LDV Communications Specification

Document Revision History

Feb 19 2002	Rev 0.1	Created document draft	JDS
Feb 22 2002	Rev 0.11	Added instructions on the use of Broadcast Messages	JDS
Mar 18 2002	Rev 1.0	Added information on broadcast mode and initialization and timestamp commands. Added documentation for Command $43	MJF
Mar 22 2002	Rev 1.01	Corrected information about Command $43	JMP
Mar 27 2002	Rev 1.02	Corrected Serial number information	JMP
May 3, 2002	Rev 1.03	New Modes 25 & 26 for High & Low speed J1850VPW speed selection	JMP
May 6, 2002	Rev 1.04	Changed operation of EEPROM Commands 10 & 11	JMP
May 9, 2002	Rev 1.05	Updated/Corrected Overview & updated broadcast mode	JMP
May 10, 2002	Rev 1.06	Created Command 44 for physical message without filters.	JMP

Firmware Revision History

Version 1.XX	Not Applicable, Old 15 byte fixed length.
Version 2.00	Updated to new variable length protocol & added broadcast & timestamp modes.
Version 2.10	Added commands $25, $26. Updated broadcast mode options. Updated EEPROM read & write access via commands 10 & 11.

Overview

The Via™ LDV family of interface converters translates RS-232 data to and from the J1979 OBDII-equipped vehicles. This section will provide a brief explanation of how to get started communicating with the LDV module.

Getting Connected

All data going back and forth to the VIA is encapsulated in a protocol packet as shown below, further described in the VIA Protocol section of this document. Please refer to that section for a detailed description of each field of the protocol.

Byte	Byte	Up to 255 Bytes	Byte	Up to 255 Bytes	Byte
Start of Frame	Control Length	Control Bytes	Data Length	Data Bytes	Checksum

Upon receiving power from the vehicle, the VIA hardware will auto detect all supported protocols. The first command send to the LDV should be request supported vehicle protocols (command $13).

To request all supported protocols send the following string to the LDV.

$01 $01 $13 $00 $15

Note: All values in examples are displayed as hexadecimal. In the above example the array sent to the VIA can be setup as follows:

```
//*****************************************************************************
LPSTR tx = (LPSTR)GlobalAlloc(LPTR, 128);
tx[0] = 0x01;
tx[1] = 0x01;
tx[2] = 0x13;
tx[3] = 0x00;
tx[4] = 0x15;
//*****************************************************************************
```

Once this string is sent, the following string will be returned from the LDV.
$01 $02 $93 $XX $00 $CS

$XX = Supported Protocols
- Bit 7-J1850VPW
- Bit 6-J1850PWM
- Bit 5-ISO-9141
- Bit 4-Chrysler SCI
- Bit 3-ISO-14230 (Keyword Protocol 2000)
- Bit 2
- Bit 1
- Bit 0

$CS = Checksum for the VIA protocol packet. This is equal to the least significant byte of the sum of all the bytes in the message, in hexadecimal format. For example, if the protocols on the vehicle are J1850VPW and ISO-9141 the returned message from the LDV is: **$01 $02 $93 $0A $00 $A0**

After the supported protocols are determined, command **$03** should be sent to the VIA to determine the current protocol. The VIA can only communicate using one protocol at any time.

Requesting Data

Once the current protocol is verified, data can be requested from the vehicle. This can be done by sending a **$40** request to the VIA. Command **$40** will pass a message to the vehicle bus. For information on data to send to the vehicle refer to the book HS-3000 written by the Society of Automotive Engineers (SAE) http://www.sae.org. This book can also be purchased from B&B Electronics at http://www.bb-elec.com/product.asp?sku=HS3000.

In this example RPM is requested from the vehicle. Note that the protocol on this vehicle is ISO9141. The following string will be sent to the VIA:

$01 $01 $40 $05 $68 $6A $F1 $01 $0C $17

Breakdown of the message:

$01 - Start of Packet
$01 - Number of Control Bytes
$40 - Command $40 for LDV: *Send Functionally Addressed Message (J1979 Command) to Bus*
$05 - Number of Data Bytes to send to vehicle bus.
$68 $6A $F1 $01 $0C – Message to be sent to the vehicle bus. The LDV hardware will append a checksum to this message as required by the vehicle.
$17 - Checksum

The VIA will respond with the following message:

$01 $01 $C0 $07 $48 $6B $D1 $41 $0C $00 $00 $9A

Breakdown of the response:

$01 - Start of Packet
$01 - Number of Control Bytes
$C0 - Control byte. The control byte in the response from the LDV are $80 greater than the corresponding request ($40 + $80 = $C0).
$07 - Number of Data bytes returned from the vehicle.
$48 $6B $D1 $41 $0C $00 $00 - Response from the vehicle.
$9A - Checksum

In this case the RPM is returned in the last two bytes of the vehicle response. The RPM is 0.

Broadcasting

The LDV is capable of transmitting one message at a specified interval. Before the LDV can accomplish this task the message must be defined and the interval rate must be set. This is done through the use of commands **$16** and **$17**. Once commands **$16** and **$17** are sent, commands **$1C** and **$1D** can be used to enable and disable broadcasting.

In this example RPM will be requested from the vehicle. This time the LDV will be configured to ask for the RPM from the vehicle every 8 seconds.

Command 1:
$01 $02 $16 $01 $05 $68 $6A $F1 $01 $0C $EF

Command 2:
$01 $02 $17 $0A $00 $24

Command 3:
$01 $01 $1C $00 $1E

Command 1 is used to set the broadcast message. Note that the message being broadcasted is the same message used above to get the RPM.

Breakdown of command 1:

- **$01** - Start of Packet
- **$01** - Number of Control Bytes
- **$16** - First Control byte. Command to set broadcast message
- **$01** – Enable filters with broadcast message. The LDV will only return the response to the broadcast message.
- **$05** - Number of Data bytes (Length of message for J1979 bus)
- **$68 $6A $F1 $01 $0C**
- **$EF** - Checksum

Command 2 is used to set the interval that the broadcast message is sent at. The broadcast interval is set to 5 seconds. To determine the interval in seconds multiply the value sent to the device by 0.524288.

Breakdown of command 2:

- **$01** - Start of Packet
- **$02** - Number of Control Bytes (Note there are two control bytes)
- **$17** - First control byte. Command to set broadcast interval
- **$0A** - Second control byte. Broadcast interval
- **$00** - Number of data bytes to be transmitted to the vehicle. (None)
- **$24** - Checksum

In this case the timeout is set to 5.24288 seconds. That the value sent to the LDV as the broadcast interval is **$0A**. *$0A * 0.524288 = 5.24288 sec*.

The broadcast message is enabled by sending Command 3.

Breakdown of command 3:

$01 - Start of Packet
$01 - Number of Control Bytes
$1C - Command to enable broadcast mode.
$00 -Number of data bytes to be transmitted to the vehicle. (None)
$1E - Checksum

When all three messages have been transmitted to the LDV, the broadcast messages will begin transmitting.

Via LDV Protocol

The LDV protocol is used to communicate with the LDV. All commands sent to the LDV as well as all bus traffic returned by the LDV are formatted in this style.

Byte	Byte	Up to 255 Bytes	Byte	Up to 255 Bytes	Byte
Start of Frame	Control Length	Control Bytes	Data Length	Data Bytes	Checksum

Start of Frame (SOF) = $01

Control Length - The length of the control bytes.

Control bytes - Internal commands used by the VIA.

Data Length - This specifies the number of data bytes to be sent to the vehicle. A length of zero may be used in cases where there is no message to be transmitted to the vehicle.

Data Bytes - This is the data that is sent to the vehicle bus.

Checksum - This is the LSB of the sum of all bytes including SOF, Control length, Control bytes, Data length, and Data bytes.

LDV Commands

$00 Request Firmware Version

Command to Send:
$01 $01 $00 $00 $02

You will receive the following:
$01 $04 $80 $XX $YY $ZZ $00 $CS

Where the Version is XX.YYZZ
- XX = Major Revision
- YY = MSB Minor Revision
- ZZ = LSB Minor Revision

$01 Request Firmware Date

Command to Send:
$01 $01 $01 $00 $03

You will receive the following:
$01 $04 $81 $YY $MM $DD $00 $CS

Date = MM/DD/YY
- YY = Year
- MM = Month
- DD = Day

$02 Request LDV Model Number

This command will return the model number (LDV100P1, LDV200P1, etc.) in an ASCII string.

Command to Send:
$01 $01 $02 $00 $04

You will receive the following:
$01 $LN $82 $XX … $XX $00 $CS
- $XX … $XX = Model number.
- $LN = Length of model number + 1 for $82 (3rd byte)

Example:
$01 $09 $82 $4C $44 $56 $31 $ 32 $33 $50 $21 $00 $79

$03 Request current Protocol

Command to Send:
$01 $01 $03 $00 $05

You will receive the following:
$01 $02 $83 $XX $00 $CS

Protocol = XX

XX = 0 No Protocol Selected
XX = 1 J1850VPW
XX = 2 J1850PWM
XX = 3 ISO9141-2
XX = 4 SCI
XX = 5 KWP2000 (ISO14230-4)
XX = 6 J2284
XX = 7 J1708
XX = 8 J1939
XX = 9 ALDL
XX = A UBP

$04 Request VIA Serial Number

Command to Send:
$01 $01 $04 $00 $06

You will receive the following:
$01 $0B $84 $XX $XX $XX $XX $XX $XX $XX $XX $XX $XX $00 $CS

The serial number is ten bytes long and returned as ASCII characters.

$05 Request Legacy Firmware Version

Command to Send:
$01 $01 $05 $73 $00 $00 $00 $00 $00 $00 $00 $00 $80 $00 $04

You will receive the following:
$01 $0B $85 $MM $DD $MA $M1 $M2 $MO $00 $00 $00 $00 $00 $04

This command is present to support old versions of the hardware. Software not written to support legacy hardware should use only the Version and Model Number commands. If you do not need reverse compatibility with older hardware units, do not use this command.

$06 Read Baud Rate Divisor

Command to Send:
$01 $01 $06 $00 $08

You will receive the following:
$01 $03 $86 $MSB $LSB $00 $CS

This command reads the baud rate divisor bytes from the 16550 UART on the Via. The power-up default data rate is 19.2kbaud, which has the following baud rate divisor:

MSB = 00
LSB = 0C

$07 Set Baud Rate Divisor

Command to Send:
$01 $03 $07 $MSB $LSB $00 $09

You will receive the following:
$01 $03 $87 $MSB $LSB $00 $CS

Baud Rate	Decimal Divisor	MSB (hex)	LSB (hex)
9600	24	00 hex	18 hex
19200	12	00 hex (default)	0C hex (default)
38,400	6	00 hex	06 hex
57,600	4	00 hex	04 hex
115,200	2	00 hex	02 hex

$08 Read ISO Baud Rate Divisor

Command to Send:
$01 $01 $08 $00 $0A

You will receive the following:
$01 $02 $88 $XX $00 $CS

$09 Set ISO Baud Rate Divisor

Command to Send:
$01 $02 $09 $XX $00 $CS

You will receive the following:
$01 $02 $89 $XX $00 $CS

$0A Read SCI Baud Rate Divisor

Command to Send:
$01 $01 $0A $00 $0C

You will receive the following:
$01 $02 $8A $XX $00 $CS

$0B Set SCI Baud Rate Divisor

Command to Send:
$01 $02 $0B $XX $00 $CS

You will receive the following:
$01 $02 $8B $XX $00 $CS

$0C Read KWP Baud Rate Divisor

Command to Send:
$01 $01 $0C $00 $0E

You will receive the following:
$01 $02 $8C $XX $00 $CS

$0D Set KWP Baud Rate Divisor

Command to Send:
$01 $02 $0D $XX $00 $CS

You will receive the following:
$01 $02 $8D $XX $00 $CS

$0E Request SCI High Speed Baud Rate Divisor (Not Yet Implemented)

Command to Send:
$01 $02 $0E $XX $00 $CS

You will receive the following:
$01 $02 $8E $XX $00 $CS

$0F Set SCI high Speed Baud Rate Divisor (Not Yet Implemented)

Command to Send:
$01 $02 $0F $XX $00 $CS

You will receive the following:
$01 $02 $8F $XX $00 $CS

$10 Read EEPROM

The LDV products contain 32 bytes of user controlled EEPROM. The memory is located at $00 and runs through $20. A maximum of 12 bytes may be read at one time.

Command to Send:
$01 $03 $10 $SA $NB $00 $CS

You will receive the following:
$01 $XX $90 $SA $NB $XX ...$XX $00 $CS

$SA is the starting address
$NB is the number of bytes

$11 Write EEPROM

The LDV products contain 32 bytes of user controlled EEPROM. The memory is located at $00 and runs through $20. A maximum of 12 bytes may be written at one time.

Command to Send:
$01 $XX $11 $SA $NB $XX …. $XX $00 $CS

You will receive the following:
$01 $XX $91 $SA $NB $XX …..$XX $00 $CS

$SA is the starting address
$NB is the number of bytes

$13 Get Interfaced Supported by the Vehicle

Command to Send:
$01 $01 $13 $00 $CS

You will receive the following:
$01 $02 $93 $XX $00 $CS

$XX Supported Protocols
- Bit 7-J1850VPW
- Bit 6-J1850PWM
- Bit 5-ISO-9141
- Bit 4-Chrysler SCI
- Bit 3-ISO-14230 (Keyword Protocol 2000)
- Bit 2
- Bit 1
- Bit 0

$16 Set Broadcast Message

Command to Send:
$01 $02 $16 $FE $NB $XX….$XX $CS

You will receive the following confirming the Broadcast message was set:
$01 $01 $96 $NB $XX… $XX $CS

Responses to Broadcast Messages will be in the following format:
$01 $01 $96 $NB $YY… $YY $CS

$FE = Filter enable.
- 0 – Send the broadcast message without changing the previously set filters.
- 1 – Send the broadcast message without any filters.
- 2 – Send the broadcast message with filters set to only allow the broadcast message's response to be returned.

$NB = Number of Bytes to Transmit or number of bytes received
$XX… $XX = The broadcast message to be transmitted to the vehicle.
$YY… $YY = The response to the broadcast message from the vehicle.

In version 2.00 hardware, the set broadcast message is a 1 byte command. There is no option to change the filters.

$17 Set Broadcast Interval

Command to Send:
$01 $02 $17 $XX $00 $CS

You will receive the following:
$01 $02 $97 $XX $00 $CS

$XX is the broadcast interval in multiples of 0.524288 seconds.

$18 Enable ISO Keep Alive

Command to Send:
$01 $01 $18 $00 $1A

You will receive the following:
$01 $01 $98 $00 $9A

$19 Disable ISO Keep Alive

Command to Send:
$01 $01 $19 $00 $1B

You will receive the following:
$01 $01 $99 $00 $9B

$1A Enable KWP Keep Alive

Command to Send:
$01 $01 $1A $00 $1C

You will receive the following:
$01 $01 $9A $00 $9C

$1B Disable KWP Keep Alive

Command to Send:
$01 $01 $1B $00 $1D

You will receive the following:
$01 $01 $9B $00 $9D

$1C Enable Broadcast Mode

Command to Send:
$01 $01 $1C $00 $1E

You will receive the following:
$01 $01 $9C $00 $9E

Note that the Broadcast Message (Command $16) and Broadcast Interval (Command $17) must be set before Enabling Broadcast Mode.

$1D Disable Broadcast Mode

Command to Send:
$01 $01 $1D $00 $1F

You will receive the following:
$01 $01 $9D $00 $9F

$1E Enable Time Stamping (J1850 VPW Protocol Only)

Command to Send:
$01 $01 $1E $00 $20

You will receive the following:
$01 $01 $9E $00 $A0

Once enabled all data from the vehicle will include a 5 byte timestamp. The timestamp is a rolling counter, and can be found in bytes 2 through 6 of each response.

Timestamp LSB resolution: 8 microseconds
LSB + 1 resolution: 2.04 milliseconds
LSB + 2 resolution: 0.5202
LSB + 3 resolution: 132.651 seconds
MSB resolution: 9.396 hours

The power-up default mode is Timestamp Disabled

$1F Disable Time Stamping

Command to Send:
$01 $01 $1F $00 $21

You will receive the following:
$01 $01 $9F $00 $A1

$20 Put LDV into Monitor Mode

Command to Send:
$01 $01 $20 $00 $22

You will receive the following:
$01 $01 $A0 $00 $A2

$21 Reinitialize Vehicle Communications

Command to Send:
$01 $01 $21 $00 $23

You will receive the following if change was successful:
$01 $01 $A1 $00 $A3

This command reinitializes communications on the bus currently active. It should be called after commanding the LDV to change to a new protocol with Command $23 (for example, after switching from ISO to SCI mode).

$22 Reinitialize Module

Command to Send:
$01 $01 $22 $00 $24

You will receive the following if change was successful:
$01 $01 $A2 $00 $A4

This command is the equivalent to a power up reset.

$23 Change current Protocol

Command to Send:
$01 $02 $23 $XX $00 $CS

You will receive the following if change was successful:
$01 $02 $A3 $XX $00 $CS

Protocol = XX

XX = 0 No Protocol Selected
XX = 1 J1850VPW
XX = 2 J1850PWM
XX = 3 ISO9141-2
XX = 4 Chrysler SCI
XX = 5 KWP2000 (ISO14230-4)
XX = 6 J2284
XX = 7 J1708
XX = 8 J1939
XX = 9 ALDL
XX = A Ford UBP
XX = B CCD

You will receive the following if change was unsuccessful.
$01 $01 $FF $XX $00 $CS

$24 Reinitialize KWP Vehicle Communications

Command to Send:
$01 $01 $24 $00 $CS

You will receive the following if change was successful:
$01 $01 $A4 $00 $CS

$25 Set Low Speed J1850VPW Mode

This command will set the J1850VPW transmission speed to 10.4 Kbps. If the LDV is already in the low speed mode, you will receive a successful response and no adverse effects.

Command to Send:
$01 $01 $25 $00 $27

You will receive the following if change was successful:
$01 $01 $A5 $00 $A7

$26 Set High Speed J1850VPW Mode

This command will set the J1850VPW transmission speed to 41.6 Kbps. If the LDV is already in the high speed mode, you will receive a successful response and no adverse effects.

Command to Send:
$01 $01 $26 $00 $28

You will receive the following if change was successful:
$01 $01 $A6 $00 $A8

$40 Send Functionally Addressed Message with Filter (J1979 Command) to Bus

This command will transmit your functionally addressed message to the vehicle bus and only return messages in response to this request. All other bus traffic is filtered. Note that if filters had been turned off (using the $43 command), sending the $40 command will re-instate the filtered mode.

Command to Send:
$01 $01 $40 $LN $DATA $CS

$LT = Length of the Data bytes to be transmitted to the vehicle.
$DATA = The data to be transmitted to the vehicle bus.

You will receive the following if transmit and receive were successful:
$01 $01 $C0 $LR $DATA $CS

$LR = Length of the response in bytes.
$DATA = The message returned from the vehicle.

$41 Send Physically Addressed Message (J2190 Command) to Bus

Command to Send:
$01 $01 $41 $LN $PP $TT $F1 $MM $ID1…$IDX $CS

LN = Length of data bytes to send to the vehicle.
PP = Priority
    $6C for J1850VPW
    $C4 for J1850PWM
MM = Mode
ID = PID

You will receive the following if transmit and receive were successful:
$01 $01 $C1 $XX $RR $6B $AD $RM $ID $DT $CS

$42 Send Message with User Defined Filter to Bus (Command Not Implemented)

Command to Send:
$01 $XX $42 $FL $FT1 $FT2…$DL $XX…$XX $CS

You will receive the following if transmit and receive were successful:
$01 $01 $C2 $XX … $XX $CS

$43 Send Functionally Addressed Message without Filter to Bus

This command will transmit your functionally addressed message to the vehicle bus and return messages in response to this request in addition to all other bus traffic. Sending a $43 request one time will turn off all filters until a $40 command is received by the LDV.

Command to Send:
$01 $01 $43 $LN $DATA $CS

$LN = Length of $DATA in bytes

$DATA is the message to be passed to the vehicle bus.

$CS is a message checksum, which is the least significant byte of the sum of the entire message in hex.

Response: You will receive the following from the LDV if the transmit was successful. Additional messages may follow.
$01 $01 $C3 $LN $RESP $CS

$LN = Length of $RESP in bytes

$RESP is the data read from the vehicle bus.

$CS is a message checksum, which is the least significant byte of the sum of the entire message in hex.

$44 Send Physically Addressed Message (J2190 Command) to Bus without Filter

Command to Send:
$01 $01 $44 $06 $PP $TT $F1 $MM $ID1…$IDX $CS
PP = Priority
- $6C for J1850VPW
- $C4 for J1850PWM

MM = Mode
ID = PID

You will receive the following if transmit and receive were successful:
$01 $01 $C4 $XX $RR $6B $AD $RM $ID $DT $CS

$48 Send a SCI Command

Command to Send:
$01 $02 $48 $XX $DD1…DDX $CS

You will receive the following if transmit and receive were successful:
$01 $02 $C8 $XX $RR1…RRX $CS

$7F Request Copyright Information

Command to Send:
$01 $01 $7F $00 $CS

You will receive the following if transmit and receive were successful:
$28 $43 $29 $32 $30 $30 $31 $20 $42 $26 $42 $20 $45 $6C $65 $63
(C)2001 B&B Elec

$FF General Command Error

You will receive the following if a general command error occurs:
$01 $02 $FF $XX $00 $CS

Where XX =

- $00 = General Error
- $01 = Too Many Control Bytes (Out of Range)
- $02 = Too Many Data Bytes (Out of Range)
- $03 = Incorrect Checksum
- $04 = Invalid Command
- $05 = Invalid Start of Frame
- $06 = Command Parameters out of Range
- $07 = Invalid Functional Address Message Format
- $08 = Invalid Physical Address Message Format
- $09 = Invalid Protocol Selected
- $0A = Both Control length and data length are zero
- $0B = Incorrect Number of Control Bytes (Doesn't match expected value)
- $0C = Incorrect Number of Data Bytes (Doesn't match expected value)

Hardware Specifications

Module Connector Pin Information:

DB9F (RS-232)

1. Factory Use Only
2. Tx
3. Rx
4. Not Connected
5. Ground
6. Factory Use Only
7. Not Connected
8. Factory Use Only
9. Factory Use Only

DB9M (Vehicle)

1. Ground
2. Ground
3. Chrysler SCI
4. ISO9141 K-Line / ISO14230
5. Not Connected
6. J1850 (-)
7. J1850 (+)
8. ISO9141 L-Line
9. Power (+12VDC)

Vehicle Cable		
DB9F	J1962M	
1	5	Ground
2	4	Ground
3	6	Chrysler SCI
4	7	ISO9141 K-Line / ISO14230
5	9	
6	10	J1850 (-)
7	2	J1850 (+)
8	15	ISO9141 L-Line
9	16	Power (+12VDC)

Specifications

Dimensions:	4.125 x 1.75 x 0.9 in (10.4 x 4.5 x 2.3 cm)
Weight:	4oz (.11kg), plus cables
RS-232 connection:	DB9 female, DCE
Bus Connection:	DB9 male
Input:	SAE J1850 VPW (Variable Pulse Width Modulation) OBD II Signal Standard SAE J1850 PWM (Pulse Width Modulation) OBD II Signal Standard ISO-9141 OBD II Signal Standard ISO-14230 (Keyword Protocol) OBD II Signal Standard Chrysler SCI - Nonstandard OBDII protocol
Output:	RS-232 serial signal
Car/Converter Cable:	4', custom molded J1962 male connector to DB-9 female, included
Converter/PC Cable:	6', DB-9 female to DB-9 male, included
External Power:	None required. Draws about 10mA from vehicle cable.
Data Rates:	RS-232: 19200 Default to 115.2k (User selectable) SAE J1850: 10.4k or 41.6k ISO9141: AutoDetected ISO14230: 10.4k Chrysler SCI: 7812.5
Data Transmission:	Word length 8, no parity, 1 stop bit
Temperature Range:	32° to 158° F (0° to 70° C) non-condensing