SURFACE VEHICLE INFORMATION REPORT

J2057™-3 DEC2022

Issued 1993-06
Reaffirmed 2006-09
Stabilized 2022-12

Superseding J2057-3 SEP2006

Class A Multiplexing Sensors

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

This document has been declared “STABILIZED” by SAE Vehicle Architecture for Data Communications Standards Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/J2057/3_202212/

FOREWORD

This SAE Information Report is the third in a series of Class A Multiplexing Information Reports. This sensors document is not a sensor definition report but intended to be a sensor multiplexing information report. The purpose of this document is to provide information about the types of sensors that can typically be used to meet Class A Bus system requirements. These sensors fall into two general categories; analog sensors and digital sensors, including the operator controlled switches. This document is not all inclusive but is meant to be used as a tool for the system engineer designing and developing a multiplexing network application.

TABLE OF CONTENTS

1. Scope 2
1.1 Three Classes of Multiplex Networks 2

2. References 2
2.1 Applicable Publications 2
2.2 Related Publications 3

3. Definitions 3
3.1 Analog Sensor 3
3.2 Digital Sensor 3
3.3 Engineering Units 3
3.4 Binary Resolution 3
3.5 Engineering Resolution 3

4. Typical Applications 4
4.1 Analog Sensors 4
4.2 Digital Sensors 4

5. Requirements 4
5.1 Network Requirements 4
5.2 Electrical Requirements 4
5.3 Latency 4
5.4 EMC Susceptibility and Radiation 4
5.5 Reliability 5
5.6 Sensor Failure 5
5.7 Diagnostics 5

6. Sensor Types and Parameters 5

7. Conclusions 5

8. Notes 5
8.1 Key Words 5

Appendix A 6

1. SCOPE

The Class A Task Force of the Vehicle Network for Multiplexing and Data Communications Subcommittee is providing information on sensors that could be applicable for a Class A Bus application. Sensors are generally defined as any device that inputs information onto the bus. Sensors can be an input controlled by the operator or an input that provides the feedback or status of a monitored vehicle function. Although there is a list of sensors provided, this list is not all-inclusive. This SAE Information Report is intended to help the network system engineer and is meant to stimulate the design thought process.

1.1 Three Classes of Multiplex Networks

The Vehicle Network for Multiplexing and Data Communications Committee has previously identified three classes of vehicle data communication networks.

1.1.1 Class A Multiplexing

Class A Multiplexing contains many of the operator-controlled functions and the monitored vehicle function status inputs. Some examples of sensor inputs would be the operator control of powered convenience features (power window switches) or the status of a fluid level (windshield washer fluid).

1.1.2 Class B Multiplexing

Class B Multiplexing provides the data communications between different modules, internal and external to the vehicle, for the purpose of sharing common data about the vehicle. An example of this is the diagnostic information shared between an internal (on-vehicle) module and an external (hand-held) module for service repair.

1.1.3 Class C Multiplexing

Class C Multiplexing contains systems that require real time, high-speed control, and normally require a significant amount of information to function properly. An example is the wheel speed sensor for the Anti-Lock Brakes System.

2. REFERENCES

2.1 Applicable Publication

The following publication forms a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE Publication

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J2057-1 Class A Multiplexing Application/Definition

2.2 Related Publication

The following publication is provided for information purposes only and is not a required part of this document.

2.2.1 SAE Publication

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1930 Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms

3. DEFINITIONS

Class A sensors fall into the areas of operator convenience, vehicle status, and vehicle message information for a monitored function. They are characterized by moderate to slow times of being read and are non-time critical.

3.1 Analog Sensor

A sensor that converts some measured continuously varying input characteristic as a continuously varying output value or magnitude. The sensor has a maximum and minimum measurable input range that corresponds to a maximum and minimum output represented value.

3.2 Digital Sensor

A sensor that converts some measured input characteristic as discrete output states. The sensor has a maximum and minimum measurable input range that corresponds to a fixed number of discrete output states.

3.3 Engineering Units

Referred to as the units of measure detected by the sensor and processed by the measuring system. For example, Volume, Voltage, Displacement, Volume/Time, etc.

3.4 Binary Resolution

The number of digits, in base 2, required to represent the full-scale numerical value measurable by a sensor. A bit is a single unit of information which has only two states, On/Off, 1/0, HI/LO, or True/False. Binary bits may be combined into serial bits of data.

3.5 Engineering Resolution

The smallest subdivision to which a sensor's output must be resolved.

4. TYPICAL APPLICATIONS

4.1 Analog Sensors

Analog sensors are used where continuously varying measured data is required for display or mathematical calculations. Analog sensors continuously measure quantities such as voltages, resistances, pressures, etc., by representing the measured quantity with another type of continuously variable quantity, voltage or current. For example, in temperature measurement, input temperature is represented by an electric voltage or current output. The output signal is solely dependent upon the input signal and the sensor's transfer function to obtain a value or magnitude to express the measured information. To extract the information, it is necessary to compare the value or magnitude of the signal to a standard. For analog data to be transmitted on the Class A Bus, it is usually first converted to a digital format and then transmitted.

4.2 Digital Sensors

Digital sensors are used where measured data is required for status information. Digital sensors measure a variable and represent it by coded pulses or states based on discrete numerical techniques. The discrete states can be a representation of numerical values; for example, the number of motor turns can represent a seat position distance from a maximum or minimum travel point.

The discrete states could represent other information based on the various combinations of the states. The information can represent an ON/OFF state, for example, is the door locked or not; or the information can represent a status, for example, if the fuel level is at FULL, 7/8, 3/4, ..., EMPTY. The discrete states can be transmitted on the Class A Bus directly and no conversion is needed.

Digital sensors can also be switch inputs that can be closed by the operator. For example the power mirror directional switches.

5. REQUIREMENTS

This is only a general list of requirements and is not meant to be specific for any one application; that would be defined by the user. The requirements in this report are for informational purposes only, the actual requirements for each specific sensor would be determined by the application and by the manufacturer.

5.1 Network Requirements

The sensor will be capable of interfacing to the Class A Bus through integral interface circuitry or through a stand-alone interface module. Reference SAE J2057-1 for specific requirements.

5.2 Electrical Requirements

The sensor must operate at all standard automotive voltages and survive the abnormal conditions, such as reverse voltage and load dump, as required by each user.

5.3 Latency

Refer to Table 2.2, Typical Class A Applications, included in SAE J2057-1.

5.4 EMC Susceptibility and Radiation

The sensor's generation and susceptibility to EMI RFI noise must meet the requirements of the user and SAE J2057-1, 7.4.