Component Procedures: Information Bus

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Data Link Communications (Article 12802)

Circuit Description

There are many components in a vehicle that rely on information from other sources, transmit information to other sources, or both. Serial data communication network s provide a reliable, cost effective, way for various components of the vehicle to “talk” to one another and share information.

GM uses a number of different communication bus es to insure the timely and efficient exchange of information between devices. When compared to each other, some of these buses are different in nature as far as speed, signal characteristics, and behavior. An example of this is the High Speed GMLAN and Low Speed GMLAN buses. On the other hand, when other buses are compared to each other they have similar characteristics and simply operate in parallel. In this case they are used to group together components which have high interaction. Examples are the High Speed GMLAN, Powertrain Expansion, and Chassis Expansion buses. This allows them to communicate with each other on a bus with reduced message congestion insuring faster and the more timely exchange of information than if all vehicle devices were on a single bus.

The majority of information that exists within a given network generally stays local; however some information will have to be shared on other networks. Control module s designated as Gateway’s perform the function of transferring information between the various buses. A Gateway module is connected to at least 2 buses and will interact with each network according to its message strategy and transmission models.

GMLAN provides the capability for a receiving device to monitor message transmissions from other devices in order to determine if messages of interest are not being received. The primary purpose is to allow reasonable default values to be substituted for the information no longer being received. Additionally, a device may set a Diagnostic Trouble Code to indicate that the device it is expecting information from is no longer communicating.

High Speed GMLAN Circuit Description

A High Speed GMLAN Bus is used where data needs to be exchanged at a high enough rate to minimize the delay between the occurrence of a change in sensor value and the reception of this information by a control device using the information to adjust vehicle system performance.

The High Speed GMLAN serial data network consists of two twisted wires. One signal circuit is identified as GMLAN-High and the other signal circuit is identified as GMLAN-Low. At each end of the data bus there is a 120 Ω termination resistor between the GMLAN-High and GMLAN-Low circuits.

Data symbols (1’s and 0’s) are transmitted sequentially at a rate of 500 Kbit/s. The data to be transmitted over the bus is represented by the voltage difference between the GMLAN-High signal voltage and the GMLAN-Low signal voltage.

When the two wire bus is at rest the GMLAN-High and GMLAN-Low signal circuits are not being driven and this represents a logic “1”. In this state both signal circuits are at the same voltage of 2.5 V. The differential voltage is approximately 0 V.

When a logic “0” is to be transmitted, the GMLAN-High signal circuit is driven higher to about 3.5 V and the GMLAN-Low circuit is driven lower to about 1.5 V. The differential voltage becomes approximately 2.0 (+/- 0.5) V.

Chassis High Speed GMLAN Circuit Description

The GMLAN Chassis Expansion Bus is basically a copy of the High Speed GMLAN Bus except that its use is reserved for chassis components. This implementation splits message congestion between two parallel buses helping to insure timely message transmission and reception. Sometimes communication is required between the Chassis Expansion Bus and the primary High Speed GMLAN Bus. This is accomplished by using the K17 Electronic Brake Control Module (EBCM) as the Gateway module. Since the High Speed GMLAN Chassis Expansion Bus and primary High Speed GMLAN Bus operate in the same manner, the diagnostics for each are similar.

Object High Speed GMLAN Circuit Description

The GMLAN Object Bus is basically a copy of the High Speed GMLAN Bus except that its use is reserved for the enhanced safety system. This implementation is used to isolate the heavy communication among the enhanced safety system devices from the other vehicle buses, reducing congestion. The K124 Active Safety Control Module is connected to the Object Bus as well as the Primary High Speed GMLAN Bus, the Chassis Expansion Bus, and the Low Speed GMLAN Bus. The K124 Active Safety Control Module acts as a Gateway module for all required communication between the Object Bus devices and devices on these other vehicle buses. The GMLAN Object Bus operates in the same manner as the Chassis Expansion and Primary High Speed buses and so the diagnostics are similar. The Object Bus is physically partitioned into a Front Object Bus and a Rear Object Bus with each partition having its own communication enable circuit to activate the partition, but functional operation of both is identical. The Front Object Bus standard devices are the K124 Active Safety Control Module, the K109 Frontview Camera Module, and the B233B Radar Sensor Module – Long Range. The Front Object Bus optional devices are the B233LF Radar Sensor Module – Short Range Left Front and the B233RF Radar Sensor Module – Short Range

Right Front. The Rear Object Bus is optional and when present will have the K124 Active Safety Control Module and B233R Radar Sensor Module – Short Range Rear on the bus, and optionally the Radar Sensor Module – Short Range Right Rear. All Object Bus components are powered by the K124 Active Safety Control Module via the communication enable circuits, except the K109 Frontview Camera Module which is powered directly by battery.

Media Oriented Systems Transport (MOST) Circuit Description

The MOST Infotainment network is a dedicated high speed multimedia streaming data bus independent from GMLAN. The MOST bus will be configured in a physical hardwired loop with each device within the bus sends and receives data on an assigned MOST addresses in a set order. Each device on the MOST bus will be required to have twisted pair copper wires (2 transmit TX, 2 receive RX, and 1 electronic control line which is a 12 V wakeup signal line). The A11 Radio is the MOST Master and will monitor the bus for vehicle configuration, Infotainment data messages and errors on the bus. The MOST initialization consists of a short 100 ms low voltage pulse on the electronic control line (or MOST control line) connected to all devices contained on the MOST ring. This wakeup message once received by each device, will first respond with a generic device response. Once these initial responses on the MOST bus are reported successfully without error to the A11 Radio, the second data request will record the MOST device addresses, their functionality requirements and capabilities within. The A11 Radio will learn this information and also record the address node sequence on the MOST bus at this point. This node address list will now be stored within the A11 Radio as the MOST bus configuration (called “Last Working MOST ID of Node 1 – 9” on scan tool data display).

When MOST receive, transmit, or control line faults are detected, transmit/receive messages will not received as expected from the wakeup request. The A11 Radio and the K74 Human Machine Interface Control Module will then perform diagnostics to isolate these MOST faults. If the MOST control line is shorted low to 0 V for excess amount of time, the A11 Radio will set a U2098 DTC and K74 Human Machine Interface Control Module will set a U0029 02 DTC. At this point the MOST bus will be unable to communicate until the shorted MOST control line is repaired.

Once the shorted MOST control line diagnostics pass, the A11 Radio will attempt to resend the initial short pulse attempts up to 3 times on the MOST control line. If the expected responses are not received, the A11 Radio continues into a failure mode setting a U0028 DTC and will continue on to send one 300 ms long pulse, which will enable the furthest upstream transmitting device to become the surrogate MOST Master in this MOST fault/diagnostic mode. When the A11 Radio receives this new MOST Master identity, the surrogate MOST master device can be identified based on scan tool data parameter “Surrogate MOST Master Node Upstream Position”. The scan tool should be used to determine the MOST bus configuration and direction by utilizing the “Last Working MOST ID of Node 1 – 9” parameters from the A11 Radio data display. When a fault is present, it will indicate the newly enabled “Surrogate MOST Master Node Upstream Position” from the A11 Radio. This will assist in determining where the MOST bus/control is at fault. The MOST device upstream from the surrogate MOST master device, transmit, receive, or control lines will be the suspect areas for diagnostics at this point. These faults can be associated with any of the MOST transmit, receive, or control line twisted copper wires or possibly an internal device fault.

The K74 Human Machine Interface Control Module will set a U0029 00 DTC when it diagnoses a MOST bus not communicating properly after one attempt. When the DTC U0029 00 is set by the K74 Human Machine Interface Control Module without the corresponding DTC U0028 from the A11 Radio, it will be an indication of an intermittent wiring/device condition.

CAN Graphical Interface (CGI) Circuit Description

This bus is used by the Entertainment sub-system to transfer high-rate display graphics between the A11 Radio and the P17 Info Display Module and/or Radio/HVAC Control. The electrical characteristics of the CAN Graphical Interface (CGI) Bus are very similar to the High Speed GMLAN Bus. The message strategy and construction of messages are different however. Sometimes communication is required between the CAN Graphical Interface Bus and the Low Speed GMLAN Bus. This is accomplished by using the A11 Radio as the Gateway module. Since the CAN Graphical Interface Bus and primary High Speed GMLAN Bus have similar electrical characteristics, the diagnostics for each are similar.

In the case where the P17 Info Display Module and Radio/HVAC Control are separate devices the P17 Info Display Module is responsible for passing information between the A11 Radio and the Radio/HVAC Control. The A11 Radio interfaces only with the P17 Info Display Module and the P17 Info Display Module then communicates with the Radio/HVAC Control through a Local Interconnect Network (LIN) interface.

A bus wake up signal will be generated by the A11 Radio or by the P17 Info Display Module when the system functionality is required. The communication function of the CAN Graphical Interface shall be enabled or disabled based on the voltage level of the Center Stack Wake. The network will stay awake as long as the circuit voltage is driven low, to less than 1.5 V. Communications are disabled with a high circuit voltage around 5.0 V.

The A11 Radio can execute a warm reset of the P17 Info Display Module if the P17 Info Display Module fails to respond to the A11 Radio’s request. The Center Stack Reset is a low-asserted pull down output (less than 1.5

V) from the A11 Radio to the P17 Info Display Module and has the same electrical characteristics as those for the Center Stack Wake signal defined above.

Mid Speed GMLAN Circuit Description

The Mid Speed GMLAN Bus is very similar to the High Speed GMLAN Bus except that it uses a slower transmission rate of 125 Kbit/s. This bus is intended for use where the system response time demands that a large amount of data be transmitted in a relatively short amount of time, such as updating a graphics display. As such it has usually been used for infotainment applications. Sometimes communication is required between the Low Speed GMLAN Bus and the Mid Speed GMLAN Bus. This is accomplished by using the A11 Radio as the Gateway module. Since the Mid Speed GMLAN Bus and primary High Speed GMLAN Bus operate in a similar manner, the diagnostics for each are similar.

Low Speed GMLAN Circuit Description

Low Speed GMLAN Bus is used in applications where a high data rate is not required which allows for the use of less complex components. It is typically used for operator controlled functions where the response time requirements are slower than those required for dynamic vehicle control.

The Low Speed GMLAN Serial Data Network consists of a single wire, ground referenced bus with high side voltage drive. During on road vehicle operation data symbols (1’s and 0’s) are transmitted sequentially at the normal rate of 33.3 Kbit/s. For component programming only, a special high speed data mode of 83.3 Kbit/s may be used.

Unlike the high speed dual wire networks, the single wire low speed network does not use terminating resistors at either end of the network.

The data symbols to be transmitted over the bus are represented by different voltage signals on the bus. When the Low Speed GMLAN Bus is at rest and is not being driven, there is a low signal voltage of approximately 0.2 V. This represents a logic “1”. When a logic “0” is to be transmitted, the signal voltage is driven higher to around 4.0 V or higher.

Local Interconnect Network (LIN) Circuit Description

The Local Interconnect Network (LIN) Bus consists of a single wire with a transmission rate of 10.417 Kbit/s. This bus is used to exchange information between a master control module and other smart devices which provide supporting functionality. This type of configuration does not require the capacity or speed of either a High Speed GMLAN Bus or Low Speed GMLAN Bus and is thus relatively simpler.

The data symbols (1’s and 0’s) to be transmitted are represented by different voltage levels on the communication bus. When the LIN Bus is at rest and is not being driven, the signal is in a high voltage state of approximately Vbatt. This represents a logic “1”. When a logic “0” is to be transmitted, the signal voltage is driven low to about ground (0.0 V).

Communication Enable Circuit Description

Devices on High Speed GMLAN Bus enable or disable communication based on the voltage level of the communication enable circuit. When the circuit voltage is high (around 12 V), communications are enabled. When the circuit is low, communications are disabled.

Data Link Connector (DLC)

The X84 Data Link Connector (DLC) is a standardized 16-cavity connector. Connector design and location is dictated by an industry wide standard, and is required to provide the following:

- Terminal 1 Low speed GMLAN communications terminal
- Terminal 2 Class 2 communications terminal
- Terminal 3 Mid speed GMLAN serial bus (+) terminal or Object high speed GMLAN serial bus (+) terminal
- Terminal 4 Scan tool power ground terminal
- Terminal 5 Common signal ground terminal
- Terminal 6 High speed GMLAN serial data bus (+) terminal
- Terminal 7 Keyword communications terminal
- Terminal 11 Mid speed GMLAN serial bus (-) terminal or Object high speed GMLAN serial bus (-) terminal
- Terminal 12 Chassis high speed GMLAN serial bus (+) terminal
- Terminal 13 Chassis high speed GMLAN serial bus (-) terminal
- Terminal 14 High speed GMLAN serial data bus (-) terminal
- Terminal 16 Scan tool power, battery positive voltage terminal

Serial Data Reference

The scan tool communicates over the various buses on the vehicle. When a scan tool is installed on a vehicle, the scan tool will try to communicate with every device that could be optioned into the vehicle. If an option is not installed on the vehicle, the scan tool will display No Comm (or Not Connected) for that optional device. In order to avert misdiagnoses of No Communication with a specific device, refer to Data Link References for a list of devices, the buses they communicate with, and the RPO codes for a specific device.

Data Communication Schematics (Article 12853)

Figure 1: High Speed GMLAN (1 of 2)
Figure 2: High Speed GMLAN (2 of 2)
Figure 3: Chassis Expansion Bus
Figure 4: Low Speed GMLAN
Figure 5: Communications Enable
Figure 6: Linear Interconnect Network (LIN) Bus 1, 3, 4, 9, 11
Figure 7: Mid Speed GMLAN (UPH)

Computer Data Lines (Article 10723)

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Serial Data Circuit Wiring Repairs (Article 12998)

Special Tools
- J-38125-8 - Splice Sleeve Crimping Tool
- DuraSeal splice sleeves
- A wire stripping tool

For equivalent regional tools, refer to Special Tools .
The DuraSeal splice sleeves have the following 2 critical features:
- A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.
- A cross hatched (knurled) core crimp provides necessary contact integrity for the sensitive, low energy circuits.

The GM Local Area Network (GMLAN) System requires special wiring repair procedures due to the sensitive nature of the circuitry. Follow the specific procedures and instructions when working on GMLAN connectors and terminals.

GMLAN Repairs

GMLAN has 2 types of networks, low speed and high speed. Low speed GMLAN has a single wire and works at slow speeds. High speed GMLAN has 2 wires in a twisted pair and works at higher speeds. For more information on GMLAN, refer to Data Link Communications Description and Operation .

GMLAN Connector Terminal Repair

If the individual terminals are damaged on any GMLAN connection, use the appropriate connector repair procedure in order to repair the terminal. Refer to Connector Repairs for the appropriate connector repair procedure.

GMLAN Wire Repair

If any wire except the pigtail is damaged, repair the wire by splicing in a new section of wire of the same gauge size (0.5 mm², 0.8 mm², 1.0 mm² etc .). Use the DuraSeal splice sleeves and EL-38125-10 - tool . For wiring repair, refer to Wire to Wire Repair .

Local Interconnect Network (LIN) Bus Wire Repair

Repair the wire by splicing in a new section of wire of the same length and gauge size. For wiring repair, refer to Wire to Wire Repair

Media Oriented Systems Transport (MOST) Wiring Repair

The following conditions need to be met to ensure a valid continuity:
- Untwisted length for all MOST 50 circuits at each wire harness connector should be no longer 50 mm max (25 mm preferred).
- When wire repairs are made, a minimum 25 twists/meter for all MOST 50 circuits.
- MOST 50 has specific receive and transmit I/O.

The transmit of one module is connected to receive of the next module in ring topology.

Ethernet Wiring Repair

- Do not splice wires or perform your own crimps.
- Service harness kits will be released per vehicle and the kit will contain a length for each leg/peripheral device.
- The lengths are designed to allow for some extra slack but loop-backs and hard turns or pinches are not desirable.
- Twisted pairs are supplied with terminals already crimped.
- If for any reason an Ethernet wiring repair kit is not available, the preferred repair procedure is to

replace the entire harness.
- Remove the respective Ethernet connector from each module (end-to-end connection).
- Depopulate the terminals using the proper terminal removal tool from both connectors.
- Overlay the proper twisted pair provided in Ethernet Wiring Repair kit.
- Insert terminals into connectors.
- Reinstall connectors.
- Neatly secure Ethernet wiring to existing harness taking up extra length without pinching wires.

All New Technical Service Bulletins (itype_432)

Tsbs
- LIN Bus Diagnostic Information (PIT5698E, 2024/09/27)

All Technical Service Bulletins (itype_100)

Tsbs
- LIN Bus Diagnostic Information (PIT5698E, 2024/09/27)

Data Link References (Article 12804)

This table identifies which serial data link that a particular device uses for in-vehicle data transmission.
Some devices may use more than one data link to communicate. Some devices may have multiple communication circuits passing through them without actively communicating on that data link. This table is used to assist in correcting a communication malfunction. Not all devices listed will be applicable to all vehicles. Refer to the schematics to determine which devices apply. For the description and operation of these serial data communication circuits, refer to Data Link Communications Description and Operation .
Code Device Data Link Type Diagnostic Procedure
Schematic Reference: Data Communication Schematics
A10 Inside Rearview Mirror Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
A11 Radio Mid Speed GMLAN Low Speed GMLAN DTC U0074 Scan Tool Does Not Communicate with Low Speed GMLAN Device
- Mid Speed GMLAN
- Low Speed GMLAN
- DTC U0074
- Scan Tool Does Not Communicate with Low Speed GMLAN Device
A20 Radio/HVAC Controls Local Interconnect Network (LIN) DTC U1500-U15FF
B99 Steering Wheel Angle Sensor Chassis High Speed GMLAN Scan Tool Does Not Communicate with Chassis High Speed GMLAN Device
B101 Immobilizer Antenna Local Interconnect Network (LIN) DTC U1500-U15FF
B119 Multi-axis Acceleration Sensor Chassis High Speed GMLAN Scan Tool Does Not Communicate with Chassis High Speed GMLAN Device
K9 Body Control Module High Speed GMLAN Low Speed GMLAN Local Interconnect Network (LIN) Scan Tool Does Not Communicate with High Speed GMLAN Device Scan Tool Does Not Communicate with Low Speed GMLAN Device DTC U1500-U15FF
- High Speed GMLAN
- Local Interconnect Network (LIN)
- Scan Tool Does Not Communicate with High Speed GMLAN Device
- DTC U1500-U15FF
K17 Electronic Brake Control Module High Speed GMLAN Chassis High Speed GMLAN Scan Tool Does Not Communicate with High Speed GMLAN Device Scan Tool Does Not Communicate with Chassis High Speed GMLAN Device
- Chassis High Speed GMLAN
- Scan Tool Does Not Communicate with Chassis High Speed GMLAN Device
K19 Suspension Control Module High Speed GMLAN Chassis High Speed GMLAN Scan Tool Does Not Communicate with High Speed GMLAN Device Scan Tool Does Not Communicate with Chassis High Speed GMLAN Device
K20 Engine Control Module High Speed GMLAN Scan Tool Does Not Communicate with High Speed GMLAN Device
K23 Folding Top Control Module Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
K27 Fuel Pump Control Module High Speed GMALN Scan Tool Does Not Communicate with High Speed GMLAN Device
K28 Headlamp Leveling Control Module High Speed GMALN Scan Tool Does Not Communicate with High Speed GMLAN Device
K29 Seat Heating Control Module Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
K33 HVAC Control Module Low Speed GMLAN Local Interconnect Network (LIN) Scan Tool Does Not Communicate with Low Speed GMLAN Device DTC U1500-U15FF
K36 Inflatable Restraint Sensing and Diagnostic Module Low Speed GMLAN Scan Tool Does Not Communicate with Low

Speed GMLAN Device
K41R Rear Parking Assist Control Module Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
K43 Power Steering Control Module High Speed GMLAN Chassis High Speed GMLAN Scan Tool Does Not Communicate with High Speed GMLAN Device Scan Tool Does Not Communicate with Chassis High Speed GMLAN Device
K61 Sunroof Control Module Local Interconnect Network (LIN) DTC U1500-U15FF
K71 Transmission Control Module High Speed GMLAN Scan Tool Does Not Communicate with High Speed GMLAN Device
K73 Telematics Communication Interface Control Module High Speed GMLAN Low Speed GMLAN Scan Tool Does Not Communicate with High Speed GMLAN Device Scan Tool Does Not Communicate with Low Speed GMLAN Device
K82 Mobile Telephone Control Module Mid Speed GMLAN DTC U0074
K85 Passenger Presence Detection Module Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
M74D Window Motor - Driver Local Interconnect Network (LIN) DTC U1500-U15FF
M74LR Window Motor - Left Rear Local Interconnect Network (LIN) DTC U1500-U15FF
M74P Window Motor - Passenger Local Interconnect Network (LIN) DTC U1500-U15FF
M74RR Window Motor - Right Rear Local Interconnect Network (LIN) DTC U1500-U15FF
P16 Instrument Cluster Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
P26 Auxiliary Gauge Module Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
P29 Head-Up Display Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device
S79D Window Switch - Driver Local Interconnect Network (LIN) DTC U1500-U15FF
T11 Multimedia Player Interface Module Low Speed GMLAN Scan Tool Does Not Communicate with Low Speed GMLAN Device