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Total Fire Systems, Inc.

SafetyNet Fire Suppression and Gas Detection System

J1939 Communications Module

Communications Interface Specification
Part no. 650.000018

Revision 1.6
December 2, 2019

Document Revision History

Revision	Rev. Date	Corresponding Firmware Version	Description
1.0	06/27/2018	01.000	Initial release
1.1	08/09/2018	01.100	Changed J1939 Source Address to new SAE standard address (93), added specific SPNs for alarm conditions
1.2	08/24/2018	01.200	Time/Date request limited to maximum of 10 requests
1.3	12/05/2018	01.200	Corrections to section 3.1.2 (incorrect PGN and firmware revision number). Correction to section 3.2 (changed number of time/date requests to a maximum of 9 requests). Added SPN location figures as addendum #1
1.4	01/04/2019	01.200	Added notes to indicate SPNs that do not exist in system as configured for test.
1.5	01/21/2019	01.210	Corrected problem with day-of-month decoding per SPN 962, revised firmware to v1.210.
1.6	12/02/19	01.210	Added spec language to document; Updated for Amerex 500kbps part number

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1. Introduction

1.1. The Total Fire Systems SafetyNet J1939 Communications Module (TFS P/N 600.000142/Amerex P/N 26429 250kbps and 600.000170/Amerex part no. 27203 500kbps) is designed to provide Fault and Alarm Notifications for a SafetyNet Fire Suppression and Gas Detection System using the SAE J1939 CAN Communications Specification. The SafetyNet system consists of an Operator Display which serves as an RS485 serial communications Master, and one or more Detection/Releasing Modules which serve as RS485 Slaves. The J1939 Communications Module monitors communications on the SafetyNet RS485 serial communications bus and converts relevant data into J1939 fault and alarm messages to broadcast on the vehicle's J1939 CAN bus.

1.2. On power-up, the SafetyNet System performs an enumeration of Detection/Releasing Modules attached to the Operator Display and compares the result with stored configuration data. If the system configuration matches the enumeration results, the system begins continuous polling of the attached modules to detect Fault and Alarm conditions. At this time, the J1939 Communications Module requests a copy of the configuration data from the Operator Display for purposes of detecting any variations in sensor/detector data that would indicate abnormal operation; this causes the SafetyNet System to reset and repeat the system enumeration. After this, the J1939 Communications Module begins monitoring normal communications between the Operator Display and attached Modules, so that Fault and Alarm conditions can be detected and broadcast as J1939 DM1 messages.

1.3. In addition, the J1939 Module will request Time and Date data from the J1939 System Controller, so that the SafetyNet System's real-time clock can be synchronized with the controller's clock. When this data is received, it is transmitted to the SafetyNet Operator Display; this operation causes the SafetyNet System to reset an additional time.

2. J1939 Source Address

2.1. The SafetyNet J1939 Communications Modules uses J1939 **Source Address 93 (5Dh)** for all J1939 messages transmitted by the module or received by the module as directed requests. The module does not support Arbitrary Addressing or the Address Claim Message (**PGN 60928**); the source address used is assumed to be unique on the J1939 CAN bus.

3. Supported J1939 PGNs

3.1. The SafetyNet J1939 Communications Module can respond to the following J1939 PGNs if requested using the J1939 Request **PGN 59904**:

3.1.1. **PGN 64965 ECU ID** The module responds with the following SPN data using the BAM Transport Protocol (34 bytes of data transmitted):

3.1.1.1. **SPN 2901 ECU Part Number** 26429*

3.1.1.2. **SPN 2902 ECU Serial Number** *

3.1.1.3. **SPN 2903 ECU Location** *

3.1.1.4. **SPN 2904 ECU Type** Safety*

3.1.1.5. **SPN 4304 ECU Manufacturer** TFS*

3.1.1.6. **SPN 6714 ECU Hardware ID** J1939 COMM MOD*

3.1.2. **PGN 65242 Software ID** The module responds with the following SPN data (8 bytes of data transmitted). Note that the data will reflect the current firmware revision:

3.1.2.1. **SPN 965 Number of Software Identification Fields** 01

3.1.2.2. **SPN 234 Software Identification** 01.210*

3.1.3. **PGN 65226 Diagnostic Message 01 (DM1)** The module responds with the current status of the system (no faults, or any/all of the supported fault/alarm SPNs described in Section 4 of this document). Any DM1 message that includes multiple SPNs will be sent using the BAM Transport Protocol. See section 4 for descriptions of fault and alarm conditions.

3.1.3.1. **SPN 987 Protect Lamp** 00 Lamp Off (not used)

3.1.3.2. **SPN 624 Amber Warning Lamp** 01 (Lamp On) if at least one Fault or Trace Gas condition exists, else 00 (Lamp Off)

3.1.3.3. **SPN 623 Red Stop Lamp** 01 (Lamp On) if at least one Fire or Significant Gas condition exists, else 00 (Lamp Off)

3.1.3.4. **SPN 1213 Malfunction Indicator Lamp** 00 Lamp Off (not used)

3.1.3.5. **SPN 3041 Flash Protect Lamp** 11h (not used)

3.1.3.6. **SPN 3040 Flash Amber Warning Lamp** 11h (not used)

3.1.3.7. **SPN 3039 Flash Red Stop Lamp** 11h (not used)

3.1.3.8. **SPN 3038 Flash Malfunction Indicator Lamp** 11h (not used)

3.1.3.9. **SPN 1214 Suspect Parameter Number** 07F000h to 07F026h

3.1.3.10. **SPN 1215 Failure Mode Identifier** 1Fh Condition Exists

3.1.3.11. **SPN 1216 Occurrence Count** 0 to 7Eh occurrences

3.1.3.12. **SPN 1706 SPN Conversion Method** 0 (Version 4 method)

3.1.4. **PGN 65228 Diagnostic Message 03 (DM3)** This PGN can be sent by the system controller to reset fault and alarm counters to zero for all defined SPNs. If the message is directed to **Source Address 93 (5Dh)**, the module will respond with an ACK message (**PGN 59392**), as follows:

3.1.4.1. **Byte 1 Control Byte** 00 (ACK)

3.1.4.2. **Byte 2 Group Function Value** FFh (N/A)

3.1.4.3. **Byte 3 Reserved** FFh

3.1.4.4. **Byte 4 Reserved** FFh

3.1.4.5. **Byte 5 Address Negative Acknowledgement** Originator's SA

3.1.4.6. **Byte 6 PGN Requested Least Significant Byte**

3.1.4.7. **Byte 7 PGN Requested Middle Byte**

3.1.4.8. **Byte 8 PGN Requested Most Significant Byte**

3.1.5. Any other PGN requested using the J1939 Request **PGN 59904** and directed to **Source Address 93 (5Dh)** will cause a NACK message (**PGN 59392**) to be sent in response, as follows:

3.1.5.1. **Byte 1 Control Byte** 01 (NACK)

3.1.5.2. **Byte 2 Group Function Value** FFh (N/A)

3.1.5.3. **Byte 3 Reserved** FFh

3.1.5.4. **Byte 4 Reserved** FFh

3.1.5.5. **Byte 5 Address Negative Acknowledgement** Originator's SA

3.1.5.6. **Byte 6 PGN Requested Least Significant Byte**

3.1.5.7. **Byte 7 PGN Requested Middle Byte**

3.1.5.8. **Byte 8 PGN Requested Most Significant Byte**

3.2. The SafetyNet J1939 Communications Module can receive and process the following PGN if sent as a response to a directed request (**PGN 59904**). The J1939 Communications Module will request this PGN from Source Address 65 (41h), the Clever

Devices AVM System, after startup at 30-second intervals a maximum of 9 times or until a response is received.

3.2.1. **PGN 65254 Time/Date** The time/date data is parsed as specified by J1939-71, converted to UNIX format, and sent to the SafetyNet Operator Display on the SafetyNet RS485 link. Time/date is assumed to be in local format; no time zone offset is applied. A time offset is added to the received time to account for the difference in the time that the J1939 message is received and the time that the command is sent to set the RTC in the SafetyNet Operator Display.

4. Fault and Alarm Reporting

4.1. The SafetyNet J1939 Communications Module can report SafetyNet system fault and alarm conditions using the J1939 **DM1** message **(PGN 65226)** and proprietary SPNs as described below. *A block of thirty-nine proprietary SPNs starting at **520192 (07F000h)** and ending at **520230 (07F026h)** is required.* SPNs from **520192 to 520210** correspond to SafetyNet Module 1; SPNs from **520211 to 520229** correspond to Module 2. All SPNs are sent with an FMI of 31 (1fh) "Condition Exists"; the SafetyNet System RS485 communications bus does not make performance data public that could be used to determine a more descriptive FMI. Any or all of the faults described below can be included in the DM1 message and transmitted simultaneously, if necessary, using the BAM transport protocol. The SPNs are described in detail below.

4.1.1. **SPN 520192 (07F000h)** Module 1 Configuration Fault

4.1.1.1. This fault occurs if a SafetyNet module is not the module type specified in the SafetyNet system configuration or if the module has stopped communicating with the Operator Display for 30 seconds or more. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.2. **SPN 520193 (07F001h)** Module 1 Sensor 1 Fault

4.1.2.1. The SafetyNet system features the ability to automatically identify several types of sensors that can be connected to the Sensor 1-4 inputs. A fault occurs if the voltages reported by the sensor are out of the normal range for the identified sensor type, or if the identified sensor type does not match the SafetyNet configuration. The fault must be detected

continuously for 5 seconds before being reported. If a fault is detected, a DM1 message that includes the fault SPN for that sensor is sent with the Amber Warning Lamp bits set to “01” (Lamp On).

4.1.3. **SPN 520194 (07F002h)** Module 1 Sensor 2 Fault

4.1.3.1. See section 4.1.2.1

4.1.4. **SPN 520195 (07F003h)** Module 1 Sensor 3 Fault

4.1.4.1. See section 4.1.2.1

4.1.5. **SPN 520196 (07F004h)** Module 1 Sensor 4 Fault

4.1.5.1. See section 4.1.2.1

4.1.6. **SPN 520197 (07F005h)** Module 1 Heat Zone 1 Fault

4.1.6.1. The SafetyNet Driver Module (P/N 16390) features two dedicated Heat Zone inputs that are used to monitor Class B heat detector devices (thermostats, linear wire, etc.). A fault occurs if the supervision voltage for either heat zone reports an “open circuit” condition, indicating a wiring discontinuity or a disconnected EOL resistance. The fault must be detected continuously for 5 seconds before being reported. If a fault is detected, a DM1 message that includes the fault SPN for that heat zone is sent with the Amber Warning Lamp bits to “01” (Lamp On).

4.1.7. **SPN 520198 (07F006h)** Module 1 Heat Zone 2 Fault

4.1.7.1. See section 4.1.6.1

4.1.8. **SPN 520199 (07F007h)** Module 1 Sensor 1 Alarm

4.1.8.1. If the sensor detects a fire or significant gas condition, a DM1 message that includes the alarm SPN for that sensor is sent with the Red Stop Lamp bits set to “01” (Lamp On).

4.1.9. **SPN 520200 (07F008h)** Module 1 Sensor 2 Alarm

4.1.9.1. See section. 4.1.8.1

4.1.10. **SPN 520201 (07F009h)** Module 1 Sensor 3 Alarm

4.1.10.1. See section. 4.1.8.1

4.1.11. **SPN 520202 (07F00Ah)** Module 1 Sensor 4 Alarm

4.1.11.1. See section. 4.1.8.1

4.1.12. **SPN 520203 (07F00Bh)** Module 1 Heat Zone 1 Alarm

4.1.12.1. If either heat zone detects a fire condition (shorted circuit), the DM1 message that includes the alarm SPN for that heat zone is sent with the Red Stop Lamp bits set to “01” (Lamp On).

4.1.13. **SPN 520204 (07F00Ch)** Module 1 Heat Zone 2 Alarm

4.1.13.1. See section 4.1.12.1

4.1.14. **SPN 520205 (07F00Dh)** Module 1 Release Zone 1 Fault

4.1.14.1. A fault occurs if the supervision circuit for a Releasing Zone indicates a disconnected (or high-resistance) release-system actuator.

4.1.15. **SPN 520206 (07F00Eh)** Module 1 Release Zone 2 Fault

4.1.15.1. See section 4.1.14.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.16. **SPN 520207 (07F00Fh)** Module 1 Pressure Switch 1 Fault

4.1.16.1. A fault occurs if the supervision circuit for a Pressure Switch indicates a bottle-pressure that is too low for proper releasing of the fire suppression system, or as the result of a release caused by a detected fire condition.

4.1.17. **SPN 520208 (07F010h)** Module 1 Pressure Switch 2 Fault

4.1.17.1. See section 4.1.16.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.18. **SPN 520209 (07F011h)** Module 1 Primary Power Fault

4.1.18.1. A fault occurs if the detected vehicle battery voltage is less than approximately +10VDC for a period of 20 seconds. The SafetyNet backup battery (if available) provides power for the system in this case.

4.1.19. **SPN 520210 (07F012h)** Module 1 Secondary Power Fault

4.1.19.1. A fault occurs if the SafetyNet backup battery is completely discharged or disconnected. Note that this SPN pertains only to SafetyNet Driver Modules (P/N 16390).

4.1.20. **SPN 520211 (07F013h)** Module 2 Configuration Fault

4.1.20.1. See section 4.1.1.1

4.1.21. **SPN 520212 (07F014h)** Module 2 Sensor 1 Fault

4.1.21.1. See section 4.1.2.1

4.1.22. **SPN 520213 (07F015h)** Module 2 Sensor 2 Fault

4.1.22.1. See section 4.1.2.1

4.1.23. **SPN 520214 (07F016h)** Module 2 Sensor 3 Fault

4.1.23.1. See section 4.1.2.1

4.1.24. **SPN 520215 (07F017h)** Module 2 Sensor 4 Fault

4.1.24.1. See section 4.1.2.1

4.1.25. **SPN 520216 (07F018h)** Module 2 Heat Zone 1 Fault

4.1.25.1. See section 4.1.6.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.26. **SPN 520217 (07F019h)** Module 2 Heat Zone 2 Fault

4.1.26.1. See section 4.1.6.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.27. **SPN 520218 (07F01Ah)** Module 2 Sensor 1 Alarm

4.1.27.1. See section 4.1.8.1

4.1.28. **SPN 520219 (07F01Bh)** Module 2 Sensor 2 Alarm

4.1.28.1. See section 4.1.8.1

4.1.29. **SPN 520220 (07F01Ch)** Module 2 Sensor 3 Alarm

4.1.29.1. See section 4.1.8.1

4.1.30. **SPN 520221 (07F01Dh)** Module 2 Sensor 4 Alarm

4.1.30.1. See section 4.1.8.1

4.1.31. **SPN 520222 (07F01Eh)** Module 2 Heat Zone 1 Alarm

4.1.31.1. See section 4.1.12.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.32. **SPN 520223 (07F01Fh)** Module 2 Heat Zone 2 Alarm

4.1.32.1. See section 4.1.12.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.33. **SPN 520224 (07F020h)** Module 2 Release Zone 1 Fault

4.1.33.1. See section 4.1.14.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.34. **SPN 520225 (07F021h)** Module 2 Release Zone 2 Fault

4.1.34.1. See section 4.1.14.1 *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.35. **SPN 520226 (07F022h)** Module 2 Pressure Switch 1 Fault

4.1.35.1. See section 4.1.16.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.36. **SPN 520227 (07F023h)** Module 2 Pressure Switch 2 Fault

4.1.36.1. See section 4.1.16.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.37. **SPN 520228 (07F024h)** Module 2 Primary Power Fault

4.1.37.1. See section 4.1.18.1

4.1.38. **SPN 520229 (07F025h)** Module 2 Secondary Power Fault

4.1.38.1. See section 4.1.19.1. *Note: This fault does not exist in system as configured for test – it is included for possible use in other applications.*

4.1.39. **SPN 520230 (07F026h)** J1939 Communications Module Fault

4.1.39.1. A fault occurs if the SafetyNet J1939 Communications Module does not detect any valid RS485 communications from the SafetyNet System for a period of 30 seconds or more.

5. DM1 Diagnostic Trouble Codes (DTCs)

Fault/Alarm	SafetyNet Display	SPN	Lamp	FMI
Mod. 1 Fault	**TROUBLE** **<Module> Comm.**	520192	AWL	31
Mod. 1, Sens. 1 Fault	**TROUBLE** **<Module> <Sensor>** **or** **TRACE GAS** **<Module> <Sensor>**	520193	AWL	31
Mod. 1, Sens. 2 Fault	Same as Sens. 1	520194	AWL	31
Mod. 1, Sens. 3 Fault	Same as Sens. 1	520195	AWL	31
Mod. 1, Sens. 4 Fault	Same as Sens. 1	520196	AWL	31
Mod. 1, HZ1 Fault	**TROUBLE** **<Module> <Heat Zone>**	520197	AWL	31
Mod. 1, HZ2 Fault	Same as HZ1	520198	AWL	31
Mod. 1, Sens. 1 Alarm	***** FIRE ***** **<Module> <Sensor>** **or** **SIGNIFICANT GAS** **<Module> <Sensor>**	520199	RSL	31
Mod. 1, Sens. 2 Alarm	Same as Sens. 1	520200	RSL	31
Mod. 1, Sens. 3 Alarm	Same as Sens. 1	520201	RSL	31
Mod. 1, Sens. 4 Alarm	Same as Sens. 1	520202	RSL	31
Mod. 1, HZ1 Alarm	***** FIRE ***** **<Module> <Heat Zone>**	520203	RSL	31
Mod. 1, HZ2 Alarm	Same as HZ1	520204	RSL	31
Mod. 1, Rel. 1 Fault	**TROUBLE** **<Module> Discharge**	520205	AWL	31
Mod. 1, Rel. 2 Fault	Same as Rel. 1	520206	AWL	31
Mod. 1, PSW 1 Fault	**TROUBLE** **<Module> Press. Low**	520207	AWL	31
Mod. 1, PSW 2 Fault	Same as PSW 2	520208	AWL	31
Mod. 1, Pri. Pwr. Fault	No display, yellow LED at 10 second intervals	520209	AWL	31
Mod. 1, Sec. Pwr. Fault	**TROUBLE** **<Module> Battery**	520210	AWL	31
Mod. 2 Fault	Same as Module 1	520211	AWL	31
Mod. 2, Sens. 1 Fault	Same as Module 1	520212	AWL	31
Mod. 2, Sens. 2 Fault	Same as Module 1	520213	AWL	31
Mod. 2, Sens. 3 Fault	Same as Module 1	520214	AWL	31
Mod. 2, Sens. 4 Fault	Same as Module 1	520215	AWL	31
Mod. 2, HZ1 Fault	Same as Module 1	520216	AWL	31
Mod. 2, HZ2 Fault	Same as Module 1	520217	AWL	31
Mod. 2, Sens. 1 Alarm	Same as Module 1	520218	RSL	31

Fault/Alarm	SafetyNet Display	SPN	Lamp	FMI
Mod. 2, Sens. 2 Alarm	Same as Module 1	520219	RSL	31
Mod. 2, Sens. 3 Alarm	Same as Module 1	520220	RSL	31
Mod. 2, Sens. 4 Alarm	Same as Module 1	520221	RSL	31
Mod. 2, HZ1 Alarm	Same as Module 1	520222	RSL	31
Mod. 2, HZ2 Alarm	Same as Module 1	520223	RSL	31
Mod. 2, Rel. 1 Fault	Same as Module 1	520224	AWL	31
Mod. 2, Rel. 2 Fault	Same as Module 1	520225	AWL	31
Mod. 2, PSW 1 Fault	Same as Module 1	520226	AWL	31
Mod. 2, PSW 2 Fault	Same as Module 1	520227	AWL	31
Mod. 2, Pri. Pwr. Fault	Same as Module 1	520228	AWL	31
Mod. 2, Sec. Pwr. Fault	Same as Module 1	520229	AWL	31
Comm. Module Fault	No display	520230	AWL	31

Table 1 SPNs broadcast by the SafetyNet J1939 Communications Module

Note: Text in brackets "< > " is determined by the SafetyNet configuration. The default text for "<Module>" is "Mod. #", where "#" is replaced by the module number. The default text for "<Sensor>" is "Sens. #", where "#" is replaced by the sensor number. The default text for "<Heat Zone>" is "HZ#", where "#" is replaced by the heat zone number.

Note: Unique and specific SafetyNet configuration names are displayed on the SafetyNet operator display. The displayed names may not directly correspond to the messages transmitted in DM1 format. Use the control panel maps below to cross reference the DM1 message to the SafetyNet configuration name.

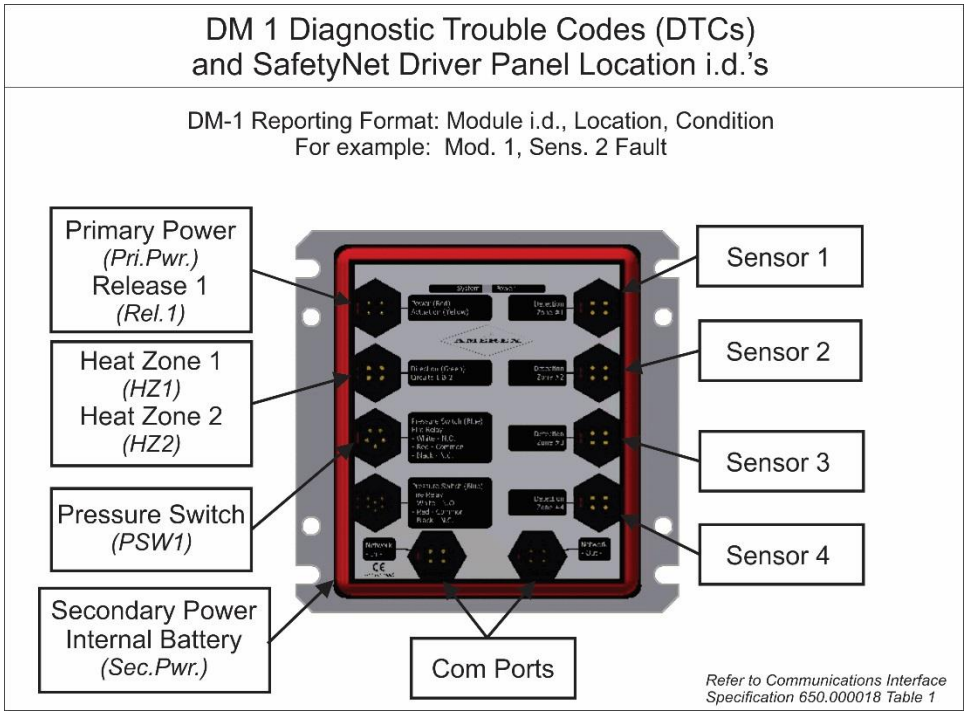

Figure 1 - SafetyNet Driver Panel input locations

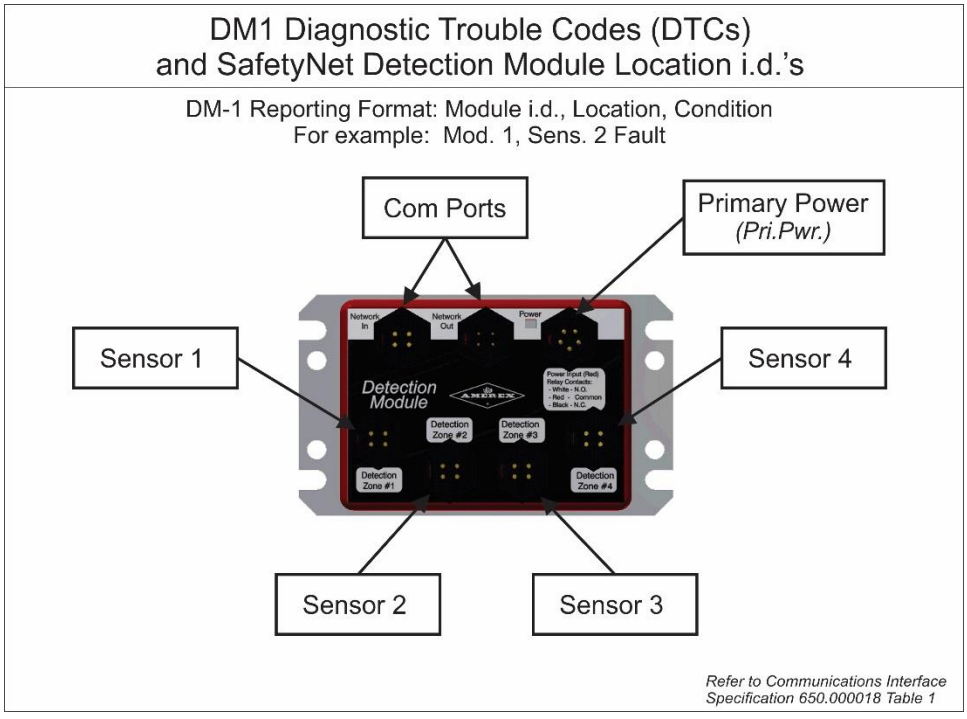

Figure 2 - SafetyNet Detection Module input locations

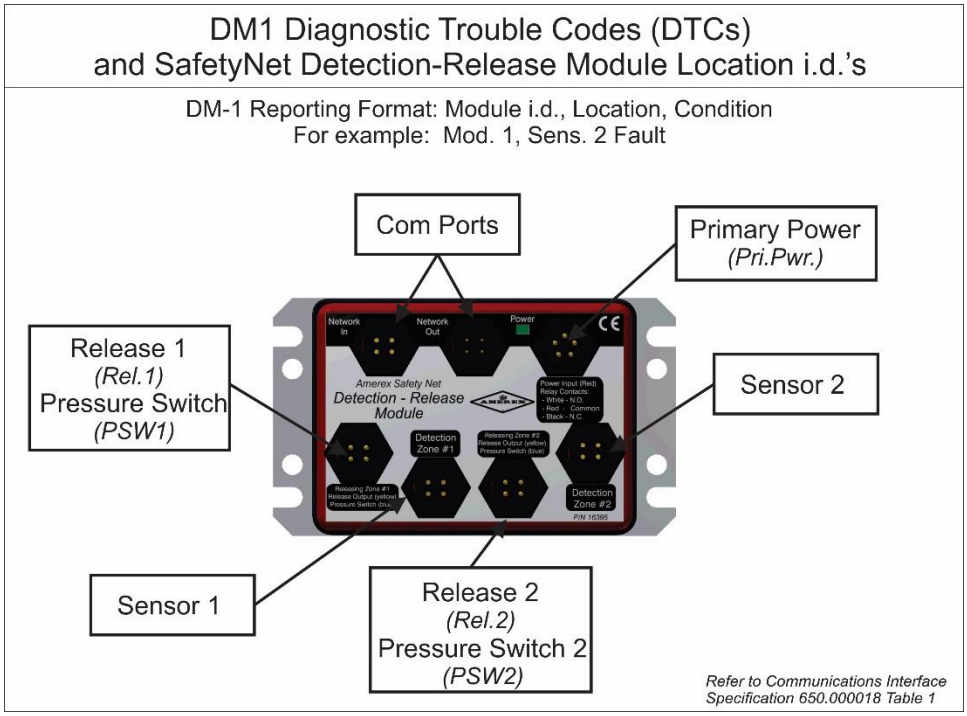

Figure 3 - SafetyNet Detection & Release Module input locations

Addendum 2 – OEM and End User Product Specification Language

A CAN/J1939 interface shall be provided which allows for discreet SafetyNet sensor and module specific identification and communication with the vehicle AVM system. The CAN/J1939 interface shall synchronize vehicle and SafetyNet real time clocks. Communication from the CAN/J1939 interface module shall use DM1 messaging format as a minimum. The CAN/J1939 module shall be tested and approved to be immune to EMC interference and certified for J1939 operation by qualified third-party test agencies. Plain English diagnostic codes shall be coordinated with the telematics provider either via DM1 or J1939-11 messaging.