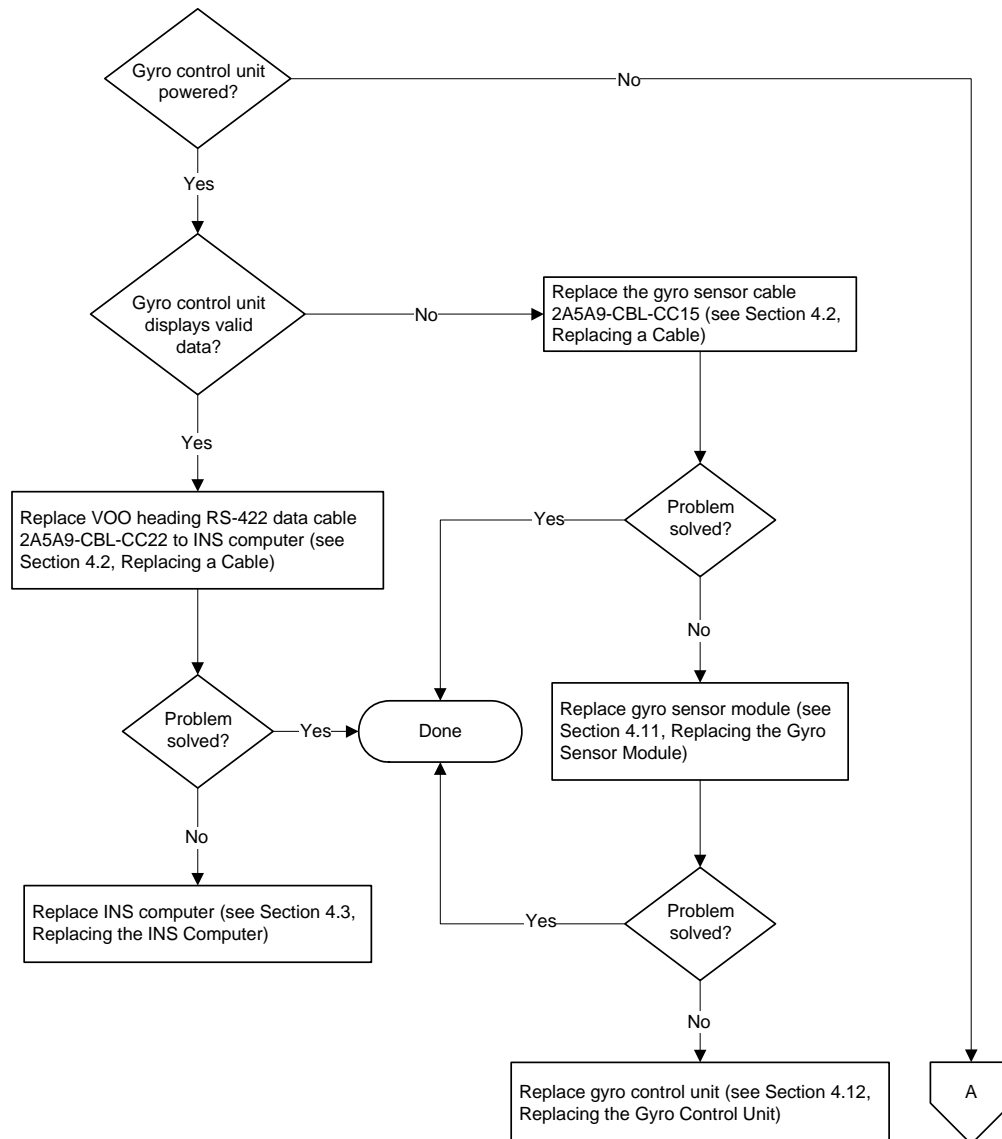


Figure 8 Troubleshooting – INS Computer is not Communicating with Gyro Control Unit – Sheet 1

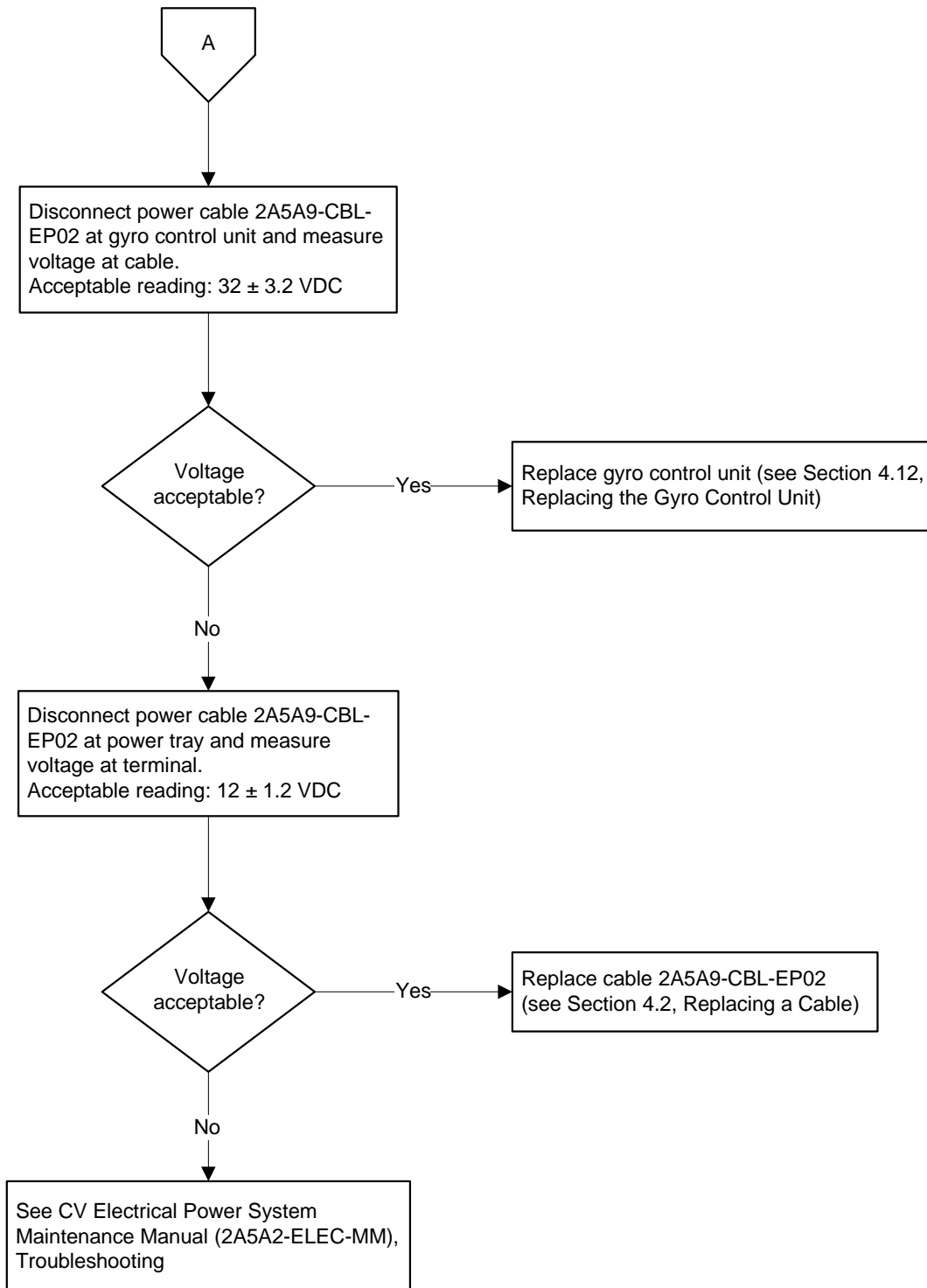


Figure 9 Troubleshooting – INS Computer is not Communicating with Gyro Control Unit – Sheet 2

5.7 INS Computer is not Communicating with APS C/D Module

Symptoms

The INS computer is not receiving data from the APS C/D module.

Procedure

1. Follow the troubleshooting steps in Figure 10.

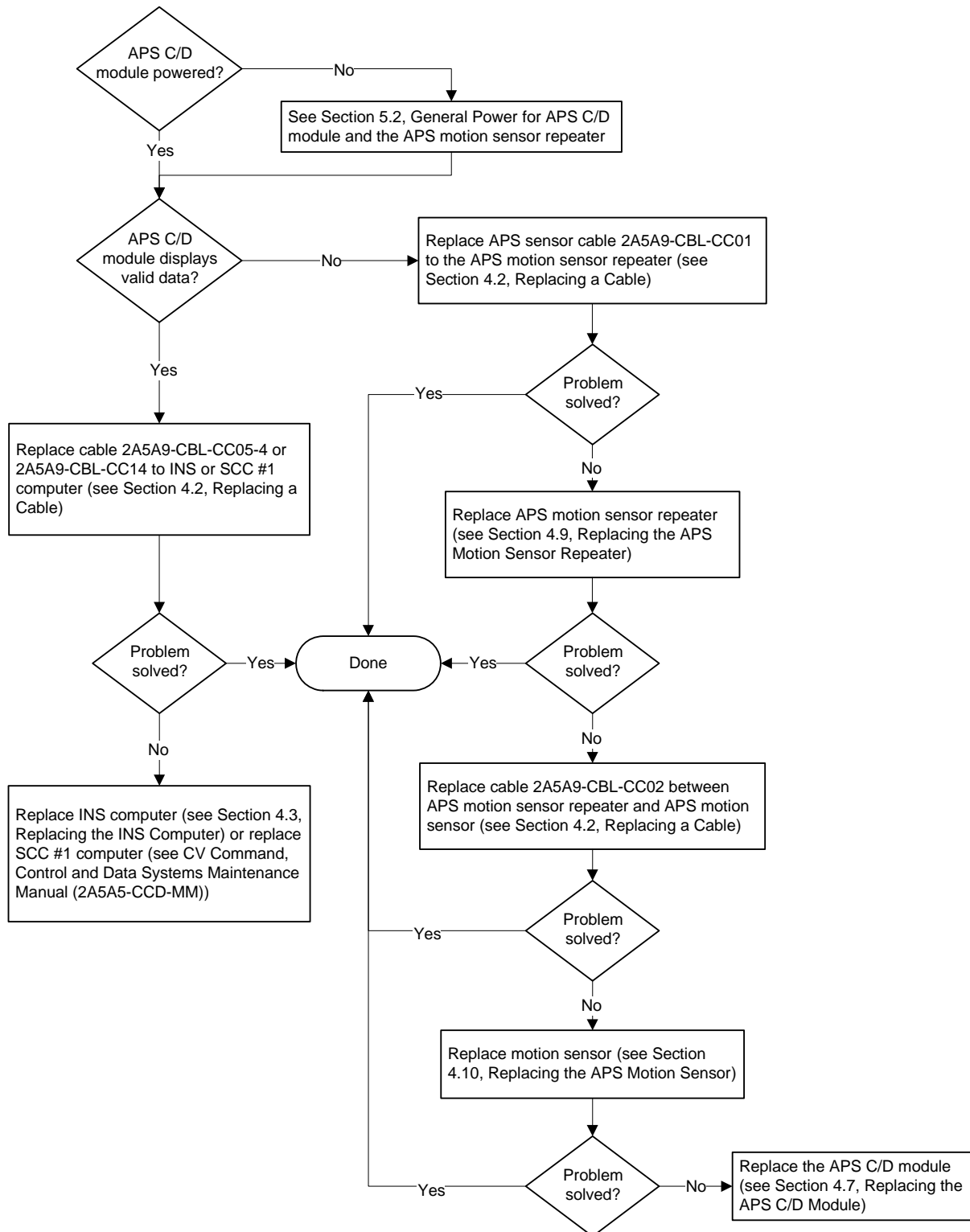


Figure 10 Troubleshooting – INS Computer is not Communicating with APS C/D Module – Sheet 1

5.8 APS C/D Module Doesn't Display Image

Symptoms

The APS C/D module does not display image, or no image is displayed using a video projector.

Procedure

1. Follow the troubleshooting steps in Figure 11.

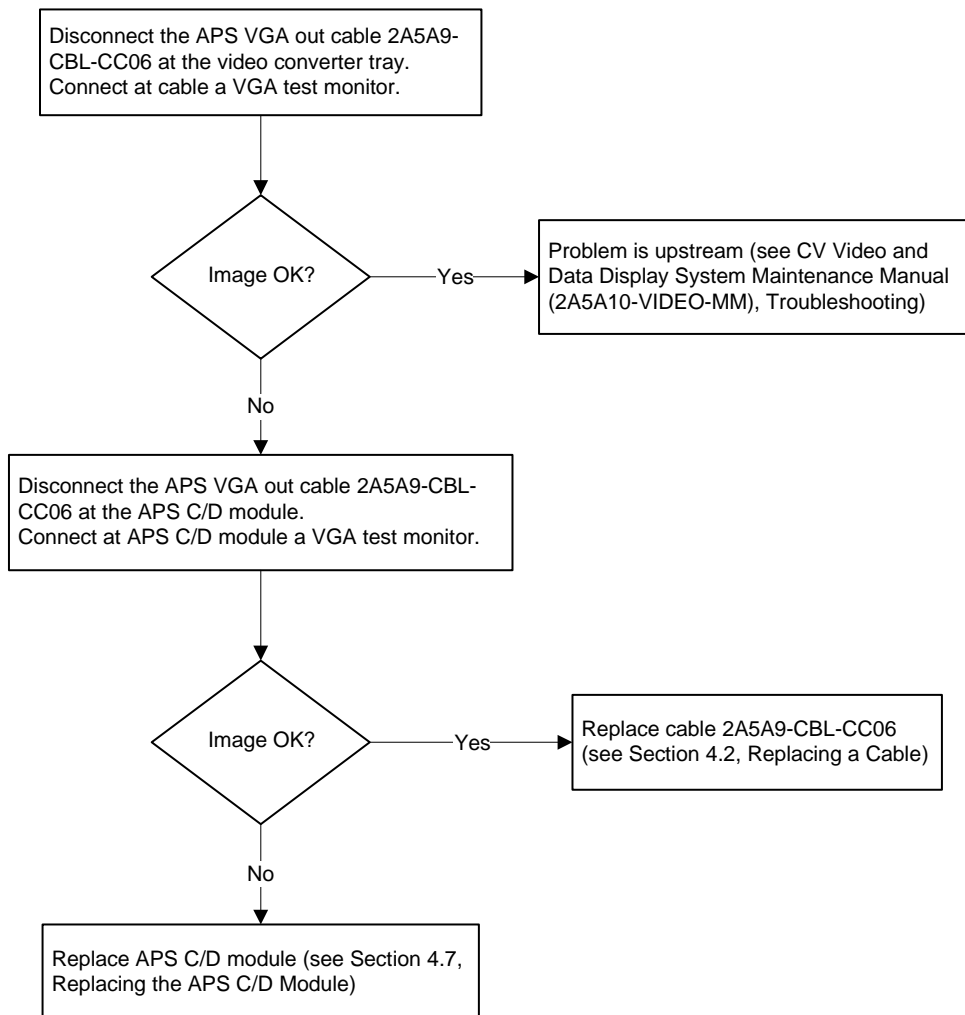


Figure 11 Troubleshooting – APS C/D Module Doesn't Display Image

5.9 No Communication Between APS C/D Module and PRM Transponder

Symptoms

The APS C/D module does not receive a response from the PRM transponder.

Procedure

1. Follow the troubleshooting steps in Figure 12.

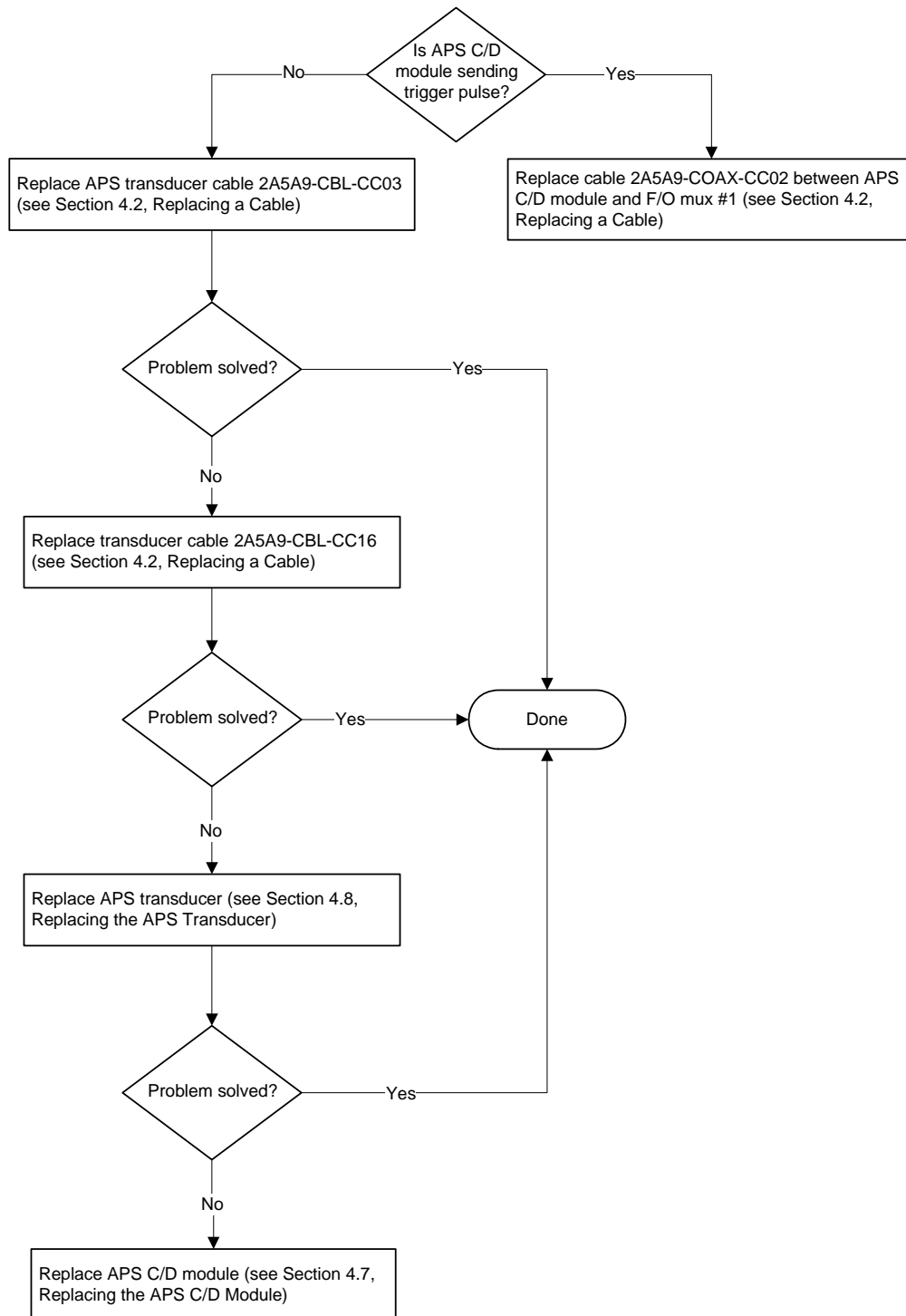


Figure 12 Troubleshooting – No Communication Between APS C/D Module and PRM Transponder

5.10 TDT Generator or Gyro Control Unit Doesn't Receive Time Code Data

Symptoms

The TDT generator and the gyro control unit do not receive time code data from the DGPS receiver.

Procedure

1. Follow the troubleshooting steps in Figure 13.

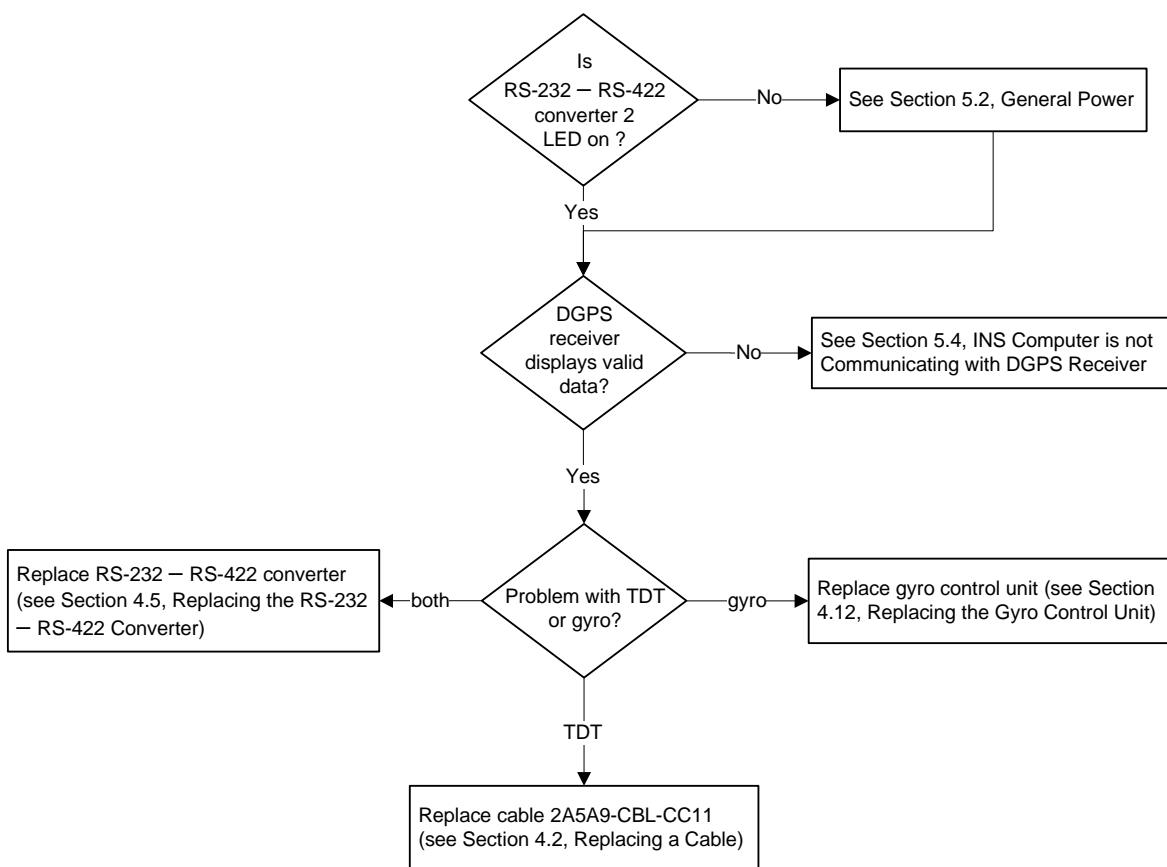


Figure 13 Troubleshooting – TDT Generator or Gyro Control Unit Doesn't Receive Time Code Data

5.11 TDT VOO Heading Data Invalid with SCC #1 or APS C/D Module

Symptoms

The INS computer, the SCC #1, or the APS C/D module does not receive VOO heading data.

Procedure

1. Follow the troubleshooting steps in Figure 14.

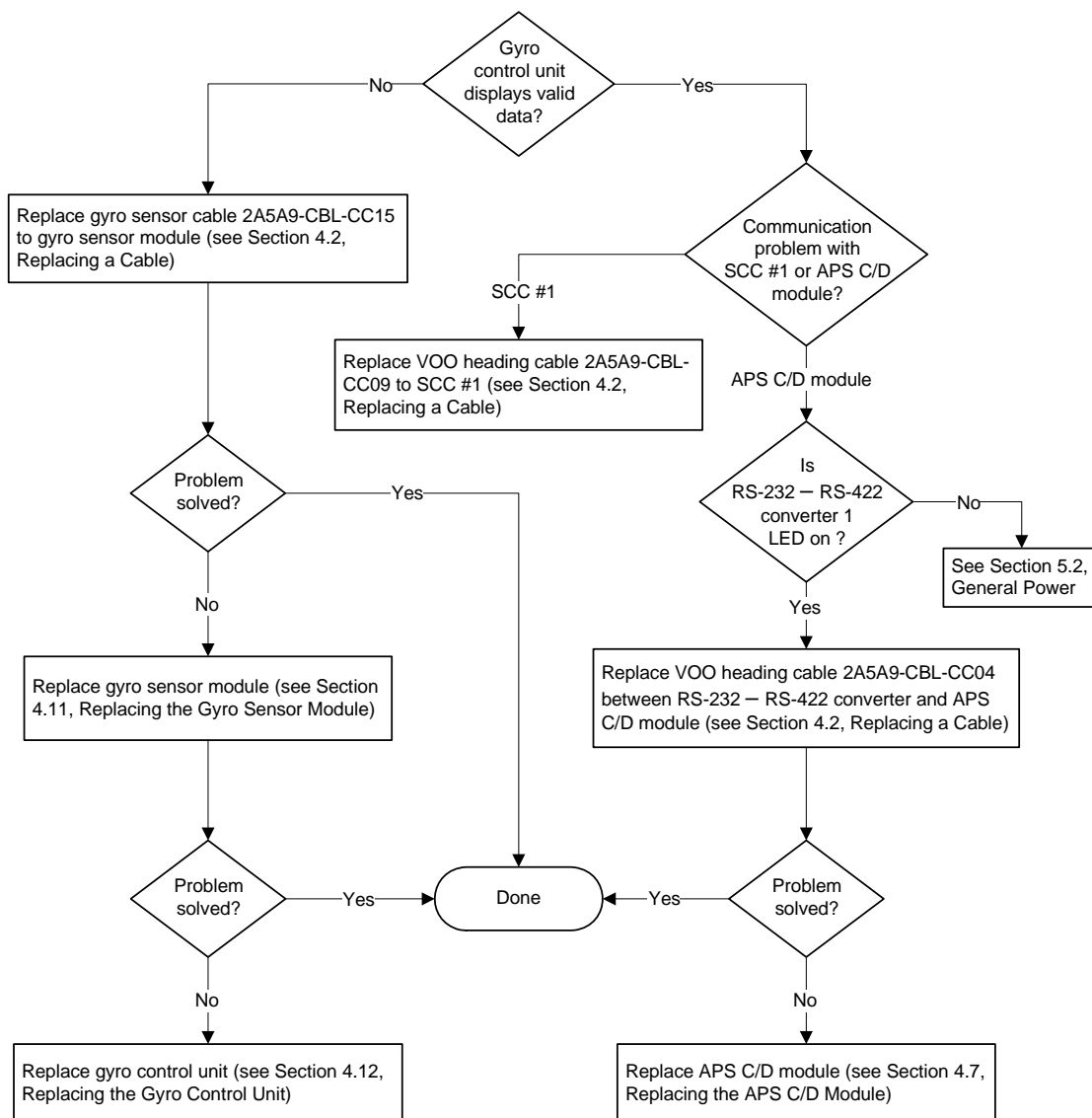


Figure 14 Troubleshooting – TDT VOO Heading Data Invalid with SCC #1 or APS C/D Module

6

General Maintenance Routines

6.1 Overview

This Chapter contains general maintenance routines that apply to several corrective and preventive procedures for the CV Navigation System.

6.2 General Notes

6.2.1 Hazmat Requirements

When disposing of parts and/or fluids removed from the CV Navigation System, follow hazmat procedures in accordance with local requirements.

6.2.2 Torque Specifications

Fasteners, through hull penetrators, and tube fittings are torqued to standard values.

Some corrective or preventive maintenance procedures identify unique torque values or torque reference materials. In all other cases, see the following drawings:

7530452

Torque specifications – fasteners

7530551

Torque specifications – tube fittings and through hull penetrators

6.2.3 Mounting Hardware

When removing and replacing parts, check the mounting hardware and surrounding area for damage, rust, and corrosion.

6.2.4 Lock Fasteners (Nylok Nuts)

Most of the nuts used as mounting hardware on the outside of the PRMS are the Nylok® type.

Nylok® nuts are disposable items. Whenever they are removed during a maintenance procedure, replace with new nuts. Dispose of the used nuts in accordance with local requirements.

Before attaching a Nylok® nut, the bolt may need to be lubricated using a specified lubricant. See the assembly drawing for the specified lubricant.

6.3 Electrical Cables Connection

CAUTION! Do not force any solid objects into female sockets in an attempt to dislodge foreign material.

CAUTION! If salt water remains on a connector when it is inserted, the salt crystals could potentially ruin the rubber connector seal. Thoroughly clean with alcohol before replacing.



Figure 15 Metal Shell Connectors – PRM Exterior



Figure 16 Rubber Molded Connectors – PRM Interior



Figure 17 Crowded Can Head Inside PRM Showing Rubber Molded Connectors (Front Row) and Metal Shell Connectors (Back Row)

The metal shell connectors (see Figure 15 and Figure 17) are usually stainless steel, or sometimes another hard metal on either side. They use rubber O-rings as sealing surfaces. They have machine-smooth surfaces, often in two places, and redundant seals. O-rings fit into those places

Rubber molded connectors (see Figure 16 and Figure 17) are all rubber, with rubber covered electrical pins — the end tip of the pin is exposed metal. They have a separate aluminum or steel assembly that holds it together and is fastened down with screws or, if the connection is cable to cable, they will screw together.

Spare Parts

MI2050

Super O-Lube-2 silicone grease Parker

Procedure

1. Follow tag in/out procedures in accordance with local requirements.
2. Follow instructions in Section 6.2, General Notes, regarding hazmat requirements, use of Nylok® nuts, torque specifications, and inspection of mounting hardware, as applicable.
3. Check labels at each end of the cable and ensure they are present and completely legible. Replace if required.
4. Inspect both the bulkhead connector and the cable connector for debris and remove if any.

5. Clean the connectors with isopropyl alcohol. Consider using canned compressed air to remove small particles, dirt suspended in alcohol, or excess alcohol.
6. Inspect the bulkhead connector as follows:
 - a. On metal cables, visually inspect sealing surfaces and O-rings for dirt or damage. Replace if necessary.
 - b. On rubber cables, visually inspect the rubber pieces for physical damage. Examine the rubber material between adjacent sockets for tears. Examine areas where metal and rubber are joined, such as the pins, for separation of metal and rubber. Replace if necessary.
 - c. Inspect the pins (if applicable) for bending. Replace if necessary.
 - d. Inspect sockets or pins for dirt.
7. Inspect the cable connector as follows:
 - a. On metal cables, visually inspect sealing surfaces and O-rings for dirt or damage. Replace if necessary.
 - b. On rubber cables, visually inspect the rubber pieces for physical damage. Examine the rubber material between adjacent sockets for tears. Examine areas where metal and rubber are joined, such as the pins, for separation of metal and rubber. Replace if necessary.
 - c. Inspect the pins (if applicable) for bending. Replace if necessary.
 - d. Inspect sockets or pins for dirt.
8. Apply a light coating of Super O-Lube-2 to each connector.
9. If the connectors are keyed, align the keys and keyways, and push connectors together.
10. If the connectors are not keyed, carefully align the sockets and pins, and push together.
11. Tighten the outer shell to secure the cable connection.
12. Ensure tag in/out procedures were followed in accordance with local requirements, as applicable.

6.4 Electrical Cables Testing

CAUTION! If salt water remains on a connector when it is inserted, the salt crystals could potentially ruin the rubber connector seal. Thoroughly clean the contact points with alcohol before connecting.

Special Tools

500 VDC insulation resistance meter
Calibrated thermometer

Procedure

Verify Continuity

1. Using a Digital MultiMeter (DMM) and the cable schematic, verify the cable continuity. Verify that the resistance of each conductor is less than 1 ohm. Most DMMs have a continuity test that will beep when the probes are connected across 1 ohm or less.
2. If any conductor has an end to end resistance greater than 1 ohm, replace the cable as soon as possible.

Measure Insulation Resistance

3. Measure and record ambient temperature.
4. For all conductor to conductor combinations and all conductor to connector shell combinations, measure the resistance between the test conductor and the remaining conductors connected together in a group. That is, when testing a 25-pin cable, for the first test measure the resistance between pin 1 and pins 2 through 25 connected as a group. For the second test, measure the resistance between pin 2 and pins 3 through 25 connected as a group. The sequence is shown in the table below:

Pin	Pin
Shell	1-25
1	2-25
2	3-25
3	4-25
4	5-25
5	6-25

5. Record the measured insulation resistance twice, once at 30 seconds, and once at 60 seconds.
6. If any measurement is less than value shown in table below, measure the resistance between all combinations of single conductor to single conductor to check for a failure.

7. If any single conductor to single conductor resistance test is less than value shown in table below, record the result and replace the cable as soon as possible.

Minimum Required Insulation Resistance Values for Observed Test Temperatures		
Range of Test Temperature Observed		Required Minimum Insulation Resistance Reading
Degrees F	Degrees C	Megohms
41–50	5–10	40
50–59	10–15	30
59–68	15–20	20
68–77	20–25	15
77–86	25–30	10
86–95	30–35	7.5
95–104	35–40	5

Dielectric Absorption Ratio

8. If the insulation resistance of any measurement taken at 30 seconds is less than full scale, then calculate and record the dielectric absorption ratio, by dividing the measurement at 60 seconds by the measurement at 30 seconds.

Example:

Measurement at 30 seconds = 20 megohm

Measurement at 60 seconds = 50 megohm

Dielectric Absorption Ratio is $50/20 = 2.5$

9. If the Dielectric Absorption Ratio is less than 1.3, replace the cable.

Glossary

This Glossary contains definitions specific to this manual.

APS	Acoustic positioning system
APS C/D	Acoustic positioning system command/display
CBL	Cable
CCD	Command, control and data
CV	Control van
COAX	Coaxial
DGPS	Differential global positioning system
F/O	Fiber optics
GPS	Global positioning system
INS	Integrated navigation system
KVM	Keyboard-video-mouse
LED	Light emitting diode
mux	Multiplexer
NTP	Network time protocol
NTSC	National television standards committee
P-code	Precision code
PRM	Pressurized rescue module
SCC	Surface control computer
TDT	Time-date-title
VAC	Volts alternating current
VDC	Volts direct current
VGA	Video graphic array
VOO	Vessel of opportunity