

HDV100A2 Command Response Protocol

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WARNING!

This Model HDV100A2 Converter Module allows you to connect to active J1708 / J1939 networks. It is possible that your transmissions through this converter module could cause malfunction of the network operation, damage to software or equipment, or bodily harm.

**Do Not Transmit Any Messages to the network
without a complete understanding
of the operation of the network.**

B&B Electronics Mfg. Co. specifically disclaims any responsibility for damage or injury to software, hardware, equipment or persons as a result of using this product.

WARNING!

Introduction

The HDV100A2 adapter has three modes of operation: J1708 Pass-through, J1708 Intelligent and J1939 Intelligent mode. In the Pass-through mode the HDV100A2 mimics the operation of B&B's J1708D15 and 232SAER. In this mode data is passed from the RS-232 side to the J1708 bus. The baud rate on the bus and on the PC are set to 9,600 baud. In the Intelligent mode the HDV100A2 works with a command protocol to control different operations of the HDV100A2.

Note that the HDV100A2 is powered from the vehicle side of the interface. If the device is to be used without a vehicle, it will be necessary to connect power to the device through the 15-pin connector. Positive voltage is connected on pin 8. Pin 7 is connected to ground.

J1708 Pass-through Mode

When power is applied to the HDV100A2 it operates in the Pass-through mode. In this mode, no data is buffered from the RS-232 or J1708 side of the converter. Voltage levels are converted from RS-232 to J1708 and J1708 to RS-232. Data sent from the RS-232 port to the J1708 bus is transmitted onto the J1708 bus as well as looped back to the RS-232 side of the converter. It is the host application's responsibility to monitor collisions by monitoring the CTS line. In this mode the HDV100A2 is compatible with application software written for B&B Electronics models J1708P1 and J1708D15.

The RS-232 CTS handshake line (pin 8 on the HDV100A2's DB9F connector) provides an idle-bus indicator to the host application software. The CTS line goes to a high (space) state when the J1708 bus has been idle for 2.18 milliseconds. In order to minimize the likelihood of a bus collision, the host application should only transmit when the CTS line is in the high (space) state.

Intelligent Modes

The HDV100A2 performs several functions in Intelligent mode in order to reduce the overhead and timing requirements of the host application when communicating with the J1708 bus. The device handles collision detection and retries with no additional interaction from the host application. This greatly reduces the processor overhead required by the host in order to communicate efficiently with the J1708 bus.

Switching to Intelligent Mode

There are two methods of switching the HDV100A2 into its Intelligent operation mode.

1. Hold the RTS line (pin 7 of the HDV100A2's DB9F connector) low. While holding RTS low, send a string of 10 ASCII "B" characters (hex 42) to the device.
2. With the RTS line high, send a string of 20 ASCII "B" characters (hex 42) to the device.

For either method, the string must be sent within the first 30 bytes received by the RS-232 port. After the device has received its first 30 bytes, it is locked into Pass-through mode and can only be switched into Intelligent mode by recycling power to the device.

If the string is accepted the device will stop receiving or transmitting data to or from the bus. The HDV100A2 is now in Intelligent mode, and is ready to receive messages using the command protocol.

Intelligent Mode Verification

To confirm that the HDV100A2 has been switched into Intelligent mode, the host application can send the time stamp message. An example of this command can be found in the Time Stamp Information section of this document.

Intelligent Mode Command Protocol

The HDV100A2 uses a simple protocol to communicate to vehicle bus. The protocol is divided into four parts:

- Start Of Frame (SOF)
- Control Field (shown in light gray)
- Data Field (shown in dark gray)
- Checksum (CS)

Intelligent Mode Message Structure

SOF	Number of Control Bytes	Control Bytes	Number of Data Bytes	Data Bytes	CS
1 byte	1 byte	1 to 20 bytes	1 byte	1 to 100 bytes	1 byte

The Start of Frame byte is the first byte in a valid frame and is always 01 hex.

The Control Field sets up the function and control of the HDV100A2 hardware and is formatted as shown below.

Control Field Structure

Number of Control Bytes to Follow	ID Byte	Function Byte	Control Data Bytes
1 byte	1 byte	1 byte	Up to 20 bytes

The first byte of the Control Field is the number of control bytes in the message. This value indicates the number of control bytes, excluding itself, to follow. If the message doesn't contain any control bytes, the Number of Control Bytes value will be set to 00 hex as a placeholder.

The next part of the message frame is the data field. The data field is preceded by the number of data bytes, excluding itself, to follow and is set to 00 hex if no data is present in the message. The data field is reserved for data that is to be communicated to the vehicle bus.

Data Field Structure

Number of Data Bytes	Data Bytes
1 byte	Up to 100 bytes

The last element of a valid message is the checksum. The checksum is calculated by adding ALL bytes from the Start of Frame (inclusive) to the last data byte and using the last 8 bits as a checksum.

Formatting the Control Bytes

The 2nd byte is “Number of Control Bytes” to follow and always precedes the control field. The third byte is the ID byte. This byte tells the hardware where to direct the message. Valid entries for functions are:

ID Codes

- =01 Message for J1708
- =02 Message for J1939
- =08 General message (for control of the HDV100A2 device)
- =05 Device identification (reverse compatible)

The fourth byte is the function byte. The functions that are supported are listed below. Note that some of the function codes are followed by additional bytes of information. These bytes must be included in the control byte count.

Valid General Function Codes

Function codes

- =01 change PC baud rate, followed by 3 bytes (UB3, Baud1, Baud2)
- =02 send time stamp
- =04 hardware handshaking
- =08 reset converter, followed by 2 bytes (01, and 02)
- =10 time stamp off
- =20 time stamp on

Valid Entries for J1708 Functions

Function codes

- = 07 set broadcast message
- = X8 set filter X off
- = X9 set filter X on
- = 11 Sync with J1708 bus and start reception
- = 10 Stop reception
- = 12 Transmit to J1708 bus

Valid Entries for J1939 Functions

Function codes

- =00 Receive off
- =01 Receive on
- =02 Transmit message
- =08 Set mask
- =X8 set filter X off
- =X9 set filter X on

Detailed Description of General Function Codes

Command Acknowledgement

All commands sent to the device will be acknowledged. If no error occurs an ACK will be sent with the ID byte that accompanied the command. If an error occurred, a NACK will be sent with the ID byte that accompanied the command as well as a Function code of \$05 and the Error Code. The responses will not be shown for each command since it is the same for almost all commands. Below is the format of the ACK/NACK response. If an ACK/NACK response is different for a particular command, it will be specified.

ACK/NACK Format:

Byte Number	Byte Value	Function
1	01	Start of frame
2	01 or 03	Number of control bytes = 1 for ACK, 3 for NACK
3	aa	ID byte 08 = internal command
4	bb	Function code 02 = send time stamp
5	cc	
6	00	Number data bytes
7	CS	Checksum

aa – ID Byte

\$01 = J1708 Interface

\$02 = J1939 Interface

\$05 = Device Id

\$08 = RS-232 Interface

\$09 = Message Xmit OK Response

bb – FC Byte

None = Command Received and Valid

\$05 = A error was detected, NACK

cc – CD Byte

None = No Error Condition

Error Code = See Section 5.10

RS-232 Baud Rate Setup

To set the baud rate for the RS-232 port, set a general command code of 08. Set the function code to 01. Then set 3 control bytes as follows.

Function	Start of Frame	Control Bytes	Command Code	Function Code	UB3	Baud 1	Baud 2	Data Bytes	Check Sum
Byte #	1	2	3	4	5	6	8	9	10
Value	01	05	08	01				00	

Setting UB3

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Divisor Latch	Set Break	Set Parity	Even Parity	Parity Enable	Stop Bits	Word Length 1	Word Length 0

Bit 7 = 1 allows baud rate divisor to be changed. 0 baud rate change is blocked. Bit 7 should not be set. The setting and resetting of this bit is handled internally.

Bit 6 = 1 forces the transmitter output to a logic 0 for alerting the remote receiver to a line break. 0 indicates no break condition.

Bit 5, 4 and 3 work together to set parity

Bit 5	Bit 4	Bit 3	Parity Selection
*	*	0	No parity (default)
0	0	1	Odd parity
0	1	1	Even parity
1	0	1	Force parity "1"
1	1	1	Force parity "0"

*Don't care state.

Bit 2, stop bit, works in conjunction with bits 1 and bit 0

Bit 2	Word Length (bits)	Stop Bit Length
0	5,6,7,8	1 (default)
1	5	1½
1	6,7,8	2

Bits 1 and 0 set the word length

Bit 0	Bit 1	Word Length
0	0	5
0	1	6
1	0	7
1	1	8 (default)

Default value. The HDV100A2 should always be set to 8-bit word length.

Setting Baud 1, Baud 2

Baud Rate Setup Table

Baud Rate	Decimal Divisor	Hex Divisor MSB (Baud 2)	Hex Divisor LSB (Baud 1)
9600	48	\$00 (default)	\$30 (default)
14400	32	\$00	\$20
19200	24	\$00	\$18
38,400	12	\$00	\$0C
57,600	8	\$00	\$08
115,200	4	\$00	\$04
230,400	2	\$00	\$02
460,800	1	\$00	\$01

All baud rates are entered as hex numbers. To calculate your own decimal divisor use the following formula. The decimal number must be converted to hexadecimal before entering the number. Baud rates below 9,600 are not recommended because of the difference in speed between the vehicle bus and PC serial port. Additionally, baud rates faster than 115,200 baud are not supported.

The UART clock = 7,372,800 Hz

Decimal Divisor = $\frac{\text{Clock frequency (7,372,800)}}{\text{Baud output} \times 16}$

If you want a baud rate of 9,600 baud

$$\text{Decimal Divisor} = \frac{7,372,800}{9,600 \times 16}$$

Decimal Divisor = 48 = 30 hex

Baud 1= 30

Baud 2= 00

Baud Rate Example

To set the PC baud rate to 57,600 baud, N,8,1, format the message as follows.

Byte Number	Byte Value Hex		Byte Function	
1	01		Start of frame	
2	05		Number of control bytes	
3	08		Command byte (08 = internal command)	
4	01		Function Bbte (01 = change baud)	
5	03		UB3	
6	08		Baud 1	
7	00		Baud 2	
8	00		Number of data bytes	
9	1A		Checksum	

The first byte is the start of frame and always 01. Next is the number of control bytes (05). There are 5 bytes in the control section (in gray). Byte number 3 sets the HDV100A2 to an internal operation (08). Byte 4 is the internal function to be executed; (01) is the change baud command. Bytes 5, 6, and 7 set the baud rate, parity, stop bits and word length. Next is the number of data bytes, in this case there are no data bytes. Last is the checksum, the value is the 8 bit addition of bytes 1 to 8.

Time Stamp Information

The HDV100A2 supports a four-byte rolling time stamp with a resolution of 1.5 microseconds per bit. The maximum time stamp value is 6,442.45 seconds before roll over. The 4-byte time stamp will be added to all transmission from the bus. The time stamp will be added to the transmission confirmation message.

The host application can request that the HDV100A2 send a time stamp, formatted as follows.

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Number of control bytes
3	08	ID byte 08 = internal command
4	02	Function code 02 = send time stamp
5	00	Number data bytes
6	0D	Checksum

Reply from HDV100A2

Byte Number	Byte Value	Function
1	01	Start of frame
2	05	Number of control bytes
3	0A	ID 0A = time stamp
4	XX	Time msb
5	XX	Time msb-1
6	XX	Time msb – 2
7	XX	Time lsb
8	00	Data bytes 00
9	CS	Checksum

The time stamp is attached to all messages received from the vehicle bus as part of the control header. After the start of frame byte, the number of control bytes, ID byte and the next 4 bytes are the time stamp. The fourth byte is the MSB the seventh byte is the LSB.

Message time stamping is the default condition when the HDV100A2 is placed in the smart mode. To stop the time stamp from being added to the J1708 message, send the following command to the HDV100A2.

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Number of control bytes
3	08	ID byte 08 = internal command
4	20	Function code 20 = stop time stamping
5	00	Number data bytes
6	2B	Checksum

To resume time stamping send the following command:

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Number of control bytes
3	08	ID byte 08 = internal command
4	10	Function code 10 = resume time stamping
5	00	Number data bytes
6	1B	Checksum

Time stamping will resume after reset.

Master Reset Command

The master reset command allows the HDV100A2 to be reset from the PC. Sending this command resets the HDV100A2 to the default mode (dumb mode). You will lose all setting sent in the smart mode.

Byte Number	Byte Value	Function
1	01	Start of frame
2	04	Number of control bytes
3	08	ID byte 08 = internal command
4	08	Function code 08= master reset
5	01	Check byte
6	02	Check byte
7	00	Number data bytes
8	18	Checksum

Note after sending a master reset the baud rate is 9,600.

Vendor Information

To receive the vendor information from the HDV100A2 send hex (01, 01, 05, 00, 07) to the device. It will respond as follows:

Hex (01, 0B, 85, MM, DD, MA, M1, M2, MO, 00, VV, VV, 00, DB, CS)

0B = Number of control bytes
85 = Compatibility with other models
MM = Month firmware was created
DD = Day firmware was created
MA = Major firmware revision number
M1 = MSB of minor firmware revision
M2 = LSB of firmware revision
MO = Model
VV = Customer code 1
VV = Customer code 2
DB = Number of data bytes
CS = Checksum

J1708 Commands

Receiving Data from the J1708 Bus

After the HDV100A2 is set into its Intelligent mode of operation and the RS-232 data rate is configured, you are now ready to communicate with the J1708 bus. A receive command must be sent to the HDV100A2 before attempting to transmit to the bus. The receive message synchronizes the HDV100A2 with the bus. To start receiving J1708 bus data, send the following to the HDV100A2.

Byte Number	Byte Value (hex)	Byte Function
1	01	Start of frame
2	02	The number of control bytes
3	01	ID byte 01= J1708
4	11	Function code 11 hex start receive
5	00	Number of data bytes (00 place holder)
6	15	Checksum (bytes 1 through 5 added together)

After sending this command to the device, the device will respond with a confirmation message. The message confirms that the command was received by the HDV100A2 and the checksum verified correctly. The reply from the device is formatted as follows:

Byte Number	Byte Value (hex)	Byte Function
1	01	Start of frame byte
2	01	Control byte
3	01	ID byte (ID of the sent message)
4	00	Number of data bytes
5	03	Checksum

The confirmation message is sent in response to a command sent to the device. The ID byte and the check-sum will change with different commands but the format will remain the same. If the checksum is not correct an error message is sent. Its format is covered at the end of this document.

To stop receiving data from the J1708 bus send the following command to the HDV100A2.

Byte number	Byte value (hex)	Byte Function
1	01	Start of frame
2	02	The number of control bytes
3	01	ID byte 01= J1708
4	10	Function code 10 hex stop receive
5	00	Number of data bytes (00 place holder)
6	14	Checksum (bytes 1 through 5 added together)

After sending this command to the device, the device will respond with a confirmation message and data will cease. Note that there is the possibility of an incomplete message being sent to the PC after sending this command. Use the check-sum to verify all messages.

To restart reception, send the (01, 02, 01, 11, 00, 15) command to the HDV.

Transmitting Data to the J1708 Bus

The HDV100A2 supports standard J1708 commands of up to 21 bytes. Additionally the HDV100A2 can send messages up to 100 bytes to the J1708 bus. It is the responsibility of the sending software to check for “ignition off” before using the J1708 bus to send messages with more than 21 bytes to the bus. Failure to check for a “quiet bus” condition before transmitting a long message may cause erratic bus operation. The format to send information to the J1708 bus is shown below:

Byte Number	Byte Value (hex)	Byte Function
1	01	Start of frame
2	03	Number of control bytes
3	01	ID bytes 1= J1708
4	12	Function code 12 (hex) transmit to J1708 bus
5	02	Priority byte 00000010 set bit 0 to 7 see below
6	XX	Number of data bytes to follow (excludes checksum byte)
	YY	Data bytes up to 100 bytes
	CS	Checksum

Set the priority bit using the chart below.

Priority Byte Value	Binary Value	Hex Value
1	00000001	01
2	00000010	02
3	00000100	04
4	00001000	08
5	00010000	10
6	00100000	20
7	01000000	40
8	10000000	80

After sending a transmit message to the HDV100A2 you will get the confirmation message if the checksum is correct. A transmit complete message is sent to the PC after the device successfully transmits the message to the J1708 bus. A second message should not be sent to the device before confirming that the first message has been sent. The transmit confirmation is formatted as follows:

Byte Number	Byte Value (hex)	Byte Function
1	01	Start of frame
2	01	Number of control bytes
3	09	ID bytes 9 = transmit OK
8	00	Number of data bytes
9	0B	Checksum

J1708 Message Filter

The J1708 message filter will operate on 4 different MID's. Only messages with the same MID as set in the filter will be sent to the PC. The filters will be OR'ed together so that multiple MID's can be filtered, MID1 or MID2 or MID3. The format for the setting of J1708 filtering is as follows:

Set Filter Active

Byte Number	Byte Value	Function
1	01	Start of frame
2	03	Control bytes
3	01	ID byte 1 = J1708 message
4	X9	Set filter 9 = Set filter active X = filter number 1 to 4
5	XX	Value of MID to filter On
6	00	Data bytes
7	CS	Checksum

Set Filter Off

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Control bytes
3	01	ID byte 1 = J1708 message
4	X8	Set filter 8 = Set filter inactive X = filter number 1 to 4
6	00	Data bytes
7	CS	Checksum

Setting all filters off will stop all data from the J1708 bus. When all filters are set off you must send the receive J1708 command to start receiving all bus messages.

Broadcast Message

The HDV100A2 supports one broadcast message. Once configured by the host application, this message will be sent repeatedly by the HDV100A2 at a programmed time interval. This feature is useful to provide a “heartbeat” function to the J1708 bus with no overhead to the host application’s software. Sending 0 in the time value stops the broadcast message from being sent.

To start a broadcast message the time interval, message slot, priority, number of data bytes, and the data must be sent to the HDV100A2. Once sent, the HDV100A2 will send the message out on the bus at the specified interval. Existing bus traffic or any bus messages sent to the HDV100A2 from the host application take priority over a pending broadcast message.

Once a broadcast message is started the “Stop Broadcast 07” message must be sent before any changes to the broadcast message can be made. Changing from one time value (17) to another (37) without stopping the broadcast will cause the HDV100A2 to act erratically.

Byte Number	Byte Value	Function
1	01	Start of frame
2	04	Control bytes
3	01	ID byte 1 = J1708 message
4	X7	Set broadcast 7 = On X = Time interval (see chart)
5	0X	Message slot number (01 only active at this time)
6	PP	Priority (see chart below)
7	YY	Data bytes
	DATA	From 4 to 21 bytes
	CS	Checksum

To stop broadcast transmission it is not necessary to send the whole message. The message below will stop broadcast transmission.

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Control bytes
3	01	ID byte 1 = J1708 message
4	07	Set broadcast 7 = On X = Time interval (see chart)
7	00	Data bytes
8	0B	Checksum

Byte 4 Values

Byte Value	Time Value
07	Stop broadcast
17	.5 sec.
27	1.0 sec
37	1.5 sec
47	2.0 sec

Byte 6 (Priority) Values

Byte Value (hex)	Byte Value Binary	Priority
01	00000001	1
02	00000010	2
04	00000100	3
08	00001000	4
10	00010000	5
20	00100000	6
40	01000000	7
80	10000000	8

J1939 Commands

The J1939 protocol is similar to the J1708 protocol.

The message starts with Start of Frame byte 01. The number of control bytes will be 06. The control code for J1939 is 02. The function codes (XX) are as follows:

- 00=Sets receive function off
- 01=Sets receive on
- 02=Transmits a message with data
- 04=Set mask
- 19=filter 1 set on
- 18=filter 1 set off
- 29=filter 2 set on
- 28=filter 2 set off
- 39=filter 3 set on
- 38=filter 3 set off
- 49=filter 4 set on
- 48=filter 4 set off

Function codes are shown in detail below.

Before operating the HDV100A2 in the J1939 mode it is recommended that the baud rate be set to 115.2kb. This is done by sending the following code: (01, 05, 08, 01, 03, 04, 00, 00 16). After sending this command the baud rate of the sending device (PC) must also be changed.

Because of the difference in baud rates between the J1939 bus and the RS-232 serial bus, the HDV100A2 may miss messages on the J1939 bus. This depends on bus load, message length, and filter settings.

Sending any message with a control code of (02) to the J1939 bus stops the operation on the J1708 bus. If you wish to restart operation on the J1708 bus you must send the start J1708 reception message (01, 02, 01, 11, 00, 15). Sending this message stops operation on the J1939 bus.

Function codes 00 and 01, Receive OFF, ON operate together to control a receive register. Sending the command (01, 02, 02, 01, 00, 06) starts reception on the J1939 bus. This command resets the filter mask to all zeros (don't care). All bus traffic is then received. However, it may not be possible to send all messages to the PC side. Any message that is not serviced before the next message is received will be overwritten by the new message. Sending the command (01, 02, 02, 00, 00, 05) turns off the receiver. It is

wise to set the receiver off when not in use. Sending the Start Receive clears the mask. This renders the filter function useless.

Start Receive on J1939 Bus

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Control bytes
3	02	ID byte 02 = J1939 message
4	01	Function code 01 start reception
5	00	Data bytes
6	06	Checksum

Stop Receive on J1939 Bus

Byte Number	Byte Value	Function
1	01	Start of frame
2	02	Control bytes
3	02	ID byte 02 = J1939 message
4	00	Function code 00 stop reception
5	00	Data bytes
6	05	Checksum

Data messages received from the HDV100A2 operating in the J1939 mode, is formatted as follows:

Control Field						Data Field														
Start of Frame	# of Control bytes	Contr Byte	Time Stamp 4 Bytes			# of Data Bytes	Arbitration Field				# of Data Bytes in Message	Bus Data Up to 8 Bytes								Check sum
01	05	02	msb		lsb	ZZ	Y1	Y2	Y3	Y4	0X									

The message starts with 01. The number of control bytes is 05. Next is the control byte 02, followed by the time stamp, four bytes, with msb first. The number of data bytes is the number of bytes to follow excluding itself and the checksum byte. Next is a four byte that contains the arbitration field. J1939 divides this field for different functions show in the chart below. The number of data bytes sent by the bus is next. This will be a value between 0 and 8. Next is the bus data followed by the checksum byte.

Arbitration Field (Y1, Y2, Y3, Y4)

The first byte Y1 contains the most significant bits in the J1939 arbitration field. It is followed by Y2, Y3 and Y4. J1939 assigns different function to the arbitration field that must be observed by the user. There is a work sheet included on page 33 to help set up this field.

Arbitration Byte	Y1								Y2								Y3								Y4							
Arbitration Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
J1939 Arbitration Field	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
J1939 Function	Priority bits		R	P	PDU Format				PDU Specific				Source Address																			

A message received from the HDV will be formatted as follows:

<01><05><02><06><C7><CC><ED><0D><67><80><20><00><08><F0><7D><DA><00><00><FF><FF><DA><C9>

The < > are placeholders and are NOT transmitted with the data.

** = value changes with message.

Byte Number	Byte Value	Function
1	01	Start of frame
2	05	Control bytes
3	02	ID byte 02 = J1939 message
4	06	Time stamp MSB **
5	C7	Time stamp MSB -1 **
6	CC	Time stamp MSB -2 **
7	ED	Time stamp LSB **
8	0D	Number of data bytes to follow (13 dec) **
9	67	First byte of arbitration field **
10	80	Second byte of arbitration field **
11	20	Third byte of arbitration field **
12	00	Fourth byte of arbitration field **
13	08	Number of data bytes in bus message **
14	F0	Data bytes **
15	7D	Data bytes **
16	DA	Data bytes **
17	00	Data bytes **
18	00	Data bytes **
19	FF	Data bytes **
20	FF	Data bytes **
21	DA	Data bytes **
22	C9	Checksum **

Function code 02 sends data to the J1939 bus.

The transmit code is set up as follows: (01, 06, 02, 02, XX, XX, XX, XX, DD, YY, YY, YY, YY, YY, YY, YY, YY, CS). The header starts with 01. There are six control bytes (06). The control code is (02). The transmit command is (02). The arbitration field is filled out as shown above. There is also a worksheet to help fill out this field. Next is the number of data bytes in the data payload. The data payload for the message is entered in the data field. After a transmission is successfully sent out and confirmed by at least one active node, an acknowledge message is sent to the PC (01, 01, 02, 00, 04). There is a form on page 33 to help set up the arbitration field.

Transmit Data to J1939 Bus

Byte Number	Byte Value	Function
1	01	Start of frame
2	06	Control bytes
3	02	ID byte 1 = J1708 message
4	02	Function byte 02 transmit message
5	XX	MSB of arbitration field (J1939 priority bits)
6	XX	MSB-1
7	XX	MSB-2
8	XX	LSB of arbitration field (J1939 source address)
9	DD	Number of data bytes
	DATA	From 0 to 8 bytes
	CS	Checksum

Set Mask

Function code 04 set mask. The mask is applied to ALL filters. The mask is 32 bits long. The last 3 bits are not used and must be set to zero. This mask covers the 29-bit arbitration field. To use the filter function, the mask must be set. The mask determines what position(s) will be tested and matched to the incoming message. If a 1 is set in a particular position, that position will be tested. It will be “and” with any active filters to determine if the message will be passed to the PC side. Any position marked with a 0 is a “don’t care” position and will pass all data in that position. There is a form on page 33 that helps set up the mask for the arbitration field.

Byte Number	Byte Value	Function
1	01	Start of frame
2	06	Control bytes
3	02	ID byte 02 = J1939
4	04	Function byte 04 set mask
5	XX	MSB of arbitration field (J1939 priority bits)
6	XX	MSB-1
7	XX	MSB-2
8	XX	LSB of arbitration field (J1939 source address)
9	00	Number of data bytes
10	CS	Checksum

The mask can be used to look at a group of messages:
 To set the mask to filter on the J1939 priority field, the mask would be loaded with:
 (01, 06, 02, 04, E0, 00, 00, 00, 00, ED)
 To set the mask to filter on the J1939 PGN field, the mask would be loaded with:
 (01, 06, 02, 04, 07, FF, F8, 00, 00, 0B)
 To set mask to filter on both the priority field and the PGN field the mask would be loaded with:
 (01, 06, 02, 04, B7, FF, F8, 00, 00, BB)

Set Filter 1 to 4

Function codes 18 and 19, 28 and 29, 38 and 39, 48 and 49 are filter pairs. These filters are set by sending the desired arbitration code to each filter, 1 to 4. The filters work with the mask function. If the mask is set to zero in a position (don't care) the value of the filter in that position doesn't matter. The filter arbitration field is set to match the arbitration code of the incoming message. A match of the filter "and" the mask will pass the message to the PC. The X9 sets the filter On; X8 sets the filter Off, where X=1 through 4.
Important: the receiver and each filter must have a different arbitration code. If the receiver and a filter are given the same arbitration code the controller may become erratic. It will need to be powered-off reset to recover from this error.

Byte Number	Byte Value	Function
1	01	Start of Frame
2	06	Control bytes
3	02	ID byte = J1708 message
4	YY	Function byte (18 or 19) (28 or 29) (38 or 39) (48 or 49)
5	XX	MSB of arbitration field (J1939 priority bits)
6	XX	MSB-1
7	XX	MSB-2
8	XX	LSB of arbitration field (J1939 source address)
9	00	Number of data bytes
10	CS	Checksum

To use the HDV100A2, the filter for a particular J1939 PGN the following procedure must be followed.

1. Turn off the “Receive” function by sending (01, 02, 02, 00, 00, 05).
2. Set the “Mask” to the desired pattern (01, 06, 02, 04, XX, XX, XX, XX, 00, CS).
3. Set a filter (1 to 4) to the match value (01, 06, 02, YY, XX, XX, XX, XX, 00, CS). Be sure that this is NOT the same as any other filter value or the HDV100A2 may become erratic.
4. Sending this value to the HDV100A2 will continuously send this match to the PC.

Note that sending the “ Start Receive” or the “Stop Receive” command resets the mask rendering the filters useless.

J1939 Header Worksheet

This worksheet will aid in filling out/decoding the J1939 arbitration field.

Bit Number	J1939 Function	CAN Frame Entry		Hex Value	
29	Priority Bits				Byte 1
28					
27					
26	Reserved	0			
25	Data Page	0			
24	PDU-Format (PGN Byte 2)				
23					
22					
21					
20					Byte 2
19					
18					
17					
16	PDU Specific (PGN Byte 3)				
15					
14					
13					
12					Byte 3
11					
10					
9					
8	Source Address				
7					
6					
5					
4					Byte 4
3					
2					
1					
		0			
		0			
		0			

Error Codes

Error Code Format:

Byte Number	Byte Value	Function
1	01	Start of frame
2	03	Number of control bytes
3	05	Function code error = 05
4	XY	ID of message that caused error
5	0Z	Error code (see chart below)
6	00	Number of data bytes
7	CS	Checksum

Error Code		Type of Error Generated	Meaning of Error Generated
DEC	HEX		
1	1	Gen	Inbuffer overflow; more than 127 bytes
2	2	Gen	Checksum mismatch
3	3	Gen	Protocol error; function, ID, code bad
4	4	J1708	J1708 input buffer full missed bus message
5	5	J1708	J1708 command unknown
6	6	J1708	J1708 output buffer full
7	7		
8	8	J1939	Bus off
9	9		
10	A	J1708	J1708 inbuffer overflow more than 127 bytes
11	B		
12	C		
13	D		
14	E		
15	F		