



Electrical Hardware Requirements for Thermal Components

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard defines the requirements for electrical hardware interfaces used for thermal components to interact in the specific electrical architecture for all current vehicle programs.

1.2 Applicability. This standard to be used for all Global A and Global B electrical architecture vehicle programs in GM.

1.3 Remarks. This standard includes definitions for Heating, Ventilation and Air Conditioning (HVAC) sensor components.

- Air Quality (see GMW16142)
- Discharge Air Temperature (DAT) (see GMW16839)
- Evaporator Air Temperature (EVAP) or also known as (EAT) or (EVAP Temp) (see GMW16839)
- Outside Air Temperature (also known as Ambient Temperature)
- Relative Humidity (GMW16143)
- Solar (Sunload); including Ambient Light, Content Theft Light-Emitting Diode (LED)

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

LIN 2.0	SAE J2602-2	SAE/USCAR2	SAE/USCAR25
SAE J2602			

2.2 GM Standards/Specifications.

GMW3059	GMW3172	GMW15841	GMW16839
GMW3097	GMW3191	GMW16142	
GMW3103	GMW14082	GMW16143	

2.3 Additional References.

- Design Validation Chart
- GM1829
- GM Connector Catalog
- GM LIN Questionnaire
- GM Local Interconnect Network (LIN) Implementation Specification
- Master Timing Chart
- Preferred LIN Transceivers Portable Document Format (pdf)
- Solar-Sensor Component Technical Specification (CTS)
- Subsystem Technical Specification (SSTS)

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3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. Not applicable.

3.1.2 Content. Not applicable.

3.1.2.1 Physical Content. Not applicable.

3.1.2.2 Functional Content. Not applicable.

3.1.3 Ambient Environment. Not applicable.

3.1.4 Interfaces.

3.1.4.1 General Electrical Requirements.

3.1.4.1.1 General Electrical/Electronic Interface Requirements. The document GMW14082: General Specification Electrical/Electronic defines the requirements that all components shall meet, with Electrical/Electronic content.

3.1.4.1.2 Electrical Connector Interface Requirements. The connector used in the component shall be recommended from the connector Bill of Material (BOM) Family Owner (BFO).

The connector shall be approved/released in the GM Connector Catalog. The connector shall comply with the following:

- a. GMW15841 Connector and Terminal Design Specification
- b. GMW3191 Connector Test and Validation Specification
- c. SAE/USCAR2 Performance Standard for Automotive Electrical Connection Systems
- d. SAE/USCAR25 Electrical Connector Assembly Ergonomic Design Criteria

3.1.4.1.3 Electromagnetic Compatibility (EMC) Requirements. Refer to GMW3103.

3.1.4.1.4 Electrostatic Discharge (ESD) Requirements. Refer to GMW3103.

3.1.4.1.5 Parasitic (Quiescent) Current Requirements. Refer to GMW3172.

3.1.4.1.6 Subsystem Short Circuit Protection Requirements. Refer to GMW3172.

3.1.4.2 Global A Electrical Architecture. The variable number of inputs shall be supported by the ability to be disabled, without a change to the Printed Circuit Board (PCB). This may be done through any combination of parts delete and/or zero ohm jumpers.

- a. All inputs shall be configurable, to allow for an internal pull-up, enabling the use of a two (2) wire sensor/thermistor.

The actual value of the pull-resistor will be dependent on sensor application, and will need to be optimized based on the sensor used in the system.

Note: The individual pull-ups shall be sized appropriately to provide the best resolution to the sensor.

3.1.4.2.1 Air Quality Sensor. This input shall have the ability to sense a low side drive Pulse Width Modulation (PWM) signal and determine the duty cycle.

- a. If equipped, the sensor reading Electronic Control Unit (ECU) must provide the following input interface according to Appendix A, A1.1 Input Low Assertion (PWM) and Table A1 following setup in Table 1.
- b. This input shall have the ability to sense a low side drive PWM signal and determine the duty cycle.

Table 1: Parameter Air Quality Sensor

Parameter	Requirement
PWM Interface Type	A
Interface Supply Voltage	12 V
Frequency	100 Hz $\pm$ 5 Hz
PWM Valid Signal Range	5% to 95% $\pm$ 2%

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3.1.4.2.2 Discharge Air Temperature Sensor. If equipped the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 2.

Table 2: Parameter Discharge Air Temperature Sensor

Parameter	Requirement
Pull-up Resistance	3.0 kΩ, shall be ± 1.0%

3.1.4.2.3 Evaporator Air Temperature Sensor. If equipped, the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 3.

Table 3: Parameter Evaporator Air Temperature Sensor

Parameter	Requirement
Pull-up Resistance	8.0 kΩ, shall be ± 1.0%

3.1.4.2.4 Outside Air Temperature Sensor. If equipped, the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 4.

Table 4: Parameter Outside Air Temperature Sensor

Parameter	Requirement
Pull-up Resistance (e.g., VICM)	3.0 kΩ, shall be ± 1.0%
Pull-up Resistance (e.g., IPC)	5.0 kΩ, shall be ± 1.0%
Pull-up Resistance (e.g., IPC)	10.0 kΩ, shall be ± 1.0%

Note: Vehicle Interface Control Module (VICM), Instrument Panel Cluster (IPC).

3.1.4.2.5 Relative Humidity Sensor. If equipped the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 5.

Table 5: Parameter Relative Humidity Sensor

Parameter	Requirement
Pull-up Resistance	8.0 kΩ, shall be ± 1.0%

3.1.4.2.6 Solar Sensor.

3.1.4.2.6.1 Solar Intensity. This interface is valid for Generation 1 (Gen1) Corporate Common Component (CCC) (single-zone) and Generation 2 (Gen2) CCC – Indicator Light and Solar Sensor (ILSS) (analog single-zone) variants. If equipped, the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 6.

Table 6: Parameter Solar Intensity

Parameter	Requirement
Pull-up Resistance	3.16 kΩ, shall be ± 1.0%

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3.1.4.2.6.2 Passenger Compartment Air Temperature. This interface is valid for Gen1 CCC (single-zone and multi-zone) and Gen2 CCC – ILSS (analog single-zone) variants. If equipped, the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 7.

Table 7: Parameter Passenger Compartment Air Temperature

Parameter	Requirement
Pull-up Resistance	3.0 kΩ, shall be ± 1.0%

3.1.4.2.6.3 Solar/Angular Data. This interface is valid for Gen1 CCC (multi-zone) variants. If equipped, the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 8.

Table 8: Parameter Solar/Angular Data

Parameter	Requirement
Pull-up Resistance	100 kΩ, shall be ± 1.0%

- a. The input interface shall be able to read the pulse train data as specified in the Solar-Sensor Component Technical Specification (CTS).

3.1.4.2.6.4 Content Theft Deterred (CTD) LED. This interface is valid for Gen1 CCC (all variants) and Gen2 CCC – ILSS (analog) variants. If equipped, the sensor reading ECU must provide the output interface according to Appendix A, A2.1 Output High Side Drive and Table A3.

3.1.4.2.6.5 Ambient Light. This interface is valid for Gen1 CCC (ambient-light, single-zone and multi-zone) and Gen2 CCC – ILSS (analog) variants. If equipped the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 9.

Table 9: Parameter Passenger Ambient Light

Parameter	Requirement
Pull-up Resistance	1.0 kΩ, shall be ± 1.0%

3.1.4.2.6.6 Local Interconnect Network (LIN). This interface is valid for Gen2 CCC – ILSS (for multi-zone/charge status indicator) LIN variants. If equipped the ECU (LIN Master) and/or sensor (LIN Slave) must provide the input/output interface according to Appendix A, A3.1 Bi-Directional LIN Bus and Table A4.

3.1.4.3 Global B Electrical Architecture.

3.1.4.3.1 Air Quality Sensor. Uses LIN interface according to SAE J2602.

3.1.4.3.2 Discharge Air Temperature Sensor. If equipped, the sensor reading ECU must provide the input interface according to Appendix A, A1.2 Input Analog Sensors, Table A2 and Table 10.

Table 10: Parameter Discharge Air Temperature Sensor

Parameter	Requirement
Pull-up Resistance	7.32 kΩ, shall be ± 1.0%

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