AIMMS-20

Aircraft Integrated Meteorological Measurement System

INSTALLATION MANUAL

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11.11.2013	Bruce H. Woodcock		HD

Customer Approval (as required)

Date	Name	Signature	Function

Table of Functions

CUST **Customer**
DE **Design Engineer**
HD **Head of Design Engineering**
PM **Production Manager**
QM **Quality Manager**

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1 INTRODUCTION

The Aventech Research Inc. AIMMS-20 (Aircraft Integrated Meteorological Measurement System) is an integrated, turn-key system for measuring accurate, real-time meteorological data on airborne platforms. The meteorological data set includes temperature, humidity, three-dimensional winds (speed, direction and vertical) and turbulence. The data generated by the system is broadcast in real-time via an RS-232 serial communications link to either a GPS navigation system or data acquisition system.

This document provides a general description on how to install the AIMMS-20 on an airframe and engineering information to support the subsequent approval process with the appropriate certifying body.

Please note that the AIMMS-20 does not carry a Supplemental Type Certificate (STC) and as such the customer is responsible for obtaining the required airworthiness approval and / or certification for their aircraft category in order to operate with the system on-board.

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2 SYSTEM COMPONENT DESCRIPTIONS

The AIMMS-20 system consists of four modules in total, an Air Data Probe (ADP) which is mounted external to the aircraft, an Inertial Measurement Unit (IMU), a GPS Phase Module (GPS) and a Central Processing Module (CPM). The following section of this manual lists the system components that should have arrived in your shipment and describes each of them in order to familiarize you with the system.

2.1 Verify the List of Supplied Components

The first thing you will want to do is verify that you have received the following items with your AIMMS-20. If anything is missing, please contact your approved reseller or Aventech Research Inc. directly.

- ✓ One Air Data Probe (ADP) [Under-Wing or Sting Mount Version].
- ✓ One Inertial Measurement Unit (IMU).
- ✓ One GPS Phase Module (GPS).
- ✓ One Central Processing Module (CPM).
- ✓ Two 3.5” diameter GPS antennas.
- ✓ One cable set (3 CAN, 1 Power, 1 Serial).
- ✓ This *Installation Manual.*
- ✓ A copy of the *AIMMS-20 Operating Manual.*
- ✓ A copy of the *aimcfg* PC-based software utility.

Figure 1: AIMMS-20 Under Wing Mount Components

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Figure 2: AIMMS-20 Sting-Mount System Components

2.2 Air Data Probe (ADP)

The Air Data Probe is mounted external to the aircraft and is the component of the AIMMS-20 which measures the three-dimensional flow vector relative to the aircraft frame of reference, Outside Air Temperature (OAT) and Relative Humidity (RH) and turbulence. Having knowledge of the atmospheric temperature allows the system to calculate accurate True Airspeed (TAS) which can be subtracted from the total flow vector to resolve the three-dimensional wind vector relative to the aircraft frame of reference.

The three-dimensional flow vector is measured using a series of five pressure ports located on the hemispherical nose the ADP's measurement boom and a ring of static pressure ports slightly aft of the measurement boom nose. Using this set of pressure ports measurement of the barometric, pitot-static, differential angle-of-attack and differential side-slip pressure measurements can be obtained which define the three-dimensional flow vector.

OAT and RH measurements are made using a small 0.038" diameter bead thermistor and thermoset polymer RH sensor respectively. Both sensors are located in a reverse-flow chamber at the aft end of the probe to protect them from direct impact with particulates and larger objects in the free stream flow.

With your AIMMS-20 system you will have received one of two Air Data Probe types depending on the airframe for the planned installation, an under-wing version as shown in Figure 1 or a sting-mount version as shown in Figure 2.

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Figure 3: AIMMS-20 Under-Wing Air Data Probe Installation

Figure 4: AIMMS-20 Sting-Mount Air Data Probe Installation

The under-wing ADP is typically utilized for fixed-wing installations while the sting-mount ADP is typically utilized in rotary-wing installations. In some cases end users have also used the sting-mount probe for fixed-wing installations with their own mounting bracket design.

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2.3 Inertial Measurement Unit (IMU)

The IMU is a six-degree of freedom inertial measurement unit consisting of three MEMS accelerometers and three MEMS rate gyros. Utilizing inexpensive MEMS-based measurement devices provides a high-accuracy, low cost method of measuring the dynamic, high-frequency motion of an airborne platform. However, the compromise is that MEMS-based measurement devices have poorer long term DC stability. The AIMMS-20 system compensates for this DC instability using a single-axis GPS carrier-phase system which is described in Section 2.4.

Figure 5: AIMMS-20 Inertial Measurement Unit

2.4 GPS Phase Module (GPS)

The GPS Phase module is a two antenna, single baseline GPS carrier-phase subsystem. Accurate, DC-stable attitude of the baseline between two GPS antennae either mounted laterally (wingtip to wingtip) or longitudinally (wingtip to wingtip or fore / aft) on the airborne platform can be determined using the GPS carrier-phase measurements from the two GPS receivers located in the module. Lateral antennae configurations are typically used on fixed-wing aircraft while longitudinal antennae configurations can be utilized on fixed or rotary wing aircraft.

Although the attitude measurement performed using this technique is stable it is low frequency (1 Hz). Higher frequency dynamic information is provided by the IMU described in Section 2.3. The mathematical algorithm used to optimally combine the two sets of different frequency data is called an Extended Kalman Filter (EKF) and runs in the firmware loaded in the CPM described in Section 2.5.

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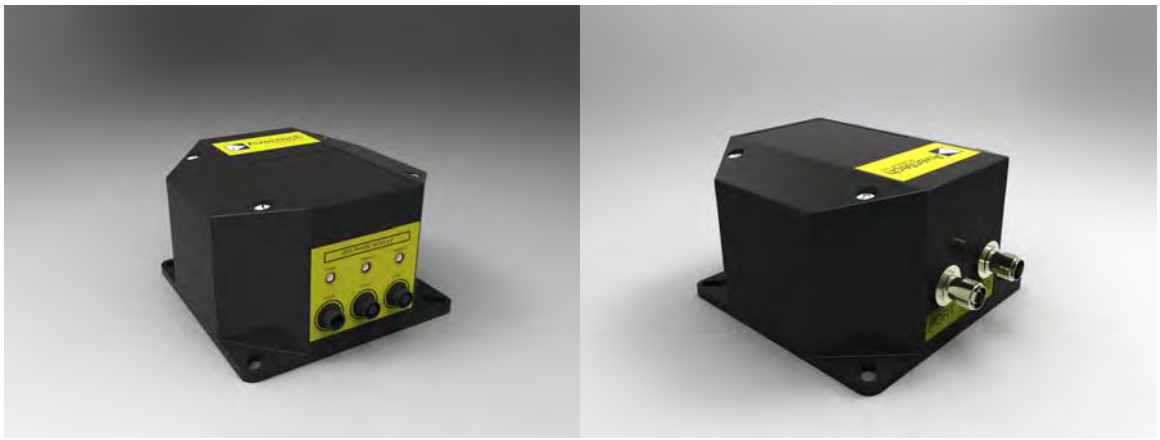

Figure 6: AIMMS-20 GPS Phase Module

2.5 Central Processing Module (CPM)

The CPM is essentially the main computational processing center for the AIMMS-20 system. The CPM firmware utilizes the acceleration and rate information from the IMU and carrier-phase information from the GPS to evaluate the accurate, three-dimensional attitude for the aircraft using an Extended Kalman Filter (EKF) routine. In parallel, the three-dimensional winds relative to the aircraft are evaluated using the air data provided by the ADP. Using the aircraft attitude the wind components are then transformed to provide the three-dimensional winds in the earth-fixed frame of reference.

The CPM also acts as the main interface between the aircraft power system and the AIMMS-20, and the GPS navigation / data acquisition system and the AIMMS-20.

The aircraft power is provided to the AIMMS-20 through the CPM module which steps the input voltage down +12 VDC and distributes it to the power the balance of the modules through the Controller Area Network (CAN) cables.

The real-time aircraft state (attitude) and meteorological (temperature, humidity, wind speed, wind direction and turbulence) data provided by the AIMMS-20 is broadcast on the second serial port of the CPM as two unique aircraft state and meteorological packets which can be read by a host computing device such as a GPS navigation system or data acquisition system.

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Figure 7: AIMMS-20 Central Processing Module

2.6 Communications

The four AIMMS-20 modules communicate with each other via a high-speed, digital serial Controller Area Network (CAN) bus. The four conductor cable connected between the modules provides power to each of the modules and communication between them.

Communication between the AIMMS-20 and a host computing device (GPS navigation or data acquisition system) is via a standard RS-232 serial port.

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3 INSTALLATION INSTRUCTIONS

3.1 Air Data Probe (ADP)

3.1.1 Under-Wing Mount Air Data Probe

The under-wing version of the AIMMS-20 ADP has an integrated pylon and mounting flange to accommodate mounting the probe to the lower surface of the wing (See Figures 3, 8 and 9). Detailed drawings of the ADP and ADP mounting flange are provided in Appendix A.1.

Typically the probe would be mounted at approximately 75% of the wing semi-span with the forward edge of the mounting flange sitting on or slightly aft of the main wing spar. The main consideration in selecting the span-wise mounting location is that the probe be well clear of any prop-wash in order to obtain accurate wind measurements. As can be seen in the drawings in Appendix A.1, the 6” by 3” ADP mounting flange has four 0.266” diameter holes located on a 5.5” by 2.5” rectangular grid to accommodate four ¼-24 mounting bolts. Figures 3, 8 and 9 provide examples of AIMMS-20 Under-Wing ADP installations.

The weight of the under-wing probe is 3.4 kg or 7.4 lbs and it has a drag coefficient of 0.002480. Drag force as a function of airspeed is provided in Table 1. Based on these forces, the installation provider will evaluate whether or not there is sufficient stringer material to mount the probe directly to the wing skin or on an inspection panel, or whether a wing skin doubler is required. It is recommended that if a wing skin doubler is installed that existing rivets in the wing spar be utilized whenever possible to avoid drilling new holes in the spar structure.

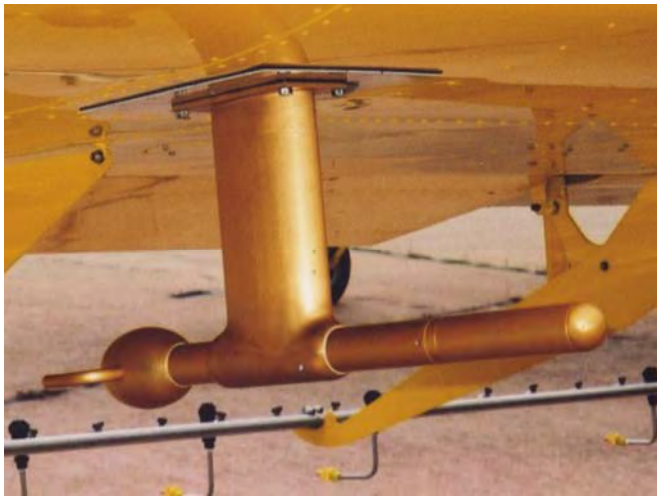

Figure 8: AIMMS-20 Under-Wing Air Data Probe Installation

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Figure 9: AIMMS-20 Under-Wing Air Data Probe Installation

True Airspeed		Drag Force	
m/s	**knots**	**N**	**lbf**
25	48.6	1.0	0.2
50	97.2	3.8	0.9
75	145.8	8.5	1.9
100	194.4	15.2	3.4
125	243.0	23.7	5.3
150	291.6	34.2	7.7

Table 1: Drag Force versus Airspeed for AIMMS-20 Under-Wing ADP

Any mounting installation must allow for a minimum 0.625” diameter hole in the vicinity of the Controller Area Network (CAN) receptacle on the ADP to accommodate passing the CAN cable through the wing skin surface so that it may be plugged into the receptacle.

3.1.2 Sting-Mount Air Data Probe

The sting-mount version of the AIMMS-20 differs from the under-wing mount version in that the pylon has been eliminated and the electronics embedded in the pylon have been moved into a 12” longer measurement boom (36” rather than 24” length). The result is a lighter unit, 3 lbs., which can be mounted far forward on a helicopter. Although initially designed with helicopter platforms in mind, the sting-mount ADP has also seen use on fixed-wing airframes. Detailed drawings of the sting-mount ADP are provided in Appendix A.2.

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On rotary wing airframes, the ADP should be mounted as far forward of the fuselage as possible. The reason for this is to insure that the probe is clear of the rotor downwash at as low a forward speed as possible as the helicopter moves forward and the downwash is advected back across the fuselage. The ADP enclosure has eight integrated mounting holes embedded in its' enclosure, two sets of four holes located circumferentially around the measurement boom separated by six inches, which are tapped to accommodate 10-32 mounting fasteners (see drawings in Appendix A.2). These tapped holes can be utilized in a customer designed bracket to mount the ADP on the nose of the helicopter, off of the skid or on the lower wire cutter if the helicopter is outfitted with a wire strike kit. The thickness of the mounting bracket components that clamp onto the measurement boom should be as thin as possible so as to not obstruct flow over the aft end of the probe. Figures 4, 10 and 11 provide examples of AIMMS-20 Sting-Mount ADP installations.

The weight of the sting-mount probe is 1.4 kg or 3.0 lbs and it has a drag coefficient of 0.001972. Drag force as a function of airspeed is provided in Table 2. Based on these forces, the installation provider can design an appropriate mounting bracket.

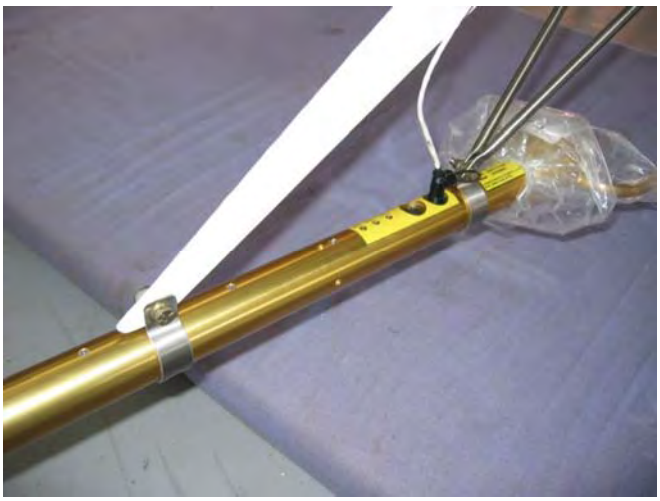

Figure 10: Sting-Mount Air Data Probe Installation

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Figure 11: AIMMS-20 Sting-Mount Air Data Probe Installation

True Airspeed		Drag Force	
m/s	**knots**	**N**	**lbf**
25	48.6	0.8	0.2
50	97.2	3.0	0.7
75	145.8	6.8	1.5
100	194.4	12.1	2.7
125	243.0	18.9	4.2
150	291.6	27.2	6.1

Table 2: Drag Force versus Airspeed for AIMMS-20 Sting-Mount ADP

3.2 Inertial Measurement Unit (IMU)

The remaining three modules, the Inertial Measurement Unit (IMU), GPS Phase Module (GPS) and Central Processing Module (CPM), are all housed in octagonal fibreglass with 40% graphite filler enclosures. The enclosures measure approximately 4.75” by 4.75” by 3.0“ dimensionally and have integrated mounting tabs with 0.25” wide slots at their base to accommodate 10-32 or ¼-28 mounting hardware. For detailed drawings of the enclosures see Appendix A.3 to A.5.

The IMU is the only other module which is orientation specific. The unit should be rigidly mounted to the airframe such that the airplane graphic label on its’ lid is aligned with the direction of flight and the base is as parallel as possible to the attitude of the aircraft in level flight (gravity vector perpendicular to the base of the module). If oriented correctly, the LEDs and receptacles on the front face of the module should be facing forward. While ideally any inertial unit should be mounted

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close to the centre-of-gravity of the aircraft, experience from multiple customer installations has shown that the system functions equally well in multiple locations on-board the aircraft. As a result, for practical purposes the IMU, GPS and CPM should be mounted together. Common mounting locations include the forward or aft baggage compartments, under the pilot and co-pilot's seats or in a rack in the cabin. Examples of module installations are presented in Figures 12 and 13.

Figure 12: AIMMS-20 IMU / GPS / CPM Module Installation

Figure 13: AIMMS-20 IMU / GPS / CPM Module Installation

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The IMU weighs 0.73 kg or 1.6 lbs

3.3 GPS Phase Module (GPS)

The GPS Phase module consists of two separate components, two GPS antennas and the module itself.

3.3.1 GPS Antennas

The AIMMS-20 utilizes differential GPS carrier-phase information from two GPS antennas mounted on the airframe to determine an accurate, stable attitude of the baseline between them.

The GPS antennas can be mounted on the airframe either laterally, i.e. wingtip to wingtip, or longitudinally, i.e. fore / aft. A minimum baseline length of at least 5 m should be maintained if at all possible. Shorter baseline lengths can be utilized with a small degradation in overall system accuracy. Both orientations can be used on fixed-wing aircraft where typically the antennas are mounted on the upper surface of the wingtips or fuselage. Helicopter platforms typically utilize a fore / aft antenna configuration with the forward antenna mounted on the nose, top of the cabin above the pilots or on the upper wire cutter, and the aft antenna on top of the vertical stabilizer / fin. Examples of antenna installations are presented in Figures 14 and 15.

Mechanical drawings and technical specifications for the two 3.0” diameter GPS antennas that have been supplied with the AIMMS-20 system are provided in Appendix A.4.

Figure 14: Fore / Aft GPS Antenna Installation

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Figure 15: AIMMS-20 Forward GPS Antenna Installation

3.3.2 GPS Phase Module

Having the identical form factor as the IMU and CPM modules, four 0.25" wide slots are integrated into the base of the module to accommodate mounting it to the airframe using 10-32 or ¼-28 mounting fasteners. Detailed drawings of the GPS module are provided in Appendix A.4.

The GPS weighs 0.82 kg or 1.8 lbs.

3.4 Central Processing Module (CPM)

Having the identical form factor as the IMU and GPS modules, four 0.25" wide slots are integrated into the base of the module to accommodate mounting it to the airframe using 10-32 or ¼-28 mounting fasteners. Detailed drawings of the CPM module are provided in Appendix A.5.

The CPM weighs 0.59 kg or 1.3 lbs.

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3.5 Electrical / Communications Wiring

The following sections describe installation of the electrical wiring for the AIMMS-20 system. A wiring diagram is provided in Appendix A.6.

Standard of workmanship is to be performed to AC43.13-1B, Chapter 11, Sections 6, 10, 11, 12, & 13. When installing wire, assure that adequate length is provided at each end to allow for installation of connectors, and strain relief. Protect wire from mechanical damage.

3.5.1 GPS Coaxial Antenna Cables

Two coaxial cables of appropriate length will have been provided for the AIMMS-20 installation. The cables will have male TNC connectors at both ends. The male TNC plug on one end of the each cable should be connected to the GPS antennas and the cable routed from the antenna through the airframe to the location at which the GPS Phase Module will be installed. To install the TNC connector onto the GPS antenna thread the TNC connector clockwise until it is snug.

Looking at the rear panel of the GPS module there are two female TNC receptacles. If the installation is utilizing a lateral antenna configuration (wingtip to wingtip), connect the Port antenna cable to the left TNC receptacle and the Starboard antenna cable to the right TNC receptacle as labeled. If the antennas are mounted fore and aft, the Forward antenna cable should be connected to the left TNC receptacle and the Aft antenna cable to the right TNC receptacle.

3.5.2 Controller Area Network (CAN) Cables

Three CAN cables will have been provided with the AIMMS-20 kit, two 2’ cables and a third longer cable sized specifically for the airframe. These cables have HiRose HR30 series, 6 pin male plugs on both ends. The function of the CAN cables is to distribute power to the modules on two of the internal conductors, and provide communications (CAN high speed digital serial bus) between the modules on the remaining two conductors.

The longest CAN cable should be installed between the ADP the GPS modules, one 2’ CAN cable between the GPS and IMU modules and the last 2’ CAN cable between the IMU and CPM modules. Once all the cables are installed, all the available CAN receptacles should be used.

The CAN cables are connected to the CAN receptacles on the modules by aligning the alignment markings on the plug and receptacle (arrows) and pushing the plug straight onto the receptacle until a click is heard indicating the cable plug has locked

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in place. To remove the connectors, first pull back on the collar which will release the locking mechanism and then the connector can be pulled straight back from the receptacle. Under no circumstances should the connector be twisted to insert or remove it.

3.5.3 Power Input Cable

The power input cable provided with the AIMMS-20 has a HiRose HR30 series, 3 pin female plug on one end of the cable and three coloured pigtailed wires on the other (red, black and green). The HiRose plug should be connected to the PWR receptacle on the Central Processing Module and the opposite end of the cable to the aircraft power supply. The red wire should be connected to the aircraft power, the black wire to the airframe or power supply return and the green wire, the cable shield, to the airframe or power supply return.

The AIMMS-20 power supply input accepts a wide range voltage input of 12.5 to 37 VDC. Current requirements are as follows:

- 720 mA typical at 12.5 VDC (9 Watts)
- 395 mA typical at 28.0 VDC (11 Watts)

The AIMMS-20 power input should be protected with a 1 to 2 Amp circuit breaker.

3.5.4 RS-232 Serial Communications Cable

You will have received an RS-232 serial communications cable with your AIMMS-20 system which has a HiRose HR30 series 6 pin female connector on one end and two female D-Sub 9 connectors on the other. This cable will be used during the AIMMS-20 setup and calibration procedures and may also be utilized to connect the AIMMS-20 to your GPS navigation system or data acquisition system. In some cases, the GPS navigation system manufacturer may supply an alternative serial communications cable to be utilized to connect the AIMMS-20 to their GPS navigation system. Using one of the two serial communications cable provided, connect the RS-232 output receptacle on the CPM to the specified RS-232 input of the GPS navigation system or data acquisition system.

Please note that the RS-232 serial communications output receptacles on the balance of the modules (ADP, IMU and GPS) are used only to apply firmware updates. When installed in the aircraft these receptacles should be left empty.

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4 GROUND TEST PROCEDURE

The first step in assessing whether an AIMMS-20 has been properly installed in an aircraft involves powering the system for the first time and performing some initial observations and tests. The following of this document describes the observations and tests which can be conducted to verify that the system is operating correctly.

4.1 Application of Power to the System

When power is applied to the system the power LEDS on each of the four modules [Air Data Probe (ADP), Inertial Measurement Unit (IMU), GPS Phase Module (GPS) and Central Processing Module (CPM)] should illuminate green.

4.2 Air Data Probe (ADP)

The under-wing or sting-mount ADPs have three LEDs mounted horizontally on the display panel of the unit. The leftmost LED is the Power LED, the centre LED the Status 1 LED and the rightmost LED the Status 2 LED.

When power is applied to the system the power LED should illuminate immediately. Once the unit boots, which takes approximately 7 seconds, both the Status 1 and 2 LEDs will illuminate green momentarily, then the Status 2 LED should remain steady green while the Status 1 LED will begin to flash green at a rate of approximately once per second when the unit is operating normally.

4.3 Inertial Measurement Unit (IMU)

Similar to the ADP, the IMU has three LEDs mounted horizontally on the front display panel of the unit. The leftmost LED is the Power LED, the centre LED the Status 1 LED and the rightmost LED the Status 2 LED. When power is applied to the system the power LED should illuminate immediately. Once the unit boots, which takes approximately 7 seconds, both the Status 1 and 2 LEDs will illuminate green momentarily, then the Status 2 LED should remain steady green while the Status 1 LED will begin to flash green at a rate of approximately once per second when the unit is operating normally.

4.4 GPS Phase Module (GPS)

Similar to the ADP and IMU, the GPS also has three LEDs mounted horizontally on the front display panel of the unit. The leftmost LED is the Power LED, the centre LED the Status 1 LED and the rightmost LED the Status 2 LED. When power is applied to the system the power LED should illuminate immediately. Once the unit

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boots, which takes approximately 7 seconds, both the Status 1 and 2 LEDs will illuminate green momentarily, then the Status 2 LED should remain steady green while the Status 1 LED will begin to flash green at a rate of approximately once per second when the unit is operating normally.

4.5 Central Processing Module (CPM)

Similar to the other modules, the CPM also has three LEDs mounted horizontally on the front display panel of the unit. The leftmost LED is the Power LED, the centre LED the Status 1 LED and the rightmost LED the Status 2 LED.

When power is applied to the system the power LED should illuminate immediately. Once the unit boots, which takes approximately 5 seconds, both the Status 1 and 2 LEDs will illuminate green momentarily, then the Status 2 LED should remain steady green while the Status 1 LED will begin to flash green at a rate of approximately once per second. Furthermore, once the Extended Kalman Filter (EKF) algorithm running on the CPM's Digital Signal Controller (DSC) has a satisfactory set of data [inertial information, GPS information and an inertial input (movement of the aircraft)] to calculate an attitude solution, the Status 1 LED will illuminate solid green indicating the unit is now fully operational.

If on start-up the CPM fails to see traffic (messages) on the Controller Area Network (CAN) bus from any of the other modules the EKF will not be able to start and an error state message on the Status 1 LED will be broadcast as described below:

1. One red Status 1 LED flash every second if the CPM doesn't detect any CAN messages from the ADP on the CAN bus.

2. Two red Status 1 LED flashes every second if the CPM doesn't detect any CAN messages from the IMU on the CAN bus.

3. And three red Status 1 LED flashes every second if the CPM doesn't detect any CAN messages from the GPS on the CAN bus.

NOTE: The CPM searches for the message traffic on the bus sequentially in the same order as listed above. For example if the CPM is reporting that it can't see any traffic from the ADP, it is possible that it may also not be seeing messages from the IMU or GPS since the bus is checked for their messages subsequent to determining whether the ADP messages are present or not.

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5 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA)

This section of the installation manual provides Instructions for Continued Airworthiness (ICA) of the Aventech Research Inc. AIMMS-20 airframe installation. It describes how you will maintain the airframe alteration of the aircraft airworthiness certificate. Specifically, instructions are included for appropriate pre-flight checks, operational checks, aircraft maintenance schedule including inspection of parts for wear and deterioration, troubleshooting procedures, and service removal.

5.1 Pre-Flight Checks

The pilot in command should verify the following items during their pre-flight check:

a) Remove AIMMS-20 ADP cover.

b) Inspect AIMMS-20 ADP mounting bolts for physical condition.

c) Inspect and insure the ADP five-hole pressure ports at the front of the probe are clear of any blockages.

d) Inspect and insure ADP temperature/humidity ventilation chamber inlet tubes at the rear of the probe are clear of any blockages.

e) Confirm AIMMS-20 circuit breaker is engaged.

5.2 Operational Checks

The pilot in command should verify the following items during system initialization:

a) Once the onboard instrumentation, i.e. non-essential GPS Navigation System or scientific Data Acquisition System, has been initialized, verify that the instrumentation has acknowledged the AIMMS-20 broadcasts and is displaying the wind speed/direction and/or temperature and humidity data.

5.3 Aircraft Maintenance Schedule

Ensure continued airworthiness by incorporating the following requirement into the aircraft maintenance schedule.

Every 200 hours of flight, or at each annual inspection, whichever is sooner:

a) Inspect ADP, IMU, GPS, GPS Antenna, and CPM mounting bolts for physical condition and to insure they are secure.

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b) Inspect the ADP installation for cracks in the surrounding stringers, ribs, and skin.

c) Inspect all cables for wear and/or improper stress at connection points.

d) Inspect all cable connections to insure they are correctly seated and locked onto the receptacles of the ADP, IMU, GPS, GPS antennas, and CPM modules.

5.4 Troubleshooting

a) Drop the ADP from the lower surface of the wing as per the Service Removal Instructions below in order to perform the cable connection and display panel inspections listed below.

b) Check and confirm that the power cable is correctly connected to the 12 or 28 VDC aircraft power bus and that the 3-pin Female HR30 Series HiRose plug is seated and locked in-place on the CPM power input receptacle.

c) Check and confirm that the 6 6-pin Male HR30 Series HiRose plugs on the 3 CAN cables connecting the ADP, IMU, GPS and CPM modules are seated and correctly locked in-place on their respective receptacles.

d) Check and confirm that the 6-pin Female HR30 Series HiRose and/or Female D-Sub 9 plugs on the serial cable connecting the serial port receptacle of the AIMMS CPM to the non-essential GPS navigation system or non-essential onboard data acquisition system are seated and correctly locked in-place on their respective receptacles.

e) Confirm AIMMS-20 breaker is engaged.

f) Turn on Avionics Master switch.

g) Check that the green power LED illuminates on all four AIMMS-20 modules (ADP, IMU, GPS, and CPM). If the power LED fails to illuminate on any of the four modules follow the Service Removal Instructions below for the failed module.

h) Proceed to view the ADP display panel. After the unit has booted up and undergone its' initialization process, the Status 1 LED should be green and cycling (blinking) once per second while the Status 2 LED should remain solid green. If the LEDs are solid red or cycling red please contact the Aventech Research Inc. technical support department and relay that information to them for further troubleshooting instructions.

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i) Proceed to view the GPS display panel. After the unit has booted up and undergone its' initialization process, the Status 1 LED should be green and cycling (blinking) once per second while the Status 2 LED should remain solid green. If the LEDs are solid red or cycling red please contact the Aventech Research Inc. technical support department and relay that information to them for further troubleshooting instructions.

j) Proceed to view the IMU display panel. After the unit has booted up and undergone its' initialization process, the Status 1 LED should be green and cycling (blinking) once per second while the Status 2 LED should remain solid green. If the LEDs are solid red or cycling red please contact the Aventech Research Inc. technical support department and relay that information to them for further troubleshooting instructions.

k) Proceed to view the CPM display panel. After the unit has booted up and undergone its' initialization process, the Status 1 LED should be green and cycling (blinking) once per second while the Status 2 LED should remain solid green. If the LEDs are solid red or cycling red please contact the Aventech Research Inc. technical support department (see contact information below) and relay that information to them for further troubleshooting instructions.

5.5 Service Removal

a) Confirm Master Avionics Switch is off.

b) Confirm Battery Power Switch is off.

c) Disengage AIMMS-20 circuit breaker.

d) Removal Procedure:

I) ADP Installation:

i) Remove four mounting bolts located at the base of the ADP pylon.

ii) Carefully drop the ADP from the lower surface of the wing being careful not to stress the CAN cable connection.

iii) Disconnect the CAN cable from the unit by pulling back on the plug collar to unlock the connector from the receptacle.

iv) Package ADP for shipping back to manufacturer.

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v) Contact Aventech Research Inc. Technical Support Department (see contact information below) and obtain an RMA number.

II) GPS Installation:

i) Unscrew and remove TNC connectors of the GPS antenna cables located at the rear of the module.

ii) Disconnect the CAN cable from the front of the module by pulling back on the plug collar to unlock the connector from the receptacle.

iii) Remove the four mounting bolts located at the base of the module.

iv) Package GPS for shipping back to manufacturer.

v) Contact Aventech Research Inc. Technical Support Department (see contact information below) and obtain an RMA number.

III) IMU Installation:

i) Disconnect the CAN cable from the front of the module by pulling back on the plug collar to unlock the connector from the receptacle.

ii) Remove the four mounting bolts located at the base of the module.

iii) Package IMU for shipping back to manufacturer.

iv) Contact Aventech Research Inc. Technical Support Department (see contact information below) and obtain an RMA number.

IV) CPM Installation:

i) Disconnect the serial, CAN, and power cables from the front of the module by pulling back on the plug collar to unlock the connector from the receptacle.

ii) Remove the four mounting bolts located at the base of the module.

iii) Package CPM for shipping back to manufacturer.

iv) Contact Aventech Research Inc. Technical Support Department and obtain an RMA number.

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APPENDIX A: AIMMS-20 COMPONENT CAD DRAWINGS

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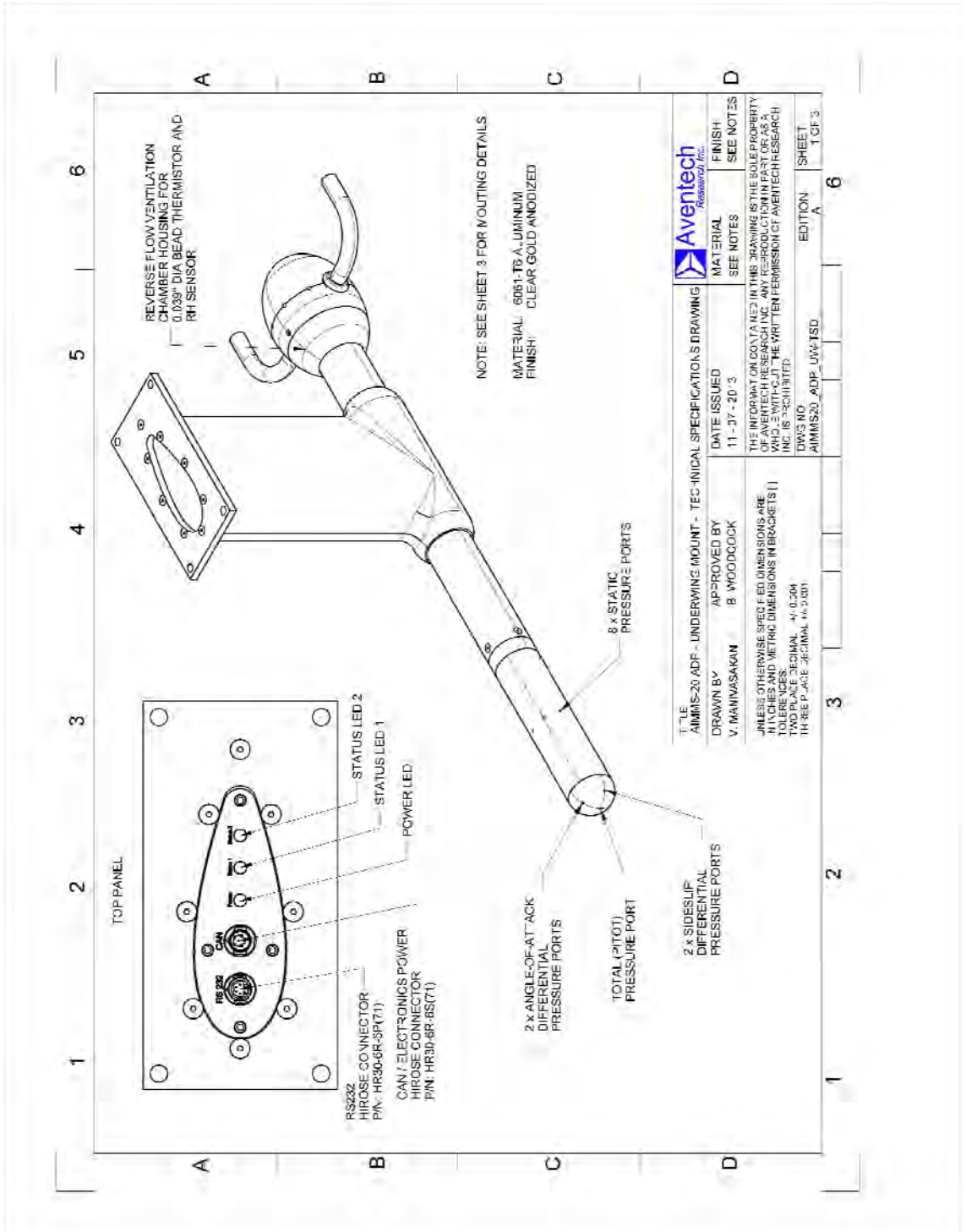
A.1 Under-Wing Air Data Probe (ADP)



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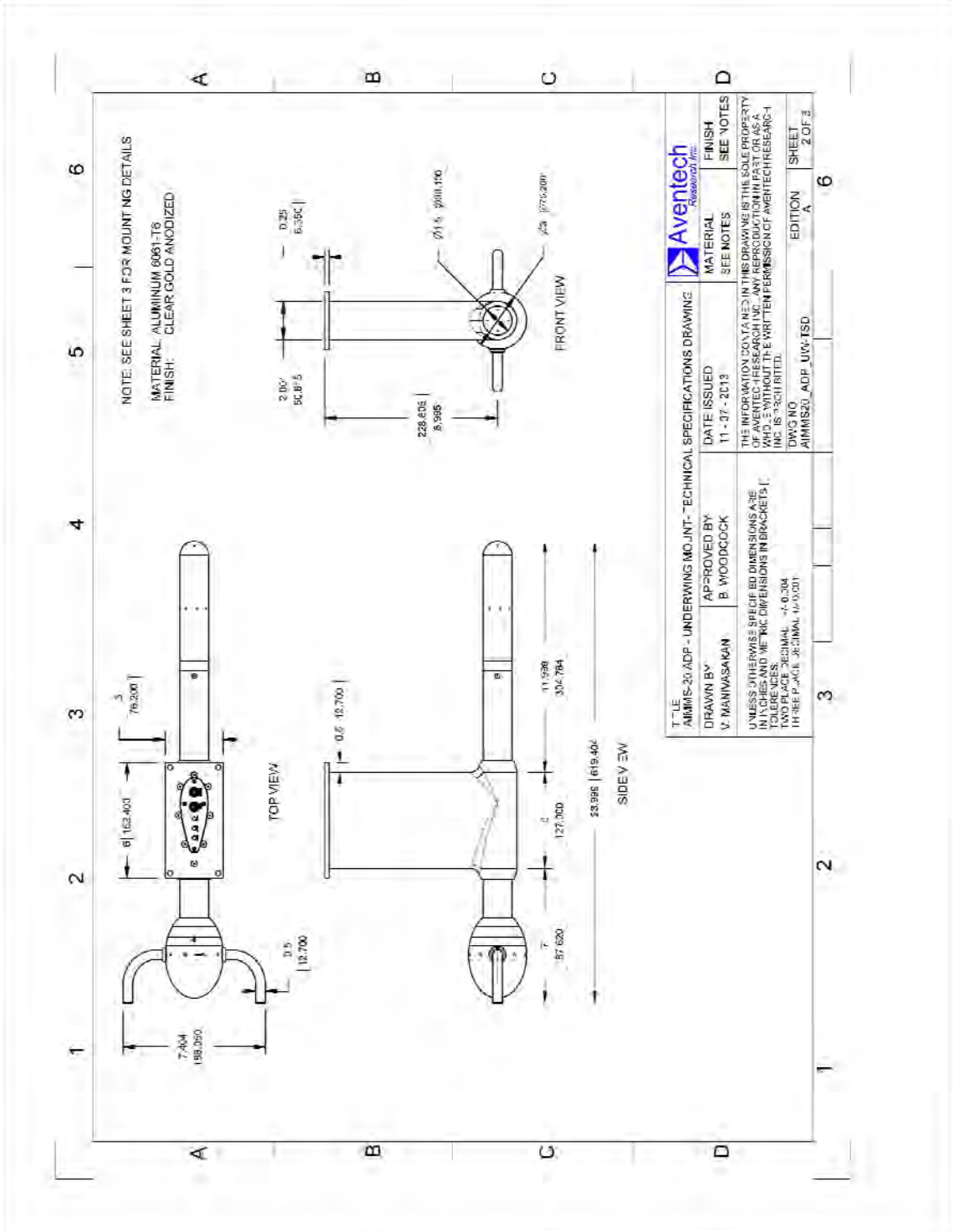

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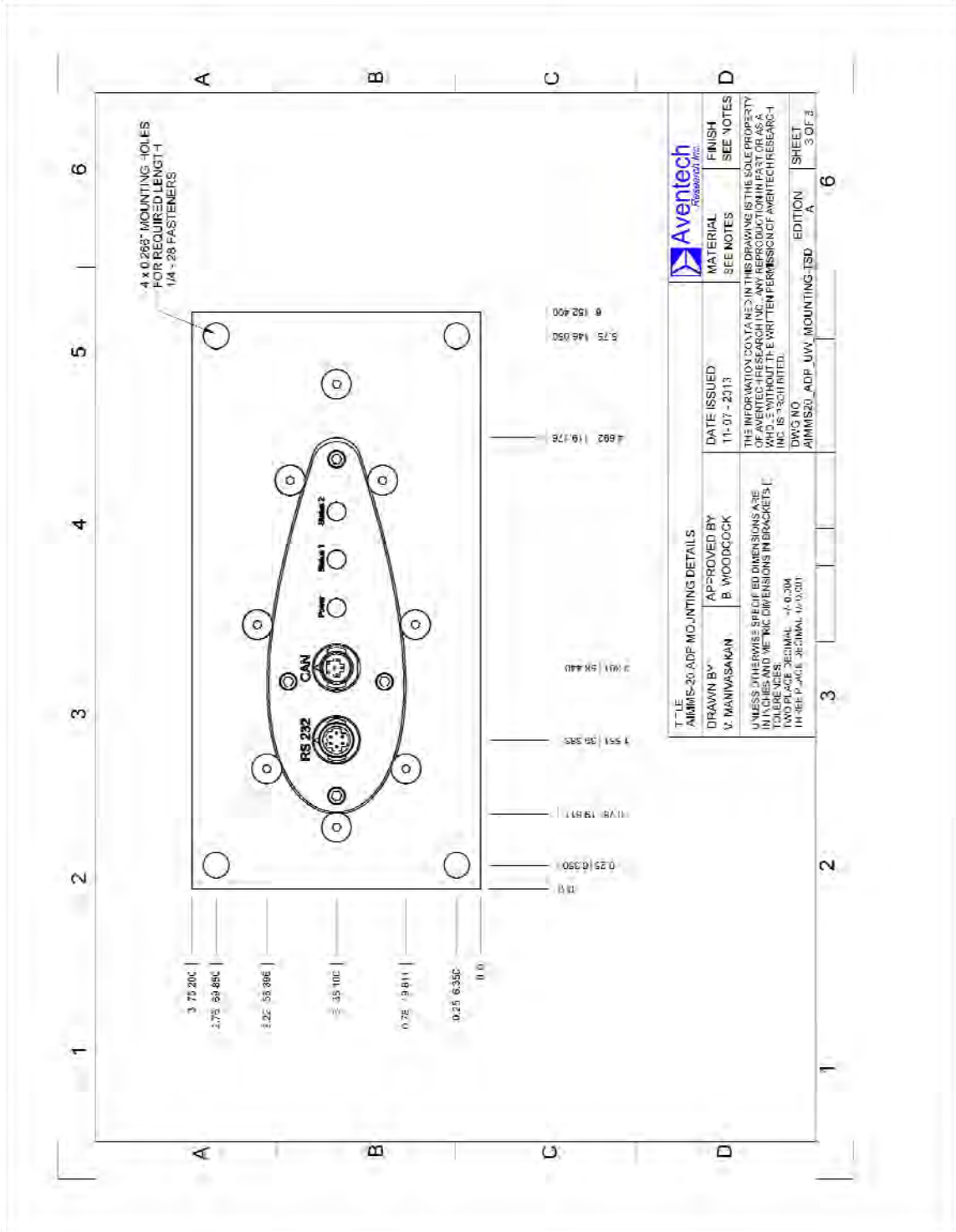

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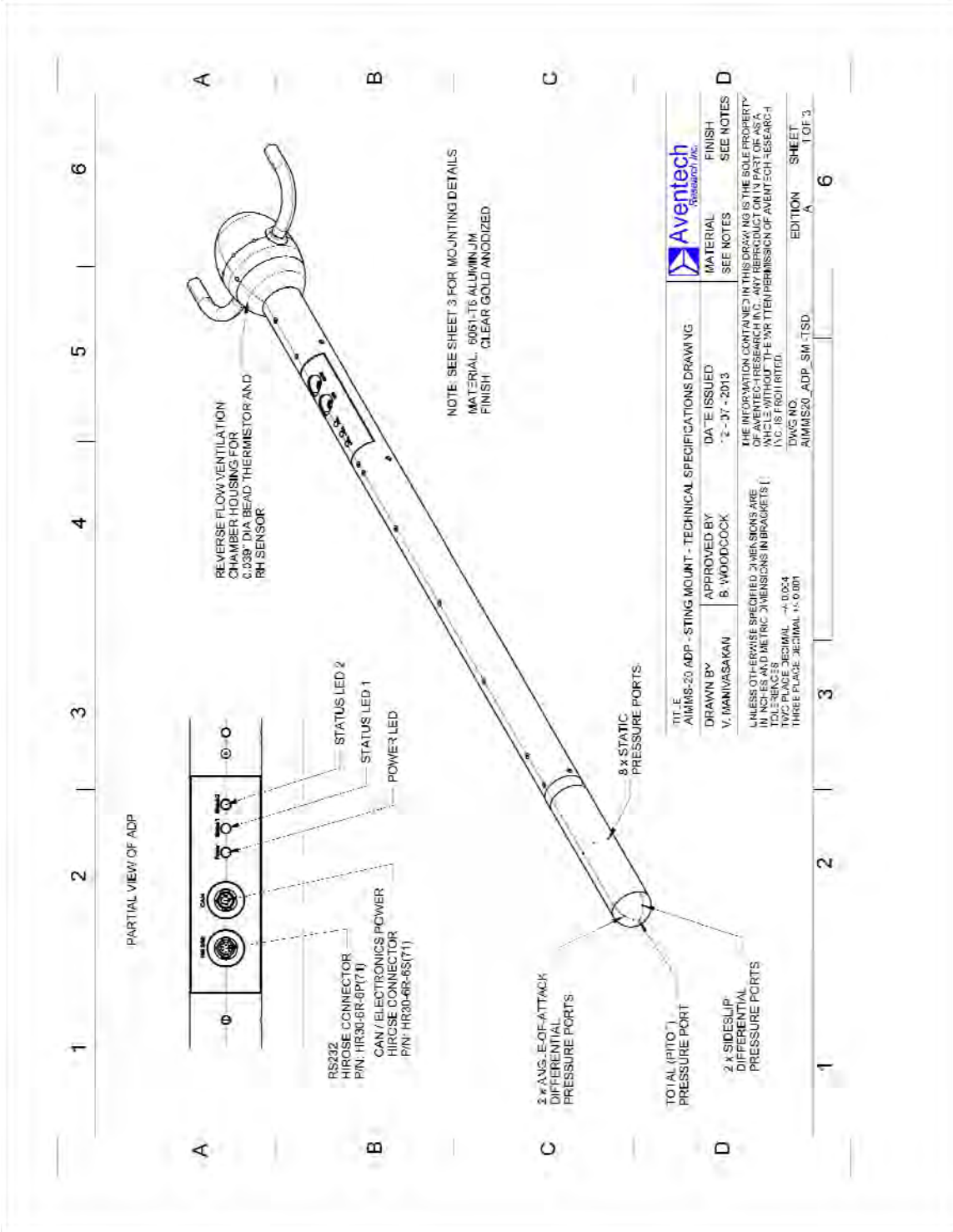
A.2 Sting Mount Air Data Probe (ADP)



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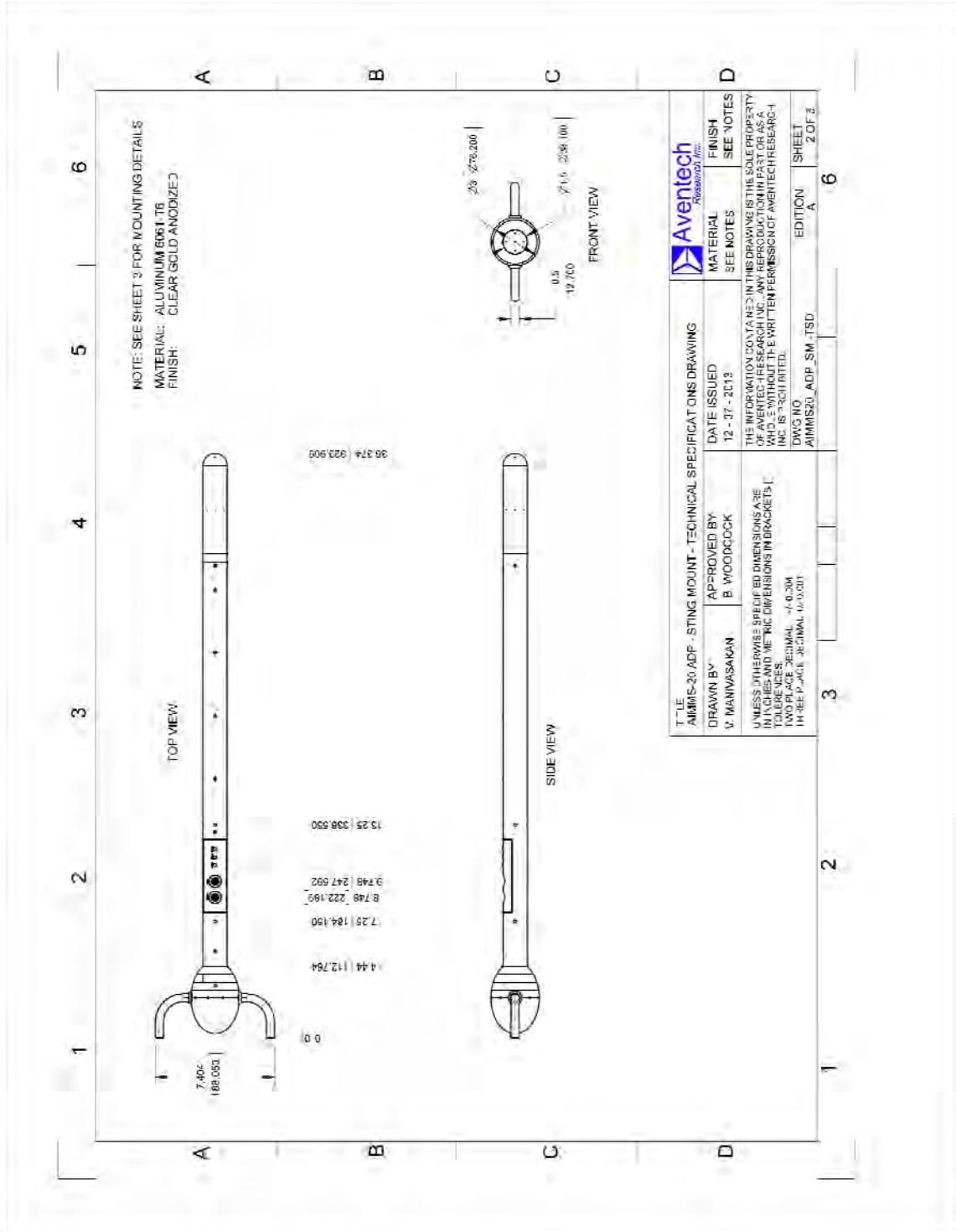

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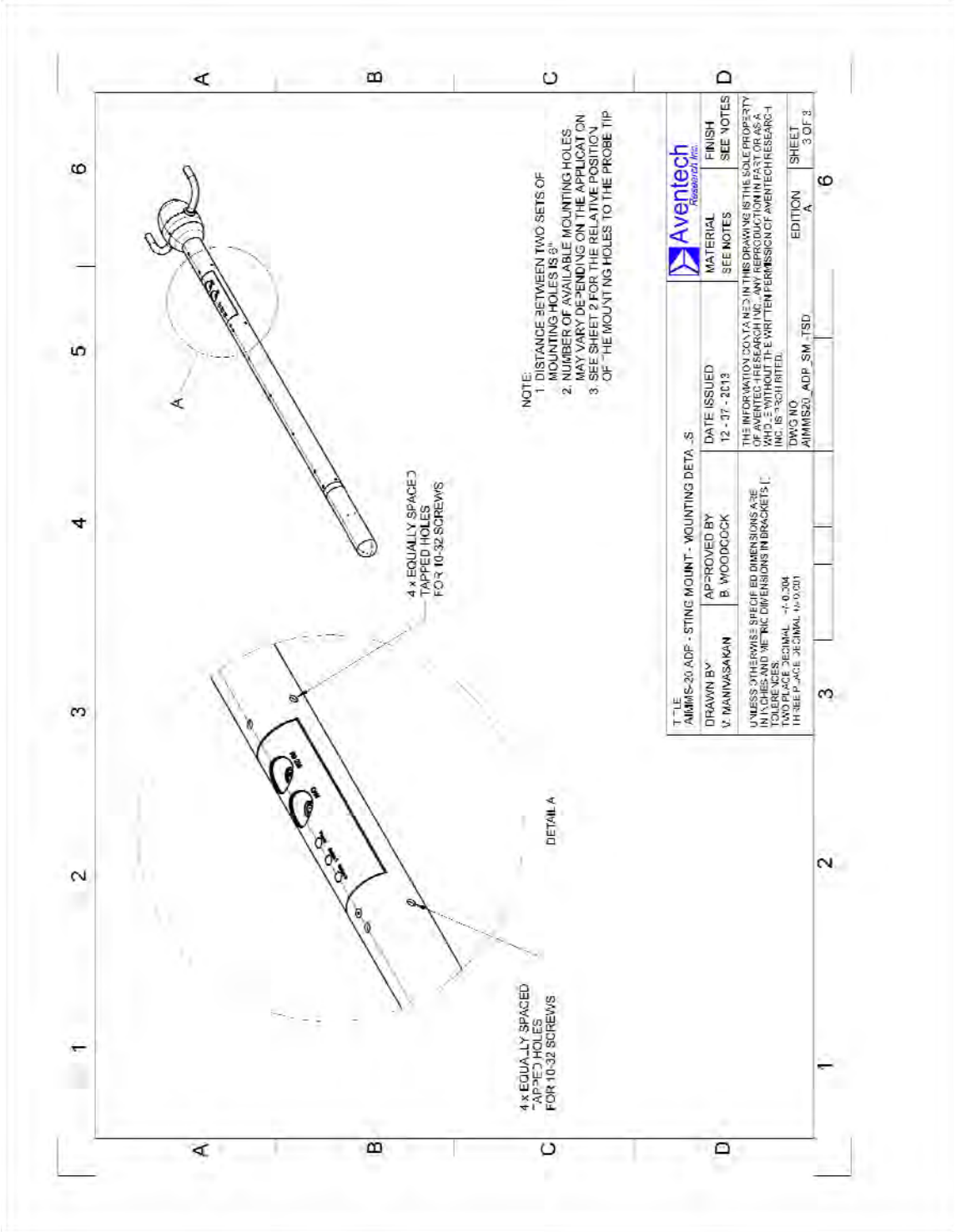

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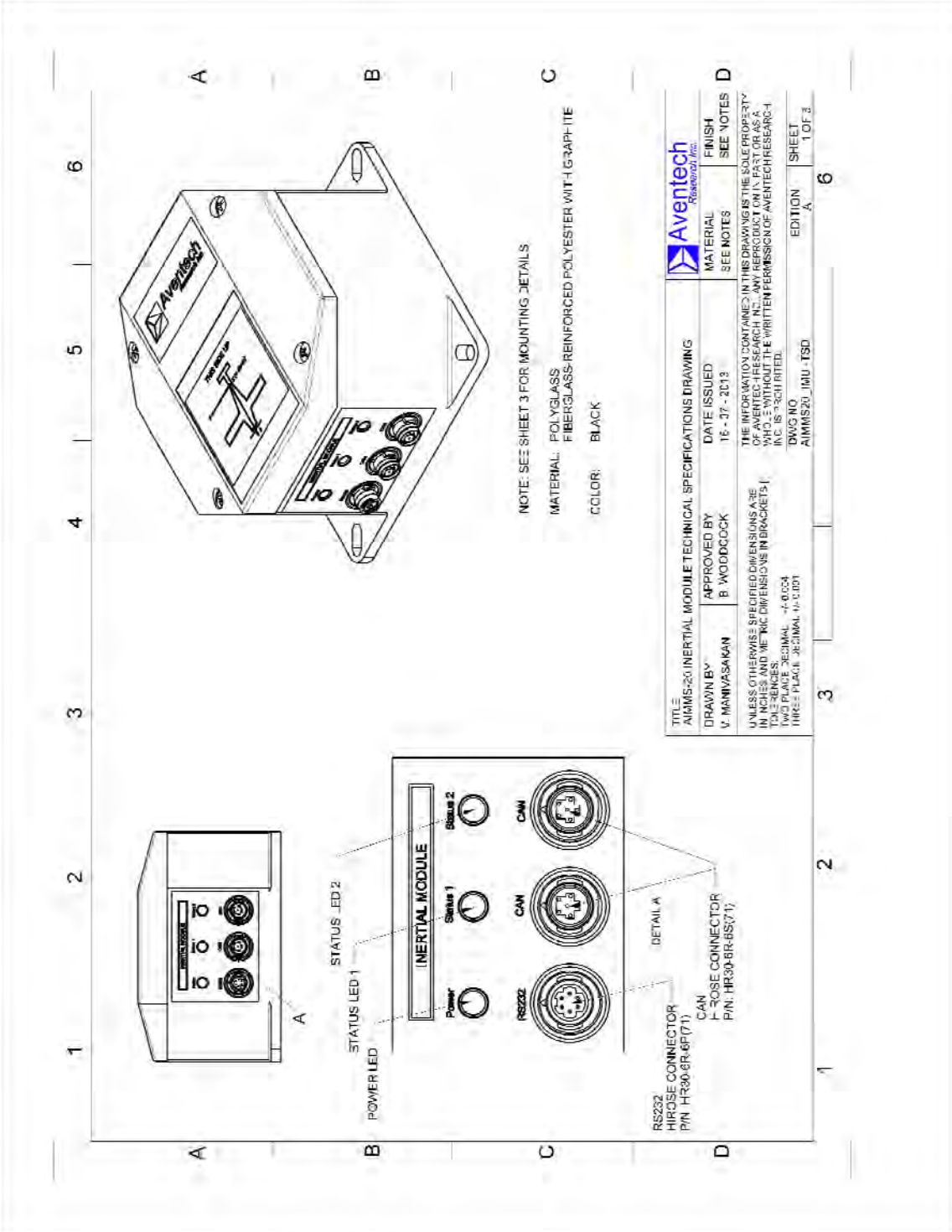
A.3 Inertial Measurement Unit (IMU)



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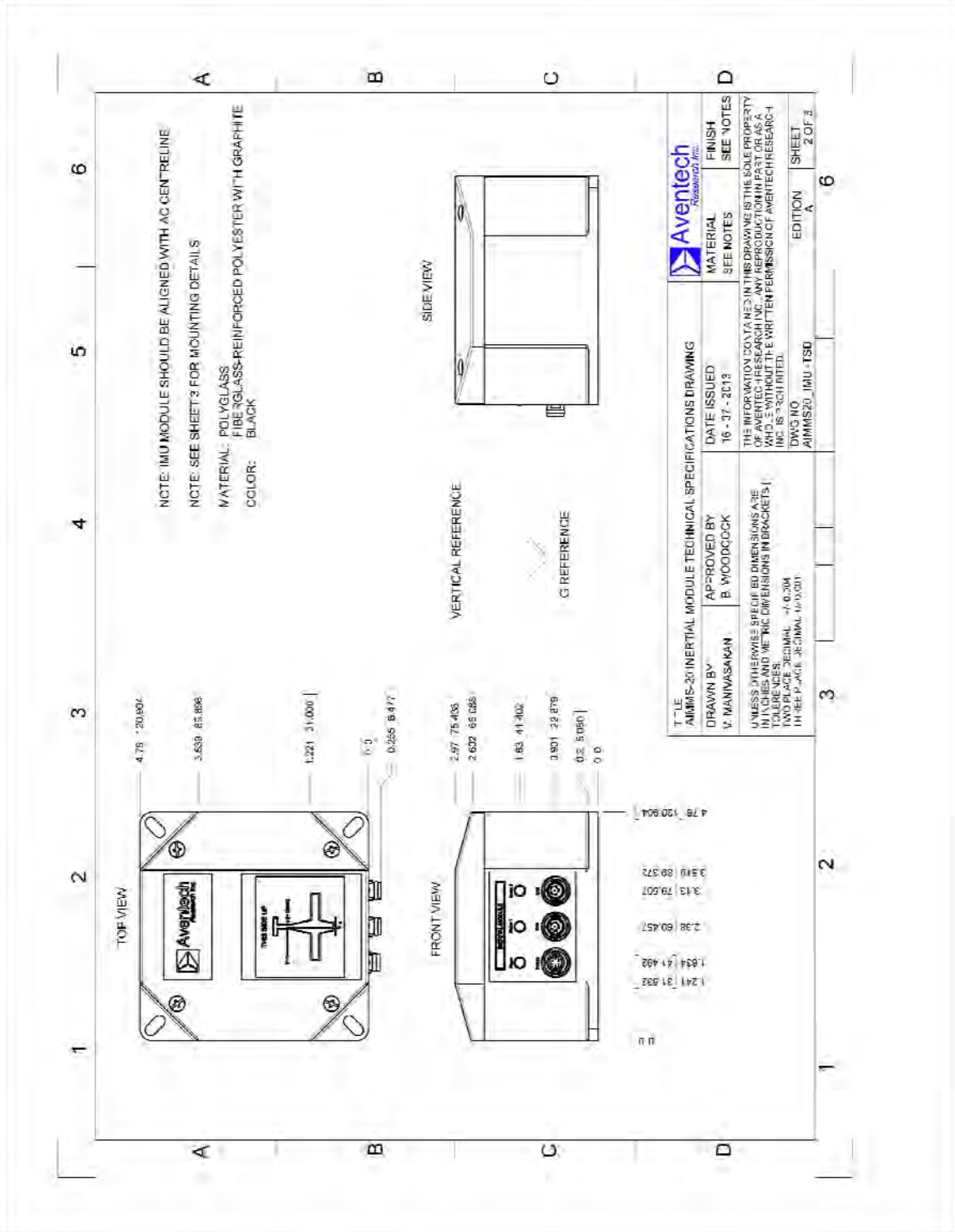

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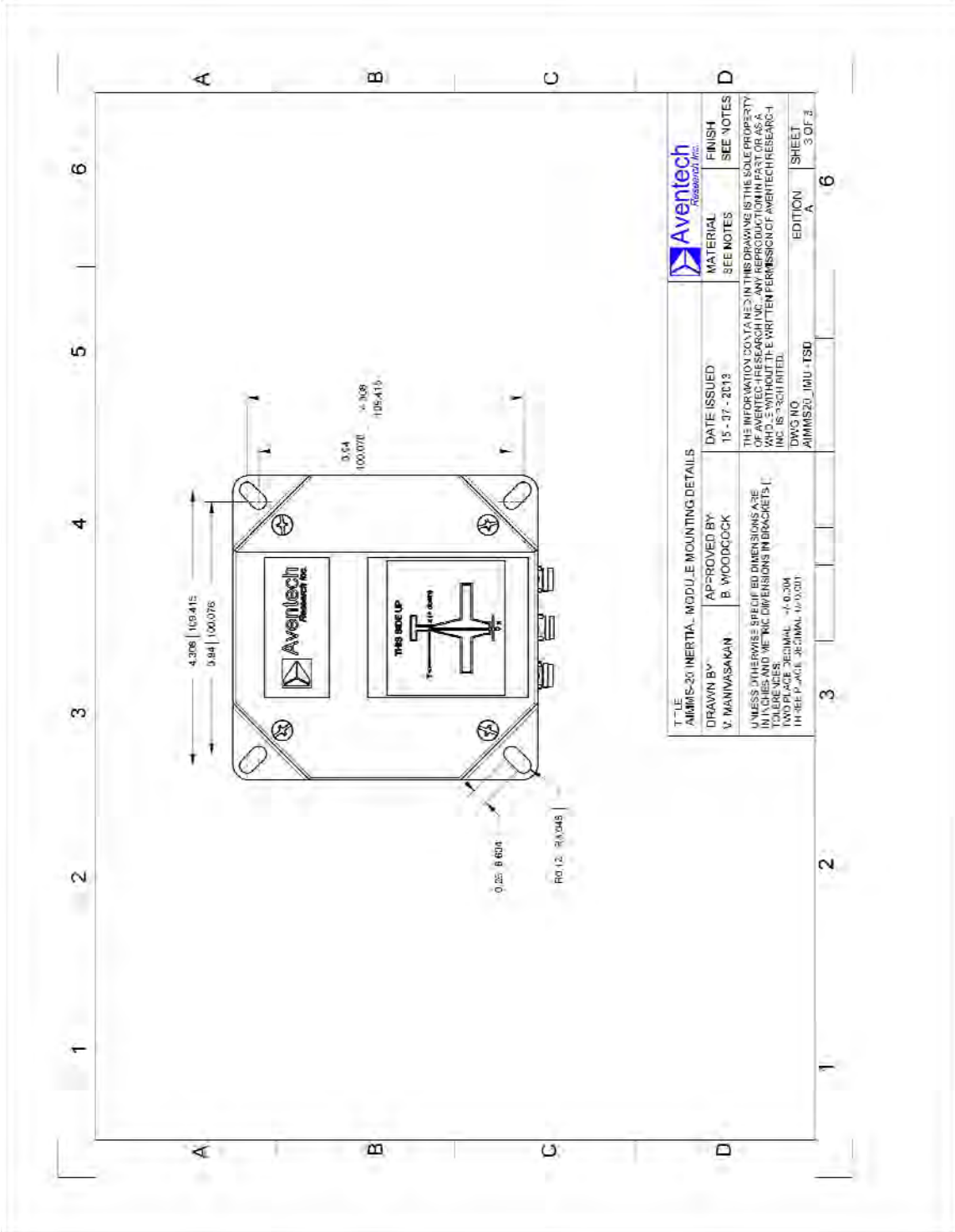

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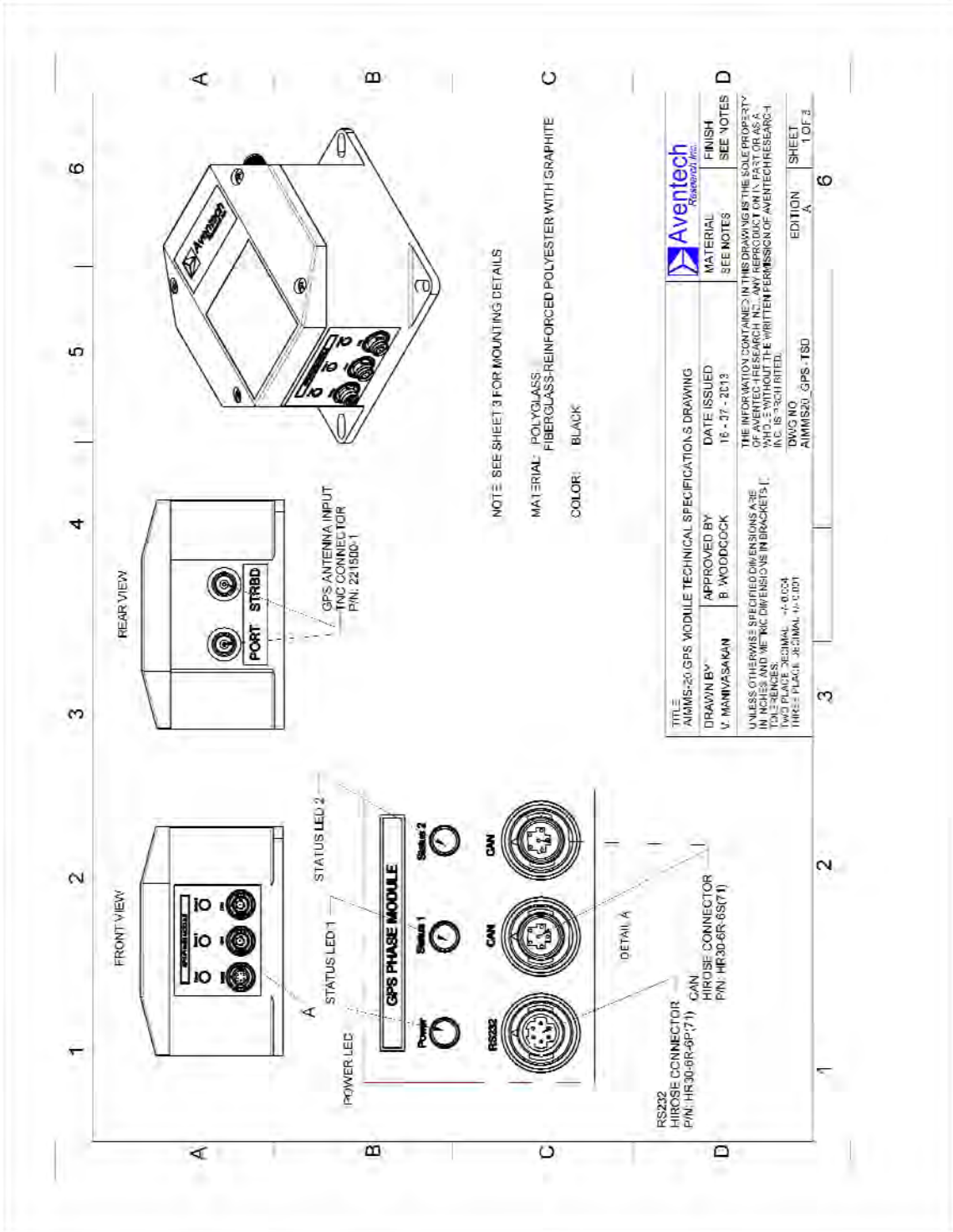
A.4 GPS Phase Module (GPS) and Antennas



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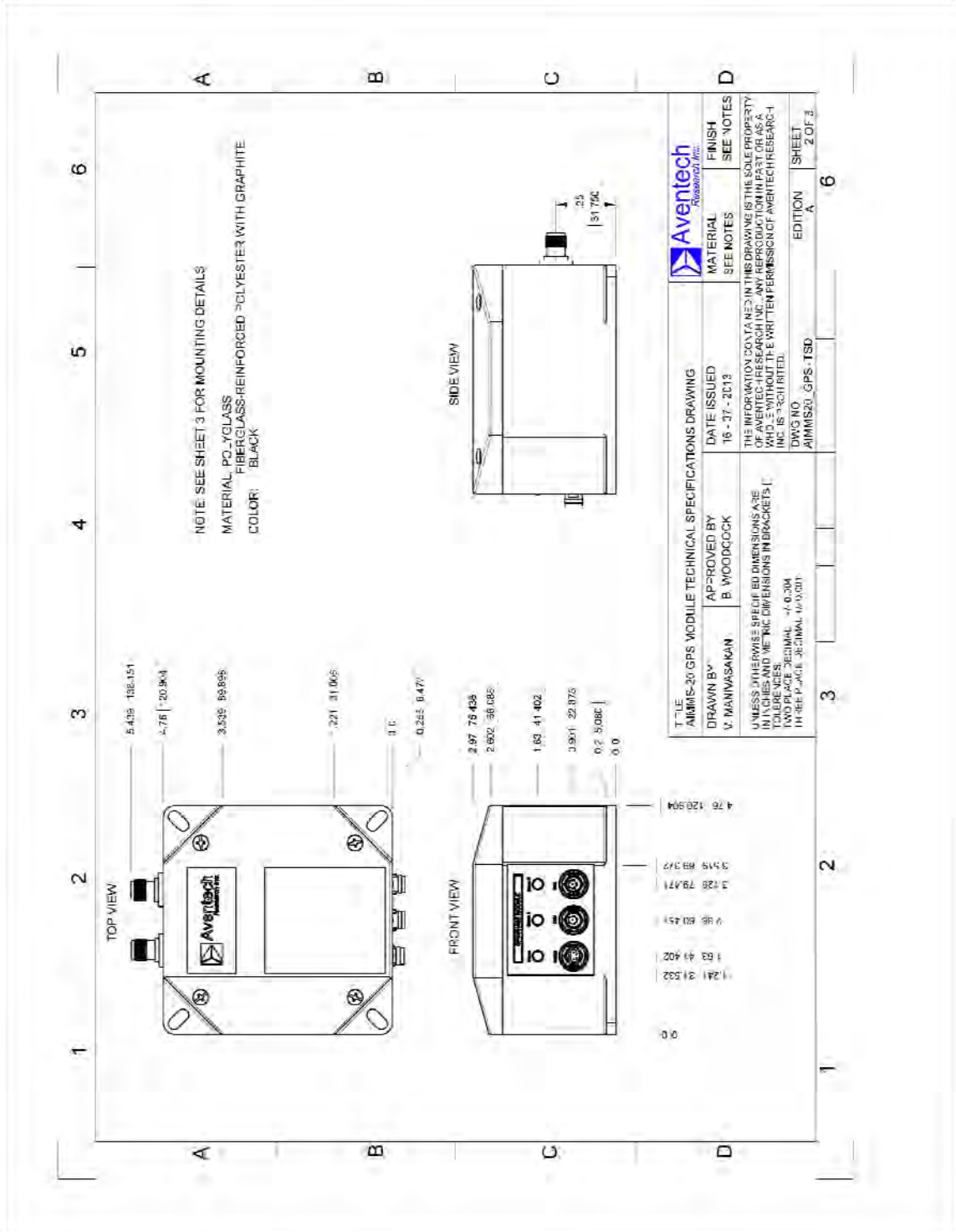

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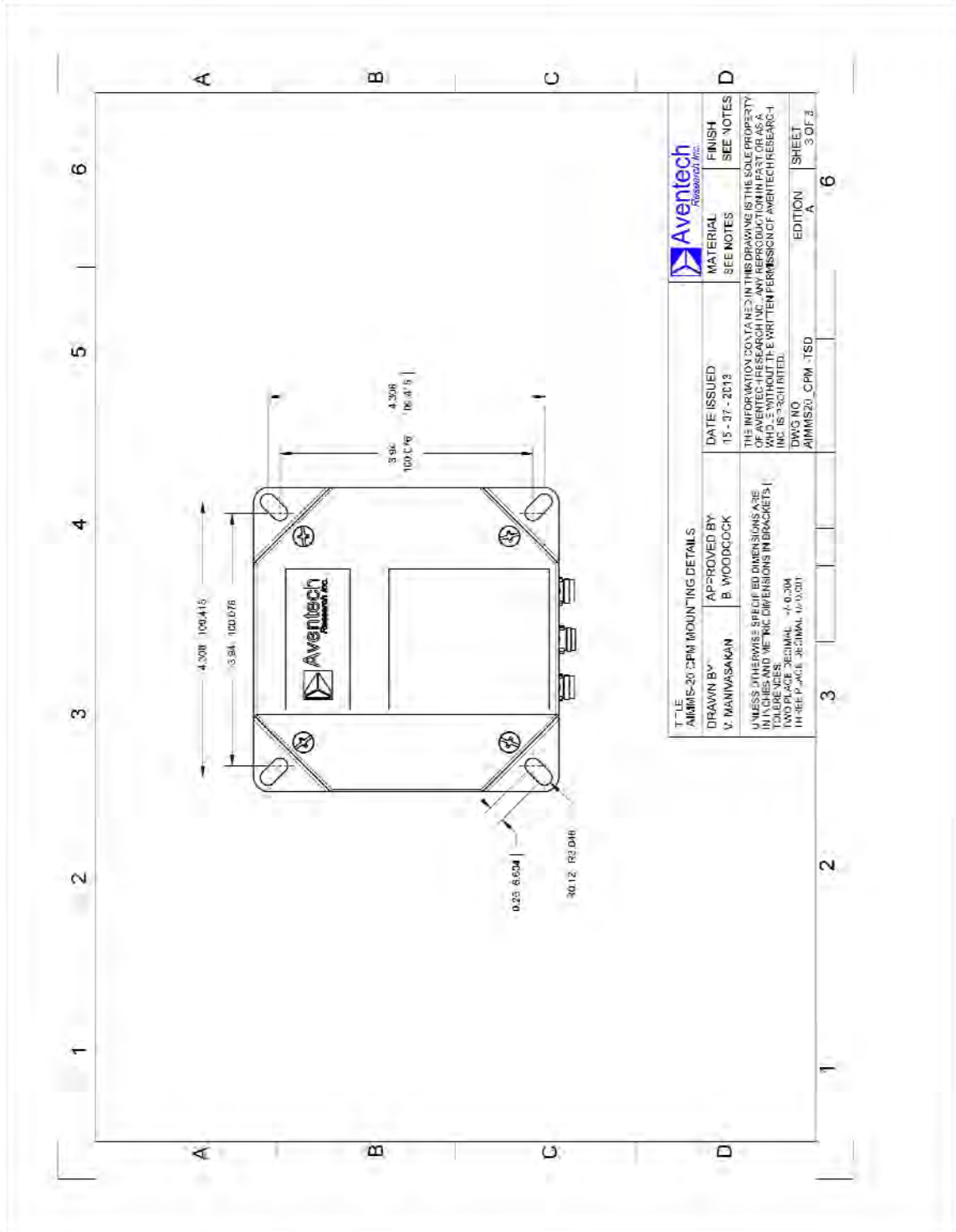

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A.4.1 Sensor Systems S67-1575-39 GPS Antenna Datasheet

GPS S67-1575-Series L1

DESCRIPTION

S67-1575-20: L1 GPS antenna operating at 1575.42 MHz. Spherical radius molded radome provides enhanced protection against rain, ice and lightning strikes. Application for airborne, marine, ground vehicles and manpack installation.

S67-1575-39: Same as (-20) except preamplifier/filter assembly. Internal 26 dB gain amplifier requires +4 to +24 VDC which is provided through the coaxial connector. Height .57 inches.

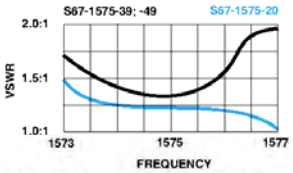
NSN: 5985-01-441-5048

S67-1575-49: Same as (-39) except 40 dB gain preamplifier. Height .60 Inches.

S67-1575-59: Same as (-49) except 13 dB gain preamplifier.

FEDERAL & MILITARY SPECS: FAA TSO C115a and C129, DO-160, MIL-STD-810, MIL-C-5541, MIL-E-5400.

PERFORMANCE

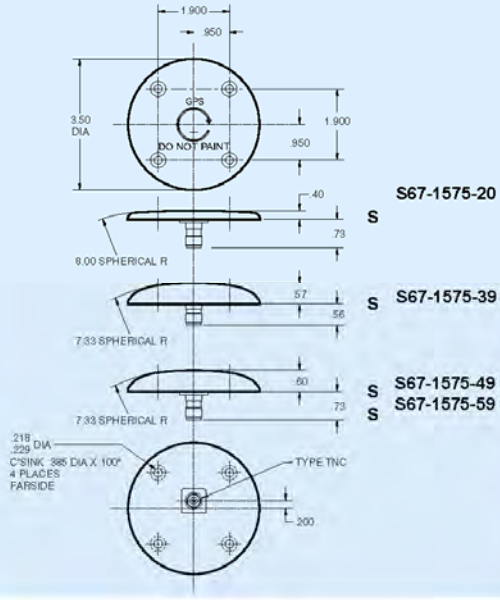


1575 MHz
L1

RADIATION PATTERN

SPECIFICATIONS	S67-1575-20	GPS S67-1575-39	S67-1575-49 S67-1575-59
ELECTRICAL			
Frequency	1575.42 MHz	1575.42 MHz	1575.42 MHz
VSWR	1.5:1	2.0:1	2.0:1
Polarization	RHCP	RHCP	RHCP
Impedance	50 ohms	50 ohms	50 ohms
Antenna Gain (Typ)	3 dBic @ Zenith		
Gain Coverage (min)	-1.0 dBic 0° ≤ θ ≤ 75° -2.5 dBic 75° < θ ≤ 80° -4.5 dBic 80° < θ ≤ 85° -7.5 dBic θ = 90° @ Horizon		
Gain (preamp)	—	26.0 dB	40.0 dB (-49) 13.0 dB (-59)
Noise Figure	—	2.8 dB	2.8 dB
Power Handling	1 watt	1 watt	1 watt
Voltage	—	+4 to 24 VDC	+4 to 24 VDC
Current	—	25 mA	45 mA
Lightning Protection	DC grounded		
MECHANICAL			
Weight	.3 oz.	5 oz.	5 oz.
Height	.40 in.	.57 in.	.60 in
Width	3.5 in.		
Material	6061-T6 aluminum / thermoset plastic		
Finish	Skydrol resistant enamel		
Connector	TNC		
ENVIRONMENTAL			
Temperature	-67°F to +185°F		
Vibration	10 G's		
Altitude	55,000 ft.		

OUTLINE DRAWING



Sensor Systems Inc.
8929 Fullbright Avenue
Chatsworth, CA 91311 USA
818-341-5366 fax: 818-341-9059
email: info@sensorantennas.com
www.sensorantennas.com

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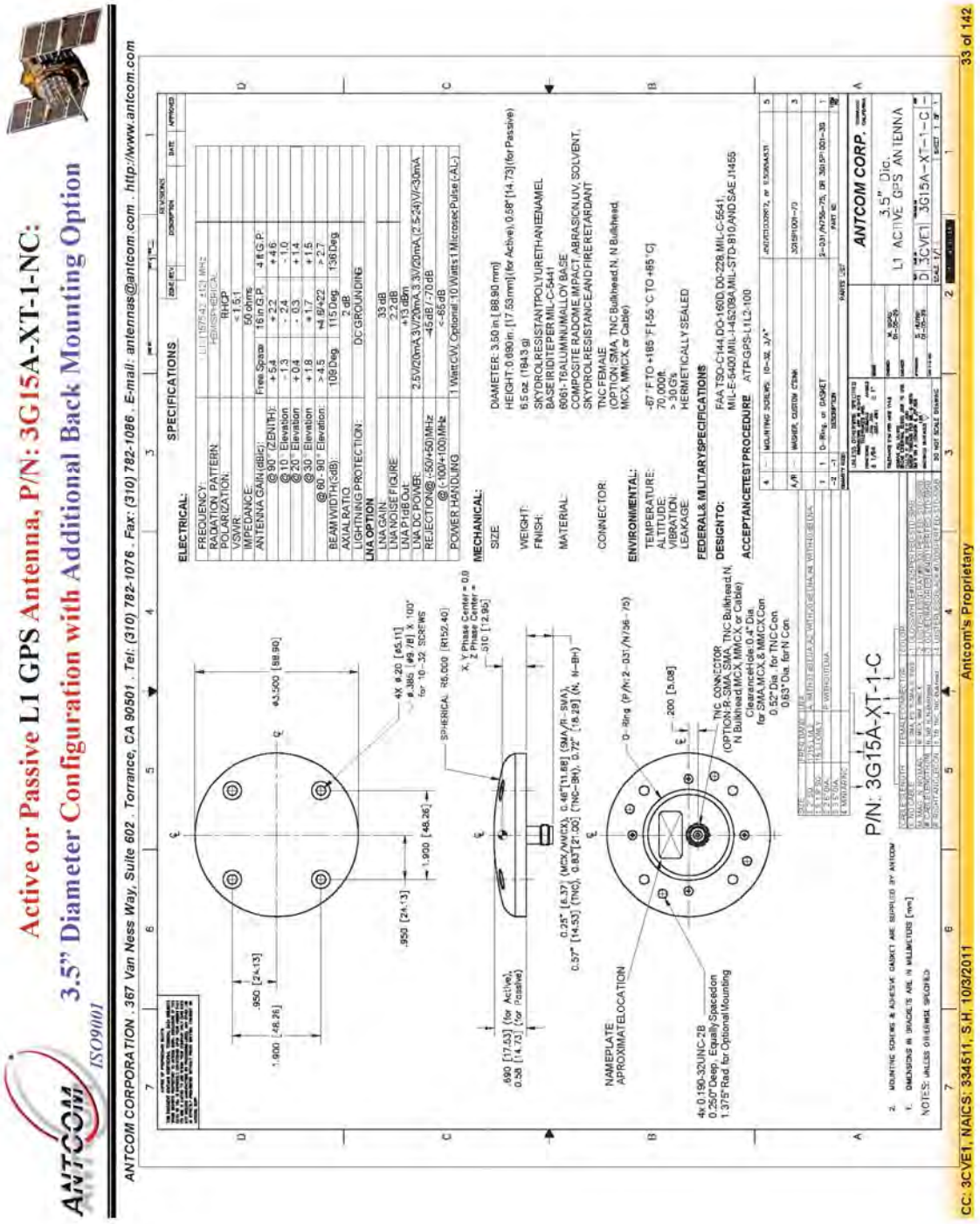
A.4.2 ANTCOM 3G15A-XT-1 GPS Antenna Datasheet



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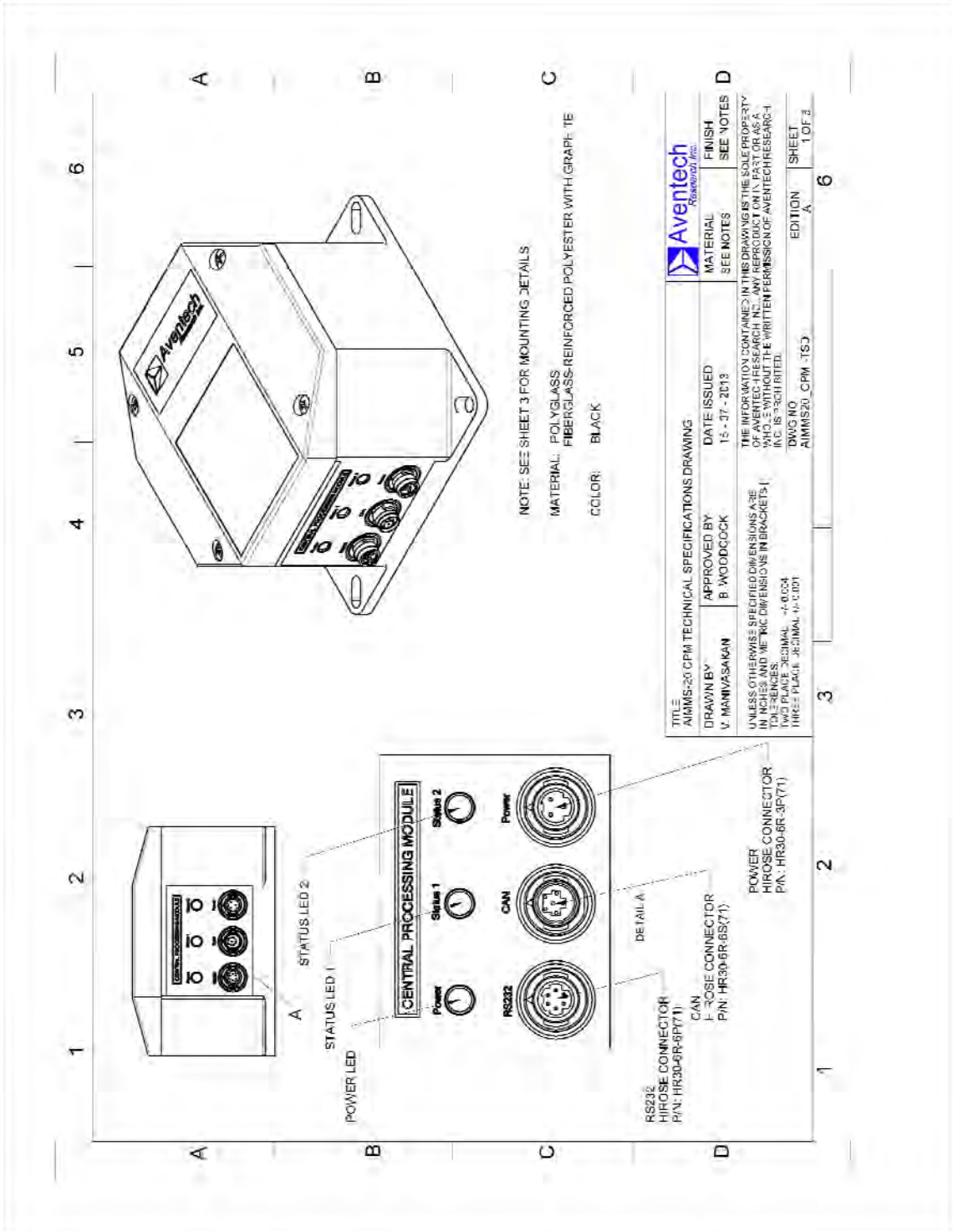
A.5 Central Processing Module (CPM)



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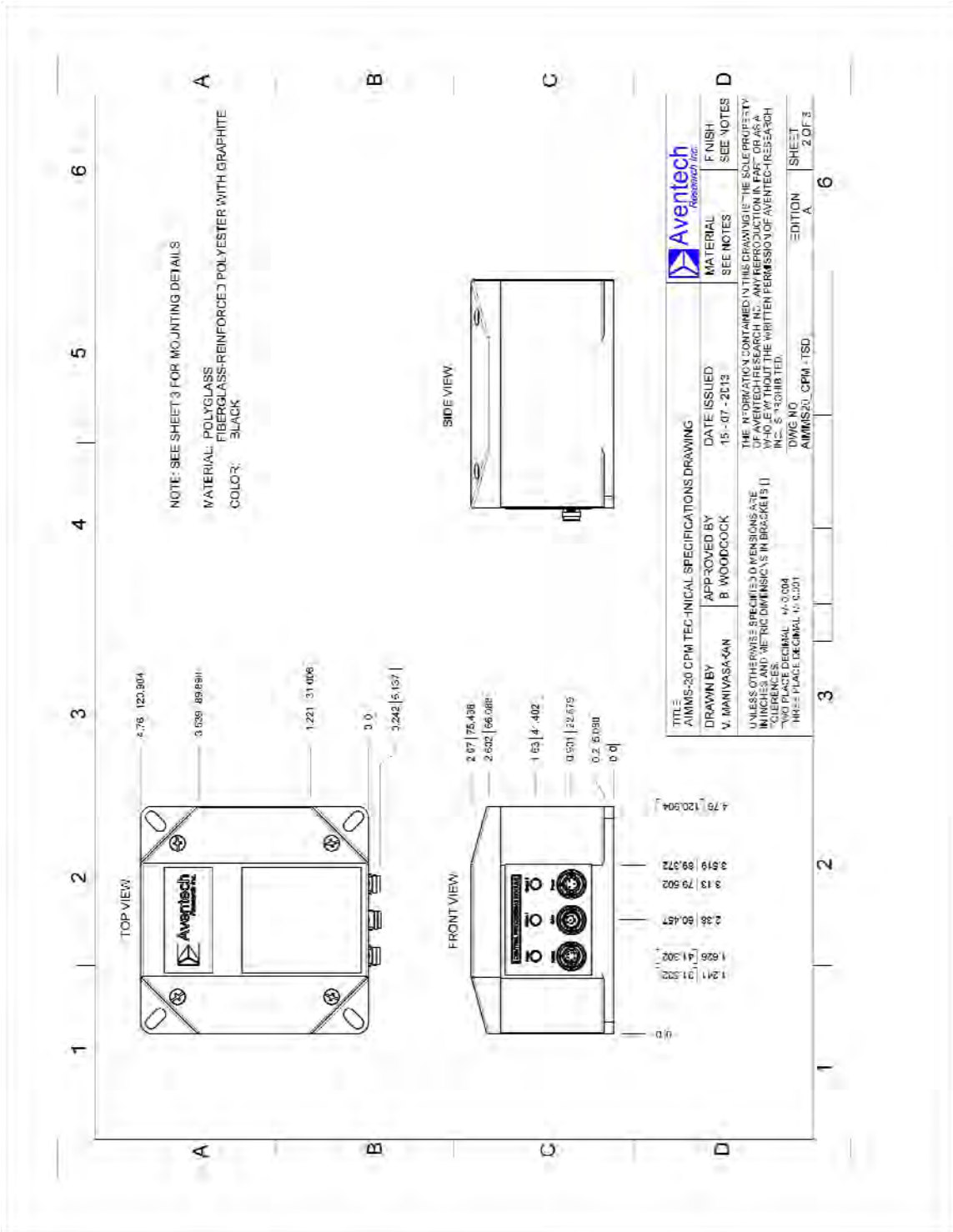

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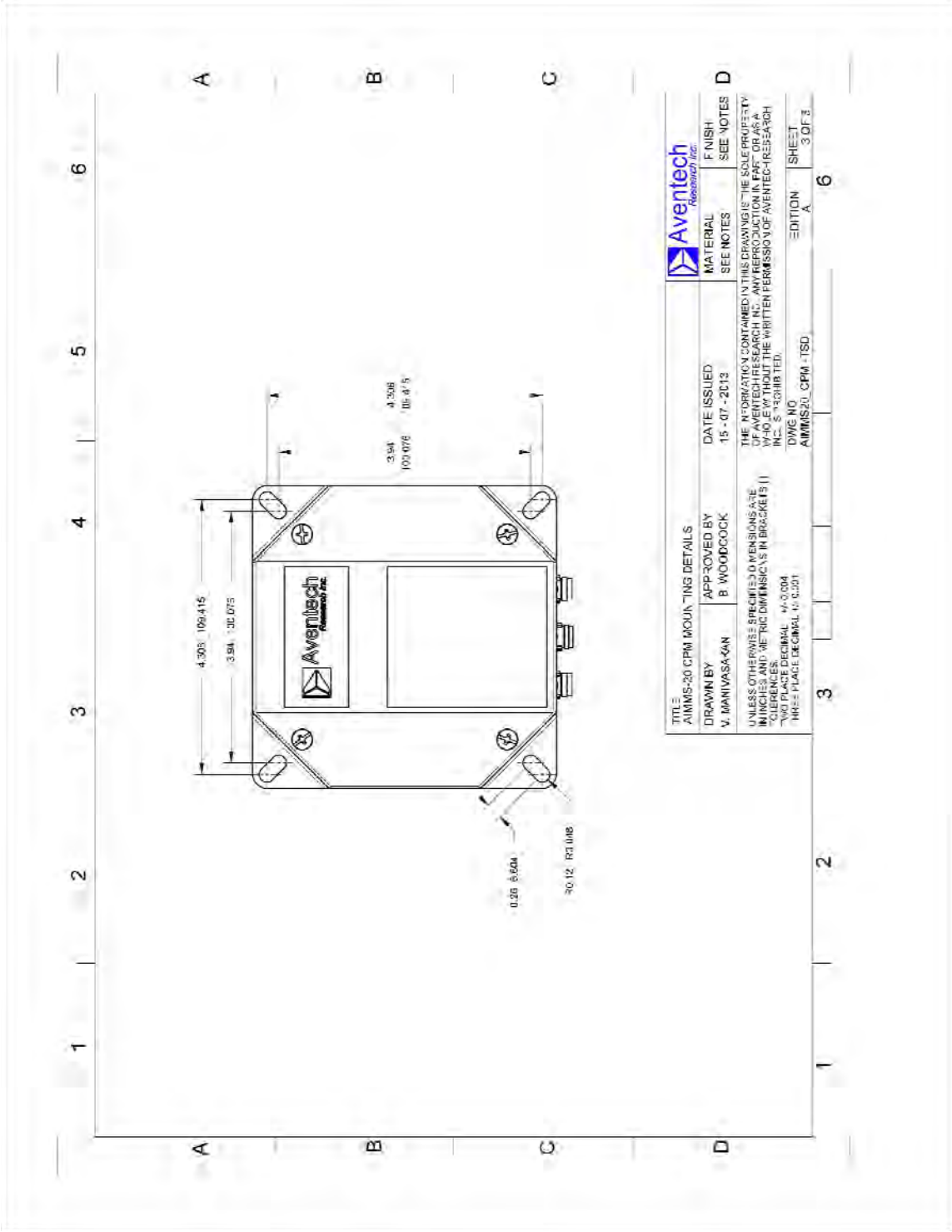

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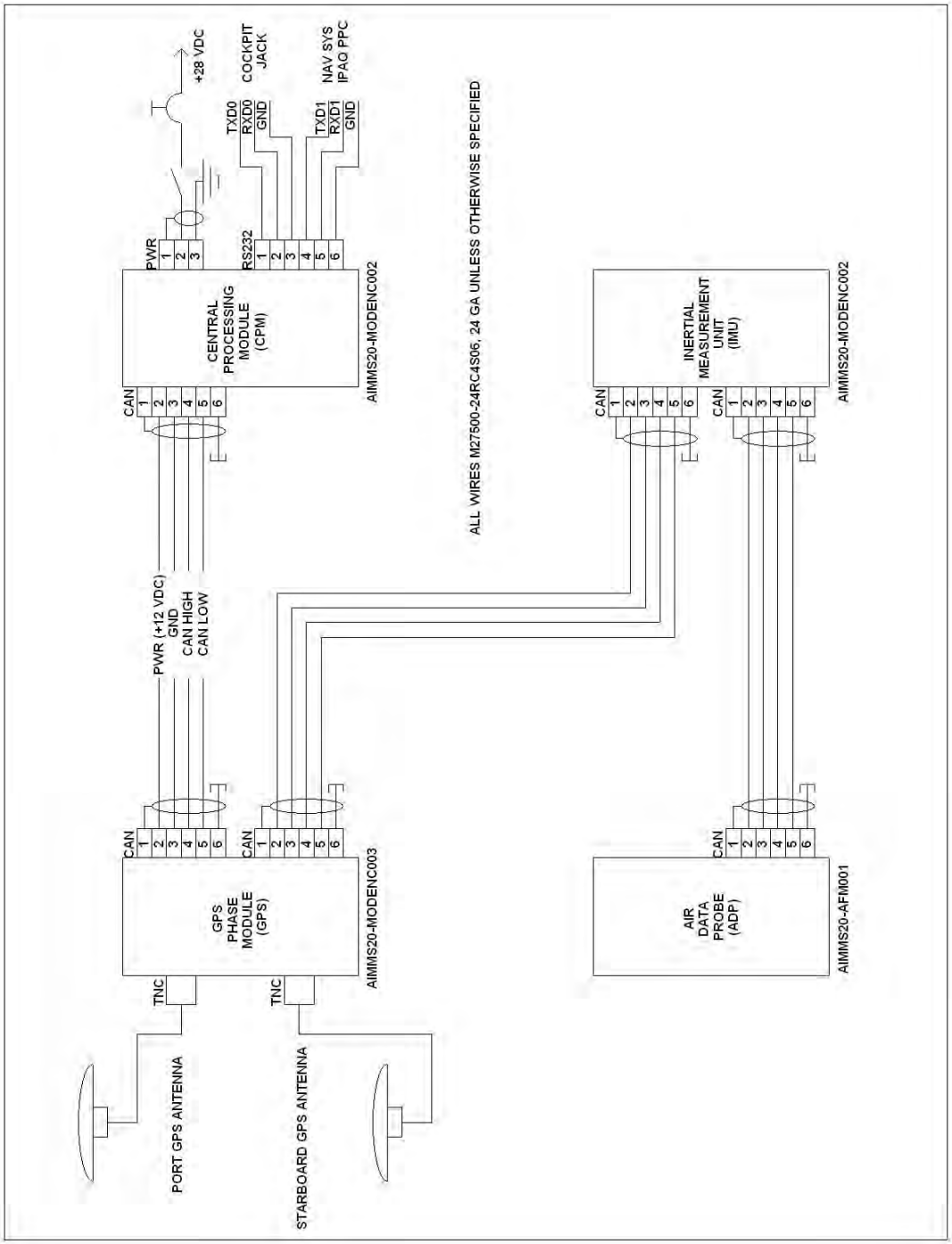
A.6 AIMMS-20 Wiring Diagram



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