Vibrant User Manual

Part Number: SCBV2A

Dated: 10 August 2026

Revision: F

Securboration, Inc
1050 W. NASA Blvd
Melbourne, FL 32901
321-409-5252
www.securboration.com
info@securboration.com

Revision History

Date	Revision	Description
20 Sep 2024	-	Initial Release
7 Oct 2024	A	Update format
8 Nov 2024	B	Incorporate comments from customers to correct some command phrases
21 Mar 2025	C	Update to support latest training sessions
18 Apr 2025	D	Update to add info relative to external ethernet interface and setting Static IP
27 Jun 2025	E	Add description of Front Panel Lights
10 Aug 2026	F	Updates to support latest Production Versions

Table of Contents

1 Overview

The Vibrant system is designed to provide the ability to passively collect, record, decode, and analyze aircraft performance and health data from a variety of avionics equipment types. Vibrant data can be easily shared with other applications for further analysis and exploitation.

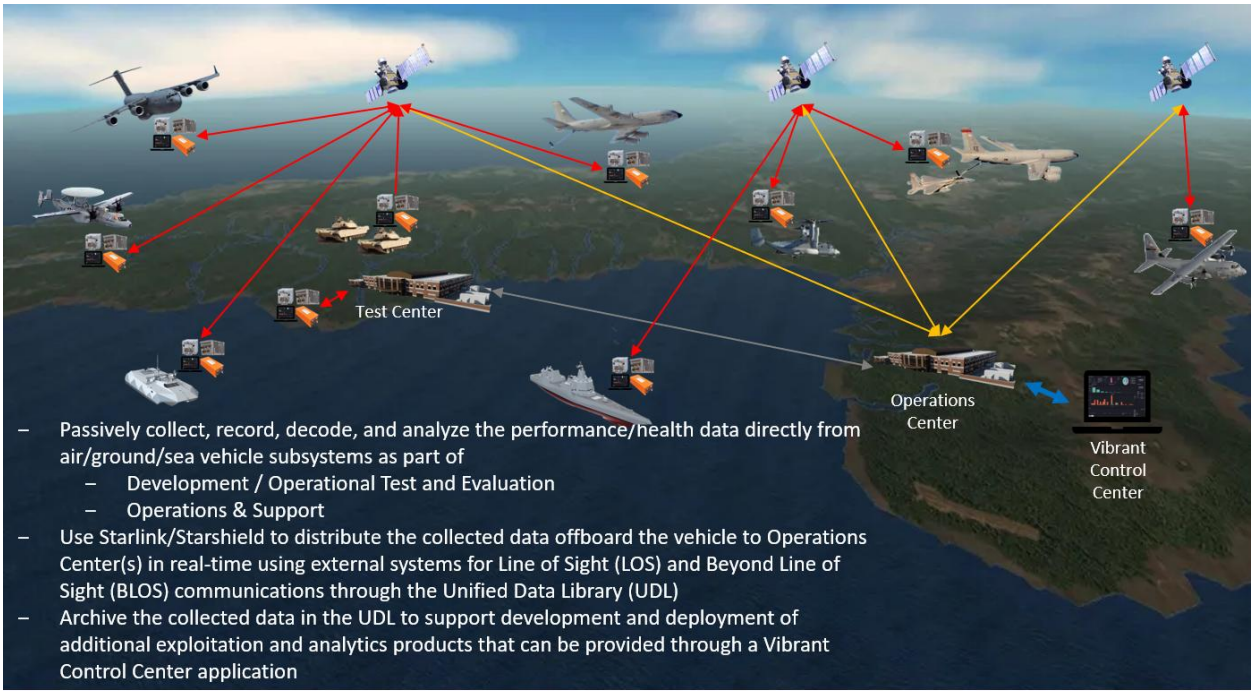
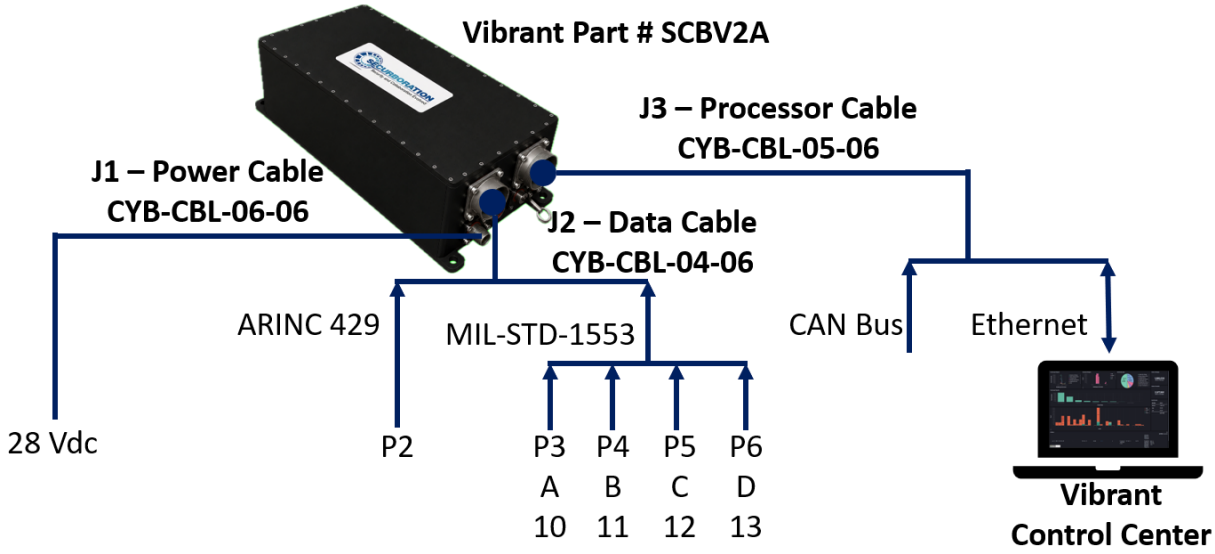


Figure 1 Vibrant Operational View

As depicted in Figure 2, the Vibrant system provides the capability to passively capture MIL-STD-1553, ARINC 429, and CAN Bus traffic and interface to external applications through an ethernet interface.



Passively collect and analyze performance/health data from MIL-STD-1553, ARINC 429, and CAN Bus. Provide data and analytics externally through the Ethernet interface.

Figure 2 Vibrant Hardware System Interfaces

The Vibrant system includes 1 Vibrant Unit, 3 separate cable bundles, and the Vibrant Software as described below:

1) SCBV2A Vibrant System
2) CYB-CBL-04-06 Vibrant J2 - Data Cable (6ft)
3) CYB-CBL-05-06 Vibrant J3 - Processor Cable (6ft)
4) CYB-CBL-06-06 Vibrant J1 - Power Cable (6ft)

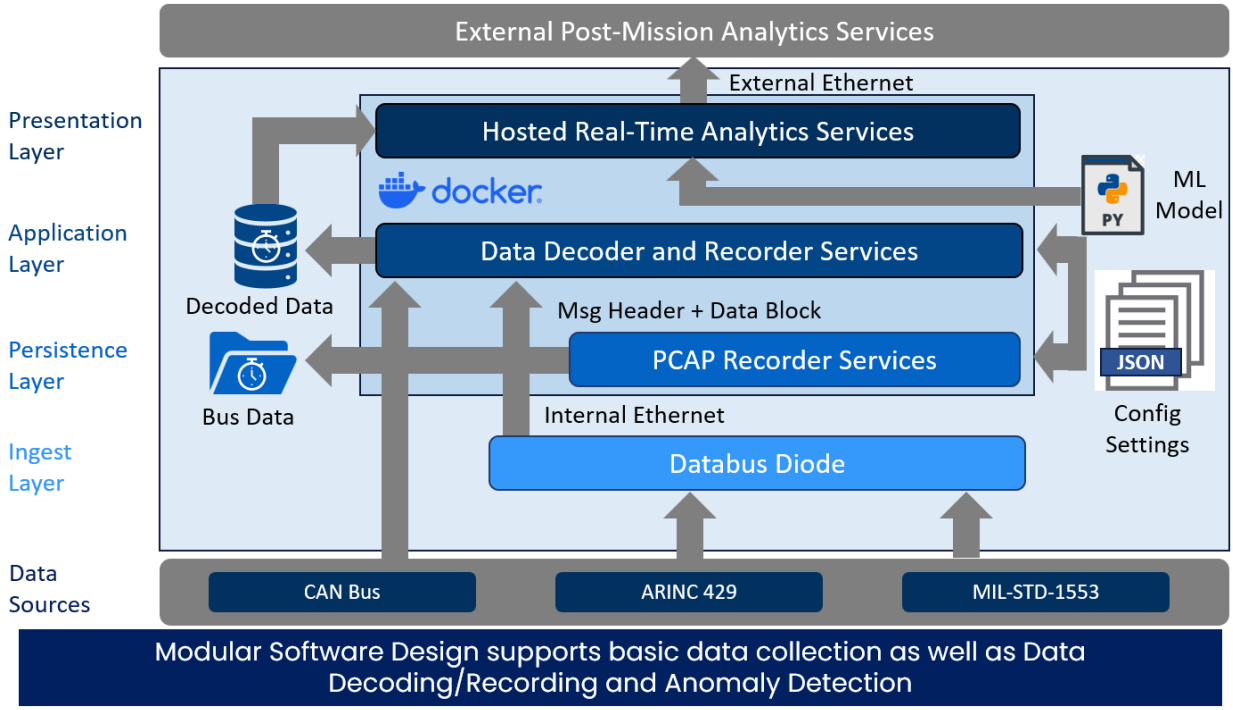


Figure 3 Vibrant Software Architecture

The Vibrant system provides multiple options for users to interface with the captured data:

1) PCAP Recorder Services - the captured data is stored internally in non-volatile memory with the ability to maintain up to 4TB of data.
2) Streaming Bus/PCAP data – the captured data is also made available as a real-time UDP broadcast to external user-provided applications through the ethernet interface (see Section 6.1)
3) Data Decoder and Recorder Services – the detailed formats of the specific messages are defined and managed within the Config Settings. The Data Decoder converts the data from binary to specific units as defined by the associated Interface Control Document (ICD) and records the information into a database.
4) Analytics Services – specific operational thresholds can be established that can be applied against the data to support triggering warnings and alerts when anomalous data is observed

Internally, the Vibrant Databus Diode decodes the bus controller (BC) / remote terminal (RT) interaction and transmits the information over the internal Ethernet connection to the Vibrant processor. For efficiency, one Ethernet packet is transmitted for every eight MIL-STD-1553 BC/RT interactions. The Vibrant internal Databus Diode also creates high precision timestamps for the BC and RT traffic. Each bus BC message has a time-stamp

resolution of 5 ns which is 4x the industry standard. The RT response also has a resolution of 5 ns which is 20x the industry standard. To protect the avionics buses, Vibrant performs as a one-way device and cannot transmit MIL-STD-1553 packets.

2 Vibrant SW Configuration Management Process

The Vibrant software configuration is maintained by the Securboration Team and is updated as necessary to respond to any anomalies identified by the customer. The Vibrant software is managed as a Docker Image, and any required updates will be coordinated between Securboration and the individual customers.

3 Configure the Vibrant IP Address Mode

The Vibrant external ethernet interface can be configured as either Static or Dynamic IP Mode.

Vibrant is configured with a default Static IP Address: 169.254.116.105 which works best when using Vibrant on an aircraft with a fixed network configuration.

When using Vibrant in a lab environment on a dynamic network, the user may need to configure Vibrant to use Dynamic Host Configuration Protocol (DHCP).

To configure the Vibrant IP Address Mode, execute the following steps:

3.1 Connect Vibrant Cables

a) with the Vibrant powered down
b) connect the J1 – Power Cable to the Vibrant box and a 28VDC power supply
c) connect the J3 – Processor Cable to the Vibrant box
d) connect one end of an ethernet cable to the J3 – Processor Cable ethernet port and the other end to a laptop

3.2 Set up Laptop IP Address

a) Laptop Static IP: 169.254.116.101, netmask 255.255.255.0
b) Open Settings by pressing Windows key + I
c) Click on Network & Internet on the left menu
d) Choose Ethernet or Wi-Fi depending on how you connect
e) For Wi-Fi, click on Hardware properties first
f) Find IP assignment and click the Edit button

g) Change the drop-down menu from Automatic (DHCP) to Manual
h) Toggle the IPv4 switch to On
i) Type in your IP address, Subnet mask, Gateway, and DNS server information
j) Click “Save” to apply the new configuration

3.3 Boot up Vibrant

a) power on the Vibrant
b) wait 1-2 minutes for boot process to finish (see Section 4 Startup Process)
c) from the laptop, right click and select “Open in Terminal”
d) ssh vibrant@169.254.116.105
   - User: “vibrant”
   - Hostname: “vibrant”
   - Password: “VibrantScB$”
   - vibrant@vibrant: cd /home/vibrant
   - vibrant@vibrant: sudo nano vibrant_system_configurations.yml
     - set “use_dhcp” to “false” for Static IP Address Mode
     - set “use_dhcp” to “true” for Dynamic IP Address Mode
   - use Ctrl+ 0 to save and Ctrl+ X to exit the editor
   - sudo reboot

4 Startup Vibrant

Before starting the Vibrant system, the user needs to ensure that all necessary cable connections are connected depending on which devices are being used.

a) Connect J1 - Power Cable to 28VDC power supply
b) Connect J2 – Data Cable to Mil-Std-1553 and/or ARINC 429 Databus
c) Connect J3 – Processor Cable to Ethernet Network
d) Power on the Vibrant
e) wait 1-2 minutes for boot process to finish
f) During Startup the lights on the front panel of the Vibrant Box will behave as follows:
   - Each light (A, B, C, and D) will be illuminated in sequence to demonstrate the lights are operational
   - Light A - will flash Green during startup of the Vibrant Hardware. It will turn solid Green upon successful completion of the startup process.

- Light B - will flash Green during startup of Vibrant Software. It will turn solid Green upon successful completion of the startup process.
- Light C - will blink Red upon failure of the Vibrant Hardware.
    - Blink 1 – Failed to grant *dotnet* the required capabilities for network capture
    - Blink 2 – Failed to restart NetworkManager
    - Blink 3 – Failed to start SSH
    - Blink 4 – Failed to open port 22 with *ufw*
    - Blink 5 – Failed to open port 22 with *firewalld*
    - Blink 6 – Failed to open port 22 with *iptables*
    - Blink 7 – Failed to initiate vibrant-network-monitor service
- Light D - will blink Red upon failure of the Vibrant Software
    - Blink 1 – Failed to start *Elasticsearch*
    - Blink 2 – Failed to start *Kibana*
    - Blink 3 – Failed to start *Vibrant*

Upon successful startup, the system will continuously monitor the J2 - Data Cable inputs for bus traffic and process accordingly.

Figure 4 Vibrant Front Panel Lights

5 Login to Vibrant

Vibrant is configured with a default Static IP Address: 169.254.116.105

If using DHCP, obtain the Vibrant_System_IP_Address by scanning the network from the customer laptop to show all connected devices

a) Windows: use a scanning tool like “Advanced IP Scanner” or “Zenmap”
b) Linux: “sudo nmap -sn <ipaddress/netmask>”

Once the Vibrant_System_IP_Address is determined

a) from the laptop, right click and select “Open in Terminal”
b) ssh vibrant@<Vibrant_System_IP_Address>
    - User: “vibrant”
    - Hostname: “vibrant”
    - Password: “VibrantScB$”

6 Data Analysis

6.1 Receiving the Real-Time Data Stream

In addition to recording data internally, the Vibrant system transmits captured bus traffic out the external ethernet interface (J3 – Processor Cable) in real time, allowing customer applications to receive and process the data as it is collected.

a) Data is transmitted as a UDP broadcast to 255.255.255.255 on port 60084.
b) A receiving application must be configured to accept broadcast traffic on this port. It will not receive data if configured to connect directly to the Vibrant IP address.
c) The broadcast does not pass through routers. The receiving computer must be connected to the same physical network segment as the Vibrant external ethernet interface.
d) The format of the transmitted messages is described in Section 6.2.

6.2 User Datagram Protocol (UDP)

The message traffic captured by the Databus Diode subsystem from the MIL-STD-1553 and ARINC 429 connections is transferred to Vibrant processing services through the Internal Ethernet connection and formatted in UDP as follows:

Table 1 Databus Diode UDP ICD (Mil-Std-1553)

Ethernet Header	0x7BB7																																
32bit Field	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Comment
0	Bus Letter				0x9				0x0				0x9				8 high bits of pkt counter								0	0	0	0	0	0	0	0	Bus Letter: A, B, C, D
1	8 low bits of pkt counter								0xE				error bits				place hold				0				0	0	0	0	0	0	0	0	
2	24 high bits of 44 bit timestamp																								0	0	0	0	0	0	0	0	Timestamp is 5 ns per bit
3	20 low bits of 44 bit timestamp																				Fine Rez				0	0	0	0	0	0	0	0	Fine Rez is 0.5 ns per bit
4	24 bits of normal message reply time																								0	0	0	0	0	0	0	0	Reply Time is 0.5 ns per bit
5	24 bits of RT 2 RT reply time																								0	0	0	0	0	0	0	0	RT 2 RT is related to the commaned RT
6	Sync	Decoded command message (17 bits) RT 2 RT																			0	0	0	0	0	0	0	0	0	0	0	0	RT 2 RT is related to the commaned RT
7	Sync	Decoded command message (17 bits)																			0	0	0	0	0	0	0	0	0	0	0	0	
8	Sync	Decoded status message (17 bits) RT 2 RT																			0	0	0	0	0	0	0	0	0	0	0	0	RT 2 RT is related to the commaned RT
9	Sync	Decoded status message (17 bits)																			0	0	0	0	0	0	0	0	0	0	0	0	
10	Sync	Decoded Data 0																			0	0	0	0	0	0	0	0	0	0	0	0	All syncs are 010 for cmd, 000 for data
11	Sync	Decoded Data 1																			0	0	0	0	0	0	0	0	0	0	0	0	
12	Sync	Decoded Data 2																			0	0	0	0	0	0	0	0	0	0	0	0	
13	Sync	Decoded Data 3																			0	0	0	0	0	0	0	0	0	0	0	0	
14	Sync	Decoded Data 4																			0	0	0	0	0	0	0	0	0	0	0	0	
15	Sync	Decoded Data 5																			0	0	0	0	0	0	0	0	0	0	0	0	
16	Sync	Decoded Data 6																			0	0	0	0	0	0	0	0	0	0	0	0	
17	Sync	Decoded Data 7																			0	0	0	0	0	0	0	0	0	0	0	0	
18	Sync	Decoded Data 8																			0	0	0	0	0	0	0	0	0	0	0	0	
19	Sync	Decoded Data 9																			0	0	0	0	0	0	0	0	0	0	0	0	
20	Sync	Decoded Data 10																			0	0	0	0	0	0	0	0	0	0	0	0	
21	Sync	Decoded Data 11																			0	0	0	0	0	0	0	0	0	0	0	0	
22	Sync	Decoded Data 12																			0	0	0	0	0	0	0	0	0	0	0	0	
23	Sync	Decoded Data 13																			0	0	0	0	0	0	0	0	0	0	0	0	
24	Sync	Decoded Data 14																			0	0	0	0	0	0	0	0	0	0	0	0	
25	Sync	Decoded Data 15																			0	0	0	0	0	0	0	0	0	0	0	0	
26	Sync	Decoded Data 16																			0	0	0	0	0	0	0	0	0	0	0	0	
27	Sync	Decoded Data 17																			0	0	0	0	0	0	0	0	0	0	0	0	
28	Sync	Decoded Data 18																			0	0	0	0	0	0	0	0	0	0	0	0	
29	Sync	Decoded Data 19																			0	0	0	0	0	0	0	0	0	0	0	0	
30	Sync	Decoded Data 20																			0	0	0	0	0	0	0	0	0	0	0	0	
31	Sync	Decoded Data 21																			0	0	0	0	0	0	0	0	0	0	0	0	
32	Sync	Decoded Data 22																			0	0	0	0	0	0	0	0	0	0	0	0	
33	Sync	Decoded Data 23																			0	0	0	0	0	0	0	0	0	0	0	0	
34	Sync	Decoded Data 24																			0	0	0	0	0	0	0	0	0	0	0	0	
35	Sync	Decoded Data 25																			0	0	0	0	0	0	0	0	0	0	0	0	
36	Sync	Decoded Data 26																			0	0	0	0	0	0	0	0	0	0	0	0	
37	Sync	Decoded Data 27																			0	0	0	0	0	0	0	0	0	0	0	0	
38	Sync	Decoded Data 28																			0	0	0	0	0	0	0	0	0	0	0	0	
39	Sync	Decoded Data 29																			0	0	0	0	0	0	0	0	0	0	0	0	
40	Sync	Decoded Data 30																			0	0	0	0	0	0	0	0	0	0	0	0	
41	Sync	Decoded Data 31																			0	0	0	0	0	0	0	0	0	0	0	0	
42	Extra Data																				0	0	0	0	0	0	0	0	0	0	0	0	
43	Extra Data																				0	0	0	0	0	0	0	0	0	0	0	0	
44	Extra Data																				0	0	0	0	0	0	0	0	0	0	0	0	
* Errors: 0x0 - No errors, 0x1 - Cmd sync error, 0x2 - Cmd error, 0x3 - Data sync error, 0x4 - Word decode error, 0x5 - Transfer error, 0x6 - Busy, 0x7 - No reply																																	

Table 2 Databus Diode UDP ICD (ARINC-429)

Ethernet Header	0x7BB7																																
32bit Field	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Comment
0	Bus Letter				0x7				0x0				0x7				16bit pkt transaction counter																Bus Letter: A, B, C, D
1	0xE				error codes				rate				reserved								high bits of timestamp												Error Codes: TBD
2	32 low bits of timestamp																																43 bit timestamp, resolution: 5ns per bit
3	char1				char2				char3				SDI				MSB				Decoded Data									LSB		SSM	Data Label: char1 & char2 & char3
4	32bits reserved for expansion																																
5	32bits reserved for expansion																																

7 Mechanical

The following sections provide details related to the physical/mechanical elements of the Vibrant system.

7.1 Chassis Drawings

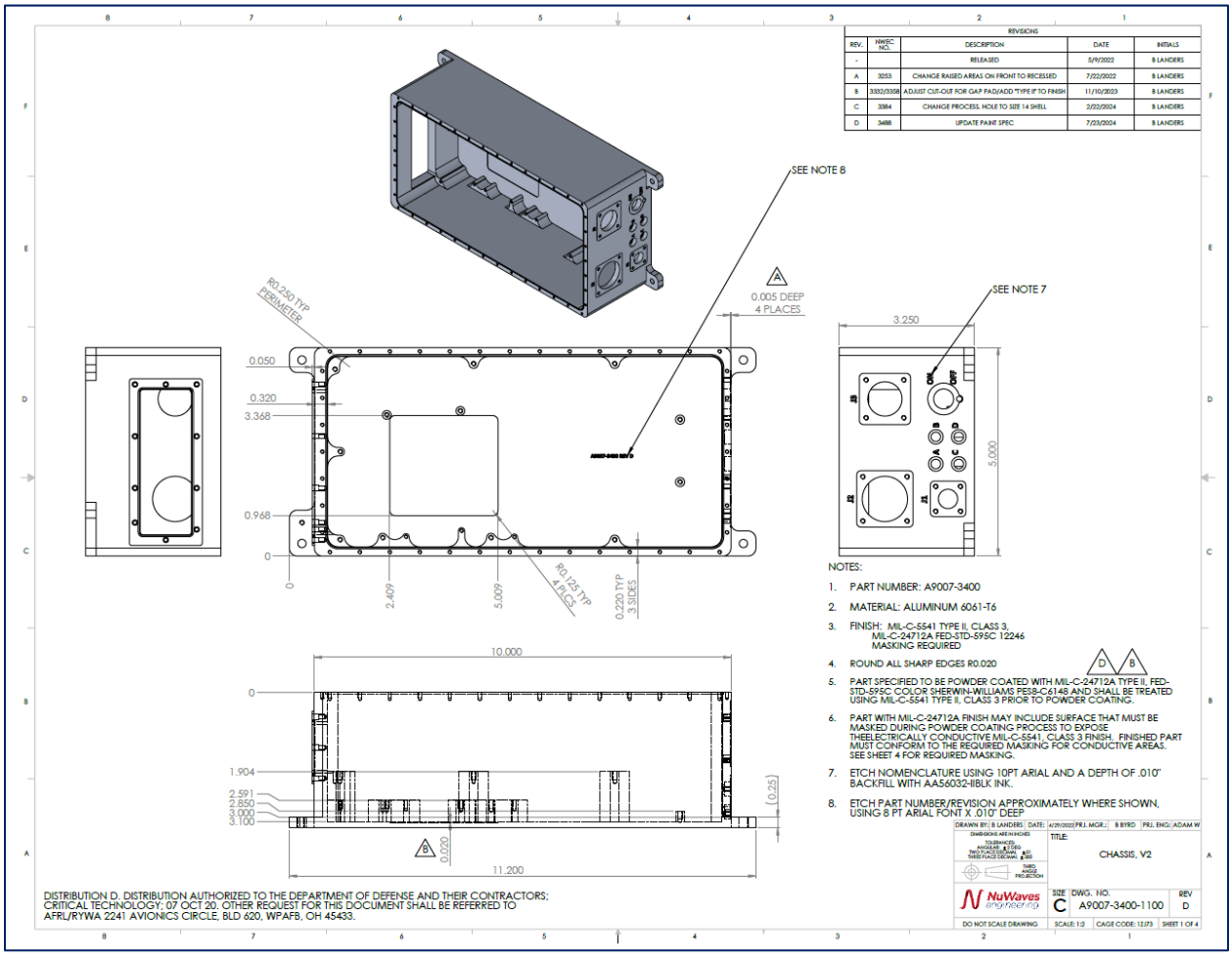


Figure 5 Vibrant Chassis Drawing #1

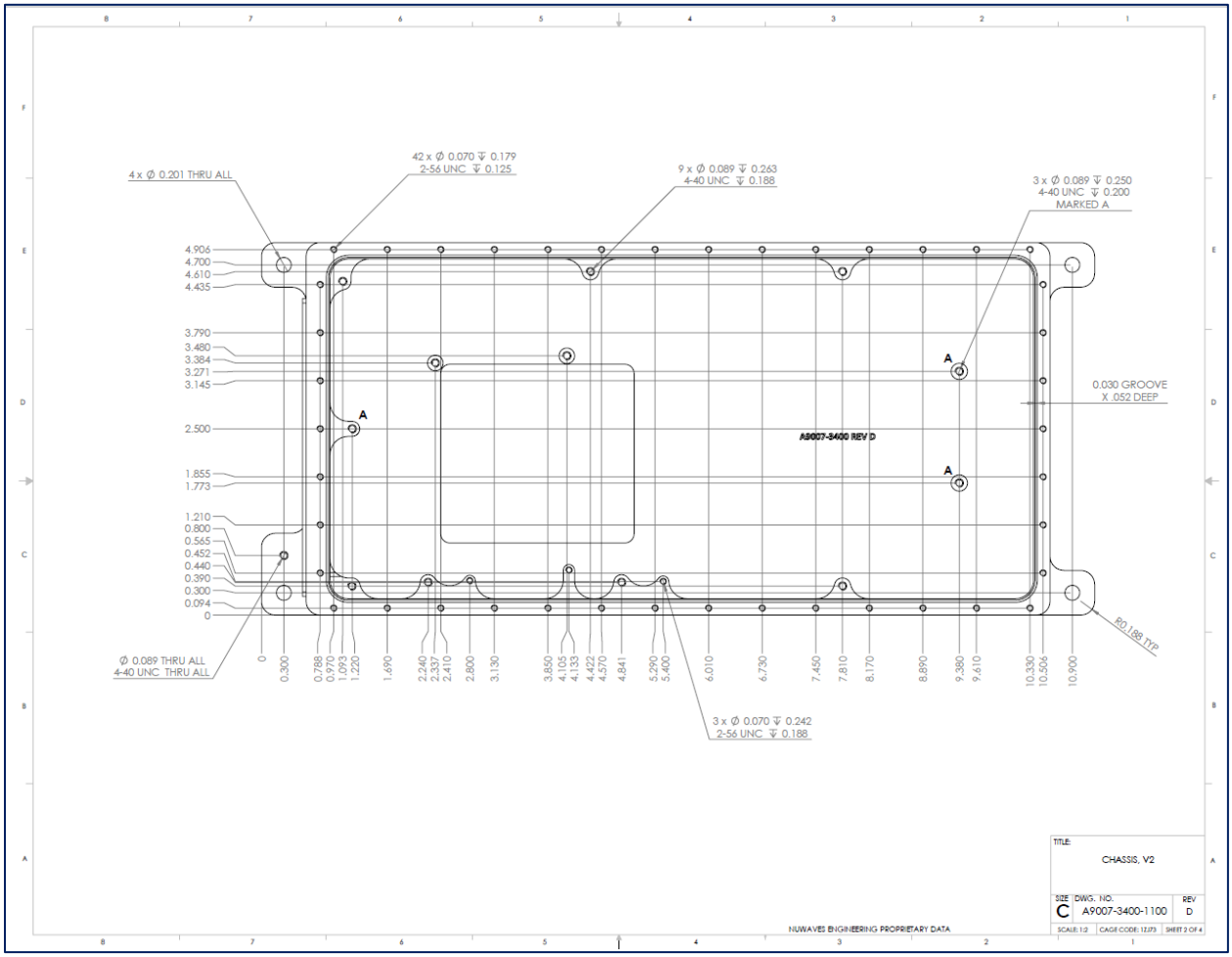
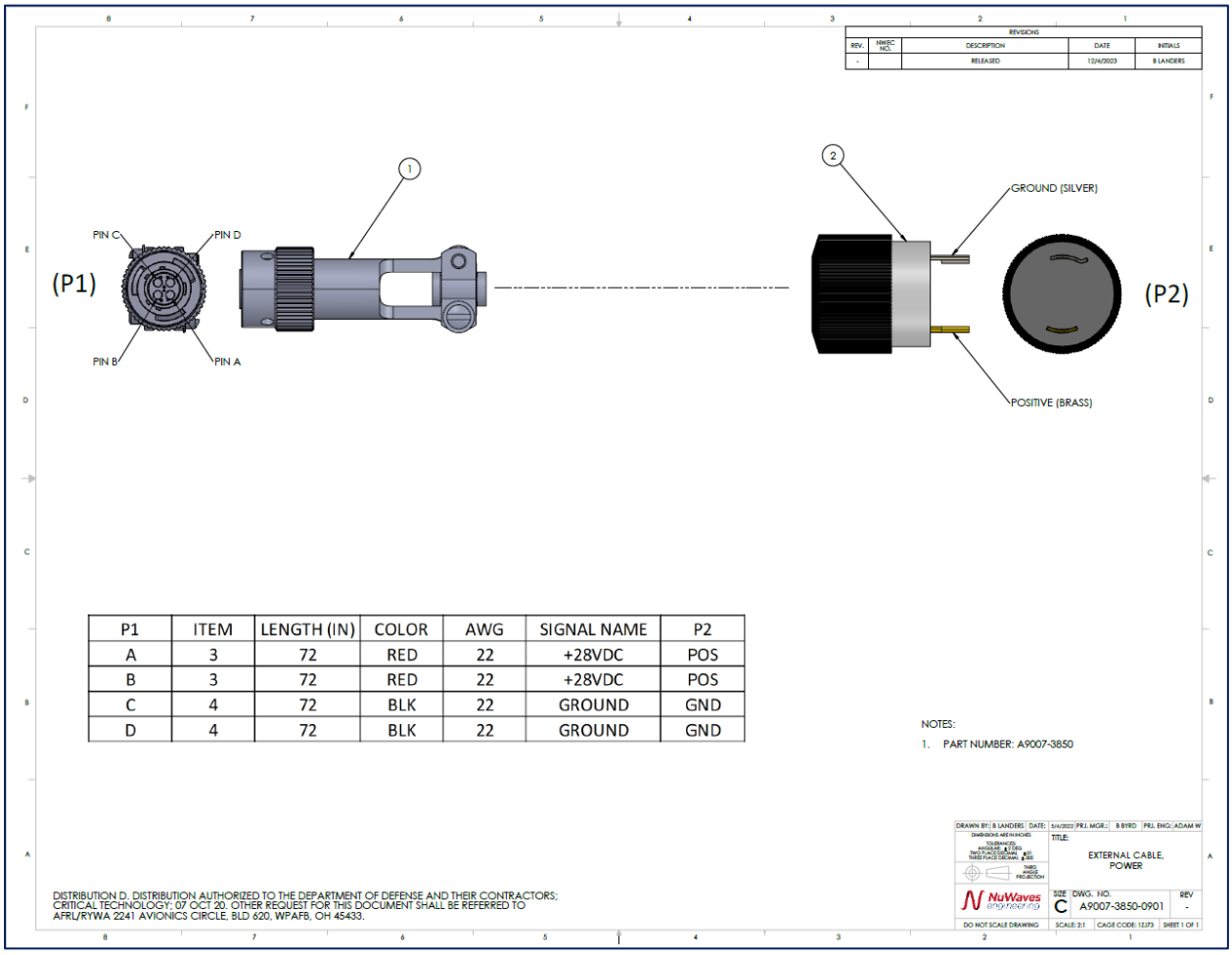


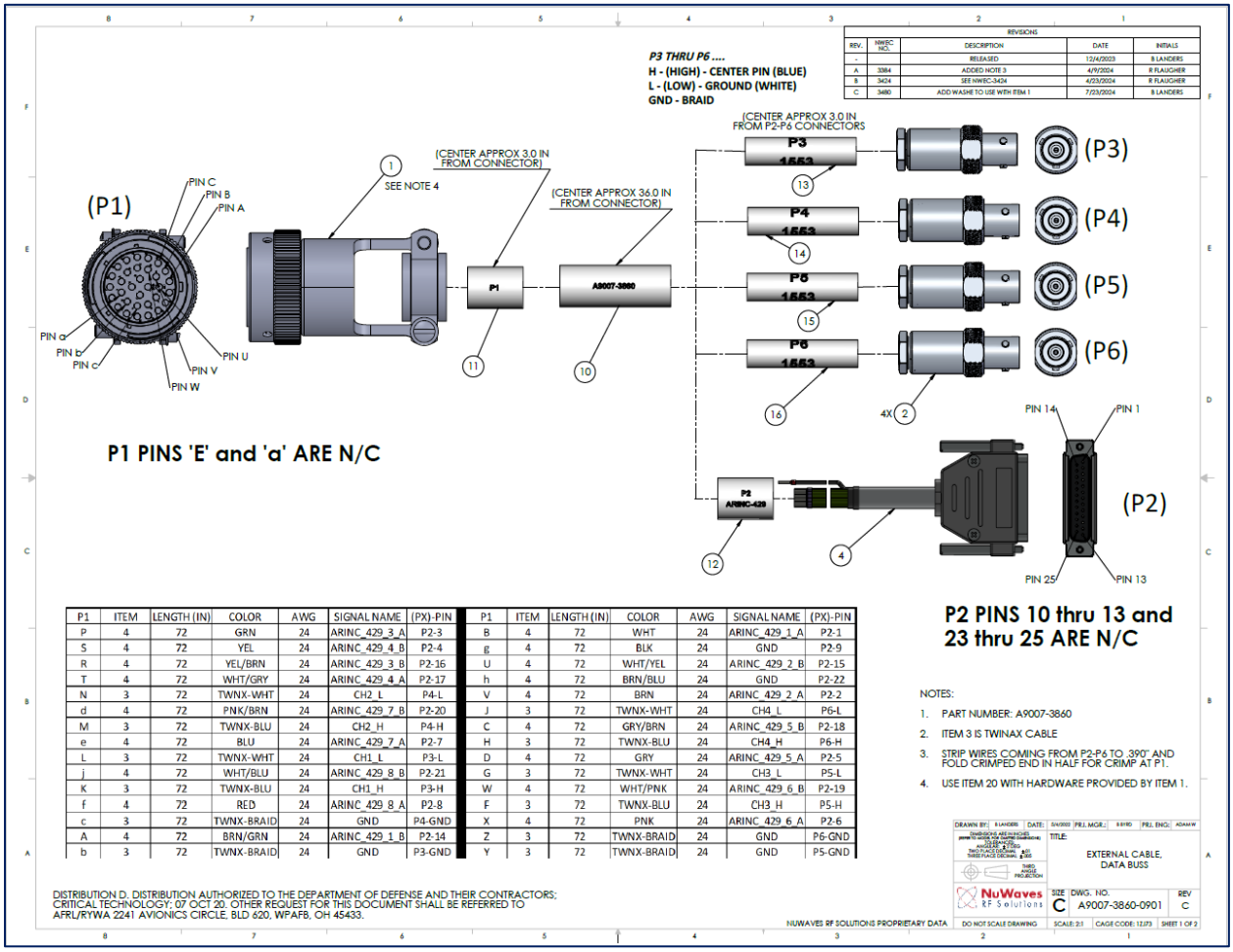
Figure 6 Vibrant Chassis Drawing #2

7.2 Cable Drawings



P1	ITEM	LENGTH (IN)	COLOR	AWG	SIGNAL NAME	P2
A	3	72	RED	22	+28VDC	POS
B	3	72	RED	22	+28VDC	POS
C	4	72	BLK	22	GROUND	GND
D	4	72	BLK	22	GROUND	GND

Figure 7 Vibrant J1 – Power Cable (CYB-CBL-06-06)

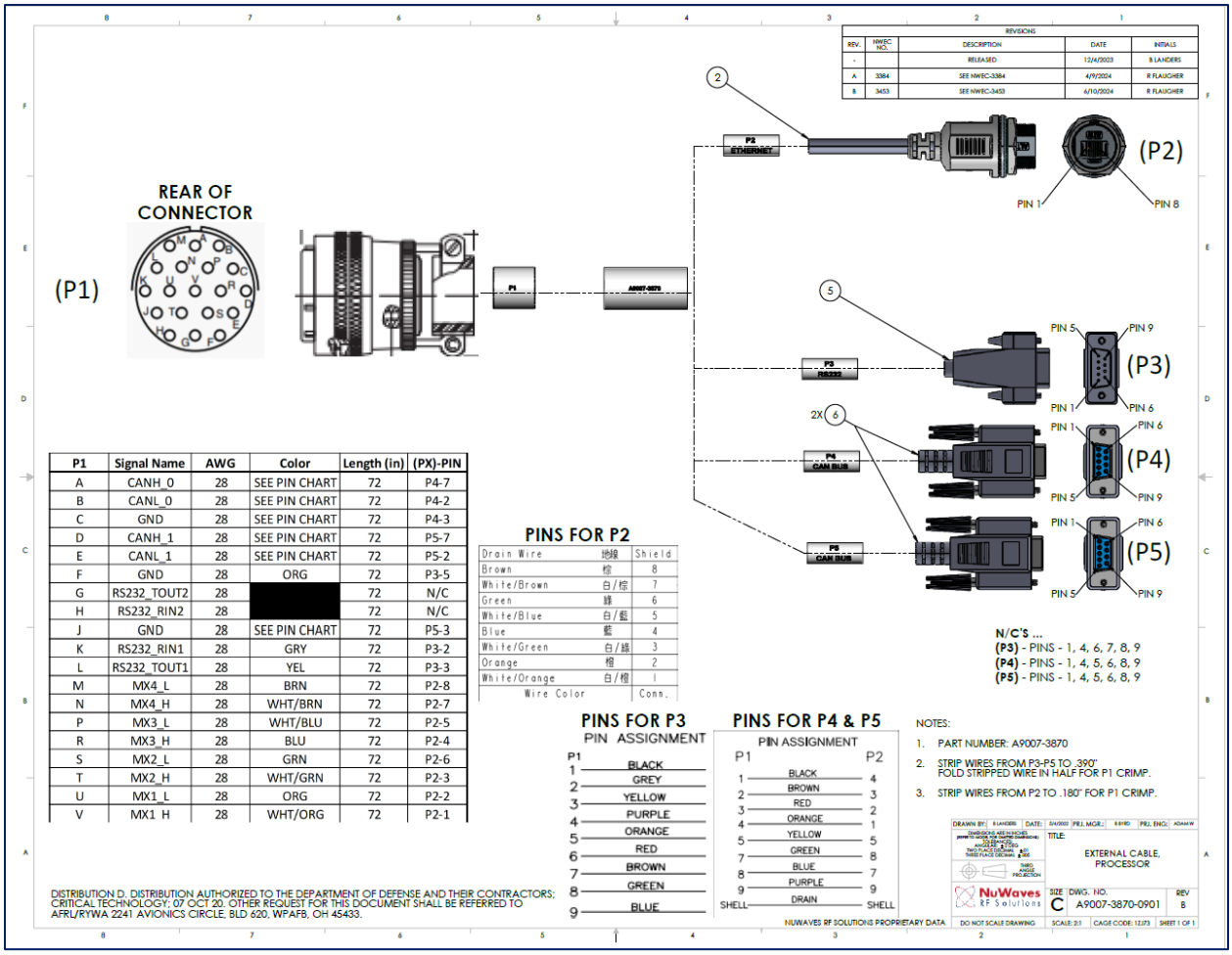


P1	ITEM	LENGTH (IN)	COLOR	AWG	SIGNAL NAME	(PX)-PIN
P	4	72	GRN	24	ARINC_429_3_A	P2-3
S	4	72	YEL	24	ARINC_429_4_B	P2-4
R	4	72	YEL/BRN	24	ARINC_429_3_B	P2-16
T	4	72	WHT/GRY	24	ARINC_429_4_A	P2-17
N	3	72	TWNX-WHT	24	CH2_L	P4-L
d	4	72	PNK/BRN	24	ARINC_429_7_B	P2-20
M	3	72	TWNX-BLU	24	CH2_H	P4-H
e	4	72	BLU	24	ARINC_429_7_A	P2-7
L	3	72	TWNX-WHT	24	CH1_L	P3-L
j	4	72	WHT/BLU	24	ARINC_429_8_B	P2-21
K	3	72	TWNX-BLU	24	CH1_H	P3-H
f	4	72	RED	24	ARINC_429_8_A	P2-8
c	3	72	TWNX-BRAID	24	GND	P4-GND
A	4	72	BRN/GRN	24	ARINC_429_1_B	P2-14
b	3	72	TWNX-BRAID	24	GND	P3-GND

P1	ITEM	LENGTH (IN)	COLOR	AWG	SIGNAL NAME	(PX)-PIN
B	4	72	WHT	24	ARINC_429_1_A	P2-1
g	4	72	BLK	24	GND	P2-9
U	4	72	WHT/YEL	24	ARINC_429_2_B	P2-15
h	4	72	BRN/BLU	24	GND	P2-22
V	4	72	BRN	24	ARINC_429_2_A	P2-2
J	3	72	TWNX-WHT	24	CH4_L	P6-L
C	4	72	GRY/BRN	24	ARINC_429_5_B	P2-18
H	3	72	TWNX-BLU	24	CH4_H	P6-H
D	4	72	GRY	24	ARINC_429_5_A	P2-5
G	3	72	TWNX-WHT	24	CH3_L	P5-L
W	4	72	WHT/PNK	24	ARINC_429_6_B	P2-19
F	3	72	TWNX-BLU	24	CH3_H	P5-H
X	4	72	PNK	24	ARINC_429_6_A	P2-6
Z	3	72	TWNX-BRAID	24	GND	P6-GND
Y	3	72	TWNX-BRAID	24	GND	P5-GND

REVISIONS				
REV.	NWRFC NO.	DESCRIPTION	DATE	INITIALS
-		RELEASED	12/4/2023	B LANDERS
A	3384	ADDED NOTE 3	4/9/2024	R FLAUGHER
B	3404	SEE NWRFC-3424	4/23/2024	R FLAUGHER
C	3480	ADD WASHETO USE WITH ITEM 1	7/23/2024	B LANDERS

Figure 8 Vibrant J2 – Data Cable (CYB-CBL-04-06)



P1	Signal Name	AWG	Color	Length (in)	(PX)-PIN
A	CANH_0	28	SEE PIN CHART	72	P4-7
B	CANL_0	28	SEE PIN CHART	72	P4-2
C	GND	28	SEE PIN CHART	72	P4-3
D	CANH_1	28	SEE PIN CHART	72	P5-7
E	CANL_1	28	SEE PIN CHART	72	P5-2
F	GND	28	ORG	72	P3-5
G	RS232_TOUT2	28		72	N/C
H	RS232_RIN2	28		72	N/C
J	GND	28	SEE PIN CHART	72	P5-3
K	RS232_RIN1	28	GRY	72	P3-2
L	RS232_TOUT1	28	YEL	72	P3-3
M	MX4_L	28	BRN	72	P2-8
N	MX4_H	28	WHT/BRN	72	P2-7
P	MX3_L	28	WHT/BLU	72	P2-5
R	MX3_H	28	BLU	72	P2-4
S	MX2_L	28	GRN	72	P2-6
T	MX2_H	28	WHT/GRN	72	P2-3
U	MX1_L	28	ORG	72	P2-2
V	MX1_H	28	WHT/ORG	72	P2-1

Figure 9 Vibrant J3 – Processor Cable (CYB-CBL-05-06)

8 Product Disposal

To ensure safe operation of the Vibrant system, as well as end-of-life disposal, please follow these guidelines when operating or disposing of the Vibrant system:

- Do not remove the cover or any hardware
- Do not remove components from the circuit card assembly
- Do not incinerate
- Do not crush or shred
- Do not dispose of as unsorted municipal waste
- Do not export e-waste outside of the original destination country for recycling
- Utilize an e-Steward or ISO14001 certified e-waste recycler
- Consider export controls during recycler selection
- If the Vibrant system is incorporated into a larger system or sub-system, ensure that these guidelines are followed at system end-of-life.

9 Product Support

For customer support for the Vibrant system please use the following:

Email: vibrant@securboration.com
Phone: 321-409-5252