CMD Flight Solutions

The Global Leader Providing The Most Comprehensive ADS-B Out AML STC's for Business and Personal Aircraft!

www.CMDFlightSolutions.com

ADS-B Out Solutions @ Booth 424

ADS-B Out Regulatory Basis

- 14 CFR 91.225 and 91.227 drive the requirement for DO-260B compliant ADS-B Out.
- Specifically 91.227(d)(8) drives the requirement for the transmission of Flight ID.
- AC 20-165B provides the installation guidance which our STCs used.
- ADS-B Out should be installed under an STC
  - Supports aircraft re-sale
  - Supports worldwide regulatory agency acceptance
- There is no Requirement for Enhanced Surveillance for ADS-B Out
- No Need for FMS updates
  - Except the UNS FMS has an integrated GPS so you must get to the SCN 1000.7 1(x)W or later
- No Impact to RVSM, Substantiation Report Included in our STC Packages.

CMD Flight Solutions

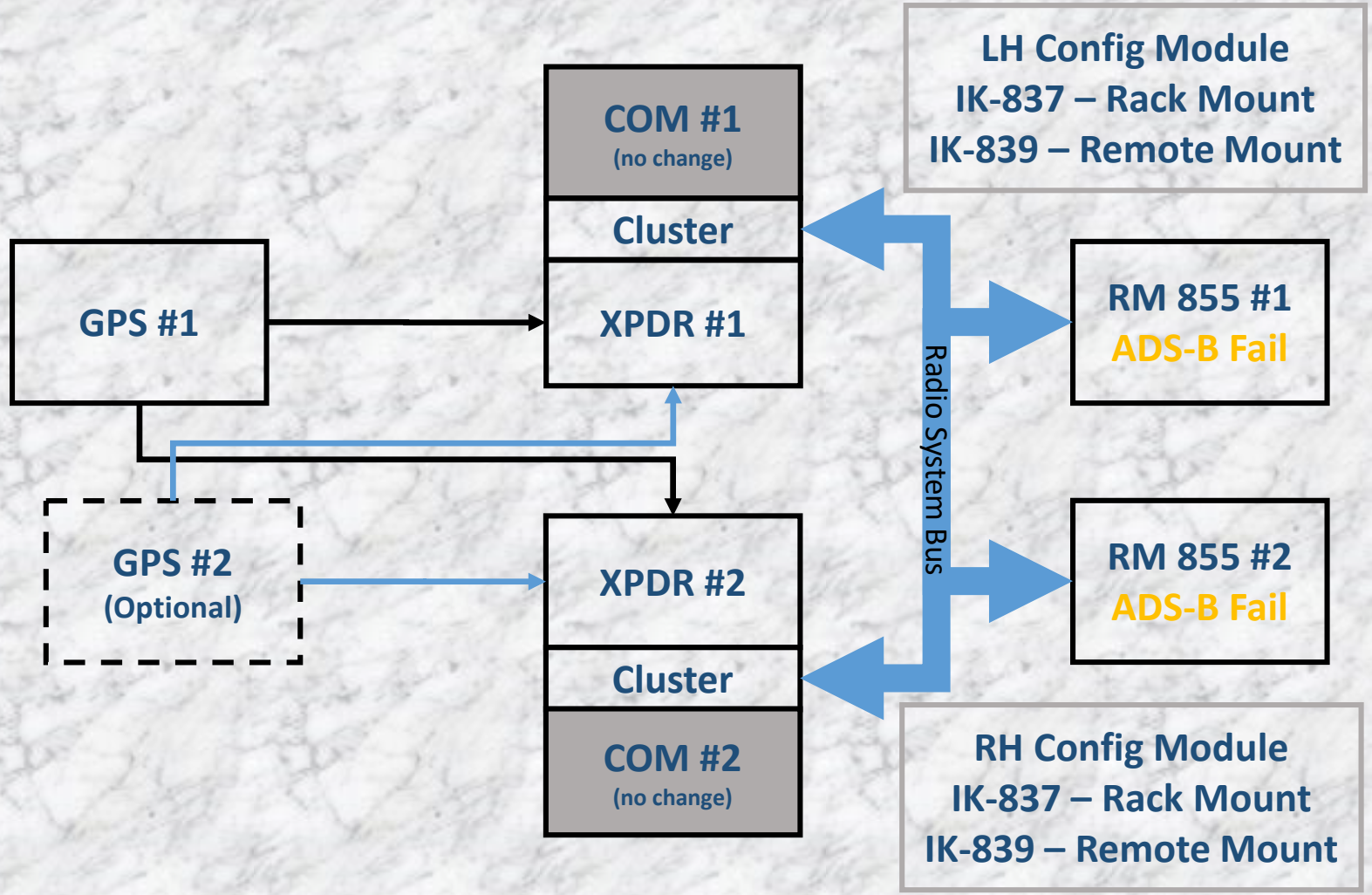
ADS-B Out Solutions

- CMD Covers Nearly All Part 25 and Part 23 Biz Jets, Turbo Props & Regional Aircraft
- Current Equipage Prerequisites are minimal.
- ST04159CH – Part 25 Primus II Radio Suite – EASA/ANAC/MEX DGAC/TCCA Validated
- ST03424CH – Part 25 TDR-94/94D – EASA/ANAC/MEX DGAC/TCCA Validated
- SA04051CH – Part 23 TDR-94/94D – EASA/ANAC/MEX DGAC/TCCA Validated
- TDR-94/D -501 is covered on all aircraft listed in our AML
  - -502 is covered on a limited set of aircraft but all GPS Pairings

- DER Services Available for Major Alteration Approvals
- Outstanding Customer and Technical Support – Please reference our website or call

When you succeed, we all succeed!

Primus II Integrated Comm Unit
ADS-B Block Diagram



TDR-94/94D ADS-B Out Block Diagram With Digital Discrete Adaptor(DDA)

(simply lights the annunciator)

H/W GNSSU

GPS-4000S

CMA-3024/5024

Collins
ATC Control
(H/W & Gables)

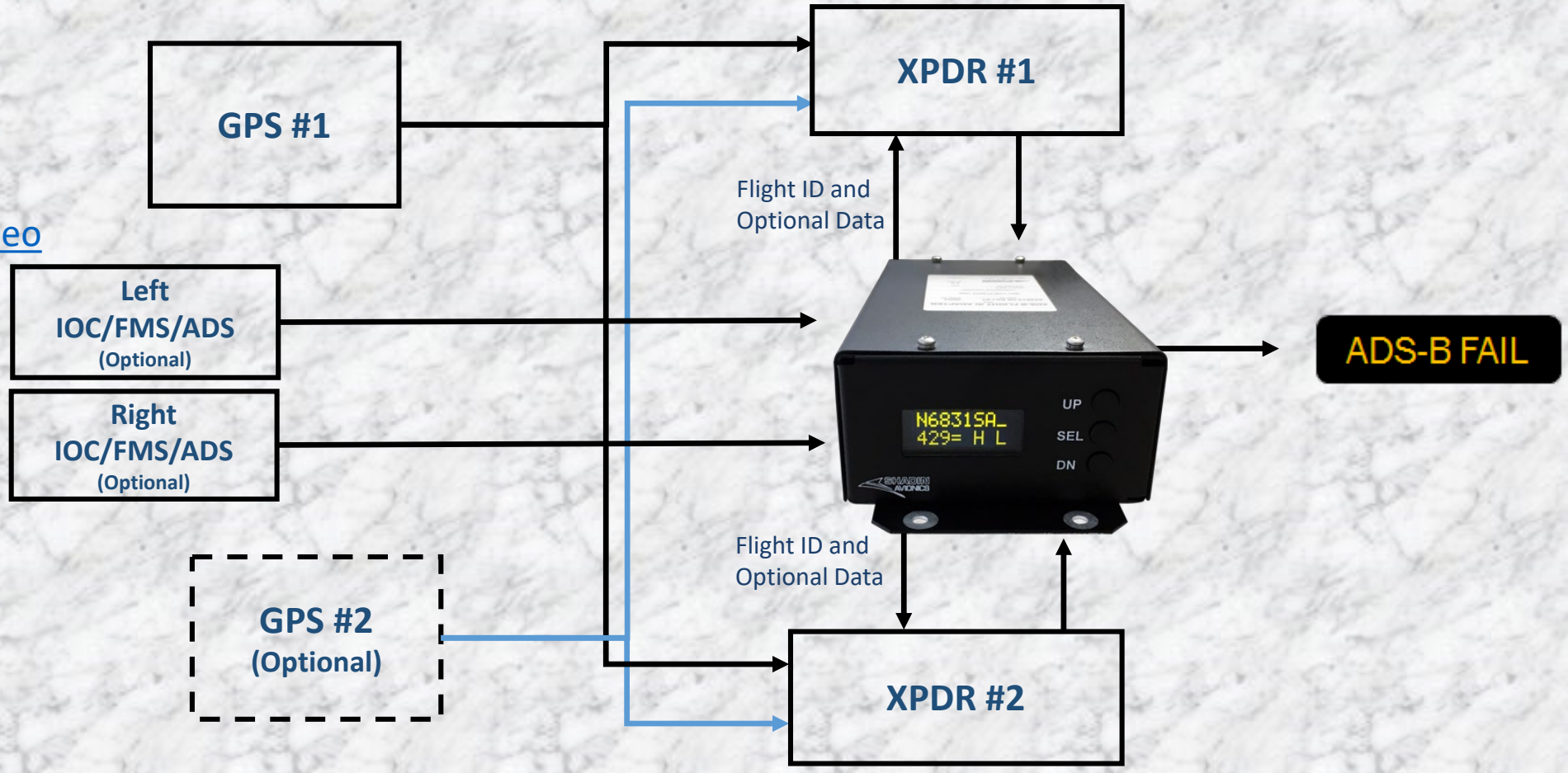
TDR-94(D) 1

TDR-94(D) 2

ADS-B FAIL

TDR-94/94D ADS-B Out Block Diagram With ADS-B Flight ID Adaptor (AFID)

AFID Config Video



- Flight ID, Drives ADS-B Fail Annunciator and provides data bus concentration
- Can save a significant amount of money in Controller and IOC Updates

TDR-94/D and H/W STC Includes:

- Covers one of 8 GPS sources: (Esterline/CMC, UNS, FFS, H/W, Collins, Bendix King)
- Includes the FAA Approved Flight Manual Supplement, Instructions for Continued Airworthiness, Installation Instructions, Strapping Document, and Ground Test
- No External Fail Annunciator Required for Honeywell STC
- TDR-94/D STC's include Digital Discrete Adapter (DDA) or AFID that drives external ADS-B Out fail annunciator.
- Installation Approval of the upgraded Transponders, our DDA/AFID, wiring and installation of the annunciator and upgraded Primus II RCZ-8xx.
- GPS Upgrades or New Stand Alone Installation Approval now included
- GPS Antenna Splitter Installation Approval now included

When you succeed, we all succeed!

Transponder / GPS Pairings

TDR-94/94D

- Universal Avionics UNS-1(x)W
- Esterline/CMC CMA-3024/5024
- FreeFlight Systems 1203C
- Collins GPS-4000S
- Honeywell HG2021GD07
- Honeywell HG2021KB02
  - (via CMC CMA-5024 part number)

Primus II RCZ-8xx

- Honeywell HG2021GD04 – D06
- Universal Avionics UNS-1(x)W
- Esterline/CMC CMA-3024
- Bendix King KGS-200

- **GPS Upgrades and Stand Alone Installations are now included in all STCs**
- **GPS Antenna upgrades of the same footprint/bolt pattern are now included**
- **GPS Antenna Splitter Now Approved as part of STC**

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GPS Splitter

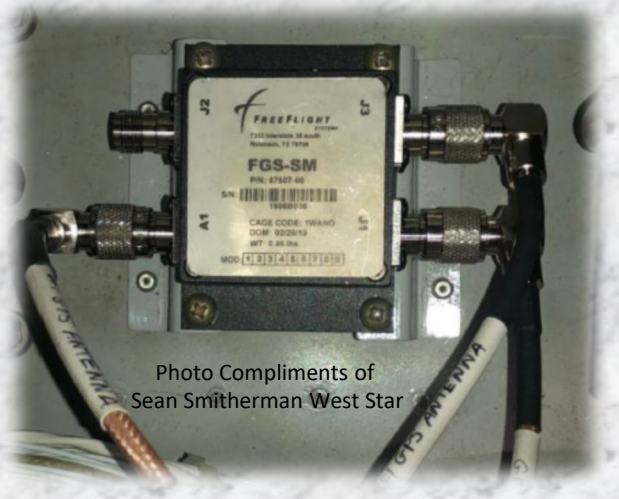

Photo Compliments of
Sean Smitherman West Star

FFS GPS Splitter 87607-00

- Use exiting or upgraded Antenna
- No New Holes in Fuselage
- Huge Time Saver
- Saves Significant Money
- No Need for Damage Tolerance Approval

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GPS Splitter

Photo Compliments of
Sean Smitherman West Star

FFS GPS Splitter 87607-00 Details

- Great Solution when installing a Stand Alone GPS Source
- Use exiting or upgraded Antenna – Upgraded Antenna Covered by our STC
- Following our Worksheet:
  - Determine New Antenna Gain vs Old – Find one with the same footprint/bolt pattern
  - Determine which GPS Source will provide the 5Vdc to the new Antenna's Pre Amp (Connect to J1)
    - J3 blocks the 5 Vdc from getting to the Antenna, A1, connector
    - Note that J2 is Unused
  - Determine Pre Amp Gain, Coax Loss and Splitter Loss to each GPS
  - Determine if additional attenuation is required in either GPS Path

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GPS Splitter Detail

5.3 GPS Antenna Splitter Loss Determination

1. Via the new GPS Antenna Splitter, re-establish a GPS Antenna connection to the existing GPS that is equivalent to the currently implemented configuration ensuring an equivalent signal level is hitting the existing GPS.
2. Via the GPS Antenna Splitter, establish a GPS Antenna connection to the new GPS with no more than loss given a 29.5 dB Pre-Amp gain antenna. (You can have up to 13.5 dB loss with a 33 dB pre-amp gain Antenna.)

Table 1 – GPS Antenna Pre-Amp Gain and Signal Level at GPS

Antenna Pre-Amp Gain	Maximum Acceptable Cable Loss	Acceptable Signal Level At GPS
26.5 +/- 3dB	0 dB ≤ Cable Loss ≥ 10 dB	13.5 to 29.5 dB
29.5 +/- 3dB	3 dB ≤ Cable Loss ≥ 13 dB	13.5 to 29.5 dB
33.0 +/- 3dB	6 dB ≤ Cable Loss ≥ 16 dB	13.5 to 29.5 dB

Table 1 – GPS Antenna Pre-Amp Gain vs Cable Loss

3. Install the splitter so either GPS's 5 Vdc power is provided to the new GPS Antenna pre-amp.

GPS Splitter Detail (cont)

Detailed Instructions:

1. Determine existing GPS Configuration: HG2021GB01
   a. Does the current GPS provide 5 Vdc over the coax to the GPS Antenna? (Yes / No)
   b. Existing GPS Antenna Part Number: S67-1575-14
   c. Existing GPS Antenna Pre-Amp Gain: 0 dBm dB
   d. Existing GPS Antenna Coax Length: 20' ft
   e. Existing GPS Antenna Coax Loss (Length (ft) x Loss/ft): .071 x 20' = 1.42 dB
   f. Determine the existing Signal Level at the GPS (Pre-Amp Gain – Coax Loss: -1.42 dB dB
2. New GPS TSO C190 Antenna Details: 1203C GPS
   a. GPS TSO C190 Antenna Part Number: S67-1575-137
   b. Enter the Pre-Amp Gain of the new GPS Antenna: 29.5 dB dB
3. Determine Splitter J1 (passes 5 Vdc to antenna) signal loss and Signal Strength at the GPS:
   a. J1 is attenuated 4 dB: 4 dB
   b. Existing GPS Coax Loss (Step 1e above): 1.42 dB dB
   c. Splitter to GPS Coax Loss (Length (ft) x Loss/ft): 0.14 dB dB
   d. Total Loss in Splitter J1 path (add a, b, c): 5.56 dB dB Total Loss
   e. Subtract Total Loss (d) from Pre-Amp Gain (2) 23.94 dB dB Signal Level at GPS
   f. Ensure Signal Level at GPS (e) is acceptable, reference Table 1. ← Good

Note: If this J1 Splitter Output is interfaced to the existing GPS, additional attenuation maybe required to the existing GPS if the existing Antenna had no Pre-Amp Gain.

GPS Splitter Detail (cont)

4. Determine Splitter J3 (does **not** pass 5 Vdc to antenna) signal loss and Signal Strength at the GPS:
   a. J3 is attenuated 7 dB: 7 dB
   b. Existing GPS Coax Loss (Step 1e above): 1.42 dB dB
   c. Splitter to GPS Coax Loss (Length (ft) x Loss/ft): 0.14 dB B
   d. Total Loss in Splitter J3 path (add a, b, c): 8.56 dB B Total Loss
   e. Subtract Total Loss (d) from Pre-Amp Gain (2) 20.94 dB Signal Level at GPS
   f. Ensure Signal Level at GPS (e) is acceptable, reference Table 1.

← Use a 20 dB attenuator (PE7003-20)

Note: If this J3 Splitter Output is interfaced to the existing GPS, additional attenuation maybe required to the existing GPS if the existing Antenna had no Pre-Amp Gain. For available attenuators visit https://www.pasternack.com/nsearch.aspx?keywords=PE7003&view_type=grid. Pasternak TNC Attenuators (PE7003-xx (xx = dB value)

5. Based on the steps above, document which Splitter outputs will be interface to each GPS and if additional attenuation is required:
   a. Splitter J1 is to be interfaced to and provides the 5 Vdc power: 1203C GPS GPS
   b. Splitter J3 is to be interface to: HG2021GB01 GPS

Best Solution for Flight ID

H/W RMU-855's provide Flight ID – Good to Go

TDR-94/94D:

- **Is the aircraft currently equipped to provide Flight ID to the Transponders?**
  - **Most European and Transoceanic Aircraft are good to go**
  - **Does the operator file Flight Plans under tail number or other fixed value?**
    - **Shadin AFID is good option and world wide aircraft registration ready.**
    - **The -502 is an option if US Registered but Flight ID will have to be solved again if sold/re-registered outside the US in the future, limiting aircraft value and market**
  - **CMD STC allows addition of Flight ID from control or AFID if aircraft is exported out of US.**

Annunciator Options

H/W RMU-855's provide ADS-B Fail Annunciation – Good to Go

- External Annunciator is NOT required with our STC

TDR-94/94D:

- **DDA and AFID**
  - Smartly determines the Operational Transponder to properly drive ADS-B Fail Annunciator
  - Installed in vicinity of TDR's utilizing TDR Power, making wire runs and bulkhead penetrations easy with only one wire required to be run to the cockpit.
  - No External Relay required
  - No external Switch or Discrete input required
  - Drives Stand Alone Annunciator or Available Blank in MCMW Panel
  - Deeply engrained in your shops installation processes – Easy and very familiar to most
- **SR429/IM available with -502**

H/W Strapping Instructions

Strap Number	Cut	Unit	Function	Strap Definition GND = Jumper wire installed (UNCUT) = 0 OPEN = Jimper wire NOT installed (CUT) = 1				
[redacted]		XPDR (ADS--B Out)	ADS--B Emitter Category	**W51 (MSB)**	**W50**	**W49 (LSB)**	**ADS--B Emitter Category (Aircraft Type 4 Code)**	
				0	0	0	No ADS--B emitter information (not used)	
W49				0	0	1	Light (< 15,000 lbs)	
[redacted]				0	1	0	Small (15,000 to 75,000 lbs)	
				0	1	1	Large (75,000 to 300,000 lbs)	
W50				1	0	0	High Vortex Large	
[redacted]				1	0	1	Heavy (> 300,000 lbs)	
				1	1	0	High Performance	
W51				1	1	1	Rotorcraft	
[redacted]		XPDR (ADS-B Out)	A/C Length & Width Category	**Length Code**		**Width Code**	**Length (Meters)**	**Width (Meters)**
				W54	**W53**	**W52**		
				ME bit 22	**ME bit 23**	**ME bit 24**		
				0	0	0	No Data	No Data
W52				0	0	1	L < 15	W < 23
[redacted]				0	1	0	L < 25	W < 28.5
				0	1	1	L < 25	W = 28.5 to 34
W53				1	0	0	L < 35	W < 33
[redacted]				1	0	1	L < 35	W = 33 to 38
				1	1	0	L < 45	W < 39.5
W54				1	1	1	L < 45	W < 45

TDR-94/D Helpful Troubleshooting Info

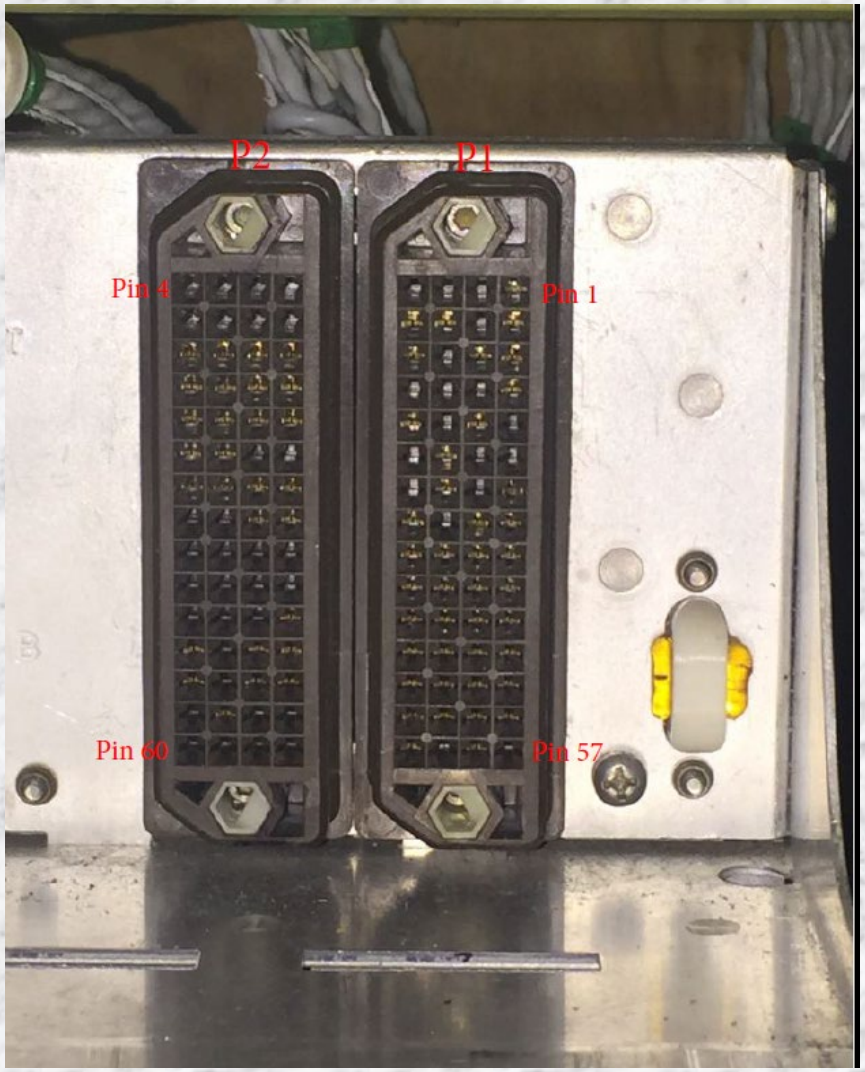
Initial Steps to Troubleshoot Annunciator Issues/suspect DDA issues:
Note: The DDA provides the ground to light the ADS-B Fail Annunciator via an internal Normally Closed Reed Relay. Pin 1 will ring to Power ground Pin 24 with no power applied.
Note: The DDA uses both TDR outputs to determine the Operational vs Standby TDR.
Note: When the Operational TDR is determined by the DDA, then it looks at the operational transponder's Label 353-20 0 = ADS-B Out good (DDA Relay opens turning the annunciator off), 1 = ADS-B Out Fail (Relay remains closed).
Note: If both TDRs are in Standby, the DDA opens the relay, turning the annunciator off.
Troubleshooting Steps:
1. Verify TDR Mode A and C (Altitude) are functioning properly using an IFR Test Set.
2. Disconnect the DDA, the annunciator should be off.
3. Verify power to the DDA
4. Apply a ground to DDA plug pin 1, the annunciator should be lit.
5. Re-install the DDA
6. Put both TDR's in Standby, the annunciator should turn off.
7. Verify the GPS Bus speed and ensure the TDR's GPS bus speed strapping pin are set appropriately.
8. Using an A429 analyzer, monitor the operational TDR output at the DDA, look at 353-20, ADS-B Out Status, 0 = ADS-B Out Good

TDR-94/D GPS Inputs and Speed Strapping		
P2	49, 50	GPS 1 A429 Input Port
P1	18	GPS 1 Input Port Bus Speed (Gnd = Hi)
P2	29, 30	GPS 2 A429 Input Port
P1	26	GPS 2 Input Port Bus Speed (Gnd = Hi)

TDR-94/D AIS/ADS/X-Side IOC Input and Speed Strapping		
P2	39, 40	AIS/ADS/X-Side IOC A429 Input Port
P1	57	AIS/ADS/X-side IOC A429 Input Port Bus Speed (Gnd = Hi)
TDR-94/D FMS/IRS/On-Side IOC Input		
P2	27, 28	FMS/IRS/On-Side IOC A429 Input Port
P1	24	FMS/IRS Input Port Bus Speed (Gnd = Hi)

GPS-4000S Strapping Matrix		
Bus Number and speed	**P1B-4C**	**P1A-5D**
1 and 2 = HS, 3 = HS	Open	Open
1 and 2 = HS, 3 = LS	Open	Ground
1 and 2 = LS, 3 = LS	Ground	Open
1 and 2 = LS, 3 = HS	Ground	Ground
GPS-1 Output Bus = P1B-1A, -1B		
GPS-2 Output Bus = P1B-6A, -6B		
GPS-3 Output Bus = P1B-11A, -11B		
Rate 1Hz/5Hz Related	**TP-4A**	
Bus 1 and 2 = 1 Hz	Open	
Bus 1 and 2 = 5 Hz	Ground	
	TP-9C	
Bus 3 = 1 Hz	Open	
Bus 3 = 5 Hz	Ground	
Strap Common (or Ground)	P1B-4D	
Side Straps	**P1B-5B**	**P1B-5A**
Left / #1	Ground	Open
Right / #2	Open	Ground

TDR-94/D Mount w/Connectors



TDR-94/D Strapping Instructions

[Link to Strapping Doc]

P1 - Pin Name		Pin #	400A/400XP/400T	Falcon2000/EX	Falcon50/EX
Length/Width (LSB)	ADS-B Configuration Pins	1	ADS-B Common	Strobe	Strobe
Length/Width		2	Open	Open	Open
Length/Width (MSB)		3	Open	Open	Open
GPS Long Offset (LSB)*1		4	Open	Open	Open
GPS Long Offset*1		5	ADS-B Common	ADS-B Common	ADS-B Common
GPS Long Offset (MSB)*1		6	Open	Open	Open
Navigational Accuracy Category-Velocity (NACv)		7	ADS-B Common	ADS-B Common	ADS-B Common
SDA		8	ADS-B Common	ADS-B Common	ADS-B Common
ADS-B RX/Fail Disable		9	ADS-B Common	ADS-B Common	ADS-B Common
ADS-B RX/Fail Disable		10	ADS-B Common	ADS-B Common	ADS-B Common
Aircraft Type 0		20	Strobe	Strobe	Strobe
Aircraft Type 1		21	Open	Open	Open
Aircraft Type 2		22	Open	Open	Open
ADS-B Configuration Parity		23	Open	ADS-B Common	ADS-B Common
TCAS Installed		13	Common	Common	Common
Control Altitude		14	Common	Common	Common
Configuration 0		28	Open	Open	Open
Configuration 1		17	Common	Common	Common
GPS #1Bus Speed	Bus Speeds	18	Common	Common	Common
GPS #2 Bus Speed		26	Common	Common	Common
Onside Concentrator (FMS/IRS) Bus Speed		24	Open	Open	Open
X-side Concentrator (AIS/ADS) Bus Speed		57	Open	Open	Open
ADS-B Strap Common		12	ADS-B Common	ADS-B Common	ADS-B Common
ADS-B Strobe Pin (& X-Side)		30	Strobe	Strobe	Strobe

Pro Line

P2					
Pin Name		Pin #	Strapping	Strapping	Strapping
IOC GPS Disable		41	Common	Common	Common
2/3 AHRS Select*2		42	Common	Common	Common
Max Airspeed		43	Open	Open	Open
Max Airspeed		44	Open	Open	Open
Max Airspeed		45	Common	Common	Common
SDI Input A		46	LH - Open RH - Common	LH - Open RH – Common	LH - Open RH - Common
SDI Input B		47	LH - Common RH Open	LH - Common RH Open	LH - Common RH Open
Disable GPS Integrity Limit		53	Open	Open	Open
CSDB/A429 Control		56	Open	Open	Open
Strap Common		52	Common	Common	Common

PMA'd Installation Accessories

- Rack Mount (IK-837) Config Modules for Primus II
- Wiring Harnesses (both DDA and AFID)
- DDA Brackets
  - Right Angle Bracket (aka L-Bracket)
  - Side Mount Bracket for stacked Transponders
- AFID Brackets
  - L – Bracket
  - Undershelf Bracket
  - Side Mount Bracket for stacked Transponders
  - Top Mount Bracket

PMA'd Installation Accessories

Harnesses, Brackets & Hardware available

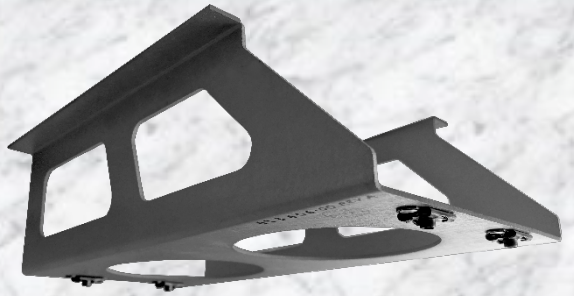
Side Mount Bracket

Wire Harness

Right Bracket

PMA'd Installation Accessories

DDA L Bracket Mount



Under Shelf Mount

Top of TDR Rack Mount

CMD Flight Solutions

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