



SURFACE VEHICLE RECOMMENDED PRACTICE

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Power Line Carrier Communications for Commercial Vehicles

RATIONALE

This technical report is stabilized because it covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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FOREWORD

This SAE Recommended Practice has been developed by the Truck and Bus Low Speed Communications Network Subcommittee of the Truck and Bus Electrical and Electronics Committee. The objectives of the subcommittee are to develop information reports, recommended practices, and standards concerned with the requirements design and usage of devices which transmit electronic signals and control information among vehicle components.

This document is intended as a guide toward standard practice and is subject to change so as to keep pace with experience and technical advances.

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1. SCOPE

This SAE Recommended Practice defines a method for implementing a bidirectional, serial communications link over the vehicle power supply line among modules containing microcomputers. This document defines those parameters of the serial link that relate primarily to hardware and software compatibility such as interface requirements, system protocol, and message format that pertain to Power Line Communications (PLC) between Tractors and Trailers.

This document defines a method of activating the trailer ABS Indicator Lamp that is located in the tractor.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 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 J1587	Electronic Data Interchange Between Microcomputer Systems In Heavy-Duty Vehicle Applications
SAE J1708	Serial Data Communications Between Microcomputer Systems In Heavy-Duty Vehicle Applications
SAE J1939	Recommended Practice for a Serial Control and Communications Vehicle Network

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 ANSI Publication

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

CISPR 25 Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers

3. ABBREVIATIONS

ABS	Antilock Brake System
AC	Alternating Current
ASK	Amplitude Shift Key modulation
CISPR	Comité International Spécial des Perturbations Radioélectriques; English: Special international committee on radio interference)
DC	Direct Current
ECU	Electronic Control Unit
FMI	Failure Mode Identifier
MID	Message Identifier
NRZ	Non Return to Zero modulation
PGN	Parameter Group Number
PID	Parameter ID
PL	Power Line
PLC	Power Line Communications
PRK	Phase Reversal Keying modulation
RF	Radio Frequency
SID	Subsystem ID
Tsd	Start Delay Time

4. INTELLECTUAL PROPERTY RIGHTS

By publication of this document, no position is taken with respect to the existence or validity of any third party patent rights in connection therewith. The SAE is not responsible for identifying patents for which a license may be required.

5. NETWORK DESCRIPTION

5.1 PLC Network

Figure 1 shows a typical PLC network. A typical network consists of Electronic Control Units (ECU) with, PLC transceivers, mounted on the tractor and trailer(s). These ECUs communicate to each other by sending Radio Frequency (RF) signals over the power line. These ECUs interface to the power line through a PLC transceiver.

The tractor PLC ECU must provide control for the Trailer ABS Indicator Lamp that is mounted in the tractor cab. This can be done by either a direct connection to the lamp, or by providing an appropriate control message (for example, by SAE J1587 or SAE J1939) to another ECU which then controls the lamp.

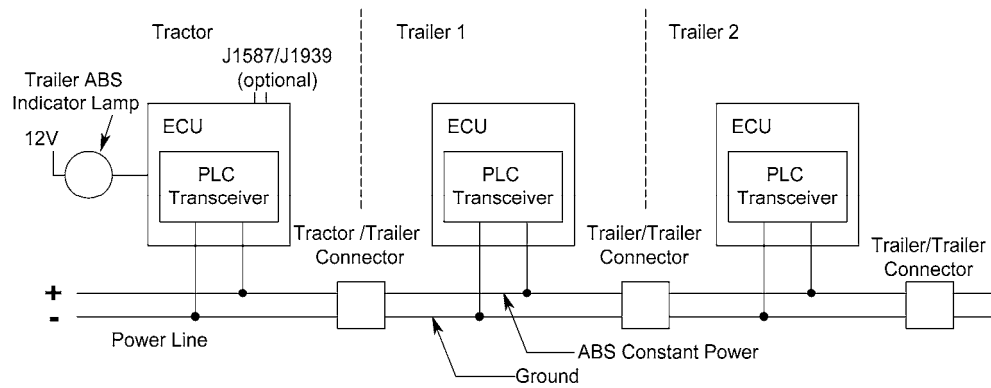


FIGURE 1 - EXAMPLE OF PLC NETWORK

5.2 PLC Transceiver

The microprocessor of an electronic module interfaces to the power line through a PLC transceiver. Refer to Figure 2. The microprocessor sends digital data (Tx) to a coding device in the PLC transceiver. This data is in the format described in SAE J1708. The coding device converts the digital data into a signal suitable for being transmitted on the power line. This signal (Signal_out) is then passed through the appropriate amplifier and filters before it is coupled onto the power line. Conversely, a PLC signal (Signal_in) is taken from the power line, filtered, and decoded into digital data (Rx). This data is sent to the host microprocessor in a format defined by SAE J1708.

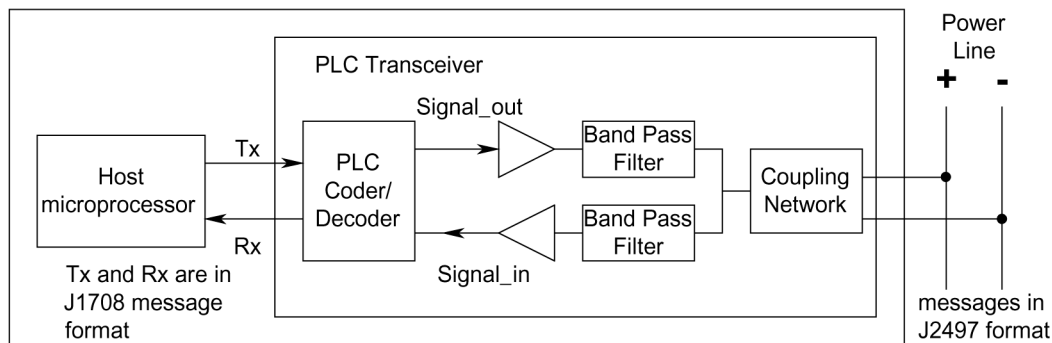


FIGURE 2 - PLC TRANSCEIVER

5.3 Coupling Examples

The PLC transceivers will interface to the power line, relative to the negative line, through the appropriate coupling network. Figure 3 illustrates two possible coupling networks. One provides capacitive coupling and the other provides transformer (inductive) coupling of the PLC signals onto the power line.

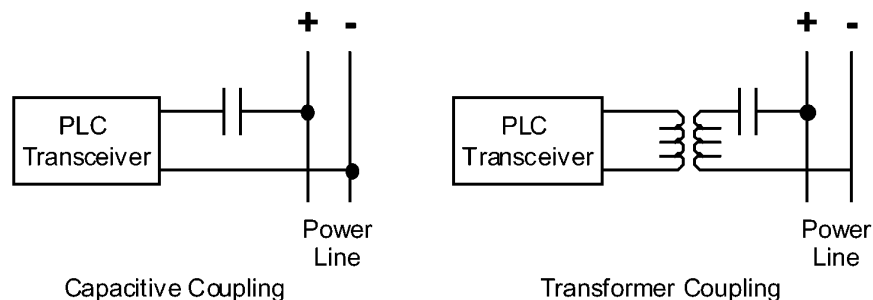


FIGURE 3 - POWER LINE COUPLING TECHNIQUES

6. POWER LINE MESSAGE

The message sent on the power line has two major parts, the preamble and the data body. Refer to Figures C1 and C2 in Appendix C for following descriptions.

6.1 Message Format Between Host Microcontroller and PLC Transceiver

The communications between the host microcontroller and the PLC transceiver follows the SAE J1708 message format. The only exception to SAE J1708 message format is the character gap between the first and second characters. The host microcontroller must wait 2 bit times after receiving the stop bit of the first character echoed back to the microcontroller before sending the second character. Refer to Figure C1 in Appendix C.

6.2 Message Format on the Power Line

The format of the message that is placed on the power line is as follows.

Message:

Preamble:

Initial Symbol(s)	Less than 2 symbols
Start bit	1 Logic low, SUPERIOR02 symbol
Data bits	8 Either Superior or Inferior symbol
Stop bit	1 Logic high, Inferior symbol

Data Body:

Sync:	5 Logic high, SUPERIOR01 symbol
Each data character:	
Start bit	1 Logic low, SUPERIOR02 symbol
Data bits	8 Either superior symbol
Stop bit	1 Logic high, SUPERIOR01 symbol
Character Gap	0 – 4 symbol times
End of message	5 Logic high, SUPERIOR01 symbol

A symbol is the signal, encoded on the power line, that is the representation of a binary state. The symbols will be discussed in more detail in subsequent sections.

The preamble is created by the PLC transceiver and uses the first character it receives, of the message to be sent, from the host microcontroller (i.e., the MID). After the preamble, the transceiver retransmits the first data character again in the data body. The host microcontroller SHOULD NOT resend the first data character again to the PLC transceiver.

6.2.1 Preamble format

Refer to Figure C1 in Appendix C. The preamble starts with less than two complete initial SUPERIOR02 symbols. The initial symbol(s) are followed by a start bit, 8 data bits, and 1 stop bits. The start bit is a SUPERIOR02 symbol and the stop bit is an Inferior symbol. The data bits are either symbol.

6.2.2 Data Body Format

A sync segment follows the preamble. This sync segment consists of 5 SUPERIOR01 symbols.

Following the sync segment is the first data character. Data characters consist of a start bit, followed by 8 data bits, and 1 stop bit. These data characters in the data body are the same characters from the SAE J1708 message sent to the PLC transceiver by the host microcontroller. The start bit is represented by a SUPERIOR02 symbol, and a stop bit is represented by a SUPERIOR01 symbol. The data bits can be either symbol.