Abrams SEPv3 ECP

PRODUCT DEVELOPMENT FABRICATION SPECIFICATION (PDFS)

for the

Meteorological Sensor (MET)

Document Number: SC-SA21160

2025-5-15

Prepared by:
General Dynamics Land Systems
38500 Mound Road
Sterling Heights, MI 48310
Controlled By: GDLS
CUI Categories: CTI, EXPT, OPSEC
Distribution: D

Revision Record

Revision	Release Date	Revision Information
-	02 April 2025	Baseline document

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

1 INTRODUCTION

1.1 Scope

This specification establishes the requirements for the functional, performance, design envelope requirements, interface requirements, and operating/non-operating environments to develop and test the Meteorological (MET) Sensor critical item for the Abrams Family of Vehicles (FOV) for the Abrams System Technical Sustainment Program.

1.2 Description

This Product Development Fabrication Specification (PDFS) defines the applicable physical, mechanical, structural, electrical and unique characteristics under which the Meteorological (MET) Sensor will operate. Specified performance is under natural and induced environments defined in the environmental condition section of this document or referenced documents.

Verification activities in Section 4 will provide the basis for qualification of the design.

2 APPLICABLE DOCUMENTS

The documents cited in Section 3 and thereafter are listed in Sections 2.1 and 2.2. The list may not include documents cited in other sections of this specification nor documents recommended for additional information or used as examples. While every effort was made to ensure the completeness of this list, be advised that all documents cited in Sections 3 and 4 of this specification shall be binding, subject to Section 4 (Order of precedence) whether or not the documents are listed in Section 2. Military Handbooks are to be used for guidance only.

2.1 Government Documents

2.1.1 Specifications, Standards, and Handbooks

Military Specifications

MIL-DTL-83133	Detail Specification: Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)
MIL-PRF-46170	Performance Specification: Hydraulic Fluid, Rust Inhibited, Fire Resistant, Synthetic Hydrocarbon Base, NATO Code No. H-544
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5

Military Standards

MIL-STD-130	Department of Defense Standard Practice for Identification Marking of US Military Property
MIL-STD-252	Classification of Visual and Mechanical Defects for Equipment, Electronic, Wired, and Other Devices
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-1275	Characteristics of 28 Volt DC Electrical Systems in Military Vehicles
MIL-STD-1472	Human Engineering Design Criteria for Military Vehicles
MIL-STD-461	Department of Defense Interface Standard, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

Military Handbook

MIL-HDBK-454	Department of Defense Handbook, General Guidelines for Electronic Equipment
MIL-HDBK-2165	Testability Handbook for Systems and Equipment

2.1.2 Other Government Documents, Drawings, Manuals, and Publications

The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Federal

DoDI 6055.11	Department of Defense Instruction: Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers
SAE AMS-STD-595	Colors used in Goverment Procurement

2.2 Non-Government Publications

The following documents form a part of this document to the extent specified herein.

Standards

IPC J-STD-001	Requirements for Soldered Electronic and Electrical Assemblies
ANSI/IPC 610A	Electronics Fabrication: Soldering, Wire Termination, Electronic Assembly Construction
ANSI/NCSL-Z540.3-2007	Requirements for the Calibration of Measuring and Test Equipment
ANSI-Z535.4	Product Safety Signs and Labels
ASME Y14.100	Engineering Drawing Practices
ASME Y14.5M-1994	Dimensioning and Tolerancing
ASTM D1655	Standard Specification for Aviation Turbine Fuels
IEEE C95.1	Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz
IPC-HDBK-830	Guidelines for Design, Selection and Application of Conformal Coatings
A-A-59133	Cleaning Compound, High Pressure (Steam) Cleaner

2.2.1 General Dynamics Land Systems Division

Standards

ATPD-2404	Environmental Conditions for the Armored Brigade Combat Team Tracked Vehicle Systems
ATPD-2407	Electromagnetic Environmental Effects (E3) for U.S. Army Tank and Automotive Vehicle Systems Tailored from MIL-STD-464C
LS1114438	Interface Voltage Standard and Characteristics for 28 Volt DC Electrical Power in the Abrams M1A2 Main Battle Tank

LS201200015649	CBRN Survivability Memorandum for the Abrams and 25 July 2011 Nuclear Survivability Criteria - Enclosure 3 (Secret)
SB-SA10005	Environmental Test Methods for ATPD-2404

Drawings

12733020	Meteorological Sensor
12731920	Assembly, Integrated Meteorological Sensor
12733022	Meteorological Sensor Mount
12344344	Exterior CARC Paint Specification
U.S. ARMY FM 3-11.5	Multi-service Tactics, Techniques and Procedures for Chemical, Biological, Radiological and Nuclear Decontamination

2.3 Document Conventions

To differentiate Figure Numbers, Table Numbers, Charts, Paragraph Number, etc. of PDFS from those of citations from external or referenced documents, citations shall be in *italic* and the referenced document shall be underlined.

Example: *Table II,* American Society of Mechanical Engineers, ASME Y14.5M - Dimensioning Tolerance

The following convention(s) are used throughout this specification:

- All ranges are inclusive; unless otherwise stated.
- Variables are identified with *italic* type.
- All measurements are given in decimal. Unless otherwise specified addresses, sub-addresses, and data values are given in Hexadecimal as the “0x” format; or as NN_H. An “X” in hexadecimal represents a “don’t care” value.

2.4 Order of Precedence

Where the requirements of this specification conflict with those of referenced documents, the following order of precedence shall apply:

1. The contract / subcontract statement of work
2. The purchase order
3. The assembly drawing(s)
4. This specification
5. All other documents

Nothing in this document supersedes applicable laws or regulations unless a specific exemption has been obtained.

3 REQUIREMENTS

3.1 Item Definition

The Meteorological Sensor (Met Sensor), hereinafter referred to as the assembly, obtains local cross and headwind speeds, barometric pressure, temperature, external temperature input, and relative humidity for use in ballistics and to support network data sharing while mounted to the exterior of the Abrams vehicle turret. (MET-9557)

3.1.1 Major Component List

This paragraph is not applicable to this specification. (MET-300)

3.1.2 Non-Government Furnished Equipment (GFE) List

This paragraph is not applicable to this specification. (MET-324)

3.1.3 Government Furnished Property (GFP) List

This paragraph is not applicable to this specification. (MET-326)

3.1.4 Government Loaned Property (GLP) List

This paragraph is not applicable to this specification. (MET-328)

3.1.5 Interfaces

3.1.5.1 Mechanical Interfaces

3.1.5.1.1 Physical Interfaces

The physical requirements for the assembly in terms of linear dimensions related to reference points along with all direct hardware connections are as specified in 12733020. The orthogonal axes are shown in Figure 3.2.1.1-1. (MET-9756)

3.1.5.1.3 Grounding

Grounding of the assembly shall be accomplished via conductive surfaces at the mounting interfaces of the assembly. These surfaces shall be located in accordance with 12733020. (MET-9757)

3.1.5.1.4 Thermal Interfaces

The mechanical interfaces between the assembly and the vehicle and its components shall not be relied upon as thermal paths. The thermal interface for the assembly is the surrounding air. (MET-9758)

3.1.5.2 Electrical Interfaces

3.1.5.2.1 Data Interface

The assembly shall provide the temperature, barometric pressure, headwind velocity, crosswind velocity, and humidity data through a serial interface. (MET-9763)

3.1.5.2.2 Cable Disconnect

The assembly shall provide two contact pins in its electrical connector for a cable disconnect continuity circuit. (MET-9764)

3.2 System Requirements

3.2.1 Physical Characteristics

3.2.1.1 Space Claim

The assembly space claim is defined in drawing 12733020. (MET-337)

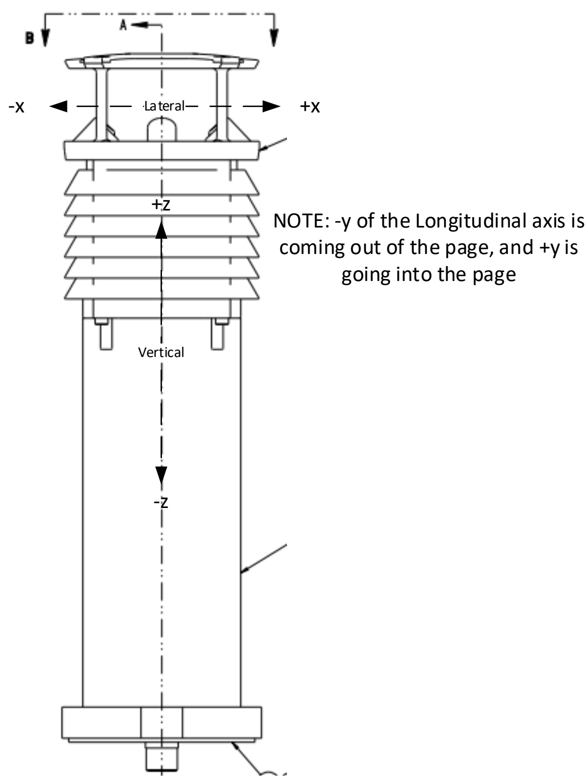


Figure 3.2.1.1-1. Met Sensor Orthogonal Axes

3.2.1.2 Reserved

3.2.1.3 Weight

The assembly shall not exceed 20 pounds (lbs). (MET-339)

3.2.1.4 Mounting

The assembly shall provide mounting interfaces in accordance with drawing 12733022. (MET-341)

3.2.1.5 Color

The assembly exterior surfaces shall be primed and top coated in accordance with 12344344, color green Teflon 383 per color chip 34094 of SAE AMS-STD-595. (MET-343)

3.2.2 Installed Performance

3.2.3 Performance

3.2.3.1 Mechanical Performance/Characteristics

3.2.3.2 Electrical Performance/Characteristics

3.2.3.2.1 Input Voltage

The assembly shall meet the requirements specified herein with a steady state input voltage of 28 Vdc, in accordance with Class 1A requirements of LS1114438. (MET-464)

a. Steady state prime input voltage connected to the input power pins listed in table 3.2.3.2.1-1. (MET-5225)

b. Power up with the prime input voltage of 3.2.2.2.1a having a dV/dT of at least 1.0 volt per second between 0 Vdc to the levels specified in 3.2.3.2.1a. (MET-5226)

Table 3.2.3.2.1-1 Input Voltage

MET J1	SIGNAL NAME	VOLTAGE
1	Input Power	22-31 Vdc
6	Input Power Return	22-31 Vdc Return

3.2.3.2.1.1 Input Voltage Transients and Protection Circuits

The assembly shall meet the requirements of 3.2.3 and shall not suffer degradation of performance after being subjected to the following abnormal conditions:

a. Reverse polarity of 32 Vdc. (MET-9484)

b. Normal polarity of 40 Vdc. (MET-9485)

c. Transients as defined in MIL-STD-1275 *Figure 7 and 8* (MET-9486)

d. Transients as defined in LS1114438 *Figures 7, 9 and Figure 11* (MET-9487)

3.2.3.2.2 Input Power

3.2.3.2.2.1 Steady State

The maximum steady state power shall not exceed 1W. (MET-9964)

3.2.3.2.2.2 Inrush Current

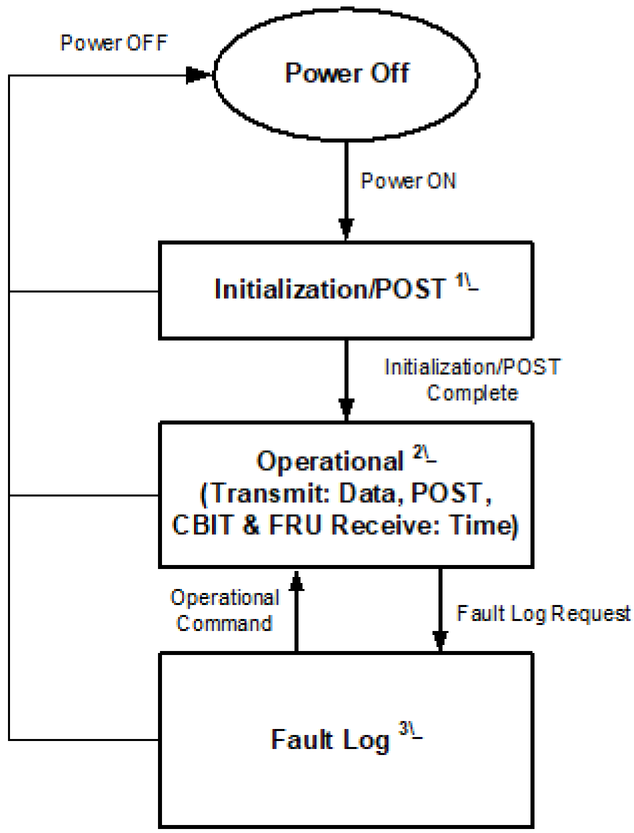
The inrush current shall not exceed 2.0 Amps for 100 microseconds. (MET-9553)

3.2.3.2.3 Chassis Isolation

The assembly chassis shall be isolated from all connector pins so the dc resistance between them is greater than 10 Megohms (Mohms). (MET-9380)

3.2.3.2.4 Power-up Timing

The assembly shall meet the performance requirements of 3.2.3 within 10 seconds of the application of input voltage as specified in 3.2.3.2.1 and Figure 3.2.3.2.4-1. (MET-9381)



Notes:
1. Upon the application of input power, the assembly shall initialize and conduct its Power On Self Test (POST).

2. Upon completion of POST, the assembly shall automatically execute CBIT and provide MET Data, POST, and CBIT. Upon request, the assembly shall set its fault log time and provide FRU data.

3. MET data and CBIT shall not be provided during access to the Fault Logs

Figure 3.2.3.2.4-1 Mode Diagram

3.2.3.2.5 Serial Interface

The assembly shall provide a RS-422 interface which shall be used to provide command, control and diagnostic data. The serial interface shall have a minimum update rate of 40 Hertz (Hz). (MET-9383)

3.2.3.3 Functional Performance

3.2.3.3.1 Temperature

3.2.3.3.1.1 Range

The assembly shall provide a minimum temperature range of operation from -40° F (-40° C) to 160° F (71° C). (MET-9781)

3.2.3.3.1.2 Accuracy

The assembly shall provide a minimum temperature accuracy of ±1.8°F (1°C). (MET-9782)

3.2.3.3.1.3 Resolution

The assembly shall provide a minimum temperature resolution of 0.18° F (0.1° C). (MET-9783)

3.2.3.3.2 Barometric Pressure

3.2.3.3.2.1 Range

The assembly shall provide a minimum pressure range of operation from 20.4 to 32.4 in Hg(inches Mercury). (MET-9787)

3.2.3.3.2.2 Accuracy

The assembly shall provide a minimum pressure accuracy of ±0.15 in Hg. (MET-9788)

3.2.3.3.2.3 Resolution

The assembly shall provide a minimum pressure resolution of 0.015 in Hg. (MET-9789)

3.2.3.3.3 Crosswind Velocity

3.2.3.3.3.1 Range

The assembly shall provide a minimum crosswind velocity range of 0 to 85.0 mph (0 to 38 m/s). (MET-9798)

3.2.3.3.3.2 Accuracy

The assembly shall provide a crosswind velocity minimum accuracy of ±1.12mph (±0.5m/s) or ±5% of actual wind velocity, whichever is greater. (MET-9799)

3.2.3.3.3.3 Resolution

The assembly shall provide a minimum crosswind velocity resolution of 0.1 mph (0.045m/s) (MET-9800)

3.2.3.3.3.4 Wind Velocity Response

The assembly shall be capable of providing crosswind speed magnitude with a minimum bandwidth of 4 Hz (<=45 deg phase shift and Gain >= -3 dB). (MET-9816)

3.2.3.3.3.5 Wind Velocity Bandwidth

The assembly response to a sinusoidally varying crosswind at 0 to 0.1 Hz and at 2 Hz shall be dc output voltages as shown in Table 3.2.3.3.3.5-1 (MET-9816)

With the assembly subjected to a constant 20 meters/second crosswind and rotated through 360° in 7.5° increments, the voltage at P1-9 (hi) to P1-10 (lo) shall be as indicated in Table 3.2.3.3.3.4-1 for 0 – 0.1 Hz. The assembly shall be at zero degrees pitch and roll. The voltage at P1-9 (hi) to P1-10 (lo) shall be positive for crosswinds coming from the right and negative for crosswinds from the left. The direction of crosswinds shall be determined by looking in the direction of the arrow inscribed on the assembly cover per 3.1.1. (MET-14259) For temperatures between minus 25 and 110 degrees F, the tolerance on the output voltage shall be ± 0.80 volts. For temperatures between minus 60 and minus 25 degrees F and between 110 and 125 degrees F, the tolerance on the output voltage shall be ± 1.09 volts.

Table 3.2.3.3.3.4-1 Crosswind Output Voltage

Angle(°)*	Voltage Output (Vdc)**	
	0 to 0.1Hz	At 2 Hz
0	0	0
7.5	1.16	0.93
15	2.26	1.81
22.5	3.25	2.6
30	4.12	3.3
37.5	4.85	3.88
45	5.46	4.37
52.5	5.97	4.78
60	6.4	5.12
67.5	6.75	5.4
75	7.02	5.62
82.5	7.19	5.75
90	7.25	5.8
97.5	7.19	5.75
105	7.02	5.62
112.5	6.75	5.4
120	6.4	5.12
127.5	5.97	4.78
135	5.46	4.37
142.5	4.85	3.88
150	4.12	3.3
157.5	3.25	2.6
165	2.26	1.81

172.5	1.16	0.93
180	0	0
187.5	-1.16	-0.93
195	-2.26	-1.81
202.5	-3.25	-2.6
210	-4.12	-3.3
217.5	-4.85	-3.88
225	-5.46	-4.37
232.5	-5.97	-4.78
240	-6.4	-5.12
247.5	-6.75	-5.4
255	-7.02	-5.62
262.5	-7.19	-5.75
270	-7.25	-5.8
277.5	-7.19	-5.75
285	-7.02	-5.62
292.5	-6.75	-5.4
300	-6.4	-5.12
307.5	-5.97	-4.78
315	-5.46	-4.37
322.5	-4.85	-3.88
330	-4.12	-3.3
337.5	-3.25	-2.6
345	-2.26	-1.81
352.5	-1.16	-0.93
360	0	0

*For rotation angles between 0.0 and 180.0 degrees, the output voltage shall be positive. For rotation angles between 180.0 and 360.0 degrees, the output voltage shall be negative.

**For temperatures between minus 25 and 110 degrees F, the tolerance on the output voltage shall be ± 0.80 volts. For temperatures between minus 60 and minus 25 degrees F, and between 110 and 125 degrees F, the tolerance on the output voltage shall be ± 1.09 volts.

3.2.3.3.3.6 Zero Level

With input power applied and with the assembly subjected to still air, the output signal shall be less than 0.150 vdc. (MET-14261)

3.2.3.3.3.7 Analog Output Fault

The assembly shall provide a ±9.5-10 Vdc signal to indicate when a fault is occurring with the analog crosswind output. (MET-14262)

3.2.3.3.4 Headwind Velocity

3.2.3.3.4.1 Range

The assembly shall provide a minimum headwind velocity range of 0 to 85.0 mph (0 to 38 m/s). (MET-9803)

3.2.3.3.4.2 Accuracy

The assembly shall provide a headwind velocity minimum accuracy of ±1.12mph (±0.5m/s) or ±5% of actual wind velocity, whichever is greater. (MET-9804)

3.2.3.3.4.3 Resolution

The assembly shall provide a minimum headwind velocity resolution of 0.1 mph (0.045m/s) (MET-13519)

3.2.3.3.4.4 Wind Velocity Response

The assembly shall be capable of providing headwind speed magnitude with a minimum bandwidth of 4 Hz (<=45 deg phase shift and Gain >= -3 dB). (MET-13522)

3.2.3.3.5 Humidity

3.2.3.3.5.1 Accuracy

The assembly shall provide a minimum humidity accuracy of ±4%. (MET-9809)

3.2.3.3.5.2 Resolution

The assembly shall provide a minimum humidity resolution of 1%. (MET-9810)

3.2.3.3.6 External Temperature Input

3.2.3.3.6.1 Range

The assembly shall accept an external temperature input from a thermistor with a minimum temperature range from -40° F (-40° C) to 160° F (71° C). (MET-9950)

3.2.3.3.6.2 Accuracy

The assembly shall provide a minimum temperature accuracy of ±1.8°F (1°C) throughout the range defined in 3.2.3.3.6.1. (MET-9952)

3.2.3.3.6.3 Resolution

The assembly shall provide a minimum temperature resolution of 0.18° F (0.1° C). (MET-9955)

3.2.3.3.7 Configuration Data

The assembly at a minimum shall store the Manufacturer's Cage Code, Product Name (Meteorological Sensor), Part Number, Serial Number and Firmware Version in non-volatile memory. The data shall be accessible through the serial interface. (MET-9948)

3.2.3.3.8 Nuclear Event Detection and Test

3.2.3.3.8.1 NED Test Input

The assembly shall provide a Nuclear Test Input to simulate a Nuclear Event Detection. Nuclear Event Detection simulation shall be accomplished by applying 28 Vdc with no more that 6 milli-amps pulse to the NED_TEST_IN, MET J1-11 (hi) to MET J1-6 (lo) for a minimum duration of 50 microseconds. By the time the Nuclear Test Input has been active for 55 microseconds, the assembly shall set the Nuclear Event Detection (NED) in accordance with 3.2.3.3.8.2 and perform a Nuclear Event Shutdown in accordance within the time specified in 3.2.3.3.8.3. The NED signal shall not be set by transients as specified in 3.2.3.2.1.1. (MET-14474)

3.2.3.3.8.2 NED (Nuclear Event Detection)

The assembly shall provide a NED output signal latched to 16.5 to 32 Vdc referenced to a NED return, when a Nuclear Event Detection in accordance with 3.6.1 occurs, or when a Nuclear Test Input simulating Nuclear Event Detection as defined in 3.2.3.3.8.1 has been applied. The NED signal shall be capable of sourcing a minimum of 20 mA at 16.5 to 32 Vdc for a minimum of 35 millisecond. Once latched to 16.5 to 32 Vdc, the NED output signal shall be reset by removal of the Nuclear Test Input voltage (if applied) and the assembly input power, followed by reapplication of the assembly input voltage in accordance with 3.2.3.2.1. (MET-14476)

3.2.3.3.8.3 Nuclear Event Shutdown

When a Nuclear Event Detection in accordance with 3.6.1 or a Nuclear Test Input simulating Nuclear Event Detection as defined in 3.2.3.3.8.2 has occurred, the assembly's output voltages of Table 3.2.2.24.1-1 shall decrease to 35% in 250us and then to 200mV in 2ms. The assembly shall be reset by removal of the Nuclear Event or the Nuclear Test Input voltage along with the assembly input power, followed by reapplication of the assembly input voltage in accordance with 3.2.3.2.1. (MET-14477)

3.2.4 Reliability

The reliability requirement for the assembly shall have a Mean Time Between Failures (MTBF) of not less than 101,809 operating hours, to be realized by full rate production, when it is operated in accordance with the duty cycle described in this specification. If a duty cycle is not provided, assume 100% usage.

An " MTBF failure" is defined as any hardware or software malfunction that results in the inability of the end item to function (failure that requires corrective action, which cannot be deferred).

(MET-2860)

3.2.5 Maintainability/Diagnostics/Testability

3.2.5.1 Qualitative Maintainability

This paragraph is not applicable to this specification. (MET-2863)

3.2.5.2 Quantitative Maintainability

This paragraph is not applicable to this specification. (MET-2868)

3.2.5.3 Preventative Maintenance Checks and Services (PMCS)

The assembly shall not require any PMCS. (MET-2871)

3.2.5.4 Special Tools and Test Equipment

The assembly shall not require special tools or special test equipment at the Field Level of maintenance. (MET-2873)

3.2.5.5 Diagnostics/Testability

The assembly shall be covered by built-in-test (BIT) diagnostics and store the fault history in non volatile memory. (MET-2875)

3.2.5.5.1 Qualitative Diagnostics/Testability

The design of the assembly will incorporate the qualitative design concepts of MIL-HDBK-2165, Appendix B.

BIT diagnostics or Built-In Diagnostics (BID) is the terminology for embedded diagnostics and herein refers to a three level hierarchy of tests: Power-up Built-In Test (PBIT) and Continuous Built-In Test (CBIT). (MET-9446)

3.2.5.5.1.1 Power-up Built-In Test

The assembly shall provide the hardware and/or software capable of supporting an embedded set of diagnostics that shall test the assembly when power is first applied.

The results of PBIT shall be retained in non-volatile memory and shall be available to the vehicle’s diagnostic system.

The assembly shall begin and complete PBIT within 10 seconds of power being applied.

As a minimum, PBIT data shall include the following:

- Power Supply GO/NO GO
- GO/NO GO board level status including tests of CPU, peripherals, clocks and memory devices
- PBIT failure, indicating PBIT hardware/software has failed (MET-9444)

3.2.5.5.1.2 Continuous Built-In Test

The assembly shall provide the hardware and/or software capable of supporting an embedded set of diagnostics running continuously in the background once PBIT has been completed. CBIT shall test the assembly to the fullest extent without intruding on of the system's normal functions of operation.

CBIT shall monitor and report the status of the assembly's performance parameters. The results of CBIT shall be retained in non-volatile memory and shall be available to the vehicle’s diagnostic system.

Each CBIT cycle shall not exceed 1 second.

As a minimum, CBIT data shall include the following:

- Power Supply GO/NO GO
- GO/NO GO board level status including tests of CPU, peripherals, clocks and memory devices
- CBIT failure, indicating CBIT hardware/software has failed (MET-2881)

3.2.5.5.1.3 Initiated Built-in Test

This paragraph is not applicable to this specification. (MET-2889)

3.2.5.5.2 Quantitative Diagnostics

BIT diagnostics shall meet the following requirements:

- Ninety nine percent probability of detecting all faults in accordance with Failure Mode and Effects Analysis (FMEA)/Design FMEA (DFMEA)
- Less than three percent BIT diagnostics false alarm rate
- BIT circuitry shall not require calibration
- BIT failure shall not degrade performance of the prime system (i.e., BIT failure is transparent to system's operation)
- BIT shall have self test capability (capability to verify PBIT and CBIT hardware/software)

The assembly shall record and store all PBIT and CBIT failures in non-volatile memory. All failures shall be timestamped and synchronized with a clock to within $\pm$ 5 milliseconds. The timestamp shall have a 1.0 milliseconds resolution. The operating time, temperature, and configuration data including hardware version, part number /serial number national stock number (NSN) cage code, model number shall also be record and stored in non-volatile memory. (MET-2898)

3.2.5.5.2.1 Field Level

Field level diagnostics is performed with the assembly installed in the vehicle. At the field level, fault isolation down to the Line Replaceable Unit (LRU)/Line Replaceable Module (LRM) is required. In order to accomplish this, BIT diagnostics of all Shop Replaceable Units (SRUs) must be reflected in the LRU/LRM level status. SRU failure indication shall be passed along to the up-assembly when the SRU fails. This indication is aggregated into the up-assembly LRU/LRM status. This LRU/LRM status is then passed along to the vehicle's diagnostic system. The MET Sensor shall be considered a LRU. (MET-2901)

3.2.5.5.2.2 Sustainment Support Level

This paragraph is not applicable to this specification. (MET-2903)

3.2.5.5.2.2.1 SRU Performance Verification

This paragraph is not applicable to this specification. (MET-2905)

3.2.5.5.2.2.2 SRU Fault Isolation

This paragraph is not applicable to this specification. (MET-2907)

3.2.5.6 Testability

The Supplier will use Design for Testability (DFT) to implement a testable design that meets the embedded diagnostics requirements using MIL-HDBK-2165 as a guide. (MET-2920)

3.2.6 Environmental Conditions

3.2.6.1 Natural Environment

3.2.6.1.1 Humidity

3.2.6.1.1.1 Operating Humidity

This paragraph is not applicable to this specification. (MET-2925)

3.2.6.1.1.2 Storage and Transportation

Storage and transportation humidity is included as part of subsystem operational humidity per section 3.2.6.1.1.3. (MET-2927)

3.2.6.1.1.3 Subsystem Operational

The assembly shall meet the performance requirements of 3.2.3 without performance degradation during and after aggravated temperature-humidity conditions up to and including:

a) Temperature range: 86 degrees F to 160 degrees F (30 degrees C to 71 degrees C)

b) Relative humidity range: 95 ± 5 percent. (MET-2929)

3.2.6.1.2 Fungus

The material used in the assembly shall not support fungal growth. Unless otherwise specified, the fungus species shall be as defined in MIL-STD-810G Method 508.6, *Table 508.6-I US Test Fungus*. (MET-2934)

3.2.6.1.3 Salt Fog

The assembly shall meet the performance requirements of 3.2.3 without performance degradation and show no evidence of damage after exposure to a 5% aqueous salt. (MET-2936)

3.2.6.1.4 Sand

3.2.6.1.4.1 Blowing Sand External

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation during and after exposure to 10.6 to 17.7 grams per cubic meter (g/m^3) blowing silica sand up to 1 mm in diameter (see Table II, ATPD-2167 for sand blend), at a velocity of 15 meters per second (m/s).

(MET-2939)

3.2.6.1.4.2 Blowing Sand Internal

This paragraph is not applicable to this specification. (MET-2941)

3.2.6.1.5 Dust

3.2.6.1.5.1 Blowing Dust External

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation during and after exposure to 10.6 to 17.7 g/m^3 silica flour dust up to 0.15 mm in diameter (see Table II, ATPD-2167 for dust blend) blowing at a velocity of no less than 8.9 m/s (+ 1.3) m/s. (MET-2944)

3.2.6.1.5.2 Blowing Dust Internal

This paragraph is not applicable to this specification. (MET-2946)

3.2.6.1.6 Altitude

3.2.6.1.6.1 Operating

The assembly shall meet the performance requirements of 3.2.3 during and after exposure to a pressure range of 508 millibars to 1080 millibars. (MET-2949)

3.2.6.1.6.2 Non-Operating

The assembly shall meet the performance requirements of 3.2.3 after exposure to elevations up to 50,000 feet above sea level (1.7 psia) for four hour minimum. (MET-2951)

3.2.6.1.7 Solar Radiation

The MET Sensor shall meet its full performance requirements without performance or physical degradation during and after exposure to solar radiation for 16 hours a day at the maximum high temperature system environment specified herein. (MET-2953)

3.2.6.1.8 Snow

The MET Sensor shall meet its full performance requirements without performance or physical degradation during and after exposure to falling snow crystals of 0.5 to 20mm diameter of sufficient density to accumulate 4 inches per hour. Snow conditions shall persist for extended durations allowing snow loads of 20 lbs./ft2. (MET-2956)

3.2.6.1.9 Ice

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation during and after exposure to icing conditions of suspended ice crystals averaging 5 to 20 microns in diameter of sufficient density to limit visibility to 5 feet. Icing conditions shall persist for extended durations allowing ice buildup of 6 inches. Removal of ice deposits before operation is permissible. (MET-2958)

3.2.6.1.10 Wind

Wind is included as part of wind velocity per section 3.2.3.3.3 (MET-2960)

3.2.6.1.11 Rain

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation during and after exposure to a 12 hour rainfall with droplet size ranging from 0.5mm to 4.5mm with a median of 2.5mm at a wind velocity of 18 m/s. (MET-2962)

3.2.6.2 Induced Environment

3.2.6.2.1 Vibration

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation during and after vibrational stresses as outlined in the composite isolated random-on-random vibration Tables III through V for turret locations applied in each direction of three mutually perpendicular axes as shown in Figure 3.2.1.1-1. (MET-2965)

Table III. Turret Vertical Vibration

Broadband Random Vibration

Break Point #	Frequency (Hz)	PSD Amplitude (g2/Hz)
1	10	0.00011396
2	36	0.00771864
3	62	0.00017939
4	87	0.000473
5	113	0.0018724
6	139	0.00498461
7	165	0.00086041
8	191	0.00148355
9	216	0.00085938
10	242	0.00580799
11	268	0.0031428
12	294	0.00107434
13	319	0.00022362
14	345	0.00030966
15	371	0.00029694
16	397	0.00095027
17	423	0.00026361
18	448	0.00116864
19	474	0.00010423
20	500	5.3726E-05

Broadband G RMS =	0.81

Test Duration
150 min for simulated 6000 miles

Amplitude Exaggeration Factor = 2.69

Notes:
1) Control System Frequency Resolution = 1Hz
2) Narrowband sweep times are for one direction. (Example: 20 min. low to high. 40 min. low to high to low

Sweeping Narrowband Random Vibration

Band #1	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	20	0.0111159
Sweep Rate	2	26	0.1456742
25 min.	3	42	0.1996458
Linear	4	50	0.0143167
	5	55	0.0176909
Bandwidth	6	79	0.0076211
4.0	7	89	0.0132166
Hz	8	101	0.1258407

Band #2	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	40	0.0086833
Sweep Rate	2	64	0.0071623
25 min.	3	83	0.0477998
Linear	4	100	0.0325563
	5	110	0.1403283
Bandwidth	6	144	0.0042402
8.0	7	179	0.0045302
Hz	8	202	0.0170295

Band #3	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	59	4.5658E-05
Sweep Rate	2	77	0.0010259
25 min.	3	125	0.0618134
Linear	4	182	0.0050753
	5	268	0.0138949
Bandwidth	6	294	0.0009843
12.0	7	303	0.0009199
Hz	8		

Band #4	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	79	0.0002384
Sweep Rate	2	129	0.0092573
25 min.	3	152	0.002058
Linear	4	243	0.0087094
	5	287	0.0003933
Bandwidth	6	316	6.6421E-05
16.0	7	357	0.0010099
Hz	8	404	0.0119685

Table IV. Turret Transverse Vibration (longitudinal)

Broadband Random Vibration

Break Point #	Frequency (Hz)	PSD Amplitude (g2/Hz)
1	10	0.00034911
2	36	0.00223195
3	62	8.573E-05
4	87	7.1971E-05
5	113	0.00021845
6	139	9.5091E-05
7	165	9.1476E-05
8	191	0.0002029
9	216	0.00036095
10	242	0.00274829
11	268	0.00030644
12	294	8.4464E-05
13	319	2.3575E-05
14	345	6.6883E-05
15	371	0.00017246
16	397	0.00079405
17	423	5.7875E-05
18	448	4.7273E-05
19	474	5.3894E-05
20	500	2.8173E-05

Broadband G RMS =	0.40

Test Duration
150 min for simulated 6000 miles

Amplitude Exaggeration Factor = 2.69

Notes:

1) Control System Frequency Resolution = 1Hz

2) Narrowband sweep times are for one direction. (Example: 20 min. low to high. 40 min. low to high to low

Sweeping Narrowband Random Vibration

Band #1	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	15	0.0022393
Sweep Rate	2	26	0.0184658
25 min.	3	38	0.2231295
Linear	4	53	0.0108915
	5	63	0.0012418
Bandwidth	6	70	0.0003341
4.0	7	89	0.0045123
Hz	8	100	0.0013935

Band #2	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	29	1.3199E-05
Sweep Rate	2	83	0.0024956
25 min.	3	100	0.0008614
Linear	4	107	0.0036374
	5	141	0.0003478
Bandwidth	6	158	0.0010078
8.0	7	189	0.0024279
Hz	8	201	0.0052833

Band #3	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	44	0.0019815
Sweep Rate	2	77	0.0003317
25 min.	3	149	0.001464
Linear	4	160	0.0032034
	5	211	0.0012248
Bandwidth	6	248	0.0020454
12.0	7	268	0.0001995
Hz	8	301	0.000183

Band #4	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	59	0.0001153
Sweep Rate	2	152	0.0002343
25 min.	3	243	0.0036255
Linear	4	252	0.0002448
	5	316	9.9412E-06
Bandwidth	6	331	1.9152E-05
16.0	7	357	0.0002139
Hz	8	401	0.0064459

Table V. Turret Longitudinal Vibration

Broadband Random Vibration

Break Point #	Frequency (Hz)	PSD Amplitude (g2/Hz)
1	10	3.3311E-05
2	36	0.00482701
3	62	0.00109504
4	87	7.5246E-05
5	113	0.00212645
6	139	0.00058694
7	165	8.7136E-05
8	191	5.5466E-05
9	216	9.1772E-06
10	242	2.6661E-05
11	268	9.266E-06
12	294	3.6813E-06
13	319	6.7726E-07
14	345	8.6117E-07
15	371	1.8513E-06
16	397	5.675E-06
17	423	1.0608E-05
18	448	0.00034245
19	474	0.00049351
20	500	6.8959E-05

Broadband G RMS =	0.43

Test Duration
150 min for simulated 6000 miles

Amplitude Exaggeration Factor = 2.69

Notes:
1) Control System Frequency Resolution = 1Hz
2) Narrowband sweep times are for one direction. (Example: 20 min. low to high. 40 min. low to high to low

Sweeping Narrowband Random Vibration

Band #1	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	19	0.002642
Sweep Rate	2	26	0.0186367
25 min.	3	26	5.9089E-05
Linear	4	50	0.0568218
	5	53	0.2356028
Bandwidth	6	70	0.0153865
4.0	7	89	0.0057652
Hz	8	101	0.0695885

Band #2	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	38	0.0006815
Sweep Rate	2	51	0.0028896
25 min.	3	53	0.0003136
Linear	4	76	0.0051134
	5	88	0.0039073
Bandwidth	6	107	0.0921744
8.0	7	141	0.0012416
Hz	8	202	0.0004206

Band #3	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	57	0.0033509
Sweep Rate	2	77	0.0011421
25 min.	3	79	1.6494E-05
Linear	4	114	0.0053923
	5	182	0.0002846
Bandwidth	6	237	3.4362E-05
12.0	7	268	5.9268E-05
Hz	8	303	1.4873E-08

Band #4	Break Point #	Center Frequency	PSD Amplitude (g2/Hz)
	1	76	0.0033509
Sweep Rate	2	105	0.0069295
25 min.	3	152	0.0003961
Linear	4	243	3.5623E-05
	5	281	1.8591E-06
Bandwidth	6	328	5.5411E-07
16.0	7	357	4.3153E-06
Hz	8	404	7.8992E-05

3.2.6.2.2 High Temperature

3.2.6.2.2.1 Storage and Transportation

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation after storage at up to 160 degrees F (71 degrees C). (MET-2973)

3.2.6.2.2.2 Operational

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation during its worst case thermal operating cycle at ambient air temperatures of 160 degrees F (71 degrees C). (MET-2975)

3.2.6.2.3 Low Temperature

3.2.6.2.3.1 Storage and Transportation

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation after storage at -60 degree F (-51 degrees C). (MET-2979)

3.2.6.2.3.2 Operational

The assembly shall meet its full performance requirements 3.2.3 without performance or physical degradation during continuous operation, immediately after power up at an ambient temperature of -40 degree F (-40 degrees C). (MET-2984)

3.2.6.2.4 Temperature Shock

The assembly shall meet its full performance requirements of 3.2.3 after withstanding sudden changes in the temperature range between the low storage temperature and high storage temperature extremes specified herein. (MET-2986)

3.2.6.2.5 Shock

3.2.6.2.5.1 Basic Shock

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation with continuous operation during and after exposure to peak wave shock impulses applied in each direction of three mutually perpendicular axes as shown in Figure 3.2.1.1-2. The shock pulse shall be as described in Table XXI. (MET-2989)

Table VI. Tabulated Acceleration Curve

Frequency (Hz)	Shock Level (g)
1	0.5
25	50
85	50
200	34
500	32

3.2.6.2.5.2 Functional Shock

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation with continuous operation during and after exposure to three half-sine wave shock impulses of 15 ± 3 g, 75.0 ms applied in each direction of the three mutually perpendicular axes as shown in Figure 3.2.1.1-2 (18 total shock impulses). (MET-3011)

3.2.6.2.5.3 Gun Firing Shock

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation with continuous operation during and after exposure to three half-sine wave shock impulses of 225 g ± 20%, 0.5 ± 0.1 ms applied in each direction of the three mutually perpendicular axes as shown in Figure 3.2.1.1-2 (18 total shock impulses). (MET-3013)

3.2.6.2.5.4 Ballistic Shock

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation with continuous operation during and after exposure to shock impulses described in Table XXII applied in each direction of the three mutually perpendicular axes as shown in Figure 3.2.1.1-2. (MET-3016)

Table VII. Ballistic Shock Equivalent Static Acceleration

Frequency (Hz)	Shock Level (g)
30	20
175	500
10000	30000
100000	300000

3.2.6.2.5.5 High Intensity Shock

The assembly shall remain intact and not become a secondary projectile when subjected to exposure of three half-sine wave shock impulses of 950 g ± 20%, 0.5 ± 0.05ms applied in each positive and negative direction of the three mutually perpendicular axes (Total of 18 shock impulses). (MET-3035)

3.2.6.2.5.6 Transport Shock

This paragraph is not applicable to this specification. (MET-3038)

3.2.6.2.5.7 Handling Shock

This paragraph is not applicable to this specification. (MET-3040)

3.2.6.2.5.8 Bench Handling Shock

The assembly shall meet the performance requirements of 3.2.3 without performance or physical degradation after undergoing a bench handling test. (MET-3042)

3.2.6.2.5.9 Wrench Impact

This paragraph is not applicable to this specification. (MET-3044)

3.2.6.2.5.10 Boot Impact

This paragraph is not applicable to this specification. (MET-3046)

3.2.6.2.6 Submergence

This paragraph is not applicable to this specification. (MET-3048)

3.2.6.2.7 Steam and Water Jet Cleaning

The assembly shall meet the performance requirements of 3.2.3, without degradation, and show no evidence of damage or deformation following a steam and water (at 75 degrees C) jet cleaning process, which uses a cleaner conforming to A-A-59133. Nozzle pressure shall be 110 + 11 pounds per square inch gage (psig). The water jet shall use a flat fan nozzle with a 0.25 to 0.30 inch orifice and 40 degree angle with water temperature of 175 +/- 10 degrees F. (MET-3050)

3.2.6.2.8 Noise Levels

This paragraph is not applicable to this specification. (MET-3053)

3.2.6.2.9 Atmospheric Pressure

This paragraph is not applicable to this specification. (MET-3055)

3.2.6.2.10 Explosive Atmosphere

This paragraph is not applicable to this specification. (MET-3057)

3.2.6.2.11 Rapid Decompression

The assembly shall meet its full performance requirements of 3.2.3 without performance or physical degradation damage after rapid decompression from an altitude of 15,000 feet to an equivalent altitude of 40,000 feet in less than 15 seconds, with sustained exposure to the reduced pressure for at least 10 minutes. (MET-3059)

3.2.6.2.12 Chemicals

The assembly shall meet its full performance requirements without performance or physical degradation after exposure to the following fluids:

a. MIL-DTL-5624U (Grade JP-4 and JP-5), MIL-DTL-83133F (Grade JP-8) or ASTM D1655-08 (Commercial turbine jet -1 or A-1)

b. ASTM D 4814-09 (MoGas) or regular automotive leaded gasoline

c. Hydraulic fluid per MIL-PRF-46170E

d. Cleaning agents per A-A-59133A (MET-9447)

3.2.6.2.13 Combined Environment

This paragraph is not applicable to this specification. (MET-3071)

3.2.6.2.14 Nuclear Hardness Criteria

This paragraph is not applicable to this specification. (MET-3073)

3.2.6.2.15 Elevation

3.2.6.2.15.1 Elevation - Operating

This paragraph is not applicable to this specification. (MET-3078)

3.2.6.2.15.2 Elevation - Non-operating

This paragraph is not applicable to this specification. (MET-3080)

3.2.6.2.16 Pressure Variation at Temperature

3.2.6.2.16.1 Pressure Variation at Operating Temperature

This paragraph is not applicable to this specification. (MET-3083)

3.2.6.2.16.2 Pressure Variation at Non-operating Temperature

This paragraph is not applicable to this specification. (MET-3085)

3.3 Design and Construction

3.3.1 Production Drawings

Drawings shall comply with:

a. ASME Y14.100-2013
b. ASME Y14.5M-2009 (MET-3088)

3.3.2 Materials, Processes and Components

3.3.2.1 Insulating and Impregnating Compounds

This paragraph is not applicable to this specification. (MET-3093)

3.3.2.2 Fasteners/Connectors/Fittings

The assembly connectors shall meet the following requirements:

- The dc bonding resistance, measured with interfacing electrical harnesses disconnected, shall not exceed 50 milliohms.
- Connectors used to provide separation of or connection to multiple electric circuits shall be selected so that it will be impossible to insert the wrong plug in a receptacle or other mating unit.
- Connector dust caps and cap retaining chains shall be installed on all test connectors, and on any other connector which does not have a cable attached during normal operation of the assembly. (MET-3095)

3.3.2.3 Castings

Parts (standard, commercial, and qualified) which are in current production and available, as indicated by qualified parts lists, shall be used whenever possible. Selection of qualified parts shall be compatible with requirements specified in the end item specifications. (MET-3100)

3.3.2.4 Soldering

Soldering shall comply with the general requirements of ANSI/IPC 610A Class 3 and ANSI/J-STD-001 Class 3. The assembly shall use Lead (Pb) based solder and/or components in the assembly. The use of Lead (Pb)-free Solder and electrical components may not be used without approval by GDLS. If the Supplier uses Lead (Pb)-free Solder and/or electrical components, the Supplier must provide a Lead (Pb)-free Control Plan which includes the following: the type(s) of Lead (Pb)-free solder used, identification of components/parts manufactured with the Lead (Pb)-free solder, tests and applicable test standards used to validate the reliability, performance, and safety requirements of the part, and the validation test results, All lead-free components and/or lead-free solder must have a lead-based rework plan. When a legacy leaded component is no longer available, an alternative lead-free component must be qualified and approved by GDLS before use following the same procedure as regular component obsolescence management. (MET-3102)

3.3.2.5 Corrosion of Metal Parts

Corrosion resistant materials shall be used wherever possible. When metal or other materials are used which require surface protection, the cleaning methods, surface treatments, metal coatings, or other finishes used to construct the assembly will be in accordance with best commercial practices and/or specifications to meet the assembly intended service life and specific corrosion requirements. (MET-3104)

3.3.2.6 Galvanic Corrosion

Dissimilar metals shall not be used in direct contact with one another unless suitably protected to prevent electrolytic corrosion. (MET-3106)

3.3.2.7 Selection of Parts and Materials

The following materials are restricted in design. Any use of these materials will require that the components be identified by part number and a waiver will be sought via GDLS Materials Engineering. GDLS Materials Engineering will review, approve or disapprove the requests based on technology, availability, cost, and functional requirements. This includes, but is not limited to, base materials, plating material, coatings, adhesives, and lubricants.

- Asbestos
- Beryllium and Beryllium Alloys
- Cadmium and Cadmium Alloys
- Class I and Class II Ozone Depleting Substances
- Hexavalent Chromium
- Lead and Leaded Alloys
- Mercury
- Radioactive Materials

- Group 1 Agents Classified as Carcinogenic to Humans by the International Agency for Research on Cancer (IARC) Monographs

Exceptions to the use of restricted materials are shown below. No waiver request is required for the following:

- Cadmium on electrical connectors and back shells used to mate with cadmium electrical connectors on Government Furnished Equipment (GFE)

- Hexavalent Chromium used as a post-treatment on Cadmium plated electrical connectors and back shells used to mate to cadmium electrical connectors on GFE.

- Lead in engine bearings

- Lead-acid batteries
- Lead solder
- Steel containing up to 0.35% lead by weight
- Aluminum containing up to 0.4% lead by weight
- Copper and Brass alloys containing up to 4% lead by weight
- Beryllium and Beryllium alloys used in electrical components
- Nickel and Nickel alloys used in electrical components
- Mercury containing components compliant with European Union (EU) Directive 2002/95/EC (RoHS)
- Trace amounts of identified prohibited materials contained in base materials and/or alloys are to be reported, but do not require a waiver. Trace amounts are defined as <0.1% for carcinogens and <1% for all other materials. (MET-3108)

3.3.2.8 Treatment and Painting

3.3.2.8.1 Protective Coatings and Surface Treatments

All metal surfaces, except for the electrical contracts shall be treated for corrosion resistance and prevention of electrolytic action between dissimilar metals.

The external surfaces of the housings shall have nonabrasive, low reflectance surfaces. All circuit card assembly surfaces, except for the following, shall be conformal coated:

- Connectors
- Thermal conduction surfaces

Conformal coatings shall not contain Class I or Class II Ozone Depleting Chemicals and shall follow the guidelines detailed in IPC-HDBK-830. (MET-3131)

3.3.2.9 Part Obsolescence

All parts of the assembly shall be selected to ensure that no parts are obsolete. (MET-3136)

3.3.3 Construction

3.3.3.1 Modular Construction

The assembly will meet the interchangeability requirement of MIL-HDBK-454B, Guideline 7. (MET-3139)

3.3.4 Workmanship

Workmanship shall be such that the assembly shall be free of burrs, chips, scratches, sharp edges, cracks, corrosion, or surfaces out of alignment or contour (visually apparent). There shall be no evidence of conditions that could present a safety hazard to operating or maintenance personnel. The assembly shall contain no loose or foreign material. Electrical portions of the assembly shall be in accordance with MIL-HDBK-454B Requirement 9 and MIL-STD-252B Type 12. (MET-3141)

3.3.5 Identification and Marking

The assembly shall be identified and marked with a machine readable information (MRI) marking protocol in accordance with MIL-STD-130N. Unique item identifier (U11) construct No.2 format is preferred with information displayed as both MRI and Human Readable Information (HRI). If achievable, MRI cell size should be 10 mil or larger. The information to be provided as MRI shall include but not limited to manufacturer cage code, original part number and serial number. The marking method is optional. (MET-3143)

3.3.6 Safety

3.3.6.1 Personnel Safety

The assembly shall be designed to minimize the probability and severity of injury to personnel throughout the system’s life cycle. (MET-3146)

3.3.6.1.1 Surface Temperature

This paragraph is not applicable to this specification. (MET-3148)

3.3.6.1.2 Entrapment

This paragraph is not applicable to this specification. (MET-3150)

3.3.6.1.3 Flammability

This paragraph is not applicable to this specification. (MET-3152)

3.3.6.1.4 Steady State Noise

This paragraph is not applicable to this specification. (MET-3154)

3.3.6.2 Mechanical Safety

The assembly shall include the mechanical safety provisions specified in section 5.13.5.4 of MIL-STD-1472G. (MET-3156)

3.3.6.3 Electrical Safety

The assembly design will include the electrical safety provisions specified in MIL-HDBK-454B, Guideline 1. (MET-3158)

3.3.6.3.1 Electrical Overload Protection

This paragraph is not applicable to this specification. (MET-3160)

3.3.6.3.2 Electrical Safety Hazards

This paragraph is not applicable to this specification. (MET-3162)

3.3.6.3.3 Electrical Interlocks

This paragraph is not applicable to this specification. (MET-3164)

3.3.6.3.4 Electromagnetic Effects

Refer to Para 3.4 (MET-3166)

3.3.6.3.5 Arc and Spark Prevention

This paragraph is not applicable to this specification. (MET-3168)

3.3.6.3.6 Electrical Grounding

The assembly shall provide a conductive surface at its mounting interface. (MET-3170)

3.3.6.3.7 Electrical Short Circuiting

This paragraph is not applicable to this specification. (MET-3172)

3.3.6.3.8 Electrical Safety Labels

This paragraph is not applicable to this specification. (MET-3174)

3.3.6.3.9 Equipment Safe Shutdown

This paragraph is not applicable to this specification. (MET-3176)

3.3.6.3.10 Non-Ionizing Radiation

The assembly shall be designed to protect personnel and equipment from Electromagnetic Radiation Hazards. The assembly shall limit personnel exposure to radio frequency or microwave radiation to values listed in IEEE C95.1 as supplemented by DoDI 6055.11. (MET-3178)

3.3.6.3.11 Warning/Caution Labels/Decals

Warning labels/ decals used on the assembly shall conform to ANSI-Z535.4. All markings will be located where they are readily visible and not be removed when a barrier or access door is opened or removed. (MET-3181)

3.3.6.4 Chemical Safety

No material or component shall be used in the assembly which, during any phase of the life cycle, emits toxic gases, vapors, fumes, or droplets. (MET-3183)

3.3.6.5 Equipment Safety

The system shall be designed to minimize equipment damage, degradation of efficiency, or mission failure due to the following conditions:

a. Operator induced errors.

b. Improper cabling.

c. Power failure or electrical overstress of components.

d. Secondary failures.

e. Improper installation, storage, operation, handling, maintenance, and transportation.

f. Lack of overload protection.

g. Connector pins used on chassis, panels, or cable entrance connectors shall be recessed to prevent breakage or damage.

h. When the interchange of connectors may result in damage to the equipment or hazards to personnel, the connectors shall be designed to prevent interchange. (MET-3185)

3.3.6.6 Environmental Safety

The assembly shall be designed to limit personnel exposure to any surface temperature greater than 140^{o}F with the assembly operating at an ambient air temperature of 125^{o}F. (MET-3195)

3.3.6.7 Software/Hardware Interface Safety

This paragraph is not applicable to this specification. (MET-3197)

3.4 Electromagnetic Environmental Effects (E3)

3.4.1 Electromagnetic Interference (EMI)

The non-prime powered MET Sensor shall meet the following requirements of MIL-STD-461F for an Army Ground application: CS114, CS115 CS116, RE102 and RS103. The CS114, CS115, and CS116 tests are only applicable to the MET Sensor interconnecting cable(s). In addition, since the MET Sensor will be mounted external to the vehicle structure, the unit shall also be shown through analysis, test, or a combination of both that it meets the additional requirements to include MIL-STD-461F’s RS105, and the RF EME levels specified in ATPD-2407, Table II. (MET-3200)

3.4.2 Electrostatic Discharge (ESD)

3.4.2.1 ESD Upset and Damage

During normal operation the assembly shall be protected from upset and damage due to a personnel electrostatic discharge described in ATPD-2407; contact discharges shall be applied at levels of ±4 kV, ±6 kV, and ±8 kV. The air discharges shall be applied at levels of ±4 kV, ±6 kV, ±8 kV, and ±15 kV.

(MET-3203)

3.4.2.2 ESD Maintenance

The assembly shall be protected against damage due to a personnel electrostatic discharge described in ATPD-2407; contact discharges shall be applied at levels of ±4 kV, ±6 kV, and ±8 kV. The air discharges shall be applied at levels of ±4 kV, ±6 kV, ±8 kV, and ±15 kV

(MET-3205)

3.4.3 Bonds and Grounds

The assembly shall provide electrical continuity across mechanical interfaces for control of E3 such that system operational performance requirements are met. The assembly shall provide a provision for attaching a ground strap between itself and vehicle structure.

The following bonding resistance limits shall apply over the life of the assembly

• 2.5 milliohms or less across the individual faying interfaces of the assembly enclosure

• 5 milliohms or less from the MET Sensor bonding provision to electrical connectors mounted on the assembly chassis

The assembly shall not use the structure for return current paths.

(MET-9442)

3.5 Human Performance/Human Engineering

Human engineering design shall be accomplished using the guidelines of MIL-STD-1472G. The human engineering effort shall also ensure that compatibility of the assembly workspace and maintenance accesses with the clothing and personal equipment to be worn by personnel maintaining the assembly shall be basic design driver. Task allocation and control movements shall be compatible with restrictions imposed on human performance by clothing and personal equipment. The range of maintainer positions shall be also considered in the design. (MET-3209)

3.6 Nuclear Survivability and Hardening

3.6.1 Nuclear Radiation

The assembly shall meet the performance requirements of section 3.2.3 after exposure to initial nuclear radiation, which includes neutron fluence, gamma dose rate and gamma total dose as specified in LS201200015649

(MET-3212)

3.6.2 Transient Response and Recovery

Transient upset of the assembly is allowable during exposure to nuclear radiation provided the assembly recovers by manually removing and reapplying input power. (MET-3214)

3.6.3 Nuclear Hardening Design and Technical Data

Hardness Critical Items (HCIs) and Hardness Critical Processes (HCPs) shall be identified in technical data drawings and specifications per 402.16.6 of DoD-STD-00100D(AR). Electronic piece part HCIs shall be source controlled except when the generic military standard part has a design margin of greater than 10 with respect to nuclear radiation or Electromagnetic Pulse (EMP) failure in the circuit application. Electronic piece parts which have a probability of survival in the circuit application of less than 99 percent at 90 percent confidence shall not be used. (MET-3216)

3.7 Chemical, Biological and Radiological Contamination Survivability (CBR CS)

3.7.1 CBR Hardening

The assembly shall utilize materials, surface treatments/coatings, and design strategies to ensure the assembly is hardened against the exterior threat levels of chemical, biological, and radiological contamination as defined in United States Army Nuclear and Combating WMD Agency (USANCA) "NBC Contamination Survivability Criteria for Army Materiel, 30 May 2005."

(MET-3220)

3.7.2 CBR Decontamination

The exterior assembly shall be hardened to decontamination procedures using 40% SuperTropical Bleach (STB) slurry for 30 minutes in accordance with thorough decontamination procedures, and the interior Assembly shall be hardened to decontamination procedures using 5% STB slurry for 30 minutes following FM 3-11.5, Multiservice tactics, techniques, and procedures for Nuclear, Biological, and Chemical Defense Operations. (MET-3226)

3.7.3 CBR Decontaminability

The assembly design shall consider the decontaminability of the system in their design(s) to include the use of materials, surface treatments (such as Chemical Agent Resistant Coating, CARC), and design approaches that facilitate decontamination and minimize the time required to decontaminate to safe levels as defined in "NBC Contamination Survivability Criteria for Army Materiel, 30 May 2005." (MET-3228)

3.7.4 Neutron Induced Gamma Activity

The assembly design, when practical, shall limit the use of materials (Tantalum, Zinc, Manganese, Gold, and Copper) that will contribute to system-level Neutron Induced Gamma Activity. NOTE: The use of alternate materials to meet the NIGA requirements should only be considered when equivalent performance/cost can be achieved.

. (MET-3230)

3.8 Useful Life

3.8.1 Service Life

The assembly shall have a minimum service life of twenty (20) years. (MET-3244)

3.8.2 Shelf Life

The assembly shall have a minimum shelf life of five (5) years when stored in an appropriate container that can maintain between 10 and 60 percent relative humidity, temperature between -25°F and +160°F, and non-corrosive environment. The assembly shall meet the performance requirements after storage of components for periods of up to five years. (MET-3246)

3.9 Logistics

3.9.1 Maintenance

3.9.1.1 Maintenance Concept

This paragraph is not applicable to this specification. (MET-3250)

3.9.1.1.1 Field Maintenance

This paragraph is not applicable to this specification. (MET-3256)

3.9.1.1.2 Sustainment Maintenance

This paragraph is not applicable to this specification. (MET-9441)

3.9.1.1.3 Supply

Maximum practical use shall be made of common modules, military standard parts, materials and equipment within the Department of Defense (DoD) inventory in order to minimize the impact upon the supply system. The assembly shall impose no unique requirements on the supply system. (MET-3260)

3.9.1.1.4 Facilities and Facility Equipment

The assembly shall be designed to be maintained in existing DoD facilities and with existing facility equipment, to the maximum extent feasible. (MET-3262)

4 Quality Assurance Provisions

4.1 General

The basic objective of Quality Assurance is to verify that all the requirements of Section 3 have been achieved. Verification of Section 3 requirements shall be accomplished by the methods defined in this specification. The formal testing/verification programs shall be designed to satisfy the demonstration, test, inspection and analysis verification requirements of this specification. (MET-3265)

4.1.1 Responsibility for Tests

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all the Quality Assurance Provisions specified herein (section 4) to determine conformance to the requirements of section 3. Except as otherwise specified, the supplier may utilize its own facilities or any commercial laboratory acceptable to the procuring activity/Government. The procuring activity/Government reserves the right to perform or witness any of the inspections set forth in this document where such inspections are deemed necessary to assure supplies and service conform to prescribed requirements. (MET-3267)

4.1.1.1 Responsibility for Compliance

All assemblies shall meet all requirements of section 3. The inspection set forth in this specification shall become a part of the supplier's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the supplier of the responsibility of ensuring that all products or supplies submitted to the procuring activity/Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the procuring activity/Government to accept defective material. (MET-3269)

4.1.2 Inspection Equipment

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the provision and maintenance of all inspection and test equipment necessary to ensure supplies and services conform to contract/purchase order requirements. The supplier may utilize equipment or methods equal to or exceeding the accuracy and precision requirements of any equipment that may be specified herein. Under any circumstance, measurements shall be made to an accuracy of ten percent of the component tolerance. Calibration of inspection and test equipment shall be in accordance with ANSI/NCSL Z540.3 or equivalent. (MET-3271)

4.1.3 Inspection Records

Unless otherwise specified in the contract or order, the contractor is responsible for maintaining detailed records of all inspections performed herein. The inspection requirements specified herein and identified in the category of inspections of Table 4.1.5-1 are classified as follows:

- Design Verification Test (see 4.1.6)

- Qualification Test (see 4.1.7)
- First Article Test (see 4.1.8)
- Acceptance Test (see 4.1.9)
- Control Tests (see 4.1.10) (MET-3273)

4.1.3.1 Category of Inspection Classification Groupings

Groupings of inspections conducted under the categories of inspection as specified in Table 4.1.5-1 are as follows:

Group A - Nondestructive inspections of all items produced to demonstrate product compliance with contractual requirements. Group A inspections examine characteristics most affected by variations in production processes or skills and functions vital to successful completion of the design mission.

Group B - Generally nondestructive inspections that are more complex or of a longer duration than Group A inspections. Group B inspections examine characteristics more affected by part or equipment quality and less affected by variations in production processes or skills, and functions requiring special fixtures or environments, and tests that are more complex and of longer duration than Group A tests. Each part shall be individually evaluated regarding its issue after performing Group B inspections.

Group C - Periodic and possibly destructive tests of characteristics depending upon product design and materials. Group C inspections consist of more complex tests; usually including simulated service environments. Tests are generally performed during qualification and first article testing and in selected instances on a control basis predicated on production quantities and/or time period. Except for articles used in qualification testing (see 4.2), each article shall be individually evaluated regarding its issue after performing Group C inspections.

Group D - Destructive tests or tests of long duration that consume all or a considerable portion of design service life. Articles subjected to Group D inspections shall not be issued. Tests are performed on few samples based on production quantities or time period.

Group E - Nondestructive examination of packaging to verify the ability of the packaging to protect items during shipment. (MET-3281)

4.1.4 Inspection Conditions

Unless otherwise specified, all tests shall be conducted under the following conditions: (MET-3283)

a. Temperature Room ambient (20 ±10 degrees C) (MET-3284)

b. Barometric pressure Facility ambient (MET-3285)

c. Humidity - Facility ambient (up to 95 percent relative) (MET-3286)

4.1.5 Category of Inspection and Verification

The requirements of section 3 of this specification shall be verified by the qualification method of section 4 using the category of qualification as shown in Table 4.1.5-1. The qualification methods are as follows: (MET-3288)

a. N/A - Not applicable (title only, etc.) (MET-13616)

b. Inspection/Examination (I/E) - Non-destructive visual, auditory, olfactory, tactile, simple physical manipulations, gaging, and measurement inspections. (MET-13617)

c. Analysis (A) - Analytical verification by mathematical analysis; statistical analysis; evaluation of the correlation of measured data and observed test result with calculated expected values; and conformance of end items with contractor generated specifications and documentation from lower tier suppliers; as well as Government-approved configuration item specifications and documentation. (MET-13618)

d. Demonstration (D) - An un-instrumented test where success is determined on the basis of observations alone. (MET-13619)

e. Test (T) - Instrumented tests verified by actual measurement that the equipment meets the requirements of the specification when subjected to the actual conditions (or simulated conditions) specified. (MET-13620)

The categories of when each requirement paragraph shall be performed are identified in Table 4.1.5-1 Category of Inspection and Verification as follows: (MET-13621)

a. Design Verification Test (DVT) - Generally for Engineering use only during design and development. DVT is intended for Engineering to identify improvement opportunities and mitigate design deficiencies as early as possible in the procurement effort. DVT is not a formal process or procedure and relies upon Engineering experience and intuition to determine appropriate test methods and interpretation of results. DVT is not a substitute for Qualification Testing but rather a way to ensure high confidence in a successful Qualification Test effort. (MET-13622)

b. Design Qualification (DQ) - Activities performed prior to production to verifiy design parameters. (MET-13623)

c. First Article Test (FAT) - Tests conducted to verify that the material, processes, tooling, equipment, techniques, standards, personnel and controls used to produce the First Article samples, meet the performance requirements of the TDP before, during and after all specified environmental and durability/endurance conditions. (MET-13624)

d. Acceptance Test (AT) - Shall be utilized and acceptance testing performed on each unit produced and before, during, and after all environmental requirements of this specification. (MET-13625)

e. Control Test (CT) - Periodic testing, including environmental and endurance tests, conducted to verify that the material, processes, tooling, equipment, techniques, standards, personnel and controls used to produce the First Article samples, which received First Article Approval, continue to produce components that meet the TDP Requirements. (MET-13626)

Table 4.1.5-1: Category of Inspection and Verification

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
Major Component List	3.1.1	MET-300		X									

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
Non-Government Furnished Equipment (GFE) List	3.1.2	MET-324		X									
Government Furnished Property (GFP) List	3.1.3	MET-326		X									
Government Loaned Property (GLP) List	3.1.4	MET-328		X									
Mechanical Interfaces	3.1.5.1	MET-331		X									
Physical Interfaces	3.1.5.1.2	MET-9756			X					X			
Grounding	3.1.5.1.3	MET-9757			X					X			
Thermal Interfaces	3.1.5.1.4	MET-9758				X				X			
Data Interface	3.1.5.2.1	MET-9763				X				X			
Cable Disconnect	3.1.5.2.2	MET-9764				X				X			
Space Claim	3.2.1.1	MET-337			X					X			
Weight	3.2.1.3	MET-339	A		X					X	X		X
Mounting	3.2.1.4	MET-341	A		X					X			
Color	3.2.1.5	MET-343	A		X					X			
Input Voltage	3.2.3.2.1	MET-464	B					X		X	X	X	X
Input Voltage Transients and Protection Circuits	3.2.3.2.1.1	MET-9485	B					X		X	X		
Short Circuit Protection	3.2.3.2.1.2	MET-9489	B	X									
Steady State	3.2.3.2.2.1	MET-9964	B					X		X	X	X	X
Inrush Current	3.2.3.2.2.2	MET-9553	B					X		X	X	X	X
Chassis Isolation	3.2.3.2.3	MET-9380	B					X		X	X	X	X
Power-up Timing	3.2.3.2.4	MET-9381	B					X		X	X	X	X
Serial Interface	3.2.3.2.5	MET-9383	B					X		X			
Temperature	3.2.3.3.1	MET-9776	B	X									
Range	3.2.3.3.1.1	MET-9781	B					X		X	X	X	X
Accuracy	3.2.3.3.1.2	MET-9782	B					X		X	X	X	X
Resolution	3.2.3.3.1.3	MET-9783	B					X		X	X	X	X
Barometric Pressure	3.2.3.3.2	MET-9777	B	X									
Range	3.2.3.3.2.1	MET-9787	B					X		X	X	X	X
Accuracy	3.2.3.3.2.2	MET-9788	B					X		X	X	X	X
Resolution	3.2.3.3.2.3	MET-9789	B					X		X	X	X	X

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
Crosswind Velocity	3.2.3.3.3	MET-9784	B	X									
Range	3.2.3.3.3.1	MET-9798	B					X		X	X	X	X
Accuracy	3.2.3.3.3.2	MET-9799	B					X		X	X	X	X
Resolution	3.2.3.3.3.3	MET-9800	B					X		X	X	X	X
Wind Velocity Response	3.2.3.3.3.4	MET-9816	B			X				X			
Wind Velocity Bandwidth	3.2.3.3.3.5	MET-9817	B					X		X	x	x	X
Zero Level	3.2.3.3.3.7	MET-9819	B					X		X	x	x	X
Analog Output Fault	3.2.3.3.3.8	MET-9820	B					X		X	x	x	X
Headwind Velocity	3.2.3.3.4	MET-9785	B	X									
Range	3.2.3.3.4.1	MET-9803	B					X		X	X	X	X
Accuracy	3.2.3.3.4.2	MET-9804	B					X		X	X	X	X
Resolution	3.2.3.3.4.3	MET-13519	B					X		X	X	X	X
Wind Velocity Response	3.2.3.3.4.4	MET-13522	B			X				X			
Humidity	3.2.3.3.5	MET-9786	B	X									
Accuracy	3.2.3.3.5.1	MET-9809	B					X		X	X	X	X
Resolution	3.2.3.3.5.2	MET-9810	B					X		X	X	X	X
Range	3.2.3.3.6.1	MET-9950	B					X		X	X	X	X
Accuracy	3.2.3.3.6.2	MET-9952	B					X		X	X	X	X
Resolution	3.2.3.3.6.3	MET-9955	B					X		X	X	X	X
Configuration Data	3.2.3.3.7	MET-9948	B					X		X	X	X	X
Nuclear Event Detection and Test	3.2.3.3.8	MET-14473	B	X									
NED Test Input	3.2.3.3.8.1	MET-14474	B					X		X	X	X	X
NED (Nuclear Event Detection)	3.2.3.3.8.2	MET-14476	B					X		X	X	X	X
Nuclear Event Shutdown	3.2.3.3.8.3	MET-14477	B					X		X	X	X	X
Reliability	3.2.4	MET-2860				X				X			
Qualitative Maintainability	3.2.5.1	MET-2863		X									
Quantitative Maintainability	3.2.5.2	MET-2868		X									
Preventative Maintenance Checks and Services (PMCS)	3.2.5.3	MET-2871			X					X			
Special Tools and Test Equipment	3.2.5.4	MET-2873				X				X			

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
Diagnostics/Testability	3.2.5.5	MET-2875				X		X		X			
Qualitative Diagnostics/Testability	3.2.5.5.1	MET-9446				X				X			
Power-up Built-In Test	3.2.5.5.1.1	MET-9444	B			X		X		X			
Continuous Built-In Test	3.2.5.5.1.2	MET-2881	B			X		X		X			
Initiated Built-in Test	3.2.5.5.1.3	MET-2889		X									
Quantitative Diagnostics	3.2.5.5.2	MET-2898	B			X		X		X			
Field Level	3.2.5.5.2.1	MET-2901				X		X		X			
Sustainment Support Level	3.2.5.5.2.2	MET-2903		X									
SRU Performance Verification	3.2.5.5.2.2.1	MET-2905		X									
SRU Fault Isolation	3.2.5.5.2.2.2	MET-2907		X									
Testability	3.2.5.6	MET-2920				X				X			
Operating Humidity	3.2.6.1.1.1	MET-2925		X									
Storage and Transportation	3.2.6.1.1.2	MET-2927		X									
Subsystem Operational	3.2.6.1.1.3	MET-2929	C					X		X	X		
Fungus	3.2.6.1.2	MET-2934	C			X		X		X	X		
Salt Fog	3.2.6.1.3	MET-2936	C					X		X	X		
Blowing Sand External	3.2.6.1.4.1	MET-2939	C					X		X	X		
Blowing Sand Internal	3.2.6.1.4.2	MET-2941	C	X									
Blowing Dust External	3.2.6.1.5.1	MET-2944	C					X		X	X		
Blowing Dust Internal	3.2.6.1.5.2	MET-2946	C	X									
Altitude	3.2.6.1.6	MET-2947	C	X									
Operating	3.2.6.1.6.1	MET-2949	C					X		X	X		
Non-Operating	3.2.6.1.6.2	MET-2951	C					X		X	X		
Solar Radiation	3.2.6.1.7	MET-2953		X									
Snow	3.2.6.1.8	MET-2956		X									
Ice	3.2.6.1.9	MET-2958	C					X		X			
Wind	3.2.6.1.10	MET-2960	C	X						X			
Rain	3.2.6.1.11	MET-2962	C					X		X			
Vibration	3.2.6.2.1	MET-2965	C D					X		X	X		X

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
High Temperature	3.2.6.2.2	MET-2971	C	X									
Storage and Transportation	3.2.6.2.2.1	MET-2973	C					X		X	X		X
Operational	3.2.6.2.2.2	MET-2975	C					X		X	X		X
Low Temperature	3.2.6.2.3	MET-2977	C	X									
Storage and Transportation	3.2.6.2.3.1	MET-2979	C					X		X	X		X
Operational	3.2.6.2.3.2	MET-2984	C					X		X	X		X
Temperature Shock	3.2.6.2.4	MET-2986	C					X		X	X		X
Basic Shock	3.2.6.2.5.1	MET-2989	C					X		X	X		X
Functional Shock	3.2.6.2.5.2	MET-3011	C					X		X	X		X
Gun Firing Shock	3.2.6.2.5.3	MET-3013	C					X		X	X		
Ballistic Shock	3.2.6.2.5.4	MET-3016	C			X				X			
High Intensity Shock	3.2.6.2.5.5	MET-3035						X		X			
Transport Shock	3.2.6.2.5.6	MET-3038		X									
Handling Shock	3.2.6.2.5.7	MET-3040		X									
Bench Handling Shock	3.2.6.2.5.8	MET-3042	C					X		X	X		X
Wrench Impact	3.2.6.2.5.9	MET-3044		X									
Boot Impact	3.2.6.2.5.10	MET-3046		X									
Submergence	3.2.6.2.6	MET-3048		X									
Steam and Water Jet Cleaning	3.2.6.2.7	MET-3050	C					X		X	X		
Noise Levels	3.2.6.2.8	MET-3053		X									
Atmospheric Pressure	3.2.6.2.9	MET-3055		X									
Explosive Atmosphere	3.2.6.2.10	MET-3057		X									
Rapid Decompression	3.2.6.2.11	MET-3059	C					X		X			
Chemicals	3.2.6.2.12	MET-9447	C					X		X	X		
Combined Environment	3.2.6.2.13	MET-3071		X									
Nuclear Hardness Criteria	3.2.6.2.14	MET-3073		X									
Elevation - Operating	3.2.6.2.15.1	MET-3078		X									
Elevation - Non-operating	3.2.6.2.15.2	MET-3080		X									
Pressure Variation at Operating Temperature	3.2.6.2.16.1	MET-3083		X									

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
Pressure Variation at Non-operating Temperature	3.2.6.2.16.2	MET-3085		X									
Production Drawings	3.3.1	MET-3088		X						X			
Insulating and Impregnating Compounds	3.3.2.1	MET-3093		X									
Fasteners/Connectors/Fittings	3.3.2.2	MET-3095	A		X					X			
Castings	3.3.2.3	MET-3100			X					X			
Soldering	3.3.2.4	MET-3102	A		X					X	X		
Corrosion of Metal Parts	3.3.2.5	MET-3104			X					X			
Galvanic Corrosion	3.3.2.6	MET-3106			X					X			
Selection of Parts and Materials	3.3.2.7	MET-3108			X					X			
Protective Coatings and Surface Treatments	3.3.2.8.1	MET-3131			X					X			
Part Obsolescence	3.3.2.9	MET-3136			X					X			
Modular Construction	3.3.3.1	MET-3139				X				X			
Workmanship	3.3.4	MET-3141	C		X					X	X	X	X
Identification and Marking	3.3.5	MET-3143	C		X					X	X	X	X
Personnel Safety	3.3.6.1	MET-3146				X				X			
Surface Temperature	3.3.6.1.1	MET-3148		X									
Entrapment	3.3.6.1.2	MET-3150		X									
Flammability	3.3.6.1.3	MET-3152		X						X			
Steady State Noise	3.3.6.1.4	MET-3154		X									
Mechanical Safety	3.3.6.2	MET-3156				X				X			
Electrical Safety	3.3.6.3	MET-3158				X				X			
Electrical Overload Protection	3.3.6.3.1	MET-3160		X									
Electrical Safety Hazards	3.3.6.3.2	MET-3162		X									
Electrical Interlocks	3.3.6.3.3	MET-3164		X									
Electromagnetic Effects	3.3.6.3.4	MET-3166		X									
Arc and Spark Prevention	3.3.6.3.5	MET-3168		X									
Electrical Grounding	3.3.6.3.6	MET-3170				X				X			
Electrical Short Circuiting	3.3.6.3.7	MET-3172		X									
Electrical Safety Labels	3.3.6.3.8	MET-3174		X									

				Methods					Verification Level				
Description	**Section Number**	**Object ID**	**Group**	**N/A**	**I/E**	**Anal**	**Demo**	**Test**	**DVT**	**DQ**	**FAT**	**AT**	**CT**
Equipment Safe Shutdown	3.3.6.3.9	MET-3176		X									
Non-Ionizing Radiation	3.3.6.3.10	MET-3178				X				X			
Warning/Caution Labels/Decals	3.3.6.3.11	MET-3181			X					X			
Chemical Safety	3.3.6.4	MET-3183				X				X			
Equipment Safety	3.3.6.5	MET-3185				X				X			
Environmental Safety	3.3.6.6	MET-3195				X				X			
Software/Hardware Interface Safety	3.3.6.7	MET-3197		X						X			
Electromagnetic Interference (EMI)	3.4.1	MET-3200	C			X		X		X			
ESD Upset and Damage	3.4.2.1	MET-3203	C					X		X			
ESD Maintenance	3.4.2.2	MET-3205	C					X		X			
Bonds and Grounds	3.4.3	MET-9442	C					X		X	X		
Human Performance/Human Engineering	3.5	MET-3209				X				X			
Nuclear Radiation	3.6.1	MET-3212	D			X		X		X			
Transient Response and Recovery	3.6.2	MET-3214	C			X		X		X			
Nuclear Hardening Design and Technical Data	3.6.3	MET-3216				X				X			
CBR Hardening	3.7.1	MET-3220				X		X		X			
CBR Decontamination	3.7.2	MET-3226				X		X		X			
CBR Decontaminability	3.7.3	MET-3228				X		X		X			
Neutron Induced Gamma Activity	3.7.4	MET-3230				X		X		X			
Service Life	3.8.1	MET-3244				X				X			
Shelf Life	3.8.2	MET-3246				X				X			
Maintenance Concept	3.9.1.1	MET-3250		X									
Field Maintenance	3.9.1.1.1	MET-3256		X									
Sustainment Maintenance	3.9.1.1.2	MET-9441		X									
Supply	3.9.1.1.3	MET-3260				X				X			
Facilities and Facility Equipment	3.9.1.1.4	MET-3262				X				X			

4.1.5.1 Test Sequence

The detailed test sequence(s) included in the overall qualification test plan shall be based on the sequence(s) most likely to identify failure modes. Since multiple failure modes may be possible, more than one test sequence may be required. The final sequence(s) is (are) subjected to the approval of the procuring activity. (MET-13629)

4.1.6 Design Verification Test

The purpose of this test is to assist in developing a robust design that functions in environmental extremes along with refinement of the PDFS. In addition, this DVT provides an outline of environments and performance test that may identify areas of design risk. (MET-3290)

4.1.6.1 Design Verification Failure

4.1.7 Design Qualification

Design qualification verfies that the hardware and software design meets the requirements included in this specification. Design qualification activities verify performance and design requirements including safety, interface, environmental and maintainability requirements. Design qualification tests generally consist of environmental and functional tests. Environmental tests will include testing to the limits of vibration, acoustics, temperatures, pressure and humidity. Functional tests include testing to the limits of performance. Design qualification shall be conducted in accordance with Table 4.1.5-1 Category of Inspection and Verification and Table 4.1.8-1 Sequence of Inspection, and shall address all the inspections / examinations, analyses, demonstrations, and tests required herein in section 3. Unless otherwise specified all the tests required shall be performed on three complete assemblies. Assemblies undergoing qualification testing shall be subjected to the performance tests (specified in applicable paragraphs) before, during (where required in the test method), and immediately after each environmental test performed. Assemblies shall be capable of withstanding all environmental paragraphs either as individual environments and/or as combined environments as listed in this and/or the vehicle system specification. (MET-3294)

4.1.7.1 Qualification Inspection Failure

Failure of an assembly during or as a result of inspection shall be cause for rejection of the assembly. (MET-3296)

4.1.8 First Article Test

Unless otherwise specified in the contract or purchase order, the procuring activity shall select two assemblies of the first 5 assemblies produced under a production contract. Two additional samples of the first 5 assemblies may be selected by the procuring activity in order to expedite completion of testing. Inspections shall be performed in accordance with Table 4.1.5-1 and may be performed in any sequence except as otherwise noted in Table 4.1.8-1. Inspections shall be performed to verify conformance to the assembly drawing, Table 4.1.5-1 and Table 4.1.8-1.

Approval of the first article sample by the procuring activity shall not relieve the contractor of his obligation to supply assemblies that are fully representative of those inspected as first article samples. Any changes or deviations of the production units from the first article samples shall be subject to the approval of the procuring activity. First Article Inspection and Test shall be performed by all manufacturers not having produced this item within the past twelve (12) months.

Note: Assemblies subjected to Table 4.1.5-1, Group D first article tests shall not be used for any other purposes and shall be indelibly marked "DO NOT PRESENT FOR ACCEPTANCE OR SHIP AS PRODUCTION UNITS." However, if additional sample(s) are used in testing in accordance with Table 4.1.8-1, the additional sample(s) may be shipped as production units. (MET-3302)

Table 4.1.8-1: Sequence of Inspection

Sequence Of Inspection							
Test sequence	**Paragraph**	**First Article Test**		**Qualification Test**			**Control Test**
		1	**2**	**1**	**2**	**3**	**1**
Workmanship	4.3.4	X	X	X	X	X	X
Bond and Grounds	4.4.3	X	X	X	X	X	
Weight	4.2.1.3	X	X	X	X	X	X
Performance1/	4.2.3	X	X	X	X	X	X
Low temperature	4.2.6.2.3	X	X	X	X	X	X
High temperature	4.2.6.2.2	X	X	X	X	X	X
Temperature Shock	4.2.6.2.4	X	X	X	X	X	X
Altitude	4.2.6.1.6	X	X	X	X	X	
Basic shock	4.2.6.2.5.1	X	X	X	X	X	X
Functional Shock	4.2.6.2.5.2	X	X	X	X	X	X
Gunfiring Shock	4.2.6.2.5.3	X	X	X	X	X	
Bench Handling Shock	4.2.6.2.5.8	X	X	X	X	X	X
Vibration	4.2.6.2.1	X	X	X	X	X	X
Steam and Water Jet Cleaning	4.2.6.2.7	X		X	X	X	
Humidity	4.2.6.1.1.3	X	X	X	X	X	
Salt Fog	4.2.6.1.3	X		X	X	X	
Chemicals	4.2.6.2.12		X	X	X	X	
Sand	4.2.6.1.4	X	X	X	X	X	
Dust	4.2.6.1.5	X	X	X	X	X	
Fungus	4.2.6.1.2	X		X			
Ice	4.2.6.1.9			X	X	X	
Rain	4.2.6.1.11			X	X	X	
Impact Shock	4.2.6.2.5.11			X	X	X	

Sequence Of Inspection							
Rapid Decompression	4.2.6.2.11			X	X	X	
Nuclear Survivability and Hardening	4.6			X			
CBR CS	4.7				X		
Electromagnetic Environmental Effects	4.4					X	
Identification and marking2/	4.3.5	X	X	X	X	X	X

1/ These tests shall also be performed using the additional sample(s), if used.

2/ Inspections shall be performed in sequence only after all other inspections have been completed. (MET-13766)

4.1.8.1 First Article Test Failure

Deficiencies found during or as a result of the first article test shall be cause for rejection of the first article test sample until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of the first article test shall be evidence that all items already produced prior to completion of the first article test are similarly deficient, unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. When the cause for FAT failure is identified and corrective action is necessary, corrections shall be made and proven by inspecting three randomly selected assemblies from the lot represented. When corrective action is implemented, the three assemblies shall be subjected to all the specified inspections up to the point of failure. Two out of the three assemblies will be selected to continue FAT testing**.** (MET-13632)

4.1.9 Acceptance Test

4.1.9.1 Examinations/Tests

Each inspection shall be performed in accordance with Table 4.1.5-1 for each assembly. (MET-13635)

4.1.9.2 Failures

Any assembly that fails to conform to any examination/test shall be rejected. The rejected assembly may be repaired or corrected, and resubmitted for inspection. (MET-13637)

4.1.10 Control Tests

4.1.10.1 Frequency

Control tests shall be conducted at a rate of 1 assembly from each lot of 200 (1/200) consecutively produced, except do not perform more than 1 test in a 6 month period, nor less than 1 test in a 12 month period. The assemblies shall be subjected to the control tests specified in Table 4.1.5-1. These inspections need not be performed on any represented lot on which first article has been performed. (MET-13640)

4.1.10.2 Failures

Failure of an assembly to meet specified control tests shall be considered cause for rejection of the entire lot represented. When the cause for control test failure is identified and corrective action is necessary, corrections shall be made and proven by inspecting three randomly selected assemblies from the lot represented. When corrective action is implemented, one of the three assemblies shall be subjected to all the specified inspections. The remaining two assembly inspections shall be limited to the parameters directly related to the failure cause and the parameters affected by the corrective action. (MET-13642)

4.2 System Requirements

4.2.1 Physical Characteristics

4.2.1.1 Space Claim

DQ

Verify the assembly does not exceed the space claim as specified in 3.2.1.1 (MET-337)

4.2.1.2 Reserved

N/A

4.2.1.3 Weight

DQ FAT CT

Weigh the assembly and verify the assembly weight does not exceed 20 lbs. (MET-339)

4.2.1.4 Mounting

DQ

Verify the mounting of the assembly is as specified in 3.2.1.4. (MET-341)

4.2.1.5 Color

DQ

Verify by inspection the assembly meets the requirement of 3.2.1.5, visually and via material certification. (MET-343)

4.2.2 Installed Performance

N/A

4.2.3 Performance

4.2.3.1 Mechanical Performance/Characteristics

N/A

4.2.3.2 Electrical Performance/Characteristics

4.2.3.2.1 Input Voltage

DQ FAT AT CT

AT/CT:

Unless otherwise specified, the perfomance test per 3.2.3.2 shall be conducted with an input voltage of 26.5 + 4.5Vdc.

DQ/FAT:

Unless otherwise specified, the perfomance test per 3.2.3.2 shall be conducted with an input voltage of 22.00 (+0.00, -0.10)Vdc. The performance test will then be repeated with an input voltage 31.00 (+0.10, -0.00) Vdc. (MET-464)

4.2.3.2.1.1 Input Voltage Transients and Protection Circuits

DQ FAT

Conduct a full performance test per 3.2.3, at the input voltage specified in 3.2.3.2.1.1. This section may be performed either after ATE or baseline performance, but prior to environmental testing. This requirement shall be verified during baseline performance and post performance only. (MET-9485)

4.2.3.2.2 Input Power

4.2.3.2.2.1 Steady State

DQ FAT AT CT

With the assembly operating in a steady state condition, measure the input voltage and current. Calculate the power using the measured voltage and current values and verify it does not exceed the power specified in 3.2.3.2.2.1. (MET-9964)

4.2.3.2.2.2 Inrush Current

DQ FAT AT CT

Apply input voltage per 3.2.3.2.1, and measure the inrush current. Verify that the inrush current is within requirements of 3.2.3.2.2.2. (MET-9553)

4.2.3.2.3 Chassis Isolation

DQ FAT AT CT

With no input voltage applied, and no external connections, measure the resistance between each of the connector pins and chassis ground. Verify the resistance meets the requirements specified in 3.2.3.2.3. (MET-9380)

4.2.3.2.4 Power-up Timing

DQ FAT AT CT

Apply input voltage per 3.2.3.2.1, and verify assembly operation per the requirements of 3.2.3.2.4 and Figure 3.2.3.2.4-1. (MET-9381)

4.2.3.2.5 Serial Interface

DQ

Verify by test the assembly meets the requirement of 3.2.3.2.5. (MET-9383)

4.2.3.3 Functional Performance

4.2.3.3.1 Temperature

4.2.3.3.1.1 Range

DQ FAT AT CT

Verified via 4.2.3.3.1.2. (MET-9781)

4.2.3.3.1.2 Accuracy

DQ FAT AT CT

QT/FAT/CT:

Verify by test over the range of -40° F (-40° C) to 160° F (71° C) in 20° F increments utilizing a reference temperature sensor that the assembly meets the accuracy requirements of 3.2.3.3.1.2, and the resolution requirements of 3.2.3.3.1.3.

AT:

Verify by test at ambient and 20° F above ambient that the assembly meets the accuracy requirements of 3.2.3.3.1.2, and the resolution requirements of 3.2.3.3.1.3.

(MET-9782)

4.2.3.3.1.3 Resolution

DQ FAT AT CT

Verified via 4.2.3.3.1.2. (MET-9783)

4.2.3.3.2 Barometric Pressure

4.2.3.3.2.1 Range

DQ FAT AT CT

Verified via 4.2.3.3.2.2.

(MET-9787)

4.2.3.3.2.2 Accuracy

DQ FAT AT CT

QT/FAT/CT:

Verify by test at ambient and over the range of 20.4 to 32.4 in Hg (inches Mercury) in 4 in Hg increments utilizing a reference pressure sensor the assembly meets the accuracy requirements of 3.2.3.3.2.2, and the resolution requirements of 3.2.3.3.2.3.

AT:

Verify by test at ambient and 8 in Hg below ambient utilizing a reference pressure sensor the assembly meets the accuracy requirements of 3.2.3.3.2.2, and the resolution requirements of 3.2.3.3.2.3.

(MET-9788)

4.2.3.3.2.3 Resolution

DQ FAT AT CT

Verified via 4.2.3.3.2.2. (MET-9789)

4.2.3.3.3 Crosswind Velocity

4.2.3.3.3.1 Range

DQ FAT AT CT

Verified via 4.2.3.3.2.2. (MET-9798)

4.2.3.3.3.2 Accuracy

DQ FAT AT CT

QT/FAT/CT:

Verify by test at 5, 25, and 85mph with 10 degree angular steps the assembly meets the accuracy requirement of 3.2.3.3.3.2, and the resolution requirements of 3.2.3.3.3.3. This requirement shall be verified at ambient conditions.

AT:

Verify by test at 0, 7.5, and 20mph at 0, 45, and 90 degree angular steps the assembly meets the accuracy requirement of 3.2.3.3.3.2, and the resolution requirements of 3.2.3.3.3.3. This requirement shall be verified at ambient conditions.

(MET-9799)

4.2.3.3.3.3 Resolution

DQ FAT AT CT

Verified via 4.2.3.3.3.2. (MET-9800)

4.2.3.3.3.4 Wind Velocity Response

DQ

Mount the assembly on a rotating fixture(s) which is capable of rotation from 0° to 360° in 7.5° increments and continuous rotation at 6 and 120 rpm. Place the fixture in the wind tunnel. Connect the multimeter to the assembly between P1-9 (hi) and P1-10 (lo). Set the wind tunnel velocity at 20 meters/second and rotate the assembly through 360° in 7.5° increments. that the assembly meets the requirement of 3.2.3.3.3.4. (MET-9816)

4.2.3.3.3.5 Wind Velocity Bandwidth

DQ FAT AT CT:

Verify by test utilizing the modulated/swept output to characterize the frequency response and phase shift that the assembly meets the requirement of 3.2.3.3.3.5. (MET-14259)

4.2.3.3.3.6 Zero Level

DQ FAT AT CT:

Verify by test by measuring the voltage difference between pins J1-9 and J1-10 such that the assembly meets the requirement of 3.2.3.3.3.7. (MET-14261)

4.2.3.3.3.7 Analog Output Fault

DQ FAT AT CT:

Verify by test that the analog output fault is triggered by subjecting the assembly to a crosswind speed that is out of range (greater than ±85.0 mph) by measuring the voltage difference between pins J1-9 and J1-10 that the assembly meets the requirement of 3.2.3.3.3.8. (MET-14262)

4.2.3.3.4 Headwind Velocity

4.2.3.3.4.1 Range

Verified via 4.2.3.3.4.2.

(MET-9802)

4.2.3.3.4.2 Accuracy

DQ FAT AT CT

QT/FAT/CT:

Verify by test at 5, 25, and 85mph with 10 degree angular steps the assembly meets the accuracy requirement of 3.2.3.3.4.2 and the resolution requirement of 3.2.3.3.4.3. This requirement shall be verified at ambient conditions.

AT:

Verify by test at 0, 7.5, and 20mph at 0, 45, and 90 degree angular steps the assembly meets the accuracy requirement of 3.2.3.3.4.2 and the resolution requirement of 3.2.3.3.4.3. This requirement shall be verified at ambient conditions. (MET-9804)

4.2.3.3.4.3 Resolution

DQ FAT AT CT

Verified via 4.2.3.3.4.2. (MET-13519)

4.2.3.3.4.4 Wind Velocity Response

DQ

Verify by anaylsis utilizing the modulated/swept output to characterize the frequency response and phase shift that the assembly meets the requirement of 3.2.3.3.4.4. (MET-13522)

4.2.3.3.5 Humidity

4.2.3.3.5.1 Accuracy

DQ FAT AT CT

Verify by test at 10, 34, 75, and 99% ± 5% humidity utilizing a reference sensor that the assembly meets the accuracy requirement of 3.2.3.3.5.1 and the resolution requirement of 3.2.3.3.5.2. (MET-9809)

4.2.3.3.5.2 Resolution

DQ FAT AT CT

Verified via 4.2.3.3.5.1. (MET-9810)

4.2.3.3.6 External Temperature Input

4.2.3.3.6.1 Range

DQ FAT AT CT

Verifed via 4.2.3.3.6.2. (MET-9950)

4.2.3.3.6.2 Accuracy

DQ FAT AT CT

QT/FAT/CT:

Verify by test over the range of -40° F (-40° C) to 160° F (71° C) in 20° F increments utilizing a reference resistance that the assembly meets the accuracy requirement of 3.2.3.3.6.2 and the resolution requirement of 3.2.3.3.6.3.

AT:

At ambient temperature, verify the assembly output corresponds to a single representative resistive load. (MET-9952)

4.2.3.3.6.3 Resolution

DQ FAT AT CT

Verifed via 4.2.3.3.6.2. (MET-9955)

4.2.3.3.7 Configuration Data

DQ FAT AT CT

Verify by test the assembly meets the requirement of 3.2.3.3.7. (MET-9948)

4.2.3.3.8 Nuclear Event Detection and Test

4.2.3.3.8.1 NED Test Input

DQ FAT AT CT

Apply +28 (0.25, -0.0) Vdc at 6 milli-amps to the NED Test Input MET J1-11 (hi) to MET J1-6 (lo) for a minimum duration of 50 microseconds. Monitor the NED outputs described above and verify the voltage is 16.5 to 32 Vdc. Verify the assembly sets (latches) the NED output in accordance with 3.2.3.3.8.2 and perform a Nuclear Event Shutdown in accordance with 3.2.3.3.8.3. (MET-14474)

4.2.3.3.8.2 NED (Nuclear Event Detection)

DQ FAT AT CT

The requirements of paragraph 3.2.3.3.8.2 is verified in 4.2.3.3.8.1. (MET-14476)

4.2.3.3.8.3 Nuclear Event Shutdown

DQ FAT AT CT

The requirements of paragraph 3.2.3.3.8.3 is verified in 4.2.3.3.8.1. (MET-14477)

4.2.4 Reliability

DQ

The MTBF requirement specified in Section 3.2.4 for the assembly shall be verified by reliability analysis of historical data (e.g., laboratory testing, vehicle testing, system level testing, and field data). The demonstrated reliability value will be calculated by combining the total experience on those assemblies used for Reliability assessment. Usage will be recorded and monitored throughout the test program. Requirement compliance will be determined through comparison of the demonstrated value with the requirement.

In the event that historical data is not sufficient to provide satisfactory evidence of compliance to the reliability requirement, compliance may be supplemented by historical performance data for like hardware, simulated test and/or models, or demonstrated test results for proposed designs. In the event that none of these sources are sufficient to provide satisfactory evidence of the MTBF and MTBSF, compliance with the reliability requirement may be supplemented by formal reliability predictions, on the final design configuration, employing recognized failure rate data sources and prediction procedures, with GDLS approval. The environment used for MTBF predictions shall be Ground Mobile at 56° C measured at the card edge of the assembly. (MET-2860)

4.2.5 Maintainability/Diagnostics/Testability

4.2.5.1 Qualitative Maintainability

This paragraph is not applicable to this specification. (MET-2863)

4.2.5.2 Quantitative Maintainability

This paragraph is not applicable to this specification. (MET-2868)

4.2.5.3 Preventative Maintenance Checks and Services (PMCS)

DQ

Verify by inspection that the assembly does not require PMCs. (MET-2871)

4.2.5.4 Special Tools and Test Equipment

DQ

The requirements of 3.2.5.4 shall be verified by analysis of data collected during testing. (MET-2873)

4.2.5.5 Diagnostics/Testability

DQ

Verify by analysis and test that the assembly meets the Diagnostic/Testability requirements of paragraph 3.2.5.5. (MET-2875)

4.2.5.5.1 Qualitative Diagnostics/Testability

DQ

The assembly shall meet the Qualitative Diagnostic/Testability requirements of paragraph 3.2.5.5.1 and shall be verified by analysis, including task 202 and 203 of MIL-HDBK-2165. (MET-9446)

4.2.5.5.1.1 Power-up Built-In Test

DQ

The assembly shall meet the PBIT requirements of 3.2.5.5.1.1 and shall be verified by analysis. A test shall verify the PBIT cycle completes within the time specified in 3.2.5.5.1.1. (MET-9444)

4.2.5.5.1.2 Continuous Built-In Test

DQ

The assembly shall meet the ST requirements of 3.2.5.5.1.2 and shall be verified by analysis. A test shall verify the ST cycle completes within the time specified in 3.2.5.5.1.2. (MET-2881)

4.2.5.5.1.3 Initiated Built-in Test

This paragraph is not applicable to this specification. (MET-2889)

4.2.5.5.2 Quantitative Diagnostics

DQ

The assembly shall meet the Quantitative Diagnostic requirements of paragraph 3.2.5.5.2 and shall be verified by analysis and test. (MET-2898)

4.2.5.5.2.1 Field Level

DQ

The assembly shall meet the field support level requirements of paragraph 3.2.5.5.2.1 and shall be verified by analysis and test. (MET-2901)

4.2.5.5.2.2 Sustainment Support Level

This paragraph is not applicable to this specification. (MET-2903)

4.2.5.5.2.2.1 SRU Performance Verification

This paragraph is not applicable to this specification. (MET-2905)

4.2.5.5.2.2.2 SRU Fault Isolation

This paragraph is not applicable to this specification. (MET-2907)

4.2.5.6 Testability

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements 3.2.5.6. (MET-2920)

4.2.6 Environmental Conditions

4.2.6.1 Natural Environment

4.2.6.1.1 Humidity

4.2.6.1.1.1 Operating Humidity

This paragraph is not applicable to this specification. (MET-2925)

4.2.6.1.1.2 Storage and Transportation

Compliance is verified under 3.2.6.1.1.3 (MET-2927)

4.2.6.1.1.3 Subsystem Operational

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2929)

4.2.6.1.2 Fungus

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. Note: In lieu of testing, a certificate of compliance with supporting data may be provided attesting to the materials used in construction will not support fungus growth. (MET-2934)

4.2.6.1.3 Salt Fog

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404.

(MET-2936)

4.2.6.1.4 Sand

4.2.6.1.4.1 Blowing Sand External

DQ FAT

Compliance shall be IAW MIL-STD-810G, Method 510.5 and Procedure II for 90 minutes on each face. Protective covering is allowed for optics. (MET-2939)

4.2.6.1.4.2 Blowing Sand Internal

This paragraph is not applicable to this specification. (MET-2941)

4.2.6.1.5 Dust

4.2.6.1.5.1 Blowing Dust External

DQ FAT

Compliance shall be IAW MIL-STD-810G, Method 510.5 and Procedure I for 90 minutes on each face. (MET-2944)

4.2.6.1.5.2 Blowing Dust Internal

This paragraph is not applicable to this specification. (MET-2946)

4.2.6.1.6 Altitude

4.2.6.1.6.1 Operating

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2949)

4.2.6.1.6.2 Non-Operating

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2951)

4.2.6.1.7 Solar Radiation

This paragraph is not applicable to this specification. (MET-2953)

4.2.6.1.8 Snow

This paragraph is not applicable to this specification.
(MET-2956)

4.2.6.1.9 Ice

DQ

Verify by test IAW MIL-STD-810G, Method 521.4. (MET-2958)

4.2.6.1.10 Wind

DQ

Compliance is verified under 3.2.3.3.3 (MET-2960)

4.2.6.1.11 Rain

DQ

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2962)

4.2.6.2 Induced Environment

4.2.6.2.1 Vibration

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404.

For CT, the vibration exposure time shall be reduced to 50% of the QT and FAT values. (MET-2965)

4.2.6.2.2 High Temperature

4.2.6.2.2.1 Storage and Transportation

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2973)

4.2.6.2.2.2 Operational

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2975)

4.2.6.2.3 Low Temperature

4.2.6.2.3.1 Storage and Transportation

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2979)

4.2.6.2.3.2 Operational

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2984)

4.2.6.2.4 Temperature Shock

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2986)

4.2.6.2.5 Shock

4.2.6.2.5.1 Basic Shock

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-2989)

4.2.6.2.5.2 Functional Shock

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-3011)

4.2.6.2.5.3 Gun Firing Shock

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-3013)

4.2.6.2.5.4 Ballistic Shock

DQ

Ballistic shock shall be performed by live fire exercises and/or analysis to verify conformance to 3.2.6.2.5.4. (MET-3016)

4.2.6.2.5.5 High Intensity Shock

DQ

Subject the assembly to the shock waves as specified in 3.2.6.2.5.5. At the conclusion of this test, examine the assembly for damage

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (GPS-6144) (MET-3035)

4.2.6.2.5.6 Transport Shock

This paragraph is not applicable to this specification. (MET-3038)

4.2.6.2.5.7 Handling Shock

This paragraph is not applicable to this specification. (MET-3040)

4.2.6.2.5.8 Bench Handling Shock

DQ FAT CT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-3042)

4.2.6.2.5.9 Wrench Impact

This paragraph is not applicable to this specification. (MET-3044)

4.2.6.2.5.10 Boot Impact

This paragraph is not applicable to this specification. (MET-3046)

4.2.6.2.6 Submergence

This paragraph is not applicable to this specification. (MET-3048)

4.2.6.2.7 Steam and Water Jet Cleaning

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-3050)

4.2.6.2.8 Noise Levels

This paragraph is not applicable to this specification. (MET-3053)

4.2.6.2.9 Atmospheric Pressure

This paragraph is not applicable to this specification. (MET-3055)

4.2.6.2.10 Explosive Atmosphere

This paragraph is not applicable to this specification. (MET-3057)

4.2.6.2.11 Rapid Decompression

DQ

Verification of the environmental requirements of this paragraph are tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404A. (MET-3059)

4.2.6.2.12 Chemicals

DQ FAT

Verification of the environmental requirements of this paragraph shall be tested as specified in SB-SA10005, Environmental Test Methods for ATPD-2404. (MET-9447)

4.2.6.2.13 Combined Environment

This paragraph is not applicable to this specification. (MET-3071)

4.2.6.2.14 Nuclear Hardness Criteria

This paragraph is not applicable to this specification. (MET-3073)

4.2.6.2.15 Elevation

4.2.6.2.15.1 Elevation - Operating

This paragraph is not applicable to this specification. (MET-3078)

4.2.6.2.15.2 Elevation - Non-operating

This paragraph is not applicable to this specification. (MET-3080)

4.2.6.2.16 Pressure Variation at Temperature

4.2.6.2.16.1 Pressure Variation at Operating Temperature

This paragraph is not applicable to this specification. (MET-3083)

4.2.6.2.16.2 Pressure Variation at Non-operating Temperature

This paragraph is not applicable to this specification. (MET-3085)

4.3 Design and Construction

4.3.1 Production Drawings

DQ

Verify by analysis the assembly meets the requirements specified in 3.3.1. (MET-3088)

4.3.2 Materials, Processes and Components

4.3.2.1 Insulating and Impregnating Compounds

This paragraph is not applicable to this specification. (MET-3093)

4.3.2.2 Fasteners/Connectors/Fittings

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.2.2. (MET-3095)

4.3.2.3 Castings

DQ

A review of assembly drawings and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.2.3. (MET-3100)

4.3.2.4 Soldering

DQ FAT

A review of assembly hardware and/or assembly procedures shall be performed to verify the assembly conforms to the requirements of 3.3.2.4. (MET-3102)

4.3.2.5 Corrosion of Metal Parts

DQ

A review of the documentation which describes the materials used in the assembly shall be performed to verify the materials are corrosion resistant or protected in accordance with 3.3.2.5. (MET-3104)

4.3.2.6 Galvanic Corrosion

DQ

A review of the documentation which describes the materials used in the assembly shall be performed to verify the materials are corrosion resistant or protected in accordance with 3.3.2.6. (MET-3106)

4.3.2.7 Selection of Parts and Materials

DQ

A review of the documentation used to produce the assembly shall be performed to verify the selection of parts, materials, and processes are in conformance with 3.3.2.7. (MET-3108)

4.3.2.8 Treatment and Painting

4.3.2.8.1 Protective Coatings and Surface Treatments

DQ

An examination of the assembly shall be performed to verify coating and surface treatments are applied to the proper surfaces and applied in the manner specified in 3.3.2.8.1. An analysis of the applicable drawings shall verify the proper materials are protected by the finishes specified in 3.3.2.8.1. (MET-3131)

4.3.2.9 Part Obsolescence

DQ

A review of assembly drawings, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.2.9. (MET-3136)

4.3.3 Construction

4.3.3.1 Modular Construction

DQ

Compliance to the modular construction requirements of 3.3.3.1 shall be by analysis, TM validation, or demonstration. (MET-3139)

4.3.4 Workmanship

DQ FAT AT CT

A visual inspection shall be performed on each assembly and at all phases of fabrication, assembly, and test to verify conformance to 3.3.4. (MET-3141)

4.3.5 Identification and Marking

DQ FAT AT CT

The assembly markings shall be examined to verify conformance to 3.3.5. (MET-3143)

4.3.6 Safety

4.3.6.1 Personnel Safety

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.6.1. (MET-3146)

4.3.6.1.1 Surface Temperature

This paragraph is not applicable to this specification. (MET-3148)

4.3.6.1.2 Entrapment

This paragraph is not applicable to this specification. (MET-3150)

4.3.6.1.3 Flammability

DQ

This paragraph is not applicable to this specification. (MET-3152)

4.3.6.1.4 Steady State Noise

This paragraph is not applicable to this specification. (MET-3154)

4.3.6.2 Mechanical Safety

DQ

Visual inspection shall be performed on each assembly and at all phases of fabrication, assembly, and test to verify conformance to 3.3.6.2. (MET-3156)

4.3.6.3 Electrical Safety

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.6.3. (MET-3158)

4.3.6.3.1 Electrical Overload Protection

This paragraph is not applicable to this specification. (MET-3160)

4.3.6.3.2 Electrical Safety Hazards

This paragraph is not applicable to this specification. (MET-3162)

4.3.6.3.3 Electrical Interlocks

This paragraph is not applicable to this specification. (MET-3164)

4.3.6.3.4 Electromagnetic Effects

Refer to Para 4.4 (MET-3166)

4.3.6.3.5 Arc and Spark Prevention

This paragraph is not applicable to this specification. (MET-3168)

4.3.6.3.6 Electrical Grounding

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.6.3.6. (MET-3170)

4.3.6.3.7 Electrical Short Circuiting

This paragraph is not applicable to this specification. (MET-3172)

4.3.6.3.8 Electrical Safety Labels

This paragraph is not applicable to this specification. (MET-3174)

4.3.6.3.9 Equipment Safe Shutdown

This paragraph is not applicable to this specification. (MET-3176)

4.3.6.3.10 Non-Ionizing Radiation

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.6.3.10. (MET-3178)

4.3.6.3.11 Warning/Caution Labels/Decals

DQ

Visual inspection shall be performed on each assembly to verify conformance to 3.3.6.3.11. (MET-3181)

4.3.6.4 Chemical Safety

DQ

A review of the documentation used to produce the assembly shall be performed to verify the selection of parts and materials are in conformance with 3.3.6.4. (MET-3183)

4.3.6.5 Equipment Safety

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.6.5. (MET-3185)

4.3.6.6 Environmental Safety

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.3.6.6. (MET-3195)

4.3.6.7 Software/Hardware Interface Safety

DQ

This paragraph is not applicable to this specification. (MET-3197)

4.4 Electromagnetic Environmental Effects (E3)

4.4.1 Electromagnetic Interference (EMI)

DQ

The assembly shall be tested in accordance with the methods and procedures identified in MIL-STD-461F.

(MET-3200)

4.4.2 Electrostatic Discharge (ESD)

4.4.2.1 ESD Upset and Damage

DQ

The assembly's ability to be protected from upset and damage due to the effects of a personnel electrostatic discharge (PESD) shall be determined and compliance verified by testing in accordance with the methods and procedures identified in ATPD-2407. At a minimum, five discharges of positive polarity and five discharges of negative polarity are to be applied using the direct application air-discharge test method for insulating surfaces (for example plastic buttons and keypads, etc.). The direct application contact discharge method shall be applied to conductive surfaces (for example, metal connector shells (not the connector contacts), metal switches, ground-strap mounting pads, etc) a minimum of 5 times in each polarity at each contact point. An ESD network consisting of a 150 picofarad capacitor and a 330 ohm resistor with a circuit inductance not to exceed 5 µH shall be used to simulate a human discharge ESD transient represented by a double exponential waveform with a rise time of 2- 10 nanoseconds and pulse duration of approximately 150 nanoseconds per ATPD-2407. The MET Sensor shall be verified for normal operation at the completion of ESD testing.

(MET-3203)

4.4.2.2 ESD Maintenance

DQ

The assembly's ability to be protected from damage due to the effects of a personnel electrostatic discharge (PESD) shall be determined and compliance verified by testing in accordance with the methods and procedures identified in ATPD-2407. Contacts which are accessible shall be tested by the direct application air-discharge test only. At a minimum, five discharges of positive polarity and five discharges of negative polarity are to be applied using the direct application air-discharge test method for insulating surfaces (for example plastic buttons and keypads, etc.). The direct application contact discharge method shall be applied to conductive surfaces (for example, metal connector shells (not the connector contacts), metal switches, ground-strap mounting pads, etc) a minimum of 5 times in each polarity at each contact point. An ESD network consisting of a 150 picofarad capacitor and a 330 ohm resistor with a circuit inductance not to exceed 5 µH shall be used to simulate a human discharge ESD transient represented by a double exponential waveform with a rise time of 2- 10 nanoseconds and pulse duration of approximately 150 nanoseconds per ATPD-2407. This ESD test takes place with the MET Sensor disconnected from external harnessing and its ground strap removed. The MET Sensor shall be verified for normal operation at the completion of ESD Maintenance testing. (MET-3205)

4.4.3 Bonds and Grounds

DQ FAT

The assembly's bonding requirements shall be individually verified by direct measurement utilizing a low-resistance, 4-wire (Kelvin) measurement technique (or equivalent) in accordance with the applicable sections of ATPD-2407. (MET-9442)

4.5 Human Performance/Human Engineering

DQ

The human performance/human engineering requirements of 3.5 shall be verified by evaluating the adequacy of the physical, visual, and auditory man/equipment interface. (MET-3209)

4.6 Nuclear Survivability and Hardening

4.6.1 Nuclear Radiation

DQ

Verification that the assembly meets 3.6.1 shall be accomplished by analysis and testing. (MET-3212)

4.6.2 Transient Response and Recovery

DQ

Verification of conformance to 3.6.2 shall be accomplished by analysis and test. (MET-3214)

4.6.3 Nuclear Hardening Design and Technical Data

DQ

Verification of conformance to 3.6.3 shall be accomplished by inspection of technical data supported by analysis. (MET-3216)

4.7 Chemical, Biological and Radiological Contamination Survivability (CBR CS)

4.7.1 CBR Hardening

DQ

Verification of conformance to 3.7.1, CBR contamination hardening, shall be accomplished through assembly testing, assembly material review, and/or test data analysis

(MET-3220)

4.7.2 CBR Decontamination

DQ

Verification of conformance to 3.7.2, CBR decontamination, shall be accomplished through assembly testing, assembly material review, and/or test data analysis

(MET-3226)

4.7.3 CBR Decontaminability

DQ

Verification of conformance to 3.7.3, CBR decontaminability, shall be accomplished through assembly testing, assembly material review, and/or test data analysis

(MET-3228)

4.7.4 Neutron Induced Gamma Activity

DQ

Verification of conformance to 3.7.4, neutron induced gamma activity (NIGA), shall be accomplished through assembly testing, assembly material review, and/or test data analysis

(MET-3230)

4.8 Useful Life

4.8.1 Service Life

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.8.1. (MET-3244)

4.8.2 Shelf Life

DQ

A review of assembly drawings, schematics, materials list, and/or hardware shall be performed to verify the assembly conforms to the requirements of 3.8.2. (MET-3246)

4.9 Logistics

4.9.1 Maintenance

4.9.1.1 Maintenance Concept

This paragraph is not applicable to this specification. (MET-3250)

4.9.1.1.1 Field Maintenance

This paragraph is not applicable to this specification. (MET-3256)

4.9.1.1.2 Sustainment Maintenance

This paragraph is not applicable to this specification. (MET-9441)

4.9.1.1.3 Supply

DQ

Verification of conformance to 3.9.1.1.3 shall be accomplished by analysis. (MET-3260)

4.9.1.1.4 Facilities and Facility Equipment

DQ

Verification of conformance to 3.9.1.1.4 shall be accomplished by analysis. (MET-3262)

5 Packaging

5.1 Production

5.1.1 Preservation, packaging, and packing

The method and materials used in preservation, packaging and packing of the assembly shall be IAW ASTM-D3951, Standard Practices for Commercial Packaging.

5.1.2 Marking for shipment and storage

Interior packages and exterior shipping containers shall be marked IAW ASTM-D3951, Standard Practices for Commercial Packaging.

5.1.3 Packaging, handling or transportability

The assembly design, including weight and envelope issues, shall be such that it and/or its components can be transported using all transportation modes.

6 Notes

This section is not applicable to this specification.

7 Appendices

7.1 Appendix A

This appendix defines the serial interface for the assembly. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance

8 Applicable Documents

This section is not applicable to this appendix.

9 Interface Definition

9.1 Serial Interface

9.1.3 Vehicle Health Management System (VHMS)

The Vehicle Health Management System is a capability that generates, stores, retrieves and uses logistic data for the purpose of improving sustainment support. The hardware configuration and fault data storage VHMS capabilities are supported for this assembly.

9.1.3.1 Non-Volatile Memory Data Storage Capability

The assembly shall include a minimum of 128 KB of non-volatile memory for the storage of hardware configuration and built-in-test fault data noted in the following paragraphs.

9.1.3.1.1 Assembly Configuration Data

The assembly shall be supplied with the hardware configuration data noted in Table 3.1.3.1.1-1 stored in the non-volatile memory data storage.

Table 3.1.3.1.1-1 Assembly Configuration Data

Hardware Configuration Data	Number of Data Bytes	Data Transmission Format	Comments
Product Name	21	8 bit ASCII	Limited to 21 alphanumeric characters, including spaces (“Meteorological Sensor”)
Part Number (Ordnance Number)	10	8 bit ASCII	8 Digit ordinance number, a dash followed by a single digit (”12733020-0”)
Serial Number	8	8 bit ASCII	Up to 8 digit alphanumeric characters
Cage Code	5	8 bit ASCII	Cage Code: 5 digital alphanumeric value (“eg 7Z4Y5”)
Firmware Version	8	8 bit ASCII	Limited to 8 digit alphanumeric characters

9.1.3.1.2 Fault Log Records Data

As the fault log reaches maximum storage space, the oldest data can be written over in that partition. Records will be stored one after another in the area of memory starting from record one (1) and growing upward to the maximum capacity. When the memory is full, the oldest records will be erased to make room for new records.

The assembly shall store ALL instances of PBIT fault condition data with timestamp.

The assembly shall store CBIT fault condition data with timestamp if there is a change in state of the fault condition (e.g.: from not fail to fail OR fail to not fail). (NOTE: this assumes that the assembly does all necessary filtering of fault data to assure that condition is a valid condition)

The fault records shall be as shown in Table 3.1.3.1.2-1

Table 3.1.3.1.2-1 BIT Fault Log Record Format

Byte(s)	Field	Description
1:4	Timestamp (seconds)	Time when event was logged. MS byte first. Time is an unsigned 32-bit value representing the time as the number of seconds from 00:00:00, January 1, 1970. This format is sufficient to maintain time stamping with 1-second resolution past the year 2100.
5:6	Timestamp (ms)	Time when event was logged in milliseconds. MS byte first. This is an unsigned 16-bit value.
7:11	Post, Self Test	Post and Self Test data shall be stored as defined in Table 5.1-1
12:17	MET Data	Air Temperature, Barometric Pressure, Crosswind, Headwind, Humidity and Aux Temperature shall be stored as defined in Table 5.1-1

9.1.3.1.2.1 BIT Data Timestamp - Clocks

Information: Three clocks are noted in the following discussion: GPS Sync Clock, Chassis Sync Clock and Local Clock. The GPS Sync Clock is input to the Mission Control Unit (MCU) General Purpose Processor (GPP) from an external Global Positioning System (GPS) at one second resolution.

Within the MCU, the Chassis Synch Clock is generated from the GPS Sync Clock to include milliseconds. The Chassis Sync Clock is distributed to modules within the MCU once per second. The MCU sends the Chassis Sync Clock to modules connected to the MCU DAIO via a RS-422 interface once per second.

The Chassis Sync Clock is then used to generate a Local Clock, the GPP within the MCU will also generate its own Local Clock. This Local Clock (synchronized or not synchronized-see loss of sync clock input) will be used to timestamp VHMS data.

The assembly shall generate a Local Clock to timestamp all stored BIT data which is synchronized to the Chassis Sync Clock. Synchronization accuracy shall be +/- 2 ms from the receipt of last bit associated with the Set Fault Log Time message. The Local Clock shall have one millisecond resolution.

During power up mode the assembly will not have access to the Chassis Sync Clock. Any data that is stored during this time will be time stamped with zeros or time since last power up.

If the assembly has synchronized to the Chassis Sync Clock input and the input is lost, the assembly shall continue to use the Local Clock to timestamp all data. When the Chassis Sync Clock returns, the assembly shall synchronize to the Chassis Sync Clock input.

9.1.3.1.3 Power-On Hours

The assembly shall store/update overall operating time no less than every 10 minutes. The overall operating time refers to the total accumulated time the assembly has been powered on with its application software/firmware executing.

9.1.4 Serial Bus Interface

9.1.4.1 ANSI/TIA/EIA-422-B

The assembly shall provide a serial communications interface compliant to ANSI/TIA/EIA-422-B. The serial interface shall consist of two layers, a physical layer and a message layer as defined in 3.1.4.1.1 and 3.1.4.1.2.

9.1.4.1.1 Physical Layer

9.1.4.1.1.1 Default Parameters

The serial interface physical layer shall have the following default parameters:

Interface:	RS-422, Full Duplex, 4 wire with ground
Transmission Type:	Asynchronous
Baud Rate:	9,600 bits per second (bps)
Data bits:	8
Start bit:	One bit - Defined as Logic Low
Stop bit:	One bit - Defined as Logic High
Parity:	None
Inactivity:	Defined as Logic High
Hardware Flow Control:	None

9.1.4.1.1.2 Physical Connection

The serial interface shall be implemented between the assembly and the platform is shown Figure 3.1.4-1. The assembly shall route its local ground to its connector. The termination impedance (Z_T) shall be 120 ohms.

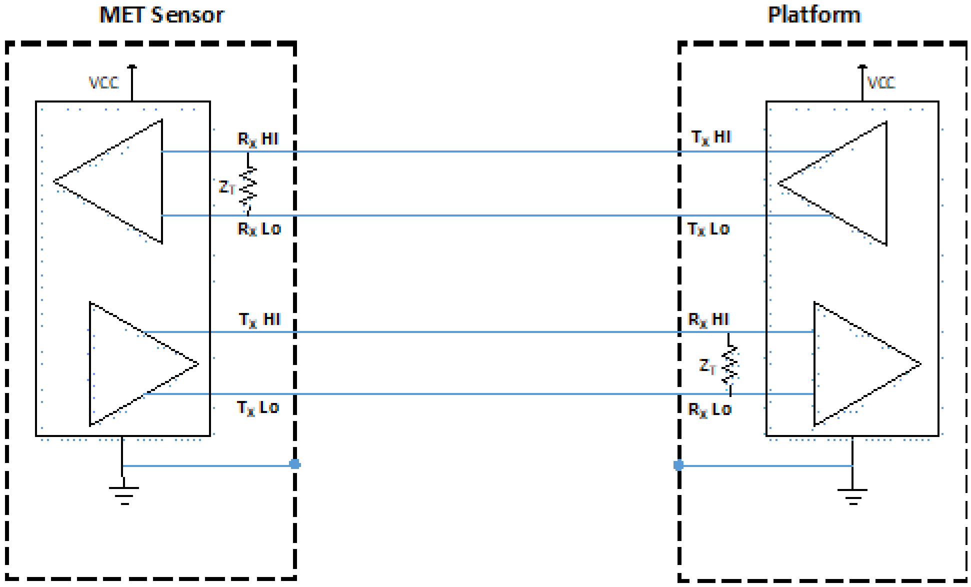


Figure 3.1.4-1 Physical Connection

9.1.4.1.1.3 Data Packet Transmission

Each byte of the data packet shall be transmitted Most Significant Bit (MSB) first. The message packet shall be transmitted header first and CRC8 last as defined in Figure 3.1.4.1.1.3-1.

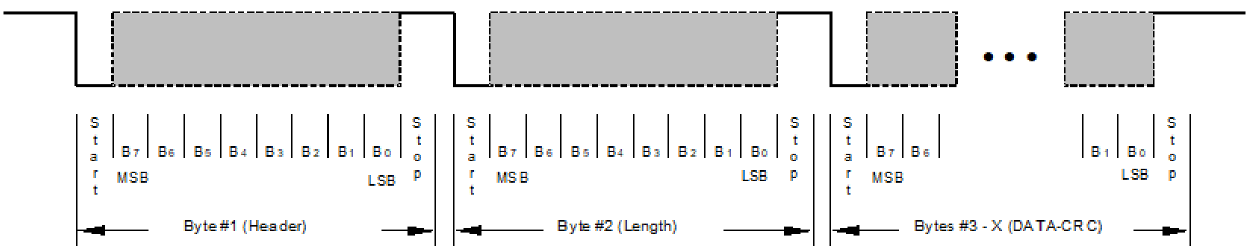


Figure 3.1.4.1.1.3-1 Serial Communications Data Format

9.1.4.1.2 Message Layer

9.1.4.1.2.1 Numerical Conventions

The conventions used within this document shall follow those typically associated with modern programming languages (i.e. C language).

Number Representations:

- Decimal, 10 digits 0 thru 9 and may use trailing subscript “d” or no trailing subscript at all
- Hexadecimal, 16 digits 0 thru F and may use preceding “0x” or trailing subscript “h” or “H”

- Binary, 8 or 16 bits (1 or 0) followed by trailing “b”

Data Format:

- UInt16 16 bit Unsigned Integer, full range of values 0:65535
- Int16 16 bit Integer, range -32768:+32767
- UInt8 8 bit Unsigned Integer, range 0:255
- String Sequence of ASCII characters enclosed with single or double quotes

9.1.4.1.2.2 General Message Format

The assembly shall support the general messaging format shown in Table 3.1.4-1for both transmission and reception of data packets on the serial interface, with the exception of the fault logs which are shown in Table 3.1.4-2.

Table 3.1.4-1 General Message Format

Byte Index	Length (bytes)	Designation	Description
1	1	Header	Message header
2	1	Remaining length	Number of remaining message bytes
3:N-1	N-3	Payload	N-3 bytes, Range of values {0:255} bytes
N	1	CRC8	CRC8 on bytes 1:N-1

Thus:

- Message length: N bytes where $4 \leq N \leq 258$
- Payload length: N-3 bytes

Table 3.1.4-2 Fault Log Message Format

Byte Index	Length (bytes)	Designation	Description
1	1	Header	Message Header
2-4	3	Remaining Length	Number of remaining message bytes
5:N-1	N-5	Payload	N-5 bytes, Range of values {0:96227} bytes
N	1	CRC8	CRC8 on bytes 1:N-1

Thus:

- Message length: N bytes where $6 \leq N \leq 96233$
- Payload length: N-5 bytes

There shall be no appreciable intra-messages gaps other than that defined by the stop bits. An intra-message gap greater than 1 byte shall be defined to be a *link idle* condition and shall result in message termination and discard of any partially received message bytes in progress.

There shall be no assumptions regarding inter-message gaps which can be as short as 1 stop bit and of indefinite duration in the case of a link idle condition.

9.1.4.1.2.3 Transmission Rate

Transmitted messages shall be either asynchronous or periodical. Periodical transmitted messages shall have a tolerance of ± 1% of the specified transmission rate.

9.1.4.1.2.4 CRC8 – 8 bit Cyclical Redundancy Check

The CRC8 byte for transmitted messages shall be performed on bytes 1:N-1 (i.e. all message bytes except the last one). Validation of received message integrity shall be performed by computation of the CRC8 on message bytes 1:N-1 and comparing for match to received byte N. Validation of the CRC8 algorithm shall be performed by computing the CRC8 of the entire message (bytes 1:N) and comparing to 0. If the CRC8 computation does not match the CRC8 message byte, the entire data packet shall be disregarded.

CRC8(UInt8 *pByteArr, UInt16 length) Algorithm (Batch processing for example bytes 1:N-1)

The CRC8 code snippet is example code for computing a CRC8 value for the last byte (byte N) of a message. For an N byte message, the Nth byte shall be set to the value computed using a pointer to the first message byte with length N-1.

```
#define     UInt8     unsigned char
#define     UInt16    unsigned int
const UInt8 CRC8_Table[] =
{
0x00, 0x07, 0x0e, 0x09, 0x1c, 0x1b, 0x12, 0x15, 0x38, 0x3f, 0x36, 0x31, 0x24, 0x23, 0x2a,
0x2d,
0x70, 0x77, 0x7E, 0x79, 0x6C, 0x6B, 0x62, 0x65, 0x48, 0x4F, 0x46, 0x41, 0x54, 0x53, 0x5A,
0x5D,
0xE0, 0xE7, 0xEE, 0xE9, 0xFC, 0xFB, 0xF2, 0xF5, 0xD8, 0xDF, 0xD6, 0xD1, 0xC4, 0xC3,
0xCA, 0xCD,
0x90, 0x97, 0x9E, 0x99, 0x8C, 0x8B, 0x82, 0x85, 0xA8, 0xAF, 0xA6, 0xA1, 0xB4, 0xB3,
0xBA, 0xBD,
0xC7, 0xC0, 0xC9, 0xCE, 0xDB, 0xDC, 0xD5, 0xD2, 0xFF, 0xF8, 0xF1, 0xF6, 0xE3, 0xE4,
0xED, 0xEA,
0xB7, 0xB0, 0xB9, 0xBE, 0xAB, 0xAC, 0xA5, 0xA2, 0x8F, 0x88, 0x81, 0x86, 0x93, 0x94,
0x9D, 0x9A,
0x27, 0x20, 0x29, 0x2E, 0x3B, 0x3C, 0x35, 0x32, 0x1F, 0x18, 0x11, 0x16, 0x03, 0x04, 0x0D,
0x0A,
0x57, 0x50, 0x59, 0x5E, 0x4B, 0x4C, 0x45, 0x42, 0x6F, 0x68, 0x61, 0x66, 0x73, 0x74, 0x7D,
0x7A,
0x89, 0x8E, 0x87, 0x80, 0x95, 0x92, 0x9B, 0x9C, 0xB1, 0xB6, 0xBF, 0xB8, 0xAD, 0xAA,
0xA3, 0xA4,
```

```
0xF9, 0xFE, 0xF7, 0xF0, 0xE5, 0xE2, 0xEB, 0xEC, 0xC1, 0xC6, 0xCF, 0xC8, 0xDD, 0xDA,
0xD3, 0xD4,
0x69, 0x6E, 0x67, 0x60, 0x75, 0x72, 0x7B, 0x7C, 0x51, 0x56, 0x5F, 0x58, 0x4D, 0x4A, 0x43,
0x44,
0x19, 0x1E, 0x17, 0x10, 0x05, 0x02, 0x0B, 0x0C, 0x21, 0x26, 0x2F, 0x28, 0x3D, 0x3A, 0x33,
0x34,
0x4E, 0x49, 0x40, 0x47, 0x52, 0x55, 0x5C, 0x5B, 0x76, 0x71, 0x78, 0x7F, 0x6A, 0x6D, 0x64,
0x63,
0x3E, 0x39, 0x30, 0x37, 0x22, 0x25, 0x2C, 0x2B, 0x06, 0x01, 0x08, 0x0F, 0x1A, 0x1D, 0x14,
0x13,
0xAE, 0xA9, 0xA0, 0xA7, 0xB2, 0xB5, 0xBC, 0xBB, 0x96, 0x91, 0x98, 0x9F, 0x8A, 0x8D,
0x84, 0x83,
0xDE, 0xD9, 0xD0, 0xD7, 0xC2, 0xC5, 0xCC, 0xCB, 0xE6, 0xE1, 0xE8, 0xEF, 0xFA, 0xFD,
0xF4, 0xF3
};
UInt8 CRC8(UInt8 *pByteArr, UInt16 length)
{
  UInt8 crc;
  UInt16 i;

  for(crc = 0x00, i = 0; i < length; i++)
  {
        crc = CRC8_Table[crc ^ pByteArr[i]];
  }
  return crc;
```

9.1.4.1.2.5 Data Packet Definition

A summary of all inbound and outbound data messages are shown in Table 3.1.4-2 and Table 3.1.4-3, respectively.

Table 3.1.4-2 Inbound Messages (Platform to MET Sensor)

Message Designation	Header (hex)	Function
DP180	B4	Get FRU Information
DP194	C2	Get Fault Log
DP198	C6	Clear Fault Log
DP202	CA	Set Fault Log Time

Table 3.1.4-3 Outbound Messages (MET Sensor to Platform)

Message Designation	Header (hex)	Function
DP151	97	Met Data
DP161	A1	Power on Self-Test (POST), Self-Test
DP171	AB	Built In Test (BIT) (Reserved)
DP181	B5	Field Replaceable Unit (FRU)
DP195	C3	Fault Log

Data Packet: **DP151 (DP 0x97) Met Data**

Source: **MET Sensor** Destination: **Platform** Message Length (bytes):**16**

Transmission Rate: **40Hz**

Byte 1: Header

1	0	0	1	0	1	1	1
7	6	5	4	3	2	1	0

Field	Description
7:0	**Header – 0x97**

Byte 2: Length

0	0	0	0	1	1	1	0
7	6	5	4	3	2	1	0

Field	Description
7:0	**Length – 14 Remaining bytes in message**

Byte 3: Msg Counter

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
7:0	**UInt8 Counter, post increments every message (roll over 0xFF to 0x00)**

Bytes 4 and 5: Air Temperature

D15	D14	D13	D12	D11	D10	D9	D8
D7	D6	D5	D4	D3	D2	D1	D0
7	6	5	4	3	2	1	

Field	Description
15:0	**Air Temperature** **Units: Degrees Fahrenheit (ºF)** **Format: Int16** **Valid range: -40.0 to +160.0 ºF** **Resolution: 0.1 ºF /LSB** **Example: +160.0 ºF = 0x0640, 0.0 ºF = 0x0000, -40.0 ºF = 0xFE70**

Bytes 6 and 7: Barometric Pressure

D15	D14	D13	D12	D11	D10	D9	D8
D7	D6	D5	D4	D3	D2	D1	D0
7	6	5	4	3	2	1	0

D15	D14	D13	D12	D11	D10	D9	D8

Field	Description
15:0	**Atmospheric Pressure** **Units: Inches Mercury (Hg)** **Format: UInt16** **Valid range: 0.00 to 33.46** **Resolution: 0.01 Hg /LSB** **Example: 33.46 Hg = 0x0D12, 19.68 Hg = 0x07B0, 0.00 Hg = 0x0000**

Bytes 8 and 9: Crosswind

D15	D14	D13	D12	D11	D10	D9	D8
D7	D6	D5	D4	D3	D2	D1	D0
7	6	5	4	3	2	1	0

Field	Description
15:0	**Crosswind Velocity** **Units: Miles per Hour (MPH)** **Format: Int16** **Valid range: -85.0 to 85.0** **Resolution: 0.1 MPH/LSB** **Example: +85.0 MPH = 0x0352, +45.0 MPH = 0x01C2, 0.0 MPH = 0x0000, -45.0 MPH = 0xFE3E, -85.0 MPH = 0xFCAE** **Positive Wind Direction shall be right to left looking forward**

Bytes 10 and 11: Headwind

D15	D14	D13	D12	D11	D10	D9	D8
D7	D6	D5	D4	D3	D2	D1	D0
7	6	5	4	3	2	1	0

	Description
15:0	**Headwind Velocity** **Units: Miles per Hour (MPH)** **Format: Int16** **Valid range: -85.0 to 85.0** **Resolution: 0.1 MPH/LSB** **Example: +85.0 MPH = 0x0352, +45.0 MPH = 0x01C2, 0.0 MPH = 0x0000, -45.0 MPH = 0xFE3E, -85.0 MPH = 0xFCAE** **Positive Wind Direction shall be front to back**

Bytes 12 and 13: Humidity

D15	D14	D13	D12	D11	D10	D9	D8
D7	D6	D5	D4	D3	D2	D1	D0

D15	D14	D13	D12	D11	D10	D9	D8
7	6	5	4	3	2	1	0

Field	Description
15:0	**Humidity** **Units: Percent RH** **Format: Int16** **Valid range: 0.0 to 100.0 %** **Resolution: 0.1 %/LSB** **Example: 100.0 % = 0x03E8, 50.0 % = 0x01F4, 0.0 % = 0x0000**

Bytes 14 and 15: Auxiliary Temperature/External Temperature Input

D15	D14	D13	D12	D11	D10	D9	D8
D7	D6	D5	D4	D3	D2	D1	D0
7	6	5	4	3		1	0

Field	Description
15:0	**Auxiliary Temperature/External Temperature Input** **Units: Degrees Fahrenheit (ºF)** **Format: Int16** **Valid range: -40.0 to +160.0 ºF** **Resolution: 0.1 ºF /LSB** **Example: +160.0 ºF = 0x0640, 0.0 ºF = 0x0000, -40.0 ºF = 0xFE70**

Byte 16: Cyclical Redundancy Check (CRC8)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
7:0	**CRC8 will include Header, Length and Payload**

Data Packet: **DP161 (DP 0xA1) Self Test**

Source: **MET Sensor** Destination: **Platform** Message Length (bytes): **8**
Transmission Rate: **1Hz**

Byte 1: Header

1	0	1	0	0	0	0	1
7	6	5	4	3	2	1	0

Field	Description
7:0	**Header – 0xA1**

Byte 2: Length

0	0	0	0	0	1	1	0
7	6	5	4	3	2	1	0

Field	Description
7:0	**Length – 6 Remaining bytes in message**

Byte 3: Fault Type

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
7:0	**Bit 7 Fault Status (0 = No Fault, 1 = Fault Set)Bit 6 Air Temperature (0 = No Fault, 1 = Fault Set)Bit 5 Humidity (0 = No Fault, 1 = Fault Set)Bit 4 Pressure (0 = No Fault, 1 = Fault Set)Bit 3 Aux Temperature (0 = No Fault, 1 = Fault Set)Bit 2 Wind (0 = No Fault, 1 = Fault Set)Bit 1 Input Voltage (0 = No Fault, 1 = Fault Set)Bit 0 Processor (0 = No Fault, 1 = Fault Set)**

Byte 4: Self Test

D	D
7	6

Field	Description
7:0	**Bit 7 Crosswind (0 = No Fault, 1 = Fault Set)Bit 6 Headwind (0 = No Fault, 1 = Fault Set)Bits 5:4 Pressure Redundancy Status (00 = No Fault, 01 = 1 Sensor Failed, 10 = 2 Sensors Failed, 11 = 3/4 Sensors Failed)Bits 3:2 Humidity Redundancy Status (00 = No Fault, 01 = 1 Sensor Failed, 10 = 2 Sensors Failed, 11 = 3/4 Sensors Failed)Bits 1:0 Temperature Redundancy Status (00 = No Fault, 01 = 1 Sensor Failed, 10 = 2 Sensors Failed, 11 = 3/4 Sensors Failed)**

Byte 5: Self Test

D	D	D	D	D	D	D	D

D7	D6	D5	D4	D3	D2	D1	D0

Field	Description
7:0	**Bits 7:6 Headwind: Wind Signal Strength S4 (00 = Very Low, 01 = Low, 10 = Moderate, 11 = High) Bits 5:4 Crosswind: Wind Signal Strength S3 (00 = Very Low, 01 = Low, 10 = Moderate, 11 = High) Bits 3:2 Headwind: Wind Signal Strength S2 (00 = Very Low, 01 = Low, 10 = Moderate, 11 = High) Bits 1:0 Crosswind: Wind Signal Strength S1 (00 = Very Low, 01 = Low, 10 = Moderate, 11 = High)**

Byte 6: Self Test

D7	D6	D5	D4	D3	D2	D1	D0

Field	Description
7:0	**Bit 7 Headwind: Excess Baseline Noise Error S4 (0 = No Fault, 1 = Fault Set)Bit 6 Crosswind: Excess Baseline Noise Error S3 (0 = No Fault, 1 = Fault Set)Bit 5 Headwind: Excess Baseline Noise Error S2 (0 = No Fault, 1 = Fault Set)Bit 4 Crosswind: Excess Baseline Noise Error S1 (0 = No Fault, 1 = Fault Set)Bit 3 Headwind: No Receive Signal Error S4 (0 = No Fault, 1 = Fault Set)Bit 2 Crosswind: No Receive Signal Error S3 (0 = No Fault, 1 = Fault Set)Bit 1 Headwind: No Receive Signal Error S2 (0 = No Fault, 1 = Fault Set)Bit 0 Crosswind: No Receive Signal Error S1 (0 = No Fault, 1 = Fault Set)**

Byte 7: Self Test

D7	D6	D5	D4	D3	D2	D1	D0

Field	Description
7:0	**Bit 7 Analog Crosswind Driver Circuit Fault (0 = No Fault, 1 = Fault Set) Bit 6 Calibration Bit 5 Auxiliary Temperature Out of Limit (0 = Fault Cleared, 1 = Fault Set)Bit 4 Auxiliary Temperature Detached (0 = Fault Cleared, 1 = Fault Set)Bit 3 Communication Synchronization Error (0 = No Fault, 1 = Fault Set)Bit 2 Inferred Temperature Fault (0 = No Fault, 1 = Fault Set)Bit 1 Headwind: Out of Limit (0 = No Fault, 1 = Fault Set)Bit 0 Crosswind: Out of Limit (0 = No Fault, 1 = Fault Set)**

Byte 8: Cyclical Redundancy Check (CRC8)

D7	D6	D5	D4	D3	D2	D1	D0

Field	Field

D	D	D	D	D	D	D	D
7:0	**7:0**						

Data Packet: **DP171 (DP 0xAB) Built in Test (BIT) Reserved (NOT APPLICABLE)**

Source: **MET Sensor** Destination: **Platform** Message Length (bytes): **N/A**
Transmission Rate: **Asynchronous**

Data Packet: **DP180 (DP 0xB4) Get FRU Information**

Source: **Platform** Destination: **MET Sensor** Message Length (bytes): **3**
Transmission Rate: **Asynchronous**

Byte 1: Header

1	0	1	1	0	1	0	0
7	6	5	4	3	2	1	0

Field	**Description**
7:0	**Header – 0xB4**

Byte 2: Length

0	0	0	0	0	0	0	1
7	6	5	4	3	2	1	0

Field	**Description**
7:0	**Length – 1 Remaining bytes in message**

Byte 3: Cyclical Redundancy Check (CRC8)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	**Description**
7:0	**CRC8 will include Header, Length and Payload**

Data Packet: **DP181 (DP 0xB5) Field Replaceable Unit (FRU)**

Source: **Assembly** Destination: **Platform** Message Length (bytes): **34**
Transmission Rate: **Asynchronous**

Byte 1: Header

1	0	1	1	0	1	0	1
7	6	5	4	3	2	1	0

Field	Description
7:0	Header – 0xB5

Byte 2: Length

0	0	1	1	0	1	0	1
7	6	5	4	3	2	1	0

Field	Description
7:0	Length – 53 Remaining bytes in message

Bytes: 3 to 23: Part Name

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
167:0	Part Name: 21 Character part name (“Meteorological Sensor”) Format: 8-bit ASCII

Bytes: 24 to 33: Part Number

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
167:0	Part Number: 10 Digit ordinance number, a dash followed by a single digit (”12733020-0”) Format: 8-bit ASCII

Bytes: 34 to 41: Serial Number

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
63:0	Serial Number: Limited to 8 alphanumeric characters (example "54AF2340") Format: 8-bit ASCII

Bytes: 42 to 46: Cage Code

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
39:0	**Cage Code: 5 Digital Alphanumeric value (example "7Z4Y5") Format: 8-bit ASCII**

Bytes: 47 to 54: Firmware Version

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
63:0	**Firmware Version: Limited to 8 alphanumeric characters (example "2017AB00") Format: 8-bit ASCII**

Byte 55: Cyclical Redundancy Check (CRC8)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
7:0	**CRC8 will include Header, Length and Payload**

Data Packet: **DP194 (DP 0xC2) Get Fault Log**

Source: Destination: **Met Sensor** Message Length (bytes): **3**
Transmission Rate: **Asynchronous**

Byte 1: Header

1	1	0	0	0	0	1	0
7	6	5	4	3	2	1	0

Field	Description
7:0	**Header – 0xC2**

Byte 2: Length

0	0	0	0	0	0	0	1
7	6	5	4	3	2	1	0

Field	Description
7:0	**Length – 1 Remaining byte in message**

Byte 3: Cyclical Redundancy Check (CRC8)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
7:0	**CRC8 will include Header, Length and Payload**

Data Packet: **DP195 (DP 0xC3) Fault Log**

Source: **Platform** Destination: **Met Sensor** Message Length (bytes): **N**
Transmission Rate: **Asynchronous**

Byte 1: Header

1	1	0	0	0	0	1	0
7	6	5	4	3	2	1	0

Field	Description
7:0	**Header – 0xC3**

Bytes 2: Length

0	1	0	0	1	1	1	0
7	6	5	4	3	2	1	0

Field	Description
7:0	**Length – 78 Remaining byte in message**

Bytes 3 to 23: Name

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
167:0	**Part Name: 21 Character part name (“Meteorological Sensor”)** **Format: 8-bit ASCII**

Bytes: 24 to 33: Part Number

D	D	D	D	D	D
7	6	5	4	3	2

Field	Description
79:0	**Part Number: 10 Digit ordinance number, a dash followed by a single digit (example”12733020-0”)** **Format: 8-bit ASCII**

Bytes: 34 to 41: Serial Number

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
63:0	**Serial Number: Limited to 8 alphanumeric characters** **(example "54AF2340")** **Format: 8-bit ASCII**

Bytes: 42 to 46: Cage Code

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description

D	D	D	D	D	D	D	D
39:0	**Cage Code: 5 Digital Alphanumeric value (example”7Z4Y5”) Format: 8-bit ASCII**						

Bytes: 47 to 54: Firmware Version

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
63:0	**Firmware Version: Limited to 8 alphanumeric characters (example "2017AB00") Format: 8-bit ASCII**

Bytes 55 to 56: Fault Log ID

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
15:0	**Fault Log Record ID within the Fault Log, MS Byte first.**

Bytes 57 to 79: Fault Log Entry Data

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
183:0	**Fault Log Entry Data: See Table 5.1-1 for details**

Note: Format of bytes 36 through 60 to be repeated for each additional fault log to be transmitted within the message.

Byte 80: Cyclical Redundancy Check (CRC8)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	Description
7:0	**CRC8 will include Header, Length and Payload**

Data Packet: **DP198 (DP 0xC6) Clear Fault Log**

Source: **Platform** Destination: **MET Sensor** Message Length (bytes): **3**
Transmission Rate: **Asynchronous**

Byte 1: Header

1	1	0	0	0	1	1	0
7	6	5	4	3	2	1	0

Field	Description
7:0	**Header – 0xC6**

Byte 2: Length

0	0	0	0	0	0	0	1
7	6	5	4	3	2	1	0

Field	Description
7:0	**Length – 1 Remaining byte in message**

Byte 3: Cyclical Redundancy Check (CRC8)

D	D	D	D	I
7	6	5	4	

Field	Description
7:0	**CRC8 will i Header, Len Payload**

Data Packet: **DP202 (DP 0xCA) Set Fault Log Time**

Source: **Platform** Destination: **MET Sensor** Message Length (bytes): **9**

Transmission Rate: **1Hz**

Byte 1: Header

1	1	0	0	1	0	1	0
7	6	5	4	3	2	1	0

Field	**Description**
7:0	**Header – 0xCA**

Byte 2: Length

0	0	0	0	0	1	1	1
7	6	5	4	3	2	1	0

Field	**Description**
7:0	**Length – 7 Remaining byte in message**

Byte 3 to 6: Timestamp (seconds)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	**Description**
31:0	**Time when event was logged. LS byte first. Time is an unsigned 32-bit value representing the time as the number of seconds from 00:00:00, January 1, 1970. This format is sufficient to maintain time stamping with 1-second resolution past the year 2100.**

Byte 7 and 8: Timestamp (ms)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	**Description**
15:0	**Time when event was logged in milliseconds. This is an unsigned 16-bit value.**

Byte 9: Cyclical Redundancy Check (CRC8)

D	D	D	D	D	D	D	D
7	6	5	4	3	2	1	0

Field	**Description**
7:0	**CRC8 will include Header, Length and Payload**

10 Fault Descriptions

10.1 Faults

The following paragraphs contain a description of the Power on Self Test (POST), Self-Test and Fault Log faults that can be generated by the Meteorological Sensor. Note: **0**= Cleared; **1** = Set.

10.1.1 Wind Faults

10.1.2 Out-of-Limit Fault

If calculated wind speed values exceed the 85 MPH maximum, this error is triggered and wind speed will be reported as erroneous.

Table 10.1.2-1 Out-of-Limit Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 2	Byte 42: Bit 2
Byte 4: Bit 6 and/or Bit 7	Byte 43: Bit 6 and/or Bit 7
Byte 7: Bit 0 and/or Bit 1	Byte 46: Bit 0 and/or Bit 1

Table 10.1.2-2 Out-of-Limit Fault Truth Table

Inputs		Outputs		
Crosswind: Out of limit Error	Headwind: Out of limit Error	Crosswind	Headwind	Wind
0	0	0	0	0
0	1	0	1	1
1	0	1	0	1
1	1	1	1	1

10.1.3 No Receive Signal Fault

If enough received sonic pulses are not received to produce a statistically valid wind reading, this error is triggered and wind speed will be reported as erroneous.

Table 10.1.4-1 No Receive Signal Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 2	Byte 42: Bit 2
Byte 4: Bit 6 and/or Bit 7	Byte 43: Bit 6 and/or Bit 7
Byte 6: Bit 0 and/or Bit 1 and/or Bit 2 and/or Bit 3	Byte 45: Bit 0 and/or Bit 1 and/or Bit 2 and/or Bit 3

Table 10.1.4-2 No Receive Signal Fault Truth Table

Inputs				Outputs		
Headwind: No Receive Signal Error S4	Crosswind: No Receive Signal Error S3	Headwind: No Receive Signal Error S2	Crosswind: No Receive Signal Error S1	Crosswind	Headwind	Wind
0	0	0	0	0	0	0
0	0	0	1	1	0	1
0	0	1	0	0	1	1
0	0	1	1	1	1	1
0	1	0	0	1	0	1
0	1	0	1	1	0	1
0	1	1	0	1	1	1
0	1	1	1	1	1	1
1	0	0	0	0	1	1
1	0	0	1	1	1	1
1	0	1	0	0	1	1
1	0	1	1	1	1	1
1	1	0	0	1	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

10.1.4 Excessive Baseline Noise Fault

If the baseline noise level prior to receiving a sonic pulse signal is above internal limits, this error is triggered and wind speed will be reported as erroneous.

Table 10.1.5-1 Excessive Baseline Noise Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 2	Byte 42: Bit 2
Byte 4: Bit 6 and/or Bit 7	Byte 43: Bit 6 and/or Bit 7
Byte 6: Bit 4 and/or Bit 5 and/or Bit 6 and/or Bit 7	Byte 45: Bit 4 and/or Bit 5 and/or Bit 6 and/or Bit 7

Table 10.1.5-2 Excessive Baseline Noise Fault Truth Table

Inputs	Outputs

Headwind: Excessive Baseline Noise Error S4	Crosswind: Excessive Baseline Noise Error S3	Headwind: Excessive Baseline Noise Error S2	Crosswind: Excessive Baseline Noise Error S1	Crosswind	Headwind	Wind
0	0	0	0	0	0	0
0	0	0	1	1	0	1
0	0	1	0	0	1	1
0	0	1	1	1	1	1
0	1	0	0	1	0	1
0	1	0	1	1	0	1
0	1	1	0	1	1	1
0	1	1	1	1	1	1
1	0	0	0	0	1	1
1	0	0	1	1	1	1
1	0	1	0	0	1	1
1	0	1	1	1	1	1
1	1	0	0	1	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

10.1.5 Wind Signal Strength

The wind signal strength is measured for each transducer, when sampling for wind speed. The condition of the signal is binned into one of four categories: High, Moderate, Low, and Very Low. If any of the received sonic pulses is determined to be of Very Low quality, the corresponding Crosswind or Headwind fault bit will be set. In the tables below, a 1 for Wind Signal Strength will indicate a Very Low measurement, while a 0 will indicate a Low or higher measurement.

Table 10.1.6-1 Wind Signal Strength Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 2	Byte 42: Bit 2
Byte 4: Bit 6 and/or Bit 7	Byte 43: Bit 6 and/or Bit 7
Byte 5:Bits 0 through 7	Byte 44: Bits 0 through 7

Table 10.1.6-2 Wind Signal Strength Truth Table

Inputs	Outputs

Headwind: Wind Signal Strength S4	Crosswind: Wind Signal Strength S3	Headwind: Wind Signal Strength S2	Crosswind: Wind Signal Strength S1	Crosswind	Headwind	Wind
0	0	0	0	0	0	0
0	0	0	1	1	0	1
0	0	1	0	0	1	1
0	0	1	1	1	1	1
0	1	0	0	1	0	1
0	1	0	1	1	0	1
0	1	1	0	1	1	1
0	1	1	1	1	1	1
1	0	0	0	0	1	1
1	0	0	1	1	1	1
1	0	1	0	0	1	1
1	0	1	1	1	1	1
1	1	0	0	1	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

10.1.6 Sensor Faults

10.1.7 Temp/Humidity Sensor Faults

Normally zero, this value indicates how many of the 4x redundant temperature/humidity sensors have failed. These sensors are housed in the same package, however the failure of humidity does not preclude the failure of its ability to measure temperature. A temperature fault in one of the sensors would trigger a temperature fault, but not a humidity fault. The redundancy of the sensors provides a means for comparing all temperature and humidity measurements independently from each other. The MET sensor reports the number of sensors that have failed. i.e 00b – No fault, 01b - One sensor failed, 10b - Two sensors failed, 11b - Three/four sensors failed. Once two of the four sensors have been identified as failing, the measurements reported from the remaining two sensors are compared to ensure that they are within 8% RH and 3.6 °F of each other. If the measurements exceed these values, the sensors will be considered unreliable and the corresponding humidity or temperature redundancy status bits will be set to state 11b. If the humidity and temperature redundancy status bits are set to either states 00b, 01b, or 10b, the corresponding Air Temperature and/or Humidity fault bit(s) will NOT be set. The corresponding Air Temperature and/or Humidity fault bit(s) will only be set when either the humidity or temperature redundancy status bits are set to state 11b. See table 4.1.2.1-1 for a list of the registers involved with temperature and humidity faults. See table 4.1.2.1-2 for a summary of the fault behaviors for Air Temperature and Humidity.

Table 10.1.8-1 Air Temperature and Humidity Sensor Faults Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 5 and/or Bit 6	Byte 42: Bit 5 and/or Bit 6
Byte 4: Bit 0, Bit 1 and/or Bit 2, Bit 3	Byte 43: Bit 0, Bit 1 and/or Bit 2, Bit 3

Table 10.1.8-2 Air Temperature and Humidity Sensor Faults Truth Table

Inputs				Outputs	
Air Temperature Redundancy Status		Humidity Redundancy Status		Air Temp	Humidity
0	0	0	0	0	0
0	0	0	1	0	0
0	0	1	0	0	0
0	0	1	1	0	1
0	1	0	0	0	0
0	1	0	1	0	0
0	1	1	0	0	0
0	1	1	1	0	1
1	0	0	0	0	0
1	0	0	1	0	0
1	0	1	0	0	0
1	0	1	1	0	1
1	1	0	0	1	0
1	1	0	1	1	0
1	1	1	0	1	0
1	1	1	1	1	1

10.1.8 Pressure Sensor Faults

Normally zero, this value indicates how many of the 4x redundant pressure sensors have failed. The MET sensor reports the number of sensors that have failed. i.e 00 – No fault, 01 - One sensor failed, 10 - Two sensors failed, 11- Three/four sensors failed. Once two of the four sensors have been identified as failing, the measurements reported from the remaining two sensors are compared to ensure that they are within 0.3 in Hg of each other. If the measurements exceed this value, the sensors will be considered unreliable and the pressure redundancy status bits will be set to state 11b. If the pressure redundancy status bit is set to either states 00b, 01b, or 10b, the corresponding Pressure fault bit will NOT be set. The corresponding Pressure fault bit will only be set when the pressure redundancy status bits are set to state 11b. See table 4.1.2.2-1 for a list of the registers involved with pressure faults. See table 4.1.2.2-2 for a summary of the fault behaviors for Pressure.

Table 10.1.9-1 Pressure Sensor Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 4	Byte 42: Bit 4
Byte 4: Bit 4, Bit 5	Byte 43: Bit 4, Bit 5

Table 10.1.9-2 Pressure Sensor Fault Truth Table

Inputs		Output
Pressure Redundancy Status		Pressure
0	0	0
0	1	0
1	0	0
1	1	1

10.1.9 Auxiliary Temperature Fault

If non-zero, this value indicates a failure with the auxiliary temperature sensor. This fault will be triggered by two conditions. One is by a reading that exceeds the range for which it is intended to measure. The second is if the auxiliary temperature sensor is detached. Since the conditions to trigger a detached fault and low out of limit temperature fault can overlap, only the detached fault will be reported in this case. The out of limit fault will only trigger for a high out of limit condition.

Table 10.1.10-1 Auxiliary Temperature Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 3	Byte 42: Bit 3
Byte 7: Bit 4 and/or Bit 5	Byte 46: Bit 4 and/or Bit 5

Table 10.1.10-2 Auxiliary Temperature Fault Truth Table

Inputs		Output
Auxiliary Temperature Out of Limit	Auxiliary Temperature Detached	Auxiliary Temperature
0	0	0
0	1	1
1	0	1
1	1	1

10.1.10 System Faults

10.1.10.1 Fault Status

The Fault Status bit indicates whether any other faults on the Tank Met system are set.

10.1.11 Processor Fault

A non-zero value indicates a failure of an internal processor system/subsystem including firmware CRC, calibration CRC, internal system RAM (Random-Access Memory), internal system ROM (Read-Only Memory), clock, or peripherals. A failure to detect and read the FRAM on power-up will also set the processor fault.

Table 10.1.12-1 Processor Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 0	Byte 42: Bit 0
Byte 7: Bit 6	Byte 46: Bit 6

Table 10.1.12-2 Processor Fault Truth Table

Processor Fault
0
1

10.1.12 Input Voltage Failure

A non-zero value indicates the input voltage exceeds 5.53V or is below 5.19V for three or more consecutive readings.

Table 10.1.13-1 Input Voltage Fault Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 3: Bit 1	Byte 42: Bit 1

Table 10.1.13-2 Input Voltage Fault Truth Table

Input Voltage Fault
0
1

10.1.13 Communication Synchronization Error

A non-zero value indicates that timestamp data from the platform has not been received for ten consecutive transmissions. This indicator is considered a flag, not a fault.

10.1.14 Table 4.1.3.4-1

10.1.15 Communication Synchronization Error Registers

DP161 – POST, Self Test	DP195 – Fault Logs
Byte 7: Bit 3	Byte 46: Bit 3

Table 10.1.16-2 Communication Synchronization Error Truth Table

Com. Sync. Error
0
1

11 Fault LOG

Table 5.1-1 Fault Log Entry Data

	Data Packet:	DP195 (DP 0xC3) Send Fault Logs		**Message Length:**	N Bytes				
	Source:	Assembly		**Destination:**	Platform				
	Transmission:	Asynchronous							
	Bit Description	**Header**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Header	1	1	0	0	0	0	1	1
	Bit Description	**Remaining Bytes In Message (N-4)**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2-4	Length	D	D	D	D	D	D	D	D
	Bit Description	**Part Number**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5-14	Part Number	D	D	D	D	D	D	D	D
	Bit Description	**Serial Number**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
15-22	Serial Number	D	D	D	D	D	D	D	D
	Bit Description	**Cage Code**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
23-27	Cage Code	D	D	D	D	D	D	D	D
	Bit Description	**Firmware Version**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
28-35	Firmware Version	D	D	D	D	D	D	D	D
	Bit Description	**Log ID**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
36-37	Log ID	D	D	D	D	D	D	D	D
	Bit Description	**Timestamp (s)**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
38-41	Timestamp (s)	D	D	D	D	D	D	D	D
	Bit Description	**Timestamp (ms)**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
42-43	Timestamp (ms)	D	D	D	D	D	D	D	D
	Bit Description	**Fault Status**	**Air Temperature**	**Humidity**	**Pressure**	**Aux. Temperature**	**Wind**	**Input Voltage**	**Processor**
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
44	Fault Type	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set
	Bit Description	**Crosswind**	**Headwind**	**Pressure Redundancy Status**		**Humidity Redundancy Status**		**Temperature Redundancy Status**	
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
45	Fault Info.	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	00b = Fault Cleared 10b = 2 Failed Sensors	01b = 1 Failed Sensor 11b = 3-4 Failed Sensors	00b = Fault Cleared 10b = 2 Failed Sensors	01b = 1 Failed Sensor 11b = 3-4 Failed Sensors	00b = Fault Cleared 10b = 2 Failed Sensors	01b = 1 Failed Sensor 11b = 3-4 Failed Sensors
	Bit Description	**Headwind: Wind Signal Strength S4**		**Crosswind: Wind Signal Strength S3**		**Headwind: Wind Signal Strength S2**		**Crosswind: Wind Signal Strength S1**	
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
46	Fault Info.	00b = Very Low 10b = Moderate	01b = Low 11b = High	00b = Very Low 10b = Moderate	01b = Low 11b = High	00b = Very Low 10b = Moderate	01b = Low 11b = High	00b = Very Low 10b = Moderate	01b = Low 11b = High
	Bit Description	**Headwind: Excessive Baseline Noise Error S4**	**Crosswind: Excessive Baseline Noise Error S3**	**Headwind: Excessive Baseline Noise Error S2**	**Crosswind: Excessive Baseline Noise Error S1**	**Headwind: No Receive Signal Error S4**	**Crosswind: No Receive Signal Error S3**	**Headwind: No Receive Signal Error S2**	**Crosswind: No Receive Signal Error S1**
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
47	Fault Info.	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set
	Bit Description	**Reserved**	**Calibration**	**Aux. Temp. Out of Limit**	**Aux. Temp. Detached**	**Com. Sync. Error**	**Inferred Temp. Fault**	**Headwind: Out of Limit**	**Crosswind: Out of Limit**
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
48	Fault Info.	X	0b = Fault Cleared 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Flag Cleared 1b = Flag Set	0b = Flag Cleared 1b = Flag Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set	0b = Fault Clear 1b = Fault Set
	Bit Description	**Air Temperature**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
49-50	Air Temperature	D	D	D	D	D	D	D	D
	Bit Description	**Barometric Pressure**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
51-52	Barometric Pressure	D	D	D	D	D	D	D	D
	Bit Description	**Crosswind**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
53-54	Crosswind	D	D	D	D	D	D	D	D
	Bit Description	**Headwind**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
55-56	Headwind	D	D	D	D	D	D	D	D
	Bit Description	**Humidity**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
57-58	Humidity	D	D	D	D	D	D	D	D
	Bit Description	**Auxiliary Temperature**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
59-60	Aux. Temperature	D	D	D	D	D	D	D	D
	Bit Description	**CRC8**							
Byte	Byte Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N	CRC8	D	D	D	D	D	D	D	D