# Master Commands and Responses

This document is the master list of all commands and responses for all of our products.

The "Change Record" exists at the very end of this document.

Any questions, comments, errors, etc. should be directed to:  "support@AVT-HQ.com"

We update this document on an "as needed" basis.

Note the revision level and date in the footer.


NOTE

If using the AVT-418 interface,  refer to the AVT-718 commands and responses.
[They are identical.]

Contact the factory if there are any questions.
I answer e-mail as soon as possible.
I answer the telephone whenever possible.
If you are in a hurry, a telephone call is the quickest.
+1-410-798-4038

We do our best to provide prompt support.

# Table Of Contents

# Notes

- All numbers are Hex digits.

- Strikethroughs (~~Strikethroughs~~) are functions not yet implemented (though the command may be supported).

- All communications between the host computer and the interface unit is conducted in 'packets.'

- The first byte in a packet is the header byte and indicates what the packet is and how long it is.

- If the packet is moving from the host computer to the interface it is a Command packet.

- If the packet is moving from the interface to the host computer it is a Response packet.

- The header byte is split into upper and lower nibble.  The upper nibble indicates what the packet contains.  The lower nibble indicates how many bytes are to follow.

- *Originally the protocol was developed to support J1850 where the messages are limited (by definition) to 12 bytes maximum length.  Therefore, the lower nibble was sufficient to indicate the maximum length of a message (either transmitted or received).*

- Some protocols support much longer messages.

- For those occasions, the following standard format exists:

- $11 $rr $xx $yy ...          $11:           Indicates that a single length byte follows.
  $rr:           Is the number of bytes to follow.
  $xx $yy ...:           Are the message bytes.

- $12 $rr $ss $xx $yy ...          $12:           Indicates that two length bytes follow.
  $rr $ss:Is the number of bytes to follow.
  $xx $yy ...:           Are the message bytes.

- For the protocols that support long messages all three forms are accepted by the unit (for messages of appropriate length).  For example a 3 byte message can be sent to the unit for transmission to the network as:
  $03 $xx $yy $zz
  $11 $03 $xx $yy $zz
  $12 $00 $03 $xx $yy $zz.

- Refer to documents  "Long Messages - Alternate Format Headers" and  "AVT-716 - KeyWord Protocol 2000 Mode" for additional information.

- When time stamping is enabled the time stamp immediately follows the header byte(s).
  Time stamps are either 2 or 4 bytes, presented in order from high to low order bytes.

- Refer to the separate document regarding block transfer mode operations.

## AVT-718  VPW  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*


0:      Transmit a message to the network.
         0x yy zz ...  x = count of bytes to follow;  yy zz ... message bytes.


1:      Transmit a message to the network, alternate header formats.
         11 tt yy zz ...  tt = count of bytes to follow;  yy zz ... message bytes.
         12 rr tt yy zz ...  rr tt = count of bytes to follow;  yy zz ... message bytes.
                  Maximum length = 8192 bytes.


2:     Reset.
         21 01:           Reset HBCC.
         21 02:           Reset SCC.
         21 03:           Reset DLC.
         21 04:           Reset FIFO #1.
         21 05:           Reset FIFO #2.
         21 06:           Reset CAN.


3:     Match table - Filtering.
         30:              Match status request, report match table contents.
         31 7B:         Match function off, clear table.
         32 xx yy:     Match table entry.
                  xx - byte position;  yy - byte value.
         34 xx yy rr ss: Match table entry.
                  xx - byte position;  yy - byte value.
                      // AND //
                  rr - byte position;  ss - byte value.
         [The 5x 1F command determines function operation.]


4:


5:     Operational commands.
         51 04:          Request 'Keep-Alive' message.
         5x 04 xx yy ...:'Keep Alive' message.  {Default is message disabled.}


         --------------------
         51 05:         Clear 'Keep Alive' message.


         --------------------
         51 06:         Request message forwarding status.
         52 06 00:     Suppress messages 'from this device.'  {Default}
         52 06 01:     Forward network messages 'from this device.'
                  [Subject to message filtering;  match function.]


         --------------------

51 07:          Request 'Keep Alive' message interval.

52 07 xx:      'Keep Alive' message transmission interval, in 0.0625 second increments.
                        {Default = $48 = 4.5 seconds}

--------------------

51 08:          Request message time stamp status.

52 08 00:      No time stamp.  {Default}
*Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*

52 08 01:      Include time stamp.  Four bytes.  1.0 microsecond resolution.
*Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
*        msg. byte (MSB) - . . . - msg. byte (LSB).*

--------------------

51 09:          Request network loading report status.

52 09 00:      Suppress network loading reports.  {Default}

52 09 01:      Send network loading reports every specified interval.

--------------------

51 0A:          Request network loading report interval.

55 0A ww xx yy zz:  Network loading report interval.
                    {Default = $07 A1 20 = 500 000 microseconds}
                    Interval range = 1 to $00 FF FF FF microseconds.

--------------------

51 16:          Timer alert status query.

52 16 00:      Disable timer alert.

52 16 01:      Enable timer alert.

--------------------

51 17:          Timer alert period query.

52 17 xx:      Timer alert period.  xx - period in 0.0625 second increments.
                    {Default = $10 = 1 sec.}

--------------------

51 18:          Timer query.  Timer rollover:  $00 FF FF FF.

--------------------

51 1F:          Match function query

52 1F 00:      Match function control;  Match = forward message to the host.  {Default}

52 1F 01:      Match function control;  Match = discard the message.

--------------------

53 20 xx yy:    Enter block transfer (transmit) mode.  Block size is xx yy bytes (MSB LSB).

--------------------

51 21:          Block transfer, transmit, no-echo status request.

52 21 00:      Block transfer, transmit, no-echo is disabled.
                  (Transmitted block is received and sent to host.)  {Default}

52 21 01:        Block transfer, transmit, no-echo is enabled.
                     (Host receives, after transmit is complete:
                              $03  status-byte  high count, low count.)

--------------------
51 24:           Request status of connection to VPW network.
52 24 00:        Disconnect from the VPW network.
52 24 01:        Connect to the VPW network.  {Default}

--------------------
51 40:           Transmit acknowledgments status query.
52 40 00:        Disable transmit acknowledgments.
52 40 01:        Enable transmit acknowledgments.  {Default}

## 6:

## 7:

72 1A xx:        Type1 periodic message status query.
                       xx - message number $01 to $14.
73 1A xx 00:  Type1 periodic message xx - disable.
73 1A xx 01:  Type1 periodic message - enable.

--------------------
72 1B xx:              Type1 periodic message interval query.
                             xx - message number $01 to $14.
74 1B xx rr ss:        Type1 periodic message interval command.
                             xx - message number, $01 to $14.
                             rr ss -time interval in 5 or 10 millisecond increments.
                                    (Time increment set by 7x 1E command.)

--------------------
71 1C:          Disable all Type1 periodic messages.

--------------------
71 1E:          Type1 periodic message timer query.
72 1E 00:      Type1 timer interval = 5 milliseconds.
72 1E 01:      Type1 timer interval = 10 milliseconds.  {Default}

--------------------
72 24 xx:             Type1 periodic message query.
                         xx - message number $01 to $14
7y 24 xx rr ss tt:  Type1 periodic message definition.
                           y - number of bytes to follow.
                         xx - message number $01 to $14.
                         rr ss tt ... - message data bytes.

8:

9:      Processor memory.
          96 01 msb xx yy lsb zz:      Processor write memory (byte), value = zz.
          96 02 msb xx yy lsb zz:      Processor read memory (byte), count = zz.
          97 03 msb xx yy lsb rr ss:   Processor write memory (word), value = rr ss.
          96 04 msb xx yy lsb zz:      Processor read memory (word), count = zz.

A:

B:      Firmware version.
          B0:             Request firmware version number.

C:      4X mode.
          C0:             Request 4X mode status.
          C1 00:          Disable 4X mode.
          C1 01:          Enable 4X mode.

D:      Operational mode.
          D0:             Request operational mode report.

E:      Mode switch.
          E1 22:          Switch to UBP mode.  [91 14]
          E1 33:          Switch to VPW mode.  [91 07]
          E1 44:          Switch to LIN mode.  [91 19]
          E1 66:          Switch to KIE mode.  [91 1A]
          E1 77:          Switch to SDM mode.  [91 1B]
          E1 96:          Switch to FLASH programming mode.  [91 2E]
          E1 99:          Switch to CAN mode.  [91 10]
          E1 BB:          Switch to URT mode.  [91 0E]
          E1 CC:          Switch to PWM mode.  [91 06]
          E1 DD:          Switch to KWP 2000 mode.  [91 0F]

F:      Re-Start.
          F1 A5:          Reset and restart.

## AVT-718  VPW  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*

0:      Message received from the network.
          0x ss yy zz ...  x = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

1:      Message received from the network;  alternate header formats.
          11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.


2:      Error notification.
        See complete list in section:  "Error Codes."


3:      Command error.
        31 xx:          xx = Header byte of command in error.


4:      Match function - Filtering.
        40:             Function off.
        41 B7:          Table full, entry ignored.
        42 xx yy:       Table entry report.
                        xx - byte position;  yy - byte value.
        44 xx yy rr ss: Table entry report.
                        xx - byte position;  yy - byte value.
                        // AND //
                        rr - byte position;  ss - byte value.


5:


6:      Operations reports.
        6x 04 xx yy ...:        Keep Alive message.


        --------------------
        61 05:          Keep alive message length = 0, suppressed.


        --------------------
        62 06 00:       Disable forwarding network messages 'from this device.'
        62 06 01:       Enable forwarding network messages 'from this device.'


        --------------------
        62 07 xx:       'Keep Alive' message interval 0.0625 second increments.


        --------------------
        62 08 00:       Message time stamps are disabled.
        62 08 01:       Message time stamps are enabled.


        --------------------
        62 09 00:       Network loading reports enabled.
        62 09 01:       Network loading reports disabled.


        --------------------
        65 0A ww xx yy zz:   Network loading report time interval in microseconds.


        --------------------

63 0F xx yy:   Network loading report.

--------------------
62 16 00:        Timer alert disabled.
62 16 01:        Timer alert enabled.

--------------------
62 17 xx:        Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.

--------------------
62 1F 00:        Match function control;  Match = forward message to the host.
62 1F 01:        Match function control;  Match = discard the message.

--------------------
62 20 00:        Exit block transfer (transmit) mode.
62 20 01:        Enter block transfer (transmit) mode.

--------------------
62 21 00:        Block transfer, transmit, no-echo is disabled.
62 21 01:        Block transfer, transmit, no-echo is enabled.

--------------------
62 24 00:        Disconnected from the VPW network.
62 24 01:        Connected to the VPW network.  {Default}

--------------------
62 40 00:        Transmit acknowledgments disabled.
62 40 01:        Transmit acknowledgments enabled.  {Default}

7: _____


8: _____
83 1A xx 00:  Type1 periodic function disabled for message xx.
83 1A xx 01:  Type1 periodic function enabled for message xx.

--------------------
84 1B xx rr ss:        Type1 periodic message interval report.
                             xx - message number.
                             rr ss - time interval in 5 or 10 millisecond increments.
                                  (Time increment set by 7x 1E command.)

--------------------
81 1C:        All Type1 periodic messages disabled.

--------------------
82 1E 00:       Type1 timer interval = 5 milliseconds.
82 1E 01:       Type1 timer interval = 10 milliseconds.


--------------------
8x 24 xx rr ss tt ... :    Periodic message definition report.
                           xx - message number.
                           rr ss tt ... - message data bytes.

9:      Board status information.
        See complete list in section:  "Board Status Information."


A:

B:


C:      4X Mode.
        C1 00:        4X mode disabled.
        C1 01:        4X mode enabled.


D:


E:      Processor memory.
        Ex msb xx xx lsb yy . . .       Processor memory status for address specified.

F:
        F0:    Used only in block transfer mode.
              One "F0" indicates the start of a received block of data.
              Fifteen "F0's" will follow at the end of a received block of data.
              Not applicable when transmitting a block with no-echo enabled.

## AVT-718 PWM Mode - Commands

*High nibble, bits b7 - b4: Command type.*

0:      Message for transmission to the network.
          0x yy zz ...  x = count of bytes to follow;  yy zz ... message bytes.


1:


2:      Reset.
          21 01:          Reset HBCC.
          21 02:          Reset SCC.
          21 03:          Reset DLC.
          21 04:          Reset FIFO #1.
          21 05:          Reset FIFO #2.
          21 06:          Reset CAN.


3:      Match table - Filtering.
          30:              Match status request, report match table contents.
          31 7B:          Match function off, clear table.
          32 xx yy:      Match table entry.
                            xx - byte position;  yy - byte value.
          34 xx yy rr ss: Match table entry.
                            xx - byte position;  yy - byte value.
                                // AND //
                            rr - byte position;  ss - byte value.
          [The 5x 1F command determines function operation.]


4:


5:      Operational commands.
          51 01:          CRC status request.
          52 01 00:      Suppress forwarding of CRC byte.
          52 01 01:      Forward the CRC byte.


          --------------------
          51 04:          Request 'Keep-Alive' message.
          5x 04 xx yy ...:'Keep Alive' message.  {Default is message disabled.}


          --------------------
          51 05:          Clear 'Keep Alive' message.


          --------------------
          51 06:          Request message forwarding status.
          52 06 00:      Suppress messages 'from this device.'  {Default}

52 06 01:       Forward network messages 'from this device.'
               [Subject to message filtering;  match function.]

--------------------
51 07:         Request 'Keep Alive' message interval.
52 07 xx:     'Keep Alive' message transmission interval, in 0.0625 second increments.
               {Default = $48 = 4.5 seconds}

--------------------
51 08:         Request message time stamp status.
52 08 00:     No time stamp.  {Default}
               *Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*
52 08 01:     Include time stamp.  Four bytes.  1.0 microsecond resolution.
               *Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
                   *msg. byte (MSB) - . . . - msg. byte (LSB).*

--------------------
51 09:         Request network loading report status.
52 09 00:     Suppress network loading reports.  {Default}
52 09 01:     Send network loading reports every specified interval.

--------------------
51 0A:         Request network loading report interval.
55 0A ww xx yy zz:  Network loading report interval.
               {Default = $07 A1 20 = 500 000 microseconds}
               Interval range = 1 to $00 FF FF FF microseconds.

--------------------
51 14:         'Look Alike' mode status request.
52 14 00:     'Look Alike' mode disabled.
52 14 01:     'Look Alike' mode enabled.

--------------------
51 16:         Timer alert status query.
52 16 00:     Disable timer alert.
52 16 01:     Enable timer alert.

--------------------
51 17:         Timer alert period query.
52 17 xx:     Timer alert period.  xx - period in 0.0625 second increments.
               {Default = $10 = 1 sec.}

--------------------
51 18:         Timer query.  Timer rollover:  $00 FF FF FF.

--------------------
51 1F:         Match function query
52 1F 00:     Match function control;  Match = forward message to the host.  {Default}

52 1F 01:        Match function control;  Match = discard the message.


6: _____


7: _____


8:        HBCC functions.
          83 01 xx yy:             HBCC write register.  Address = xx,  value = yy.
          83 02 xx yy:             HBCC read register.  Address = xx, byte count = yy.
          83 03 xx yy:             HBCC write RAM.  Address = xx,  value = yy.
          83 04 xx yy:             HBCC read RAM.  Address = xx, byte count = yy.


9:        Processor memory.
          96 01 msb xx yy lsb zz:          Processor write memory (byte), value = zz.
          96 02 msb xx yy lsb zz:          Processor read memory (byte), count = zz.
          97 03 msb xx yy lsb rr ss:       Processor write memory (word), value = rr ss.
          96 04 msb xx yy lsb zz:          Processor read memory (word), count = zz.


A: _____


B:        Firmware version.
          B0:              Request firmware version number.


C: _____


D:        Operational mode.
          D0:              Request operational mode report.


E:        Mode switch.
          E1 22:           Switch to UBP mode.  [91 14]
          E1 33:           Switch to VPW mode.  [91 07]
          E1 44:           Switch to LIN mode.  [91 19]
          E1 66:           Switch to KIE mode.  [91 1A]
          E1 77:           Switch to SDM mode.  [91 1B]
          E1 96:           Switch to FLASH programming mode.  [91 2E]
          E1 99:           Switch to CAN mode.  [91 10]
          E1 BB:           Switch to URT mode.  [91 0E]
          E1 CC:           Switch to PWM mode.  [91 06]
          E1 DD:           Switch to KWP 2000 mode.  [91 0F]


F:        Re-Start.
          F1 A5:           Reset and restart.

## AVT-718  PWM  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*

0:      Message received from the network.
        0x ss yy zz ...  x = count of bytes to follow;  ss - message number;  yy zz ... message bytes.

1:      Message received from the network;  alternate header formats.
        11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.
        12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

2:      Error notification.
        See complete list in section:  "Error Codes."

3:      Command error.
        31 xx:        xx = Header byte of command in error.

4:      Match function - Filtering.
        40:           Function off.
        41 B7:      Table full, entry ignored.
        42 xx yy:    Table entry report.
                    xx - byte position;  yy - byte value.
        44 xx yy rr ss: Table entry report.
                    xx - byte position;  yy - byte value.
                    // AND //
                    rr - byte position;  ss - byte value.

5:

6:      Operations reports.
        62 01 00:    CRC byte is suppressed.
        62 01 01:    CRC byte is forwarded.

        --------------------
        62 08 00:    Message time stamps are disabled.
        62 08 01:    Message time stamps are enabled.

        --------------------
        62 09 00:    Network loading reports enabled.
        62 09 01:    Network loading reports disabled.

        --------------------
        65 0A ww xx yy zz:   Network loading report time interval in microseconds.

        --------------------

63 0F xx yy:   Network loading report.

--------------------
62 14 00:      "Look Alike" mode disabled.
62 14 01:      "Look Alike" mode enabled.

--------------------
62 16 00:      Timer alert disabled.
62 16 01:      Timer alert enabled.

--------------------
62 17 xx:      Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.

--------------------
62 1F 00:      Match function control;  Match = forward message to the host.
62 1F 01:      Match function control;  Match = discard the message.

7:

8:      HBCC access.
        8x 02 yy zz ... :       HBCC register state, yy = address, zz ... register value.
        8x 04 yy zz ... :       HBCC RAM state, yy = address, zz ... RAM value.

9:      Board status information.
        See complete list in section:  "Board Status Information."

A:      Transmit acknowledgment.
        Ax yy:        yy = Node address of node acknowledging receipt of message.
                              (Only when transmitting a message.)

B:

C:      Monitor acknowledgment.
        Cx yy:        yy = Node address of node acknowledging receipt of message.
                              (Only when in network monitor mode.)

D:

E:      Processor memory.
        Ex msb xx xx lsb yy . . .                 Processor memory state for address specified.

---

F:

## AVT-718  KWP  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*

0:       Transmit a message to the network.
       0x yy zz ...  x = count of bytes to follow;  yy zz ... message bytes.

1:       Transmit a message to the network, alternate header formats.
       11 tt yy zz ...  tt = count of bytes to follow;  yy zz ... message bytes.
       12 rr tt yy zz ...  rr tt = count of bytes to follow;  yy zz ... message bytes.
            Maximum length = 259 or 260 bytes.

2:       Reset.
       21 01:        Reset HBCC.
       21 02:        Reset SCC.
       21 03:        Reset DLC.
       21 04:        Reset FIFO #1.
       21 05:        Reset FIFO #2.
       21 06:        Reset CAN.

3:       Match table - Filtering.
       30:              Match status request, report match table contents.
       31 7B:         Match function off, clear table.
       32 xx yy:     Match table entry.
             xx - byte position;  yy - byte value.
       34 xx yy rr ss: Match table entry.
             xx - byte position;  yy - byte value.
                // AND //
             rr - byte position;  ss - byte value.
       [The 5x 1F command determines function operation.]

4:       

5:       Operational commands.
       51 01:        Checksum status request.
       52 01 00:     Suppress forwarding of checksum byte.
       52 01 01:     Forward the checksum byte.

       --------------------
       51 03:        Request counter/timer value - this controls K-Line baud rate.
       53 03 xx yy:  Counter/timer load.  xx yy are upper and lower bytes of new load, respectively.
             (Formula in User's Manual and at end of this document.)
             (Minimum value:  $00 02)
             {Default = $00 0B}

       --------------------
       51 04:        Request 'Keep-Alive' message.

5x 04 xx yy ...:'Keep Alive' message.  {Default:  68 6A F1 01 00}

--------------------
51 05:          Clear 'Keep Alive' message.


--------------------
51 06:          Request message forwarding status.
52 06 00:     Suppress messages 'from this device.'  {Default}
52 06 01:     Forward network messages 'from this device.'
                 [Subject to message filtering;  match function.]


--------------------
51 07:          Request 'Keep Alive' message interval.
52 07 xx:     'Keep Alive' message transmission interval, in 0.0625 second increments.
                 {Default = $48 = 4.5 seconds}


--------------------
51 08:          Request message time stamp status.
52 08 00:     No time stamp.  {Default}
                 *Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*
52 08 01:     Include time stamp.  Four bytes.  1.0 microsecond resolution.
                 *Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
                     *msg. byte (MSB) - . . . - msg. byte (LSB).*


--------------------
51 09:          Request network loading report status.
52 09 00:     Suppress network loading reports.  {Default}
52 09 01:     Send network loading reports every specified interval.


--------------------
51 0A:          Request network loading report interval.
55 0A ww xx yy zz:  Network loading report interval.
                 {Default = $07 A1 20 = 500 000 microseconds}
                 Interval range = 1 to $00 FF FF FF microseconds.


--------------------
52 0C xx:     Enter "pass through" mode #1.
                 The unit will respond with 62 0C xx and then immediately enter
                 pass through mode.
                 The unit will respond with 62 0C 00 when it exits pass through mode.
                 Break symbol on the RS-232 line from the host will cause the unit to
                 exit pass through mode.
                 "xx" is the inactivity time out in 0.0625 second increments.
                 If there no network activity (transmit or receive) for the specified time
                 interval, the unit exits pass through mode.


--------------------
52 0D 01:     Enter "pass through" mode #2.

The unit will respond with 62 0D 01 and then immediately enter pass through mode.
The only way to exit this pass through mode is a hardware reset (cycle power to the unit).

--------------------
51 13:              5-baud address query.
52 13 xx:           Set the 5-baud address.


--------------------
51 16:              Timer alert status query.
52 16 00:           Disable timer alert.
52 16 01:           Enable timer alert.


--------------------
51 17:              Timer alert period query.
52 17 xx:           Timer alert period.  xx - period in 0.0625 second increments.
                    {Default = $10 = 1 sec.}


--------------------
51 18:              Timer query.  Timer rollover:  $00 FF FF FF.


--------------------
51 19:              Transmit checksum status query.  (Transmit to the K-line network.)
52 19 00:           Disable transmit checksum.
52 19 01:           Enable transmit checksum.  {Default}


--------------------
51 1F:              Match function query
52 1F 00:           Match function control;  Match = forward message to the host.  {Default}
52 1F 01:           Match function control;  Match = discard the message.


--------------------
51 26:              K-line baud rate status query.
52 26 00:           115.2 kbaud on K-line disabled.  {Default}
52 26 01:           115.2 kbaud on K-line enabled  [5x 03 command is disabled].
52 26 02:           K-line baud rate set by external 16x clock  [5x 03 command is disabled].


--------------------
51 27:              P4_min (interbyte time for transmit message) status query.
55 27 rr ss tt vv:  P4_min value to  rr ss tt vv  microseconds.
                    1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                    {Default = $00 00 13 88 = 5 000 usec}


--------------------
51 28:              Format byte processing status query.
52 28 00:           Disable format byte processing.  {Default}

--------------------

52 28 01:       Enable format byte processing.

--------------------
51 2A:              P3_min (end of ECU response to new tester request) status query.
55 2A rr ss tt vv:    P3_min value to  rr ss tt vv  microseconds.
                      1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                      {Default = $00 00 D6 D8 = 55 000 usec}

--------------------
51 2B:              Request buffer expiration time.
55 2B rr ss tt vv:    Buffer expiration time to  rr ss tt vv  microseconds.
                      1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                      {Default = $00 00 59 D8 = 23 000 usec}

--------------------
51 2C:       Query for Keywords.
               Keywords from latest initialization attempt are returned.
               Keywords are set to $00 00 at start of an initialization attempt.

--------------------
51 2D:       First byte notification status query.
52 2D 00:    Disable first byte notification.
52 2D 01:    Enable first byte notification.

--------------------
51 2F:       Request 'Disconnect' time-out interval.
52 2F xx:     'Disconnect' time-out interval, in 0.0625 second increments.
               {Default = $50 = 5.0 seconds}

--------------------
51 3C:       Auto buffer termination (on transmit only), status query.
52 3C 00:    Auto buffer termination, function disabled.  {Default}
52 3C 01:    Auto buffer termination, function enabled.

--------------------
51 3D:       P1/P2 threshold checking function status query.
52 3D 00:    Disable P1/P2 threshold checking.  {Default}
52 3D 01:    Enable P1/P2 threshold checking.

--------------------
51 3E:              Query for P1 threshold value.
55 3E rr ss tt vv:    P1 threshold setting to  rr ss tt vv  microseconds.
                      1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                      {Default = $07 A1 20 = 500 000 usec}

--------------------
51 3F:              Query for P2 threshold value.

---

55 3F rr ss tt vv:      P2 threshold setting to  rr ss tt vv  microseconds.
1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
{Default = $07 A1 20 = 500 000 usec}

--------------------

51 40:          Transmit acknowledgments status query.
52 40 00:       Disable transmit acknowledgments.
52 40 01:       Enable transmit acknowledgments.  {Default}

--------------------

51 46:          T0_min status query.  [Special Mode #1 initialization method.]
55 46 rr ss tt vv:      T0_min value to  rr ss tt vv  microseconds.
1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
{Default = $00 00 27 10 = 10 000 usec}

--------------------

51 47:          T1_max status query.  [Special Mode #1 initialization method.]
55 47 rr ss tt vv:      T1_max value to  rr ss tt vv  microseconds.
1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
{Default = $00 06 1A 80 = 400 000 usec}

--------------------

51 48:          T2_max status query.  [Special Mode #1 initialization method.]
55 48 rr ss tt vv:      T2_max value to  rr ss tt vv  microseconds.
1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
{Default = $00 03 0D 40 = 200 000 usec}

--------------------

51 49:          T3_max status query.  [Special Mode #1 initialization method.]
55 49 rr ss tt vv:      T3_max value to  rr ss tt vv  microseconds.
1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
{Default = $00 03 0D 40 = 200 000 usec}

--------------------

51 4A:          T4_min status query.  [Special Mode #1 initialization method.]
55 4A rr ss tt vv:      T4_min value to  rr ss tt vv  microseconds.
1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
{Default = $00 00 03 E8 = 1 000 usec}

--------------------

51 4B:     Checksum type status query.
52 4B 00:     Checksum is normal.  {Default}
52 4B 01:     Checksum is 2's complement.

--------------------

51 57:     Parity status query.
52 57 00:     No parity.  [1 start, 8 data, 1 stop]  {Default}

52 57 01:      Odd parity.  [1 start, 8 data, odd parity, 1 stop]

52 57 02:      Even parity.  [1 start, 8 data, even parity, 1 stop]

--------------------

51 5F:          Receive message source query.

52 5F 00:      Receive no messages.

52 5F 01:      Receive KWP mode messages.  {Default}

52 5F 02:      Receive CAN mode messages.

52 5F 03:      Receive both KWP and CAN mode messages.

--------------------

51 64:          W2_max status query.

55 64 rr ss tt vv:      W2_max value to  rr ss tt vv  microseconds.
          1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
          {Default = $00 00 4E 20 = 20 000 usec}

--------------------

51 65:          W3_max status query.

55 65 rr ss tt vv:      W3_max value to  rr ss tt vv  microseconds.
          1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
          {Default = $00 00 4E 20 = 20 000 usec}

6:      KWP mode control.

60:          Request KWP mode status.

--------------------

61 01:          Disconnect.

--------------------

61 04:          Force a network connection.  {Default:  10.4 kbps}

--------------------

61 11:          Initialize using "CARB" method.

--------------------

61 12:          Initialize using "5-Baud" method.

--------------------

6x 13 xx yy:      Initialize using "Fast Initialization" method.
          xx yy .. is the initialization message.

--------------------

61 14:          Initialize using "Special Mode #1" method.

--------------------

6x 15 xx yy:      Initialize using "Special Mode #2" method.
          xx yy .. is the initialization message.

--------------------
62 16 xx:        Initialize using "Special Mode #3" method.
                 xx  -  is the inactivity time out in 0.0625 second increments.


--------------------
61 17:           Initialize using "Special Mode #4" method.

**NOTE:**        Refer to document "INIT_03c.PDF" for detailed information about initialization
                 modes and methods.

7:      CAN specific parameters
        71 01:           Global mask - 11-bit;  query.
        73 01 xx yy:     Global mask - 11 bits, right justified.
                                xx - upper byte  (upper 5 bits are ignored).
                                yy - lower byte  (full byte).


--------------------
        71 02:           Global mask - 29-bit;  query.
        75 02 rr ss tt vv:     Global mask - 29 bits, right justified.
                                rr - upper byte  (upper 3 bits are ignored).
                                ss - next byte  (full byte).
                                tt - next byte  (full byte).
                                vv - lowest byte  (full byte).


--------------------
        71 03:           Object 15 mask;  query.
        73 03 xx yy:     Object 15 mask ;  11-bits;  right justified.
                                xx - upper byte  (upper 5 bits are ignored).
                                yy - lower byte  (full byte).
        75 03 rr ss tt vv:     Object 15 mask;  29 bits;  right justified.
                                rr - upper byte  (upper 3 bits are ignored).
                                ss - next byte  (full byte).
                                tt - next byte  (full byte).
                                vv - lowest byte  (full byte).


--------------------
        72 04 xx:        Object status query.
                                xx - object number (1 to F).
        73 04 xx yy:     Object status command.
                                xx - object number (1 to F).
                                yy - commanded value.
                                        00 = object disabled.
                                        01 = object enabled as receive.
                                        10 = object enabled as transmit.


--------------------

72 05 xx:                   Object setup query.
                              xx - Object number (1 to F).
7x 05 xx yy zz rr aa bb cc ...
                  Object setup.
                              xx - object number (1 to F).
                              yy - 01 = receive;  10 = transmit.
                              zz - 01 = 11-bit;  10 = 29-bit.
                              rr - data length, updated when data field is written (7x 06 command).
                              Arbitration field is right justified.
                                    aa bb:  11-bit arbitration field.
                                    aa bb cc dd:  29-bit arbitration field.


--------------------
72 06 xx:                   Object data query.
                              xx - object number (1 to F).
7x 06 xx aa bb cc ... : Object data.
                              xx - object number (1 to F).
                              aa bb cc ...  - data field, variable length.


--------------------
72 07 xx:                   Object transmit status query.
73 07 xx yy:                Object transmit command.
                              xx - object number (1 to F).
                              yy - 01 = transmit the object.
                                    00 = abort transmission.


--------------------
71 08 :                     Object transmission report query.
72 08 xx:                   Object transmission report command.
                              xx - 01 = inform the host of successful transmission.
                                    00 = do not inform host of successful transmission.


--------------------
71 0A:                      Baud rate setting request.
72 0A xx:                   Baud rate setting command.
                            xx = 00 is a unique value (user writes to Bit Timing Registers).
                            xx = 01  -  1 Mbps.
                            xx = 02  -  500 kbps.
                            xx = 03  -  250 kbps.  {Default}
                            xx = 04  -  125 kbps.
                            xx = 05  -  100 kbps.
                            xx = 06  -  50 kbps.
                            xx = 07  -  41.67 kbps.
                            xx = 08  -  25 kbps.
                            xx = 09  -  80 kbps.
                            xx = 0A  -  33.333 kbps.
                            xx = 0B  -  83.333 kbps.

--------------------
**Note:**

Ford HS-CAN  [High Speed CAN]  500 kbaud.  The following baud rate command is recommended:  73 0B 40 2B  (instead of the 72 0A 02 setting listed above).

Ford MS-CAN  [Medium Speed CAN]  250 kbaud.  The following baud rate command is recommended:  73 0B C1 58  (instead of the 72 0A 03 setting listed above).

Ford MS-CAN  [Medium Speed CAN]  125 kbaud.  The following baud rate command is recommended:  73 0B C3 58  (instead of the 72 0A 04 setting listed above).

--------------------
71 0B:              Read CAN device Bit Timing Registers.
73 0B xx yy:        Set CAN device Bit Timing Registers.
                    xx  -  Bit Timing Register 0.
                    yy  -  Bit Timing Register 1.

--------------------
71 0C:              Sequential periodic message status query.
72 0C xx:           Sequential periodic message disable/enable command.
                    xx:     00      Group1  Type1 ops.
                                    Group2  Type1 ops.
                    xx:     01      Group1  Type2 ops.
                                    Group2  Type1 ops.
                    xx:     02      Group1  Type1 ops.
                                    Group2  Type2 ops.
                    xx:     03      Group1  Type2 ops.
                                    Group2  Type2 ops.

--------------------
71 0D:              Empty sequential message slot skip status query.
72 0D 00:           Skip empty sequential messages.  {Default}
72 0D 01:           Do not skip empty sequential messages  (time delay for empty slots).

--------------------
71 0E:              ST_MIN setting query.
72 0E xx:           Set ST_MIN to value "xx".
                    ST_MIN is in the flow control frame of an ISO 15765 exchange.

--------------------
71 10:              Query the CAN-B error latch.  Latch is cleared when read.

--------------------
71 11:              Status query for operational mode.
72 11 00:           Select no physical layer;  completely disconnected.
72 11 01:           Single wire CAN (SWC) operations.  (J2411)
72 11 02:           2-wire CAN operations.  (CAN-C;  ISO 11898;  J1939)

--------------------

72 11 03:                2-wire CAN operations.  (CAN-B;  ISO 11519)


--------------------
71 12:                   Status query for SWC device mode.
72 12 00:                SWC sleep.
72 12 01:                High speed mode.
72 12 02:                Wake up mode.
72 12 03:                Normal mode.


                         Refer to the CAN periodic messages document (CAN_04x.PDF) for
                         detailed information about Type0 and Type1 periodic message
                         functions, operations, commands, use, etc.


--------------------
72 14 xx:                Type0 periodic message status query.  xx - object number.
73 14 xx 00:             Type0 periodic function disabled for object xx.
73 14 xx 01:             Type0 periodic function enabled for object xx.
                         Note:  Valid object numbers:  $01 to $0E.


--------------------
72 15 xx:                Type0 periodic message interval query.  xx - object number.
73 15 xx yy:             Type0 periodic message interval command.
                         xx - object number, $01 to $0E.
                         yy - time interval in 5 or 10 millisecond increments.
                                 (Time increment set by 7x 1E command.)


--------------------
71 16:                   Disable all Type0 periodic messages.


--------------------
7x 18 xx yy zz rr aa bb cc ...
                         Type1 periodic message setup.
                                 xx - message number ($1 to $14).
                                 yy - 01 = receive;  10 = transmit.
                                 zz - 01 = 11-bit;  10 = 29-bit.
                                 rr - data length, updated when data field is written
                                         (7x 19 command).
                                 Arbitration field is right justified.
                                 aa bb:  11-bit arbitration field.
                                 aa bb cc dd:  29-bit arbitration field.


--------------------
72 19 xx:                Type1 periodic message data query.
                                 xx - message number ($1 to $14).
7x 19 xx aa bb cc ... :  Type1 periodic message data.
                                 xx - message number ($1 to $14).
                                 aa bb cc ...  - data field, variable length.


--------------------

--------------------
72 1A xx:              Type1, Type2 periodic message status query.
                              xx - message number $01 to $14.
73 1A xx 00:          Type1, Type2 periodic message xx - disable.
73 1A xx 01:          Type1, Type2 periodic message xx - enable.
74 1A xx rr ss:       Type1, Type2 enable mask;  direct write.
                      xx  -  Group number;  1 or 2.
                      rr ss  -  Mask;  only bits 1 to 10 (decimal) are valid.
                              Bit value of '0' disables that message.
                              Bit value of '1' enables that message.


--------------------
72 1B xx:              Type1, Type2 periodic message interval query.
                              xx - message number $01 to $14.
74 1B xx rr ss:       Type1, Type2 periodic message interval command.
                              xx - message number, $01 to $14.
                              rr ss -time interval in 5 or 10 millisecond increments.
                                      (Time increment set by 7x 1E command.)


--------------------
71 1C:                Disable all Type1, Type2 periodic messages.


--------------------
7x 1D command was in firmware version "6.9B"  only.
71 1D:          Status query for rolling nibble function, periodic messages 10 and 20.
72 1D 0A:      Status query for rolling nibble function, periodic message 10.
72 1D 14:      Status query for rolling nibble function, periodic message 20.
73 1D 0A 00:  Disable rolling nibble function, periodic message 10.
73 1D 0A 01:  Enable rolling nibble function, periodic message 10.
73 1D 14 00:  Disable rolling nibble function, periodic message 20.
73 1D 14 01:  Enable rolling nibble function, periodic message 20.


--------------------
71 1E:                Type0, 1, 2 periodic message timer query.
72 1E 00:             Type0, 1, 2 timer interval = 5 milliseconds.
72 1E 01:             Type0, 1, 2 timer interval = 10 milliseconds.  {Default}


--------------------
71 2D:                Status query for data field match function.
72 2D xx:             Disable / Enable the data field match function.
                      xx = 00 = disabled.
                      xx = 01 = enabled.


--------------------
71 2E:                Status query for data field match value.
75 2E rr ss tt vv:    Set the data field match value.
                      rr ss tt vv = match value.

--------------------
71 2F:                      Status query for data field mask value.
75 2F rr ss tt vv:          Set the data field mask value.
                            rr ss tt vv = mask value.


8: _____


9: _____ Processor memory.
96 01 msb xx yy lsb zz:     Processor write memory (byte), value = zz.
96 02 msb xx yy lsb zz:     Processor read memory (byte), count = zz.
97 03 msb xx yy lsb rr ss:  Processor write memory (word), value = rr ss.
96 04 msb xx yy lsb zz:     Processor read memory (word), count = zz.


A: _____


B: _____ Firmware version.
B0:                 Request firmware version number.


C: _____


D: _____ Operational mode.
D0:                 Request operational mode report.


E: _____ Mode switch.
E1 22:              Switch to UBP mode.  [91 14]
E1 33:              Switch to VPW mode.  [91 07]
E1 44:              Switch to LIN mode.  [91 19]
E1 66:              Switch to KIE mode.  [91 1A]
E1 77:              Switch to SDM mode.  [91 1B]
E1 96:              Switch to FLASH programming mode.  [91 2E]
E1 99:              Switch to CAN mode.  [91 10]
E1 BB:              Switch to URT mode.  [91 0E]
E1 CC:              Switch to PWM mode.  [91 06]
E1 DD:              Switch to KWP 2000 mode.  [91 0F]


F: _____ Re-Start.
F1 A5:              Reset and restart.


## AVT-718  KWP  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*


0: _____ Message received from the network.

0x ss yy zz ...  x = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.


1:      Message received from the network;  alternate header formats.
        11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.
        12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.


2:      Error notification.
        See complete list in section:  "Error Codes."


3:      Command error.
        31 xx:          xx = Header byte of command in error.


4:      Match function - Filtering.
        40:             Function off.
        41 B7:          Table full, entry ignored.
        42 xx yy:       Table entry report.
                        xx - byte position;  yy - byte value.
        44 xx yy rr ss: Table entry report.
                        xx - byte position;  yy - byte value.
                        // AND //
                        rr - byte position;  ss - byte value.


5:


6:      Operations reports.
        62 01 00:       Checksum byte is suppressed.
        62 01 01:       Checksum byte is forwarded.


        --------------------
        63 03 xx yy:    Counter/timer load.


        --------------------
        6x 04 xx yy ...:        Keep Alive message.


        --------------------
        61 05:          Keep alive message length = 0, suppressed.


        --------------------
        62 06 00:       Disable forwarding network messages 'from this device.'
        62 06 01:       Enable forwarding network messages 'from this device.'


        --------------------
        62 07 xx:       'Keep Alive' message interval in 0.0625 second increments.


        --------------------

62 08 00:        Message time stamps are disabled.

62 08 01:        Message time stamps are enabled.

--------------------

62 09 00:        Network loading reports enabled.

62 09 01:        Network loading reports disabled.

--------------------

65 0A ww xx yy zz:   Network loading report time interval in microseconds.

--------------------

62 0C xx:       Unit will immediately enter pass through mode #1.

--------------------

62 0D 01:       Unit will immediately enter pass through mode #2.

--------------------

63 0F xx yy:  Network loading report.

--------------------

62 13 xx:       5-baud address report.

--------------------

62 16 00:       Timer alert disabled.

62 16 01:       Timer alert enabled.

--------------------

62 17 xx:       Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------

65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.

--------------------

62 19 00:       Transmit checksum disabled.  (Transmit to the K-line network.)

62 19 01:       Transmit checksum enabled.

--------------------

62 1F 00:       Match function control;  Match = forward message to the host.

62 1F 01:       Match function control;  Match = discard the message.

--------------------

62 26 00:       K-line comm's in normal mode  [baud rate controlled by 5x 03 command].

62 26 01:       K-line baud rate set to 115.2 kbaud.

62 26 02:       K-line baud rate set by external 16x clock  [5x 03 command is disabled].

--------------------

65 27 rr ss tt vv:     P4_min value;  rr ss tt vv microseconds.

--------------------

62 28 00:     Format byte processing disabled.

62 28 01:     Format byte processing enabled.

--------------------

65 2A rr ss tt vv:     P3_min value;  rr ss tt vv microseconds.

--------------------

65 2B rr ss tt vv:     Buffer time out value;  rr ss tt vv microseconds.

--------------------

63 2C xx yy:     Keyword report.  xx is Keyword 1, yy is Keyword 2.

--------------------

62 2D 00:     First byte notification disabled.

62 2D 01:     First byte notification enabled.

--------------------

62 2F xx:     'Disconnect' time-out interval in 0.0625 second increments.

--------------------

62 3C 00:     Auto buffer termination, function disabled.

62 3C 01:     Auto buffer termination, function enabled.

--------------------

62 3D 00:     P1/P2 threshold checking disabled.

62 3D 01:     P1/P2 threshold checking enabled.

--------------------

65 3E rr ss tt vv:     P1 threshold value;  rr ss tt vv microseconds.

--------------------

65 3F rr ss tt vv:     P2 threshold value;  rr ss tt vv microseconds.

--------------------

62 40 00:     Transmit acknowledgments disabled.

62 40 01:     Transmit acknowledgments enabled.  {Default}

--------------------

65 46 rr ss tt vv:     T0_min value;  rr ss tt vv microseconds.

--------------------

65 47 rr ss tt vv:     T1_max value;  rr ss tt vv microseconds.

--------------------

65 48 rr ss tt vv:     T2_max value;  rr ss tt vv microseconds.

--------------------
65 49 rr ss tt vv:        T3_max value;  rr ss tt vv microseconds.


--------------------
65 4A rr ss tt vv:        T4_min value;  rr ss tt vv microseconds.


--------------------
62 4B 00:      Checksum is normal.
62 4B 01:      Checksum is 2's complement.


--------------------
62 57 00:      No parity.  [1 start, 8 data, 1 stop]
62 57 01:      Odd parity.  [1 start, 8 data, odd parity, 1 stop]
62 57 02:      Even parity.  [1 start, 8 data, even parity, 1 stop]


--------------------
62 5F 00:      Receive no messages.
62 5F 01:      Receive KWP mode messages.  {Default}
62 5F 02:      Receive CAN mode messages.
62 5F 03:      Receive both KWP and CAN mode messages.


--------------------
65 64 rr ss tt vv:        W2_max value rr ss tt vv  microseconds.
                          1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                          {Default = $00 00 4E 20 = 20 000 usec}


--------------------
65 65 rr ss tt vv:        W3_max value rr ss tt vv  microseconds.
                          1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                          {Default = $00 00 4E 20 = 20 000 usec}

7:      KWP mode response.
        71 01:      Disconnected and idle.
        71 02:
        71 03:      Initialization completed successfully.  Normal operations.
        71 04:      Manual connection.
        71 FF:      Mode error.

8: ____
        83 01 xx yy:        Global mask - 11-bits;  right justified.
                                 xx - upper byte  (upper 5 bits zero).
                                 yy - lower byte  (full byte).


        --------------------
        85 02 rr ss tt vv:        Global mask - 29 bits;  right justified.
                                 rr - upper byte  (upper 3 bits zero).

ss - next byte  (full byte).
tt - next byte  (full byte).
vv - lowest byte  (full byte).

--------------------
83 03 xx yy:              Object 15 mask;  11-bits;  right justified.
                          xx - upper byte  (upper 5 bits ignored).
                          yy - lower byte  (full byte).
85 03 rr ss tt vv:       Object 15 mask;  29 bits;  right justified.
                          rr - upper byte  (upper 3 bits zero).
                          ss - next byte  (full byte).
                          tt - next byte  (full byte).
                          vv - lowest byte  (full byte).

--------------------
83 04 xx yy:              Object status report.
                          xx - object number (1 to F).
                          yy -    00 = object disabled.
                                    01 = object enabled as receive.
                                    10 = object enabled as transmit.

--------------------
8x 05 xx yy zz rr aa bb cc ... : Object setup report.
                          xx - object number (1 to F).
                          yy - 01 = receive;  10 = transmit.
                          zz - 01 = 11-bit;  10 = 29-bit.
                          rr - data length (0 to 8).
                          Arbitration field is right justified.
                                    aa bb - 11-bit arbitration field.
                                    aa bb cc dd - 29-bit arbitration field.

--------------------
8x 06 xx aa bb cc ... :        Object data report.
                          xx - object number (1 to F).
                          aa bb cc ... :  data field, variable length.

--------------------
8x 07 xx yy:              Object transmit status report.
                          xx - object number (1 to F).
                          yy - transmit status
                                  00 = transmit operation not pending.
                                  01 = transmit operation requested / pending.

--------------------
82 08 xx:                 Object transmission report control.
                          xx - status.
                                  00 = do not inform host of successful transmission.

01 = inform host of successful transmission.

--------------------
82 0A xx:                CAN baud rate (preset value).
                         xx = 00 is a unique value (user defined the Bit Timing Registers).
                         xx = 01  -  1 Mbps.
                         xx = 02  -  500 kbps.
                         xx = 03  -  250 kbps.
                         xx = 04  -  125 kbps.
                         xx = 05  -  100 kbps.
                         xx = 06  -  50 kbps.
                         xx = 07  -  41.67 kbps.
                         xx = 08  -  25 kbps.
                         xx = 09  -  80 kbps.
                         xx = 0A  -  33.333 kbps.
                         xx = 0B  -  83.333 kbps.


--------------------
83 0B xx yy:             Bit Timing Register values.
                         xx  -  Bit Timing Register 0.
                         yy  -  Bit Timing Register 1.


--------------------
82 0C xx:                Sequential periodic message disable/enable command.
                         xx:     00      Group1  Type1 ops.
                                         Group2  Type1 ops.
                         xx:     01      Group1  Type2 ops.
                                         Group2  Type1 ops.
                         xx:     02      Group1  Type1 ops.
                                         Group2  Type2 ops.
                         xx:     03      Group1  Type2 ops.
                                         Group2  Type2 ops.


--------------------
82 0D 00:                Skip empty sequential messages.
82 0D 01:                Do not skip empty sequential messages  (time delay for empty slots).


--------------------
82 0E xx:                ST_MIN value is: "xx".
                         ST_MIN is in the flow control frame of an ISO 15765 exchange.


--------------------
82 10 xx:                CAN-B error latch status.
                         xx = 00 = no error detected since last read.
                         xx = 01 = at least one error detected since last read.


--------------------

| | |
|---|---|
| 82 11 00: | No CAN physical layer selected;  completely disconnected. |
| 82 11 01: | Single wire CAN (SWC) operations.  (J2411) |
| 82 11 02: | 2-wire CAN operations.  (CAN-C;  ISO 11898;  J1939) |
| 82 11 03: | 2-wire CAN operations.  (CAN-B;  ISO 11519) |

--------------------

| | |
|---|---|
| 82 12 00: | SWC sleep. |
| 82 12 01: | High speed mode. |
| 82 12 02: | Wake up mode. |
| 82 12 03: | Normal mode. |

--------------------

| | |
|---|---|
| 83 14 xx 00: | Type0 periodic function disabled for object xx. |
| 83 14 xx 01: | Type0 periodic function enabled for object xx. |

--------------------

83 15 xx yy:  Type0 periodic message interval report.
xx - object number, $01 to $0E.
yy - time interval in 5 or 10 millisecond increments.
        (Time increment set by 7x 1E command.)

--------------------

81 16:  All Type0 periodic messages disabled.

--------------------

8x 18 xx yy zz rr aa bb cc ... : Type1 message setup report.
xx - message number ($1 to $14).
yy - 01 = receive;  10 = transmit.
zz - 01 = 11-bit;  10 = 29-bit.
rr - data length (0 to 8).
Arbitration field is right justified.
        aa bb - 11-bit arbitration field.
        aa bb cc dd - 29-bit arbitration field.

--------------------

8x 19 xx aa bb cc ... :  Type1 periodic message data report.
xx - message number ($1 to $14).
aa bb cc ... :  data field, variable length.

--------------------

| | |
|---|---|
| 83 1A xx 00: | Type1, Type2 periodic function disabled for message xx. |
| 83 1A xx 01: | Type1, Type2 periodic function enabled for message xx. |
| 84 1A xx rr ss: | Type1, Type2 enable mask. |

xx  -  Group number;  1 or 2.
rr ss:  -  Mask value;  only bits 1 to 10 (decimal) are valid.

--------------------

83 1B xx yy:        Type1, Type2 periodic message interval report.
                          xx - message number, $01 to $14.
                          yy - time interval in 5 or 10 millisecond increments.
                                (Time increment set by 7x 1E command.)

--------------------
81 1C:                All Type1, Type2 periodic messages disabled.

--------------------
83 1D 0A 00:  Rolling nibble function, periodic message 10, disabled.
83 1D 0A 01:  Rolling nibble function, periodic message 10, enabled.
83 1D 14 00:  Rolling nibble function, periodic message 20, disabled.
83 1D 14 01:  Rolling nibble function, periodic message 20, enabled.

--------------------
82 1E 00:          Type0, 1, 2 timer interval = 5 milliseconds.
82 1E 01:          Type0, 1, 2 timer interval = 10 milliseconds.

--------------------
82 2D xx:         Data field match function status.
                          xx = 00 = disabled.
                          xx = 01 = enabled.

--------------------
85 2E rr ss tt vv:    Data field match value.

--------------------
85 2F rr ss tt vv:    Data field mask value.

9:     Board status information.
      See complete list in section:  "Board Status Information."

A:

B:

C:

D:

E:     Processor memory.
      Ex msb xx xx lsb yy . . .          Processor memory status for address specified.

F:

## AVT-718  CAN  Mode  -  Commands

**Note:** 11-bit or 29-bit Arbitration Field is the Message ID.

*High nibble, bits b7 - b4:  Command type.*

### 0:        Transmit message  {Default}  [ISO 15765 support disabled]
Acceptable forms
- 01 0x:
    x:  object number.
    Triggers transmission of the specified object.
    All object setup is assumed to be complete (message ID, data, etc.).
- 03 0x rr ss:
    x:  object number
    rr ss:  11-bit arbitration field
    no data is specified, no data is transmitted.
- 05 8x rr ss tt vv:
    x:  object number
    rr ss tt vv:  29-bit arbitration field
    no data is specified, no data is transmitted.
- 0y 0x rr ss mm nn ...
    y:  count of bytes to follow
    x:  object number
    rr ss:  11-bit arbitration field
    mm nn ... :  data field  [0 to 8 bytes].
- 0y 8x rr ss tt vv mm nn ...
    y:  count of bytes to follow
    x:  object number
    rr ss tt vv:  29-bit arbitration field
    mm nn ... :  data field  [0 to 8 bytes].

Note:
    The AVT-718 unit will only respond to these commands if transmit acknowledgments
    are enabled through the 7x 08 command.

### Transmit  message  [ISO 15765 support  enabled]

Also known as "Segmented Messages" or "Multi-Frame Messages."

$\Rightarrow$ Commands:  7x 26  and  7x 27.

$\Rightarrow$ Refer to ISO 15765 specification.

$\Rightarrow$ Normal and extended addressing is as designated by ISO 15765.

$\Rightarrow$ The extended address byte  ("N_TA"  or  "N_AE") is defined in ISO 15765.
    *In this document the extended address byte is generically listed as "ae".*

$\Rightarrow$ Do NOT include any control byte information or control bytes in the data field of the command.

$\Rightarrow$ The AVT-418 & AVT-718 will handle all:
      handshaking
      control bytes  (N_PCI)  (First Frame, Flow Control Frame, Consecutive Frame, etc.)
      extended address byte (ae)

**Transmit commands for normal addressing**

- 0y  0x  rr  ss  mm  nn  ...
    y:  count of bytes to follow
    0:  11-bit arbitration field, right justified
    x:  object number
    rr ss:  11-bit arbitration field or message ID
    mm nn ... :  data field  [0 to $C  (12 decimal)  bytes].

- 0y  8x  rr  ss  tt  vv  mm  nn  ...
    y:  count of bytes to follow
    8:  29-bit arbitration field, right justified
    x:  object number
    rr ss tt vv:  29-bit arbitration field or message ID
    mm nn ... :  data field  [0 to $A  (10 decimal)  bytes].

- 11  yy  0x  rr  ss  mm  nn  ...
    yy:  count of bytes to follow
    0:  11-bit arbitration field, right justified
    x:  object number
    rr ss:  11-bit arbitration field or message ID
    mm nn ... :  data field  [0 to $FC  (252 decimal)  bytes].

- 11  yy  8x  rr  ss  tt  vv  mm  nn  ...
    y:  count of bytes to follow
    8:  29-bit arbitration field, right justified
    x:  object number
    rr ss tt vv:  29-bit arbitration field or message ID
    mm nn ... :  data field   [0 to $FA  (250 decimal)  bytes].

- 12  yy  zz  0x  rr  ss  mm  nn  ...
    yy zz:  count of bytes to follow
    0:  11-bit arbitration field, right justified
    x:  object number
    rr ss:  11-bit arbitration field or message ID
    mm nn ... :  data field  [0 to $FFF  (4095 decimal)  bytes].

- 12  yy  zz  8x  rr  ss  tt  vv  mm  nn  ...
    yy zz:  count of bytes to follow
    8:  29-bit arbitration field, right justified

---

      x:  object number
      rr ss tt vv:  29-bit arbitration field or message ID
      mm nn ... :  data field   [0 to $FFF  (4095 decimal)  bytes].

### Transmit commands for extended addressing

- 0y  0x  rr  ss  n_ta  mm  nn ...
      y:  count of bytes to follow
      0:  11-bit arbitration field, right justified
      x:  object number
      rr ss:  11-bit arbitration field or message ID
      n_ta:  address extension byte
      mm nn ... :  data field  [0 to $B  (11 decimal)  bytes].

- 0y  8x  rr  ss  tt  vv  n_ae  mm  nn ...
      y:  count of bytes to follow
      8:  29-bit arbitration field, right justified
      x:  object number
      rr ss tt vv:  29-bit arbitration field or message ID
      n_ae:  address extension byte
      mm nn ... :  data field  [0 to $9  (9 decimal)  bytes].

- 11  yy  0x  rr  ss  n_ta  mm  nn ...
      yy:  count of bytes to follow
      0:  11-bit arbitration field, right justified
      x:  object number
      rr ss:  11-bit arbitration field or message ID
      n_ta:  address extension byte
      mm nn ... :  data field  [0 to $FB  (251 decimal)  bytes].

- 11  yy  8x  rr  ss  tt  vv  n_ae  mm  nn ...
      y:  count of bytes to follow
      8:  29-bit arbitration field, right justified
      x:  object number
      rr ss tt vv:  29-bit arbitration field or message ID
      n_ae:  address extension byte
      mm nn ... :  data field   [0 to $F9  (249 decimal)  bytes].

- 12  yy  zz  0x  rr  ss  n_ta  mm  nn ...
      yy zz:  count of bytes to follow
      0:  11-bit arbitration field, right justified
      x:  object number
      rr ss:  11-bit arbitration field or message ID
      n_ta:  address extension byte
      mm nn ... :  data field  [0 to $FFF  (4095 decimal)  bytes].

- 12  yy  zz  8x  rr  ss  tt  vv  n_ae  mm  nn ...
      yy zz:  count of bytes to follow

8:  29-bit arbitration field, right justified

x:  object number

rr ss tt vv:  29-bit arbitration field or message ID

n_ae:  address extension byte

mm nn ... :  data field   [0 to $FFF  (4095 decimal)  bytes].


<u>1:</u>


<u>2:</u>        <u>Reset.</u>

| | |
|---|---|
| 21 01: | Reset HBCC. |
| 21 02: | Reset SCC. |
| 21 03: | Reset DLC. |
| 21 04: | Reset FIFO #1. |
| 21 05: | Reset FIFO #2. |
| 21 06: | Reset CAN |

Restore baud rate setting and physical layer selection.

Disable all objects, clear all objects, clear all masks.

21 0C:        Reset CAN

Restore all parameters and settings.


<u>3:</u>


<u>4:</u>


<u>5:</u>        <u>Operational commands.</u>

51 08:        Request message time stamp status.

52 08 00:     No time stamp.  {Default}

*Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*

52 08 01:     Include time stamp.  Four bytes.  1.0 microsecond resolution.

*Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
*msg. byte (MSB) - . . . - msg. byte (LSB).*


--------------------

51 09:        Request network loading report status.

52 09 00:     Suppress network loading reports.  {Default}

52 09 01:     Send network loading reports every specified interval.


--------------------

51 0A:            Request network loading report interval.

55 0A ww xx yy zz:  Network loading report interval.

{Default = $07 A1 20 = 500 000 microseconds}

Interval range = 1 to $00 FF FF FF microseconds.


--------------------

51 16:        Timer alert status query.

52 16 00:      Disable timer alert.

52 16 01:      Enable timer alert.


--------------------

51 17:         Timer alert period query.

52 17 xx:      Timer alert period.  xx - period in 0.0625 second increments.
              {Default = \$10 = 1 sec.}


--------------------

51 18:         Timer query.  Timer rollover:  \$00 FF FF FF.


--------------------

51 1D:         Minimum time between frames (when streaming data).

55 1D vv ww xx yy:  Minimum time between frames in microseconds.
              1 microsecond increments.  Range = 1 to \$00 FF FF FF microseconds.
              {Default = \$00 00 00 00}


--------------------

51 1F:         Data field match function query

52 1F 00:      Data field match function control.
              Match = forward message to the host.  {Default}

52 1F 01:      Data field match function control.
              Match = discard the message.



6: ____


7:      CAN specific parameters

      71 01:         Global mask - 11-bit;  query.

      73 01 xx yy:  Global mask - 11 bits, right justified.
                  xx - upper byte  (upper 5 bits are ignored).
                  yy - lower byte  (full byte).


--------------------

      71 02:         Global mask - 29-bit;  query.

      75 02 rr ss tt vv:  Global mask - 29 bits, right justified.
                  rr - upper byte  (upper 3 bits are ignored).
                  ss - next byte  (full byte).
                  tt - next byte  (full byte).
                  vv - lowest byte  (full byte).


--------------------

      71 03:         Object 15 mask;  query.

      73 03 xx yy:      Object 15 mask;  11-bits;  right justified.
                  xx - upper byte  (upper 5 bits are ignored).
                  yy - lower byte  (full byte).

75 03 rr ss tt vv:      Object 15 mask;  29 bits;  right justified.
                rr - upper byte  (upper 3 bits are ignored).
                ss - next byte  (full byte).
                tt - next byte  (full byte).
                vv - lowest byte  (full byte).

--------------------

72 04 xx:      Object status query.
           xx - object number (1 to F).
73 04 xx yy:      Object status command.
           xx - object number (1 to F).
           yy - commanded value.
                00 = object disabled.
                01 = object enabled as receive.
                10 = object enabled as transmit.

--------------------

72 05 xx:      Object setup query.
           xx - Object number (1 to F).
7x 05 xx yy zz rr aa bb cc ...
          Object setup.
           xx - object number (1 to F).
           yy - 01 = receive;  10 = transmit.
           zz - 01 = 11-bit;  10 = 29-bit.
           rr - data length, updated when data field is written (7x 06 command).
           Arbitration field is right justified.
                aa bb:  11-bit arbitration field.
                aa bb cc dd:  29-bit arbitration field.

--------------------

72 06 xx:      Object data query.
           xx - object number (1 to F).
7x 06 xx aa bb cc ... : Object data.
           xx - object number (1 to F).
           aa bb cc ...  - data field, variable length.

--------------------

72 07 xx:      Object transmit status query.
73 07 xx yy:      Object transmit command.
           xx - object number (1 to F).
           yy - 01 = transmit the object.
              00 = abort transmission.

--------------------

71 08 :      Object transmission report query.
72 08 xx:      Object transmission report command.
           xx - 01 = inform the host of successful transmission.

00 = do not inform host of successful transmission.

--------------------
71 0A:                      Baud rate setting request.
72 0A xx:                   Baud rate setting command.

xx = 00 is a unique value (user writes to Bit Timing Registers).
xx = 01  -  1 Mbps.
xx = 02  -  500 kbps.
xx = 03  -  250 kbps.  {Default}
xx = 04  -  125 kbps.
xx = 05  -  100 kbps.
xx = 06  -  50 kbps.
xx = 07  -  41.67 kbps.
xx = 08  -  25 kbps.
xx = 09  -  80 kbps.
xx = 0A  -  33.333 kbps.
xx = 0B  -  83.333 kbps.

--------------------
**Note:**

Ford HS-CAN  [High Speed CAN]  500 kbaud.  The following baud rate command is recommended:  73 0B 40 2B  (instead of the 72 0A 02 setting listed above).

Ford MS-CAN  [Medium Speed CAN]  250 kbaud.  The following baud rate command is recommended:  73 0B C1 58  (instead of the 72 0A 03 setting listed above).

Ford MS-CAN  [Medium Speed CAN]  125 kbaud.  The following baud rate command is recommended:  73 0B C3 58  (instead of the 72 0A 04 setting listed above).

--------------------
71 0B:                      Read CAN device Bit Timing Registers.
73 0B xx yy:                Set CAN device Bit Timing Registers.
                            xx  -  Bit Timing Register 0.
                            yy  -  Bit Timing Register 1.

--------------------
71 0C:                      Sequential periodic message status query.
72 0C xx:                   Sequential periodic message disable/enable command.
                            xx:      00      Group1  Type1 ops.
                                             Group2  Type1 ops.
                            xx:      01      Group1  Type2 ops.
                                             Group2  Type1 ops.
                            xx:      02      Group1  Type1 ops.
                                             Group2  Type2 ops.
                            xx:      03      Group1  Type2 ops.
                                             Group2  Type2 ops.

--------------------

| | |
|---|---|
| 71 0D: | Empty sequential message slot skip status query. |
| 72 0D 00: | Skip empty sequential messages.  {Default} |
| 72 0D 01: | Do not skip empty sequential messages  (time delay for empty slots). |

--------------------

| | |
|---|---|
| 71 0E: | ST_MIN setting query. |
| 72 0E xx: | Set ST_MIN to value "xx". |
| | ST_MIN is in the flow control frame of an ISO 15765 exchange. |

--------------------

| | |
|---|---|
| 71 10: | Query the CAN-B error latch.  Latch is cleared when read. |

--------------------

| | |
|---|---|
| 71 11: | Status query for operational mode. |
| 72 11 00: | Select no physical layer;  completely disconnected. |
| 72 11 01: | Single wire CAN (SWC) operations.  (J2411) |
| 72 11 02: | 2-wire CAN operations.  (CAN-C;  ISO 11898;  J1939) |
| 72 11 03: | 2-wire CAN operations.  (CAN-B;  ISO 11519) |

--------------------

| | |
|---|---|
| 71 12: | Status query for SWC device mode. |
| 72 12 00: | SWC sleep. |
| 72 12 01: | High speed mode. |
| 72 12 02: | Wake up mode. |
| 72 12 03: | Normal mode. |

--------------------

| | |
|---|---|
| 73 13 xx yy: | Fast transmit command. |
| | Transmit the specified object as fast as possible for the specified number of times. |
| | User must have the object set up prior to sending this command. |
| | xx  -  object number. |
| | yy  -  transmit count;  00 to FF. |
| | |
| | Refer to the CAN periodic messages document (CAN_04c.PDF) for detailed information about Type0 and Type1 periodic message functions, operations, commands, use, etc. |

--------------------

| | |
|---|---|
| 72 14 xx: | Type0 periodic message status query.  xx - object number. |
| 73 14 xx 00: | Type0 periodic function disabled for object xx. |
| 73 14 xx 01: | Type0 periodic function enabled for object xx. |
| | Note:  Valid object numbers:  $01 to $0E. |

--------------------

| | |
|---|---|
| 72 15 xx: | Type0 periodic message interval query.  xx - object number. |
| 73 15 xx yy: | Type0 periodic message interval command. |
| | xx - object number, $01 to $0E. |

yy - time interval in 5 or 10 millisecond increments.
(Time increment set by 7x 1E command.)


--------------------
71 16:                          Disable all Type0 periodic messages.


--------------------
72 18 xx                        Type 1 periodic message, query for status, message "xx".
7x 18 xx yy zz rr aa bb cc ...
                                Type1 periodic message setup.
                                        xx:  message number ($01 to $20).
                                        yy:  01 = receive;  10 = transmit.
                                        zz:  01 = 11-bit;  10 = 29-bit.
                                        rr:  data length, updated when data field is written
                                                (7x 19 command).
                                        Arbitration field is right justified.
                                        aa bb:  11-bit arbitration field.
                                        aa bb cc dd:  29-bit arbitration field.


--------------------
72 19 xx:                       Type1 periodic message data query.
                                        xx:  message number ($01 to $20).
7x 19 xx aa bb cc ... :  Type1 periodic message data.
                                        xx:  message number ($01 to $20).
                                        aa bb cc ...  - data field, variable length.


--------------------
72 1A xx:                       Type1, Type2 periodic message status query.
                                        xx:  message number ($01 to $20).
73 1A xx 00:                    Type1, Type2 periodic message xx - disable.
73 1A xx 01:                    Type1, Type2 periodic message xx - enable.
74 1A xx rr ss:                 Type1, Type2 enable mask;  direct write.
                                xx  -  Group number;  1 or 2.
                                rr ss  -  Enable mask;  only bits 1 to 10 (decimal) are valid.
                                        Bit value of '0' disables that message.
                                        Bit value of '1' enables that message.


--------------------
72 1B xx:                       Type1 periodic message interval query.
                                        xx:  message number ($01 to $20).
74 1B xx rr ss:                 Type1 periodic message interval command.
                                        xx:  message number ($01 to $20).
                                        rr ss -time interval in 5 or 10 millisecond increments.
                                                (Time increment set by 7x 1E command.)


--------------------
71 1C:          Disable all Type1 and Type2 periodic messages.

--------------------

--------------------
7x 1D command was in firmware version "6.9B" only.

71 1D:        Status query for rolling nibble function, periodic messages 10 and 20.
72 1D 0A:     Status query for rolling nibble function, periodic message 10.
72 1D 14:     Status query for rolling nibble function, periodic message 20.
73 1D 0A 00:  Disable rolling nibble function, periodic message 10.
73 1D 0A 01:  Enable rolling nibble function, periodic message 10.
73 1D 14 00:  Disable rolling nibble function, periodic message 20.
73 1D 14 01:  Enable rolling nibble function, periodic message 20.


--------------------
71 1E:        Type0 & 1 periodic message timer query.
72 1E 00:     Type0 & 1 timer interval = 5 milliseconds.
72 1E 01:     Type0 & 1 timer interval = 10 milliseconds.  {Default}
72 1E 02:     Type0 & 1 timer interval = 2 milliseconds.


--------------------
**Auto Response  [Do not use if ISO 15765 processing is enabled]**
7x 20:        Auto Respond #0.  (Refer to the "Auto Response Supplement.)
71 20:        Status request.
72 20 00:     Disable the function.  {Default}
72 20 01:     Enable the function.
7x 20 KK LL MM NN PP RR xx yy zz ...
              KK:  00 to disable,  01 to enable.
              LL:  transmit object number  (01 to 0E).
              MM:  receive object number  (01 to 0F).
              NN:  data byte number  (00 to 07).
              PP:  mask value  (00 to FF).
              RR:  match value  (00 to FF).
              xx yy zz ... :  optional data field of variable length,  0 to 8 bytes.


--------------------
7x 21:        Auto Respond #1.  (Refer to the 7x 20 command, above, for details.)


--------------------
7x 22:        Auto Respond #2.  (Refer to the 7x 20 command, above, for details.)


--------------------
7x 23:        Auto Respond #3.  (Refer to the 7x 20 command, above, for details.)


--------------------
**Programmable Delay for Auto Response  [Do not use if ISO 15765 processing is enabled]**
72 25 xx:         Status query for Auto Respond #xx.

73 25 xx 00:      Auto Respond #xx to mode 00, no delay.  {Default}
                  'xx' = 00 to 03.

74 25 xx 01 yy: Auto Respond #xx to mode 01, fixed delay.
       'xx' = 00 to 03.
       'yy' is wait time in milliseconds.

74 25 xx 02 yy: Auto Respond #xx to mode 02, message specified delay.
       'xx' = 00 to 03.
       'yy' is received message byte position indicating time to wait, in msec.
       'yy' = 00 to 07.

75 25 xx 03 yy zz: Auto Respond #xx to mode 03, message specified delay plus
       fixed delay.
       'xx' = 00 to 03.
       'yy' is received message byte position indicating time to wait, in msec.
       'yy' = 00 to 07.
       'zz' is fixed time to wait, in milliseconds.

--------------------
## ISO 15765 Processing - **Not** Recommended for new designs
71 26:     ISO 15765 support status query.
72 26 00:    ISO 15765 support disabled.  {Default.}
73 26 01 0x:   ISO 15765 support enabled.
        Normal addressing.
        Flow control transmit object is:  0x  [01 to 0E].
74 26 02 0x yy:  ISO 15765 support enabled.
        Extended addressing.
        Flow control transmit object is:  0x  [01 to 0E].
        Flow control address extension byte is:  yy.

--------------------
71 27:  ISO 15765 message padding status query.
72 27 00:  Disable ISO 15765 message padding.
72 27 01:  Enable ISO 15765 message padding.  {Default}
      All data fields are 8 bytes long.  Default pad byte value is 00.
73 27 01 xx: Enable ISO 15765 message padding.  Pad byte value = xx.

--------------------
## ISO 15765 Processing  Alternate method (version 5.9 and above)
         Recommended method
71 28:     Object pairing status query.
       Default is no objects are paired.
72 28 0x:    Disable ISO 15765 processing for object 0x and it's mate.
73 28 0x 0y   Declare objects 0x and 0y as paired.
       Enable ISO 15765 processing for the pair.
       Address extension is disabled for the pair.
       (Object order is not important.)
74 28 0x 0y ww  Declare objects 0x and 0y as paired.

Enable ISO 15765 processing for the pair.
Enable address extension and use byte ww in flow control frame.

--------------------
| | |
|---|---|
| 71 2D: | Status query for data field match function. |
| 72 2D xx: | Disable / Enable the data field match function. |

xx = 00 = disabled.
xx = 01 = enabled.

--------------------
| | |
|---|---|
| 71 2E: | Status query for data field match value. |
| 75 2E rr ss tt vv: | Set the data field match value. |

rr ss tt vv = match value.

--------------------
| | |
|---|---|
| 71 2F: | Status query for data field mask value. |
| 75 2F rr ss tt vv: | Set the data field mask value. |

rr ss tt vv = mask value.

--------------------
75 33 xx yy rr ss:  Stream data to the CAN network.  CAN object should be set up.
xx = timeout in 0.0625 sec increments.
yy = CAN object number (01 to 0E).
rr ss = data length (byte count).

8:

9: Processor memory.

| | |
|---|---|
| 96 01 msb xx yy lsb zz: | Processor write memory (byte), value = zz. |
| 96 02 msb xx yy lsb zz: | Processor read memory (byte), count = zz. |
| 97 03 msb xx yy lsb rr ss: | Processor write memory (word), value = rr ss. |
| 96 04 msb xx yy lsb zz: | Processor read memory (word), count = zz. |

A:

B: Firmware version.
B0: Request firmware version number.

C:

D: Operational mode.
D0: Request operational mode report.

E: Mode switch.

E1 22:          Switch to UBP mode.  [91 14]
E1 33:          Switch to VPW mode.  [91 07]
E1 44:          Switch to LIN mode.  [91 19]
E1 66:          Switch to KIE mode.  [91 1A]
E1 77:          Switch to SDM mode.  [91 1B]
E1 96:          Switch to FLASH programming mode.  [91 2E]
E1 99:          Switch to CAN mode.  [91 10]
E1 BB:          Switch to URT mode.  [91 0E]
E1 CC:          Switch to PWM mode.  [91 06]
E1 DD:          Switch to KWP 2000 mode.  [91 0F]

F:        Re-Start.
F1 A5:          Reset and restart.


## AVT-718  CAN  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*


0:        Received message
0x [time stamp] 0y jj kk aa bb cc ... :
                              0x - count of bytes to follow.
                              [Time stamp, 4-bytes, microsecond, if enabled.]
                              0y - object number (1 to F).
                              jj kk - 11-bit arbitration field, right justified.
                              aa bb cc ... :  data from object.


0x [time stamp] 8y jj kk ll mm aa bb cc ... :
                              0x - count of bytes to follow.
                              [Time stamp, 4-bytes, microsecond, if enabled.]
                              8y - object number (1 to F).
                              jj kk ll mm - 29-bit arbitration field, right justified.
                              aa bb cc ... :  data from object.


1:        Alternate header formats.
11 rr [time stamp] 0y jj kk aa bb cc ... :
                              rr - count of bytes to follow.
                              [Time stamp, 4-bytes, microsecond, if enabled.]
                              0y - object number (1 to F).
                              jj kk - 11-bit arbitration field, right justified.
                              aa bb cc ... :  data from object.


11 rr [time stamp] 8y jj kk ll mm aa bb cc ... :
                              rr - count of bytes to follow.
                              [Time stamp, 4-bytes, microsecond, if enabled.]
                              8y - object number (1 to F).
                              jj kk ll mm - 29-bit arbitration field, right justified.
                              aa bb cc ... :  data from object.

12 rr ss [time stamp] 0y jj kk aa bb cc ... :

> rr ss - count of bytes to follow.
> [Time stamp, 4-bytes, microsecond, if enabled.]
> 0y - object number (1 to F).
> jj kk - 11-bit arbitration field, right justified.
> aa bb cc ... :  data from object.

12 rr ss [time stamp] 8y jj kk ll mm aa bb cc ... :

> rr ss - count of bytes to follow.
> [Time stamp, 4-bytes, microsecond, if enabled.]
> 8y - object number (1 to F).
> jj kk ll mm - 29-bit arbitration field, right justified.
> aa bb cc ... :  data from object.

2:      Error notification.
>     See complete list in section:  "Error Codes."

3:      Command error.
>     31 xx:          xx = Header byte of command in error.

4:      

5:      

6:      Operations reports.
>     62 08 00:      Message time stamps are disabled.
>     62 08 01:      Message time stamps are enabled.

>     --------------------
>     62 09 00:      Network loading reports enabled.
>     62 09 01:      Network loading reports disabled.

>     --------------------
>     65 0A ww xx yy zz:   Network loading report time interval in microseconds.

>     --------------------
>     63 0F xx yy:   Network loading report.

>     --------------------
>     62 16 00:      Timer alert disabled.
>     62 16 01:      Timer alert enabled.

>     --------------------
>     62 17 xx:      Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.


--------------------
65 1D vv ww xx yy:   Minimum time between frames in microseconds.


--------------------
62 1F 00:       Data field match function.  Match = forward message to the host.  {Default}
62 1F 01:       Data field match function.  Match = discard the message.


7: _____


8: _____
--------------------
83 01 xx yy:         Global mask - 11-bits;  right justified.
                     xx - upper byte  (upper 5 bits zero).
                     yy - lower byte  (full byte).


--------------------
85 02 rr ss tt vv:   Global mask - 29 bits;  right justified.
                     rr - upper byte  (upper 3 bits zero).
                     ss - next byte  (full byte).
                     tt - next byte  (full byte).
                     vv - lowest byte  (full byte).


--------------------
83 03 xx yy:         Object 15 mask;  11-bits;  right justified.
                     xx - upper byte  (upper 5 bits ignored).
                     yy - lower byte  (full byte).
85 03 rr ss tt vv:   Object 15 mask;  29 bits;  right justified.
                     rr - upper byte  (upper 3 bits zero).
                     ss - next byte  (full byte).
                     tt - next byte  (full byte).
                     vv - lowest byte  (full byte).


--------------------
83 04 xx yy:         Object status report.
                     xx - object number (1 to F).
                     yy -    00 = object disabled.
                             01 = object enabled as receive.
                             10 = object enabled as transmit.


--------------------
8x 05 xx yy zz rr aa bb cc ... : Object setup report.

---

xx - object number (1 to F).
yy - 01 = receive;  10 = transmit.
zz - 01 = 11-bit;  10 = 29-bit.
rr - data length (0 to 8).
Arbitration field is right justified.
aa bb - 11-bit arbitration field.
aa bb cc dd - 29-bit arbitration field.

--------------------
8x 06 xx aa bb cc ... :  Object data report.
xx - object number (1 to F).
aa bb cc ... :  data field, variable length.

--------------------
8x 07 xx yy:  Object transmit status report.
xx - object number (1 to F).
yy - transmit status
00 = transmit operation not pending.
01 = transmit operation requested / pending.

--------------------
82 08 xx:  Object transmission report control.
xx - status.
00 = do not inform host of successful transmission.
01 = inform host of successful transmission.

--------------------
82 09 xx:  Object successful transmission report.
xx - object number (1 to F).

--------------------
82 0A xx:  CAN baud rate (preset value).
xx = 00 is a unique value (user defined the Bit Timing Registers).
xx = 01  -  1 Mbps.
xx = 02  -  500 kbps.
xx = 03  -  250 kbps.
xx = 04  -  125 kbps.
xx = 05  -  100 kbps.
xx = 06  -  50 kbps.
xx = 07  -  41.67 kbps.
xx = 08  -  25 kbps.
xx = 09  -  80 kbps.
xx = 0A  -  33.333 kbps.
xx = 0B  -  83.333 kbps.

--------------------
83 0B xx yy:  Bit Timing Register values.

--------------------

xx  -  Bit Timing Register 0.

yy  -  Bit Timing Register 1.

--------------------

82 0C xx:    Sequential periodic message disable/enable command.

        xx:  00   Group1  Type1 ops.
                 Group2  Type1 ops.
        xx:  01   Group1  Type2 ops.
                 Group2  Type1 ops.
        xx:  02   Group1  Type1 ops.
                 Group2  Type2 ops.
        xx:  03   Group1  Type2 ops.
                 Group2  Type2 ops.

--------------------

82 0D 00:    Skip empty sequential messages.

82 0D 01:    Do not skip empty sequential messages  (time delay for empty slots).

--------------------

82 0E xx:    ST_MIN value is: "xx".

        ST_MIN is in the flow control frame of an ISO 15765 exchange.

--------------------

82 10 xx:    CAN-B error latch status.

        xx = 00 = no error detected since last read.

        xx = 01 = at least one error detected since last read.

--------------------

82 11 00:    No CAN physical layer selected;  completely disconnected.

82 11 01:    Single wire CAN (SWC) operations.  (J2411)

82 11 02:    2-wire CAN operations.  (CAN-C;  ISO 11898;  J1939)

82 11 03:    2-wire CAN operations.  (CAN-B;  ISO 11519)

--------------------

82 12 00:    SWC sleep.

82 12 01:    High speed mode.

82 12 02:    Wake up mode.

82 12 03:    Normal mode.

--------------------

81 13:    Fast transmit command completed.

--------------------

83 14 xx 00:    Type0 periodic function disabled for object xx.

83 14 xx 01:    Type0 periodic function enabled for object xx.

--------------------

83 15 xx yy:         Type0 periodic message interval report.
                           xx - object number, $01 to $0E.
                           yy - time interval in 5 or 10 millisecond increments.
                                (Time increment set by 7x 1E command.)

--------------------
81 16:         All Type0 periodic messages disabled.

--------------------
8x 18 xx yy zz rr aa bb cc ... : Type1 message setup report.
                                xx - message number ($1 to $14).
                                yy - 01 = receive;  10 = transmit.
                                zz - 01 = 11-bit;  10 = 29-bit.
                                rr - data length (0 to 8).
                                Arbitration field is right justified.
                                       aa bb - 11-bit arbitration field.
                                       aa bb cc dd - 29-bit arbitration field.

--------------------
8x 19 xx aa bb cc ... :      Type1 periodic message data report.
                                xx - message number ($1 to $14).
                                aa bb cc ... :  data field, variable length.

--------------------
83 1A xx 00:       Type1, Type2 periodic function disabled for message xx.
83 1A xx 01:       Type1, Type2 periodic function enabled for message xx.
84 1A xx rr ss:    Type1, Type2 enable mask.
                        xx  -  Group number;  1 or 2.
                        rr ss:  -  Mask value;  only bits 1 to 10 (decimal) are valid.

--------------------
83 1B xx yy:       Type1 periodic message interval report.
                        xx - message number, $01 to $14.
                        yy - time interval in 5 or 10 millisecond increments.
                                (Time increment set by 7x 1E command.)

--------------------
81 1C:         All Type1 periodic messages disabled.

--------------------
83 1D 0A 00: Rolling nibble function, periodic message 10, disabled.
83 1D 0A 01: Rolling nibble function, periodic message 10, enabled.
83 1D 14 00: Rolling nibble function, periodic message 20, disabled.
83 1D 14 01: Rolling nibble function, periodic message 20, enabled.

--------------------
82 1E 00:         Type0 & 1 timer interval = 5 milliseconds.

82 1E 01:                Type0 & 1 timer interval = 10 milliseconds.
82 1E 02:                Type0 & 1 timer interval = 2 milliseconds.


--------------------
8x 20:                   Auto Respond #0 status report.
82 20 00:                Auto Respond #0 disabled.
82 20 01:                Auto Respond #0 enabled.
8x 20 KK LL MM NN PP RR xx yy zz
        KK:  00 disabled,  01 enabled.
        LL:  transmit object number  (01 to 0E).
        MM:  receive object number  (01 to 0F).
        NN:  data byte number  (00 to 07).
        PP:  mask value  (00 to FF).
        RR:  match value  (00 to FF).
        xx yy zz ... :  data field of variable length,  0 to 8 bytes.


--------------------
8x 21:                   Auto Respond #1 status report.
                              (Refer to the 8x 20 response, above, for details.)


--------------------
8x 22:                   Auto Respond #2 status report.
                              (Refer to the 8x 20 response, above, for details.)


--------------------
8x 23:                   Auto Respond #3 status report.
                              (Refer to the 8x 20 response, above, for details.)


--------------------
83 25 xx 00:             Auto Respond #xx set to mode 00, no delay.
                         'xx' = 00 to 03.


--------------------
84 25 xx 01 yy:          Auto Respond #xx set to mode 01, fixed delay.
                         'xx' = 00 to 03.
                         'yy' is wait time in milliseconds.


--------------------
84 25 xx 02 yy:          Auto Respond #xx set to mode 02, message specified delay.
                         'xx' = 00 to 03.
                         'yy' is received message byte position indicating time to wait, in msec.
                         'yy' = 00 to 07.


--------------------
85 25 xx 03 yy zz:       Auto Respond #xx set to mode 03, message specified delay
                         plus fixed delay.
                         'xx' = 00 to 03.

--------------------

'yy' is received message byte position indicating time to wait, in msec.
'yy' = 00 to 07.
'zz' is fixed time to wait, in milliseconds.

--------------------
82 26 00:                ISO 15765 support disabled.
83 26 01 0x:          ISO 15765 support enabled.
                                 Normal addressing.
                                 Flow control transmit object is:  0x  [01 to 0E].
84 26 02 0x yy:      ISO 15765 support enabled.
                                 Extended addressing.
                                 Flow control transmit object is:  0x  [01 to 0E].
                                 Flow control address extension byte is:  yy.

--------------------
82 27 00:   ISO 15765 message padding disabled.
82 27 01 xx:   ISO 15765 message padding enabled.  Pad byte value = xx.

--------------------
82 28 00:          No objects are paired.
83 28 0x 0y:      Objects 0x and 0y are paired.
                                 ISO 15765 processing is enabled for the pair.
                                 Address extension is disabled for the pair.
84 28 0x 0y ww:   Objects 0x and 0y are paired.
                                 ISO 15765 processing is enabled for the pair.
                                 Address extension is enabled for the pair.

--------------------
82 2D xx:          Data field match function status.
                                 xx = 00 = disabled.
                                 xx = 01 = enabled.

--------------------
85 2E rr ss tt vv:     Data field match value.

--------------------
85 2F rr ss tt vv:     Data field mask value.

82 33 01:       Ready to stream data to the CAN network.
82 33 00:       Completed streaming data to the CAN network.

9:     Board status information.
     See complete list in section:  "Board Status Information."

A:    

B:    

C: ____

D: ____

E: ____ Processor memory.
    Ex msb xx xx lsb yy . . .                    Processor memory status for address specified.

F: ____

## AVT-718  UBP  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*

0:  Transmit a message to the network.
   0x yy zz ...  x = count of bytes to follow;  yy zz ... message bytes.

1:  Transmit a message to the network, alternate header formats.
   11 tt yy zz ...  tt = count of bytes to follow;  yy zz ... message bytes.
   12 rr tt yy zz ...  rr tt = count of bytes to follow;  yy zz ... message bytes.

2:  Reset.
   21 01:  Reset HBCC.
   21 02:  Reset SCC.
   21 03:  Reset DLC.
   21 04:  Reset FIFO #1.
   21 05:  Reset FIFO #2.
   21 06:  Reset CAN.

3:  Match table - Filtering.
   30:  Match status request, report match table contents.
   31 7B:  Match function off, clear table.
   32 xx yy:  Match table entry.
      xx - byte position;  yy - byte value.
   34 xx yy rr ss: Match table entry.
      xx - byte position;  yy - byte value.
         // AND //
      rr - byte position;  ss - byte value.
   [The 5x 1F command determines function operation.]

4:  

5:  Operational commands.
   51 01:  Checksum status request.
   52 01 00:  Suppress forwarding of checksum byte.
   52 01 01:  Forward the checksum byte.

   --------------------
   51 02:  Wait_RxNACK query.
   55 02 vv ww xx yy:  Wait_RxNACK parameter, in microseconds.
      1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
      {Default = $00 00 08 24 = 2 084 usec}

   --------------------
   51 04:  Request 'Keep-Alive' message.
   5x 04 xx yy ...:'Keep Alive' message.  [C2 10 F1 01 00]

---

--------------------
51 05:        Clear 'Keep Alive' message.


--------------------
51 06:        Request message forwarding status.
52 06 00:    Suppress messages 'from this device.'  {Default}
52 06 01:    Forward network messages 'from this device.'
            [Subject to message filtering;  match function.]


--------------------
51 07:        Request 'Keep Alive' message interval.
52 07 xx:    'Keep Alive' message transmission interval, in 0.0625 second intervals.
            {Default = $48 = 4.5 seconds}


--------------------
51 08:        Request message time stamp status.
52 08 00:    No time stamp.  {Default}
            *Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*
52 08 01:    Include time stamp.  Four bytes.  1.0 microsecond resolution.
            *Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
                *msg. byte (MSB) - . . . - msg. byte (LSB).*


--------------------
51 09:        Request network loading report status.
52 09 00:    Suppress network loading reports.  {Default}
52 09 01:    Send network loading reports every specified interval.


--------------------
51 0A:           Request network loading report interval.
55 0A ww xx yy zz:  Network loading report interval.
                {Default = $07 A1 20 = 500 000 microseconds}
                Interval range = 1 to $00 FF FF FF microseconds.


--------------------
51 16:        Timer alert status query.
52 16 00:    Disable timer alert.
52 16 01:    Enable timer alert.


--------------------
51 17:        Timer alert period query.
52 17 xx:    Timer alert period.  xx - period in 0.0625 second increments.
            {Default = $10 = 1 sec.}


--------------------
51 18:        Timer query.  Timer rollover:  $00 FF FF FF.


--------------------
51 19:        Transmit checksum status query.

52 19 00:      Disable transmit checksum.
52 19 01:      Enable transmit checksum.  {Default}

--------------------

51 1B:            Reduced_Transmit_Wait query.
55 1B vv ww xx yy:  Reduced_Transmit_Wait parameter, in microseconds.
                  1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                  {Default = $00 00 0F 78 = 3 960 usec}

--------------------

51 1C:            Maximum_Idle query.
55 1C vv ww xx yy:  Maximum_Idle parameter, in microseconds.
                  1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                  {Default = $00 00 22 99 = 8 857 usec}

--------------------

51 1D:            Break or NACK time.
55 1D vv ww xx yy:  Break or NACK time in microseconds.
                  1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                  {Default = $00 00 05 4A = 1 354 usec}

--------------------

51 1E:            Wait_TxNACK query.
55 1E vv ww xx yy:  Wait_RxNACK parameter, in microseconds.
                  1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                  {Default = $00 00 14 C2 = 5 314 usec}

--------------------

51 1F:      Match function query
52 1F 00:     Match function control;  Match = forward message to the host.  {Default}
52 1F 01:     Match function control;  Match = discard the message.

--------------------

51 22:      Auto NACK generation on error detect.
52 22 00:     Auto NACK generation disabled.
52 22 01:     Auto NACK generation enabled.

--------------------

51 23:      Auto NACK echo on receipt of a NACK.
52 23 00:     Auto NACK echo disabled.
52 23 01:     Auto NACK echo enabled.

--------------------

51 40:      Transmit acknowledgments status query.
52 40 00:     Disable transmit acknowledgments and transmission status reports.
52 40 01:     Enable transmit acknowledgments.  {Default}

---

--------------------
| | |
|---|---|
| 51 4B: | Checksum type status query. |
| 52 4B 00: | Checksum is normal.  {Default} |
| 52 4B 01: | Checksum is 2's complement. |

6: _____

7: _____

8: _____

9: _____ Processor memory.

| | |
|---|---|
| 96 01 msb xx yy lsb zz: | Processor write memory (byte), value = zz. |
| 96 02 msb xx yy lsb zz: | Processor read memory (byte), count = zz. |
| 97 03 msb xx yy lsb rr ss: | Processor write memory (word), value = rr ss. |
| 96 04 msb xx yy lsb zz: | Processor read memory (word), count = zz. |

A: _____

B: _____ Firmware version.

B0: Request firmware version number.

C: _____

D: _____ Operational mode.

D0: Request operational mode report.

E: _____ Mode switch.

| | |
|---|---|
| E1 22: | Switch to UBP mode.  [91 14] |
| E1 33: | Switch to VPW mode.  [91 07] |
| E1 44: | Switch to LIN mode.  [91 19] |
| E1 66: | Switch to KIE mode.  [91 1A] |
| E1 77: | Switch to SDM mode.  [91 1B] |
| E1 96: | Switch to FLASH programming mode.  [91 2E] |
| E1 99: | Switch to CAN mode.  [91 10] |
| E1 BB: | Switch to URT mode.  [91 0E] |
| E1 CC: | Switch to PWM mode.  [91 06] |
| E1 DD: | Switch to KWP 2000 mode.  [91 0F] |

F: _____ Re-Start.

F1 A5: Reset and restart.

---

## AVT-718  UBP  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*

0:      Message received from the network.
        0x ss yy zz ...  x = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

1:      Message received from the network;  alternate header formats.
        11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.
        12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

2:      Error notification.
        See complete list in section:  "Error Codes."

3:      Command error.
        31 xx:        xx = Header byte of command in error.

4:      Match function - Filtering.
        40:        Function off.
        41 B7:      Table full, entry ignored.
        42 xx yy:    Table entry report.
                     xx - byte position;  yy - byte value.
        44 xx yy rr ss: Table entry report.
                     xx - byte position;  yy - byte value.
                     // AND //
                     rr - byte position;  ss - byte value.

5:   

6:      Operations reports.
        62 01 00:    Checksum byte is suppressed.
        62 01 01:    Checksum byte is forwarded.

        --------------------
        65 02 vv ww xx yy:   Wait_RxNACK time, in microseconds.

        --------------------
        6x 04 xx yy ...:      Keep Alive message.

        --------------------
        61 05:       Keep alive message length = 0, suppressed.

        --------------------
        62 06 00:    Disable forwarding network messages 'from this device.'
        62 06 01:    Enable forwarding network messages 'from this device.'

--------------------
62 07 xx:        'Keep Alive' message interval 0.0625 second increments.

--------------------
62 08 00:        Message time stamps are disabled.
62 08 01:        Message time stamps are enabled.

--------------------
62 09 00:        Network loading reports enabled.
62 09 01:        Network loading reports disabled.

--------------------
65 0A ww xx yy zz:   Network loading report time interval in microseconds.

--------------------
63 0F xx yy:   Network loading report.

--------------------
62 16 00:        Timer alert disabled.
62 16 01:        Timer alert enabled.

--------------------
62 17 xx:        Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.

--------------------
62 19 00:        Transmit checksum disabled.
62 19 01:        Transmit checksum enabled.

--------------------
65 1B vv ww xx yy:   Reduced_transmit_wait time, in microseconds.

--------------------
65 1C vv ww xx yy:   Maximum_idle time, in microseconds.

--------------------
65 1D vv ww xx yy:   Break or NACK time, in microseconds.

--------------------
65 1E vv ww xx yy:   Wait_TxNACK time, in microseconds.

--------------------
62 1F 00:        Match function control;  Match = forward message to the host.
62 1F 01:        Match function control;  Match = discard the message.

```
            --------------------
            62 22 00:       Auto NACK generation disabled.
            62 22 01:       Auto NACK generation enabled.


            --------------------
            62 23 00:       Auto NACK echo disabled.
            62 23 01:       Auto NACK echo enabled.


            --------------------
            62 40 00:       Transmit acknowledgments disabled.
            62 40 01:       Transmit acknowledgments enabled.  {Default}


            --------------------
            62 4B 00:       Checksum is normal.
            62 4B 01:       Checksum is 2's complement.
```

7:

8:

9:      Board status information.
        See complete list in section:  "Board Status Information."

A:      Transmission Status report
        A1 yy:          yy - status byte, bit map.

|     |                               |
|-----|-------------------------------|
| b7: | Arbitration failure limit.    |
| b6: | 0                             |
| b5: | Successful transmission.      |
| b4: | Lost arbitration.             |
| b3: | 0                             |
| b2: | Break received.               |
| b1: | 0                             |
| b0: | 0                             |

B:

C:

D:

E:      Processor memory.

Ex msb xx xx lsb yy . . .                    Processor memory status for address specified.

F:_____

## AVT-718  LIN  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*

[Firmware version 6.9 LIN mode supports communications, as master only, with an ABIC module.]

0:      Transmit a LIN message to the network.

      0x yy zz rr ss ...

| | | |
|---|---|---|
| x | = | count of bytes to follow |
| yy | = | Slave  =  00 |
| | | Master  =  01 |
| zz | | message ID byte |
| rr ss ... = | | message data bytes, 8 maximum |

      *Alternate header formats are supported.*

0:      Transmit an ABIC message to the network.

      0x 15 yy zz rr ss ...

| | | |
|---|---|---|
| x | = | count of bytes to follow |
| 15 | = | transmit message, as master, to an ABIC device. |
| yy | = | count of expected/desired response bytes from ABIC device. |
| zz | | protected ID byte |
| rr ss ... = | | message command and optional data |

      *Alternate header formats are supported.*

2:      Reset.

| | | |
|---|---|---|
| 21 01: | Reset HBCC. | [No response.] |
| 21 02: | Reset SCC. | [91 02] |
| 21 03: | Reset DLC. | [No response.] |
| 21 04: | Reset FIFO #1. | [91 0C] |
| 21 05: | Reset FIFO #2. | [91 0C] |
| 21 06: | Reset CAN. | [No response.] |
| 21 09: | Purge any pending transmit message. | [91 18] |

3:      Match table - Filtering.

      30:      Match status request, report match table contents.
      31 7B:      Match function off, clear table.
      32 xx yy:      Match table entry.
                  xx - byte position;  yy - byte value.
      34 xx yy rr ss: Match table entry.
                  xx - byte position;  yy - byte value.
                     // AND //
                  rr - byte position;  ss - byte value.
      [The 5x 1F command determines function operation.]

4:

5:      Operational commands.

51 01:            Checksum status request.
52 01 00:       Suppress forwarding of checksum byte.
52 01 01:       Forward the checksum byte.


--------------------
51 04:                  Request 'Keep-Alive' message.
5x 04 yy zz rr ss ...:   'Keep Alive' message.  {Default is none.}
                                    [Use same format as transmit message:  yy zz rr ss ...]


--------------------
51 05:           Clear 'Keep Alive' message.


--------------------
51 06:           Request message forwarding status.
52 06 00:       Suppress messages 'from this device.'  {Default}
52 06 01:       Forward network messages 'from this device.'
                      [Subject to message filtering;  match function.]


--------------------
51 07:           Request 'Keep Alive' message interval.
52 07 xx:       'Keep Alive' message transmission interval, in 0.0625 second intervals.
                      {Default = $48 = 4.5 seconds}


--------------------
51 08:           Request message time stamp status.
52 08 00:       No time stamp.  {Default}
                      *Msg order: Header byte - Status byte - ID byte - msg. byte (MSB) - . . . - msg. byte (LSB)*
52 08 01:       Include time stamp.  Four bytes.  1.0 microsecond resolution.
                      *Msg order:  Header byte - Time (MSB) - Time() - Time() - Time (LSB) - Status byte -*
                            *ID byte - msg. byte (MSB) - . . . - msg. byte (LSB).*


--------------------
51 09:           Request network loading report status.
52 09 00:       Suppress network loading reports.  {Default}.
52 09 01:       Send network loading reports every specified interval.


--------------------
51 0A:                  Request network loading report interval.
55 0A ww xx yy zz:   Network loading report interval.
                            {Default = $07 A1 20 = 500 000 microseconds}
                            Interval range = 1 to $00 FF FF FF microseconds.


--------------------
51 16:           Timer alert status query.
52 16 00:       Disable timer alert.
52 16 01:       Enable timer alert.


--------------------

51 17:        Timer alert period query.

52 17 xx:     Timer alert period.  xx - period in 0.0625 second increments.
            {Default = $10 = 1 sec.}

--------------------

51 18:        Timer query.  Timer rollover:  $00 FF FF FF.

--------------------

51 19:        Transmit checksum status query.

52 19 00:     Disable transmit checksum.

52 19 01:     Enable transmit checksum.  {Default}

--------------------

51 1D:        Synch Break time status query.

55 1D ww xx yy zz:  Synch Break time in microseconds.
            1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
            {Default is baud rate dependent,  updated when baud rate is changed.}

--------------------

51 1F:        Match function status query.

52 1F 00:     Match function control;  Match = forward message to the host.  {Default}

52 1F 01:     Match function control;  Match = discard the message.

--------------------

51 27:        P4_min (interbyte time for transmit message) status query.

55 27 rr ss tt vv:  P4_min value to  rr ss tt vv  microseconds.
            1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
            {Default = $00 00 00 68 = 104 usec.}

--------------------

51 28:        Format byte processing of received frames.

52 28 00:     Disable format byte processing.

52 28 01:     Enable format byte processing.  {Default}

--------------------

51 2A:        ABIC receive buffer 'byte time out' status query.

55 2A: rr ss tt vv:  Set byte time out to rr ss tt vv  microseconds.
            1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
            {Default = $00 00 61 A8 = 25 000 usec.}

--------------------

51 2B:        ABIC strobe duration status query.

55 2B rr ss tt vv:  Set strobe duration to rr ss tt vv  microseconds.
            1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
            {Default = $00 00 00 68 = 104 usec.}

--------------------

```
51 40:              Transmit acknowledgments status query.
52 40 00:           Disable transmit acknowledgments.
52 40 01:           Enable transmit acknowledgments.  {Default}
```

--------------------

```
51 50:              Baud rate query.
52 50 xx:           Baud rate command.
                            xx = 01 = 2400 baud.
                            xx = 02 = 9600 baud.  {Default}
                            xx = 03 = 19200 baud.
54 50 04 xx yy:     Baud rate command.  Baud rate divisor specified in xx yy bytes.
                    xx yy are hex digits;  maximum value = $1FFF.
                    Baud rate = 524288 (decimal) / xx yy  (early firmware versions).
                    Baud rate = 655360 (decimal) / xx yy  (firmware version 3.0 and above).
```

--------------------

```
51 51:              Network relay status query.
52 51 00:           Open network relay;  disconnect AVT-718 from the network.
52 51 01:           Shut network relay;  connect AVT-718 to the network.  {Default}
```

--------------------

```
51 52:              Maximum frame time status query.
55 52 rr ss tt vv:  Maximum frame time  rr ss tt vv  microseconds.
                    1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                    {Default is baud rate dependent,  updated when baud rate is changed.}
```

--------------------

```
51 53:              Synch break delimiter time status query.
55 53 rr ss tt vv:  Synch break time rr ss tt vv  microseconds.
                    1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                    {Default is baud rate dependent,  updated when baud rate is changed.}
                    [Minimum synch break delimiter time is nominally 100 microseconds.]
```

--------------------

```
51 5A:              Checksum method status query.
52 5A 00:           Use "classic" checksum method.  {Default.}
52 5A 01:           Use "enhanced" checksum method.

                    Slave Auto Response Function.  Refer to Firmware version 6.6 update
                    document for details.  Document name:  718_S10A.PDF
```

--------------------

```
51 5D:              Report status of all messages.
52 5D zz:           Query message #zz.
53 5D zz 00:        Disable message #zz.
53 5D zz 01:        Enable message #zz.
53 5D FF 00:        Disable all messages.
53 5D FF 01:        Enable all messages.  (Must define messages prior to this.)
```

5x 5D zz ww ID {rr ss tt ...}        zz  -  message number.
                              ww -  Disable / Enable.
                              ID  -  Message ID.
                              {rr ss tt ...} Data field;  maximum of 8 data bytes.


Message number $20 is special.  Define slave auto response message number $20 as follows:
5C 5D 20 01 FB 04 50 E2 E3 FF FF 00 00

                  5C  -  Command header.
                  5D  -  Command type.
                  20  -  LIN mode slave response message number.
                  01  -  Enable this message.
                  FB  -  Response ID;  this is the ID to respond to with this message.
                  04  -  Complement of the message ID.
                  50  -  ID of the message to watch for that will contain the "S" value.
                  E2  -  Dummy byte, place holder.
                      After the value "S" is received, "V" will be calculated and placed here.
                  E3  -  Dummy byte, place holder.
                      After the value "S" is received, "D" will be calculated and placed here.
                  FF  -  Required according to the spec.
                  FF  -  Required according to the spec.
                  00  -  Required according to the spec.
                  00  -  Required according to the spec.


--------------------
53 6B xx yy:          Send a break onto the K-line for "xx yy" microseconds.


6: _____


7: _____


8: _____


9:      Processor memory.
      96 01 msb xx yy lsb zz:     Processor write memory (byte), value = zz.
      96 02 msb xx yy lsb zz:     Processor read memory (byte), count = zz.
      97 03 msb xx yy lsb rr ss:     Processor write memory (word), value = rr ss.
      96 04 msb xx yy lsb zz:     Processor read memory (word), count = zz.


A: _____


B:      Firmware version.
      B0:          Request firmware version number.

C:

D:      Operational mode.
        D0:             Request operational mode report.


E:      Mode switch.
        E1 22:          Switch to UBP mode.  [91 14]
        E1 33:          Switch to VPW mode.  [91 07]
        E1 44:          Switch to LIN mode.  [91 19]
        E1 66:          Switch to KIE mode.  [91 1A]
        E1 77:          Switch to SDM mode.  [91 1B]
        E1 96:          Switch to FLASH programming mode.  [91 2E]
        E1 99:          Switch to CAN mode.  [91 10]
        E1 BB:          Switch to URT mode.  [91 0E]
        E1 CC:          Switch to PWM mode.  [91 06]
        E1 DD:          Switch to KWP 2000 mode.  [91 0F]


F:      Re-Start.
        F1 A5:          Reset and restart.


## AVT-718  LIN  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*


0:      LIN message received from the network.
        0x yy zz rr ss ...
                x       =       count of bytes to follow
                yy      =       receive status byte
                zz      =       ID byte
                rr ss ... =     message data bytes, 8 maximum

0:      ABIC message received from the network.
        0x 15 yy zz rr ss ...
                x       =       count of bytes to follow
                15      =       message from ABIC device.
                yy      =       receive status byte
                zz      =       ID byte
                rr ss ... =     message data bytes, 8 maximum

2:      Error notification.
        See complete list in section:  "Error Codes."


3:      Command error.
        31 xx:          xx = Header byte of command in error.


4:      Match function - Filtering.
        40:             Function off.

41 B7:   Table full, entry ignored.

42 xx yy:   Table entry report.

        xx - byte position;  yy - byte value.

44 xx yy rr ss: Table entry report.

        xx - byte position;  yy - byte value.

        // AND //

        rr - byte position;  ss - byte value.


5: _____


6:   Operations reports.

  62 01 00:   Checksum byte is suppressed.

  62 01 01:   Checksum byte is forwarded to the host.


--------------------

  6x 04 xx yy ...:   Keep Alive message.


--------------------

  61 05:   Keep alive message length = 0, suppressed.


--------------------

  62 06 00:   Disable forwarding network messages 'from this device.'

  62 06 01:   Enable forwarding network messages 'from this device.'


--------------------

  62 07 xx:   'Keep Alive' message interval 0.0625 second increments.


--------------------

  62 08 00:   Message time stamps are disabled.

  62 08 01:   Message time stamps are enabled.


--------------------

  62 09 00:   Network loading reports enabled.

  62 09 01:   Network loading reports disabled.


--------------------

  65 0A ww xx yy zz:  Network loading report time interval in microseconds.


--------------------

  63 0F xx yy:  Network loading report.


--------------------

  62 16 00:   Timer alert disabled.

  62 16 01:   Timer alert enabled.


--------------------

62 17 xx:        Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.

--------------------
62 19 00:        Transmit checksum disabled.
62 19 01:        Transmit checksum enabled.

--------------------
65 1D vv ww xx yy:  Synch Break time, in microseconds.

--------------------
62 1F 00:        Match function control;  Match = forward message to the host.
62 1F 01:        Match function control;  Match = discard the message.

--------------------
65 27 rr ss tt vv:     P4_min (interbyte time) value;  rr ss tt vv microseconds.

--------------------
65 2A: rr ss tt vv:   ABIC byte time out set to rr ss tt vv  microseconds.

--------------------
65 2B rr ss tt vv:    ABIC strobe set to rr ss tt vv  microseconds.

--------------------
62 40 00:        Transmit acknowledgments disabled.
62 40 01:        Transmit acknowledgments enabled.  {Default}

--------------------
62 50 xx:        Baud rate response.
                     xx = 01 = 2400 baud.
                     xx = 02 = 9600 baud.  {Default}
                     xx = 03 = 19200 baud.
64 50 04 xx yy:     Baud rate response.  Baud rate divisor specified in xx yy bytes.
                     xx yy are hex digits;  maximum value = $1FFF.

--------------------
62 51 00:        Network relay open;  AVT-718 disconnected from the network.
62 51 01:        Network relay shut;  AVT-718 connected to the network.

--------------------
65 52 rr ss tt vv:    Maximum frame time  rr ss tt vv  microseconds.

--------------------
65 53 rr ss tt vv:    Synch break time rr ss tt vv  microseconds.

--------------------
62 5A 00:      "Classic" checksum method selected.
62 5A 01:      "Enhanced" checksum method selected.


--------------------
63 5D zz 00:      Slave auto response message zz disabled.
63 5D zz 01:      Slave auto response message zz enabled.
6x 5D zz ww ID {rr ss tt ...}      zz  -  Slave auto response message number.
      ww  -  00  =  Disabled.
      ww  -  01  =  Enabled.
      ID  -  Message ID.
      {rr ss tt ...}  Data field.


--------------------
63 6B xx yy:      A break of "xx yy" microseconds was sent onto the K-line.

7: _____


8: _____


9: _____ Board status information.
      See complete list in section:  "Board Status Information."

A: _____


B: _____


C: _____


D: _____


E: _____ Processor memory.
      Ex msb xx xx lsb yy . . .      Processor memory status for address specified.

F: _____

## AVT-718  KIE  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*

0:     Transmit a message to the network.
        0x yy zz ...  x = count of bytes to follow;  yy zz ... message bytes.

1:     Transmit a message to the network, alternate header formats.
        11 tt yy zz ...  tt = count of bytes to follow;  yy zz ... message bytes.
        12 rr tt yy zz ...  rr tt = count of bytes to follow;  yy zz ... message bytes.
                Maximum length is 257 bytes.

2:     Reset.
        21 01:         Reset HBCC.
        21 02:         Reset SCC.
        21 03:         Reset DLC.
        21 04:         Reset FIFO #1.
        21 05:         Reset FIFO #2.
        21 06:         Reset CAN.

3:     Match table - Filtering.
        30:             Match status request, report match table contents.
        31 7B:         Match function off, clear table.
        32 xx yy:      Match table entry.
                xx - byte position;  yy - byte value.
        34 xx yy rr ss: Match table entry.
                xx - byte position;  yy - byte value.
                    // AND //
                rr - byte position;  ss - byte value.
        [The 5x 1F command determines function operation.]

4:     _____

5:     Operational commands.
        51 01:         ETX status request for received messages.
        52 01 00:     Suppress forwarding of ETX byte.  {Default}
        52 01 01:     Forward the ETX byte.

        --------------------
        51 03:         Request counter/timer value - this controls K-Line baud rate.
        53 03 xx yy:  Counter/timer load.  xx yy are upper and lower bytes of new load, respectively.
                (Formula in User's Manual and at end of this document.)
               (Minimum value:  $00 02)
               {Default = $00 0B}

        --------------------
        51 04:         Request 'Keep-Alive' message.

5x 04 xx yy ...:'Keep Alive' message.  {Default:  Off}


--------------------
51 05:             Clear 'Keep Alive' message.


--------------------
51 06:             Request message forwarding status.
52 06 00:          Suppress messages 'from this device.'  {Default}
52 06 01:          Forward network messages 'from this device.'
                   [Subject to message filtering;  match function.]


--------------------
51 07:             Request 'Keep Alive' message interval.
52 07 xx:          'Keep Alive' message transmission interval, in 0.0625 second increments.
                   {Default = $48 = 4.5 seconds}


--------------------
51 08:             Request message time stamp status.
52 08 00:          No time stamp.  {Default}
                   *Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*
52 08 01:          Include time stamp.  Four bytes.  1.0 microsecond resolution.
                   *Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
                   *          msg. byte (MSB) - . . . - msg. byte (LSB).*


--------------------
51 09:             Request network loading report status.
52 09 00:          Suppress network loading reports.  {Default}
52 09 01:          Send network loading reports every specified interval.


--------------------
51 0A:             Request network loading report interval.
55 0A ww xx yy zz: Network loading report interval.
                   {Default = $07 A1 20 = 500 000 microseconds}
                   Interval range = 1 to $00 FF FF FF microseconds.


--------------------
51 13:             5-baud address query.
52 13 xx:          Set the 5-baud address. {Default:  33}


--------------------
51 16:             Timer alert status query.
52 16 00:          Disable timer alert.
52 16 01:          Enable timer alert.


--------------------
51 17:             Timer alert period query.
52 17 xx:          Timer alert period.  xx - period in 0.0625 second increments.
                   {Default = $10 = 1 sec.}

--------------------
51 18:          Timer query.  Timer rollover:  $00 FF FF FF.


--------------------
51 19:          Transmit ETX status query.
52 19 00:       Disable transmit ETX.  {Default}
52 19 01:       Enable transmit ETX.


--------------------
51 1A:                  T_rb;  time between messages;  query.
55 1A vv ww xx yy:  Set the time, in microseconds.
                        1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                        {Default = $00 04 93 E0 = 300,000 usec}


--------------------
51 1B:                  T_rb_max;  message time out;  query.
55 1B vv ww xx yy:  Set the time, in microseconds.
                        1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                        {Default = $00 10 C8 E0 = 1,100,000 usec}


--------------------
51 1C:                  T_r6_echo;  time from receiving a byte to transmit the inverted echo.
55 1C vv ww xx yy:  Set the time, in microseconds.
                        1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                        {Default = $00 00 0F A0 = 4,000 usec}


--------------------
51 1D:                  T_r6_xmit;  time from receiving the echo to transmit the next byte.
55 1D vv ww xx yy:  Set the time, in microseconds.
                        1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                        {Default = $00 00 17 70 = 6,000 usec}


--------------------
51 1E:                  T_r6_max;  time to wait for the echo before terminating the transaction.
55 1E vv ww xx yy:  Set the time, in microseconds.
                        1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                        {Default = $00 00 D6 D8 = 55,000 usec}


--------------------
51 1F:          Match function query
52 1F 00:       Match function control;  Match = forward message to the host.  {Default}
52 1F 01:       Match function control;  Match = discard the message.


--------------------
51 26:          115 kbaud on K-line status query.
52 26 00:       115 kbaud on K-line disabled.  {Default}

52 26 01:      115 kbaud on K-line enabled  [5x 03 command is disabled].

--------------------
51 2C:      Query for Keywords.
              Keywords from latest initialization attempt are returned.
              Keywords are set to $00 00 at start of an initialization attempt.

--------------------
51 40:      Transmit acknowledgments status query.
52 40 00:      Disable transmit acknowledgments.
52 40 01:      Enable transmit acknowledgments.  {Default}

--------------------
51 46:      T0_min;  minimum idle time;  query.
55 46 rr ss tt vv:      Set time, in microseconds.
              1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
              {Default = $00 00 27 10 = 10 000 usec}

--------------------
51 47:      T_r1;  time from address byte to synch byte;  query.
55 47 rr ss tt vv:      T_r1 value to  rr ss tt vv  microseconds.
              1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
              {Default = $00 03 47 D8 = 215 000 usec}

--------------------
51 48:      T_r2;  time from synch byte to keybyte #1;  query.
55 48 rr ss tt vv:      T_r2 value to  rr ss tt vv  microseconds.
               1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
              {Default = $00 00 61 A8 = 25 000 usec}

--------------------
51 49:      T_r3;  time from keybyte #1 to keybyte #2;  query.
55 49 rr ss tt vv:      T_r3 value to  rr ss tt vv  microseconds.
               1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
              {Default = $00 00 61 A8 = 25 000 usec}

--------------------
51 4A:      T_r4;  time from keybyte #2 to transmitting inverted reply;  query.
55 4A rr ss tt vv:      T_r4 value to  rr ss tt vv  microseconds.
               1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
              {Default = $00 00 69 78 = 27 000 usec}

6:      KIE mode control.
      60:      Request KIE mode status.
      61 01:      Disconnect.
      61 04:      Force a network connection.  {Default:  10.4 kbps}
      61 15:      Initialize with 5-baud address.

NOTE:        Refer to document "INIT_03c.PDF" for detailed information about initialization modes and methods.

7: _____

8: _____

9:        Processor memory.
         96 01 msb xx yy lsb zz:        Processor write memory (byte), value = zz.
         96 02 msb xx yy lsb zz:        Processor read memory (byte), count = zz.
         97 03 msb xx yy lsb rr ss:     Processor write memory (word), value = rr ss.
         96 04 msb xx yy lsb zz:        Processor read memory (word), count = zz.

A: _____

B:       Firmware version.
         B0:             Request firmware version number.

C: _____

D:       Operational mode.
         D0:             Request operational mode report.

E:       Mode switch.
         E1 22:          Switch to UBP mode.  [91 14]
         E1 33:          Switch to VPW mode.  [91 07]
         E1 44:          Switch to LIN mode.  [91 19]
         E1 66:          Switch to KIE mode.  [91 1A]
         E1 77:          Switch to SDM mode.  [91 1B]
         E1 96:          Switch to FLASH programming mode.  [91 2E]
         E1 99:          Switch to CAN mode.  [91 10]
         E1 BB:          Switch to URT mode.  [91 0E]
         E1 CC:          Switch to PWM mode.  [91 06]
         E1 DD:          Switch to KWP 2000 mode.  [91 0F]

F:       Re-Start.
         F1 A5:          Reset and restart.

## AVT-718  KIE  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*

<u>0:</u>      Message received from the network.

     0x ss yy zz ...  x = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

<u>1:</u>      Message received from the network;  alternate header formats.

     11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

     12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

<u>2:</u>      Error notification.

     See complete list in section:  "Error Codes."

<u>3:</u>      Command error.

     31 xx:          xx = Header byte of command in error.

<u>4:</u>      Match function - Filtering.

     40:             Function off.
     41 B7:          Table full, entry ignored.
     42 xx yy:       Table entry report.
               xx - byte position;  yy - byte value.
     44 xx yy rr ss: Table entry report.
               xx - byte position;  yy - byte value.
               // AND //
               rr - byte position;  ss - byte value.

<u>5:</u>   <u>    </u>

<u>6:</u>      Operations reports.

     62 01 00:       ETX byte is suppressed.  Received messages.
     62 01 01:       ETX byte is forwarded.

     --------------------
     63 03 xx yy:   Counter/timer load.

     --------------------
     6x 04 xx yy ...:        Keep Alive message.

     --------------------
     61 05:         Keep alive message length = 0, suppressed.

     --------------------
     62 06 00:      Disable forwarding network messages 'from this device.'
     62 06 01:      Enable forwarding network messages 'from this device.'

     --------------------
     62 07 xx:      'Keep Alive' message interval in 0.0625 second increments.

--------------------
62 08 00:       Message time stamps are disabled.

62 08 01:       Message time stamps are enabled.

--------------------
62 09 00:       Network loading reports enabled.

62 09 01:       Network loading reports disabled.

--------------------
65 0A ww xx yy zz:   Network loading report time interval in microseconds.

--------------------
63 0F xx yy:   Network loading report.

--------------------
62 13 xx:       5-baud address report.

--------------------
62 16 00:       Timer alert disabled.

62 16 01:       Timer alert enabled.

--------------------
62 17 xx:       Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.

--------------------
62 19 00:       Transmit ETX byte disabled.

62 19 01:       Transmit ETX byte enabled.

--------------------
65 1A rr ss tt vv:       T_rb;  time between messages;  rr ss tt vv microseconds.

--------------------
65 1B rr ss tt vv:       T_rb_max;  message time out;  rr ss tt vv microseconds.

--------------------
65 1C rr ss tt vv:       T_r6_echo;  time from receiving a byte to transmitting the inverted echo;
       rr ss tt vv microseconds.

--------------------
65 1D rr ss tt vv:       T_r6_xmit;  time from receiving the echo and transmitting the next byte;
       rr ss tt vv microseconds.

--------------------

65 1E rr ss tt vv:       T_r6_max;  time to wait for the echo before termination the transaction;
rr ss tt vv microseconds.


--------------------
62 1F 00:       Match function control;  Match = forward message to the host.
62 1F 01:       Match function control;  Match = discard the message.


--------------------
62 26 00:       K-line comm's in normal mode  [baud rate controlled by 5x 03 command].
62 26 01:       K-line baud rate set to 115 kbaud.


--------------------
63 2C xx yy:  Keyword report.  xx is Keyword 1, yy is Keyword 2.


--------------------
62 40 00:       Transmit acknowledgments disabled.
62 40 01:       Transmit acknowledgments enabled.  {Default}


--------------------
65 46 rr ss tt vv:       T0_min;  minimum idle time;  rr ss tt vv microseconds.


--------------------
65 47 rr ss tt vv:       T_r1;  time from address byte to synch byte;  rr ss tt vv microseconds.


--------------------
65 48 rr ss tt vv:       T_r2;  time from synch byte to keybyte #1;  rr ss tt vv microseconds.


--------------------
65 49 rr ss tt vv:       T_r3;  time from keybyte #1 to keybyte #2;  rr ss tt vv microseconds.


--------------------
65 4A rr ss tt vv:       T_r4;  time from keybyte #2 to transmitting inverted reply;
rr ss tt vv microseconds.

7:     KIE mode response.
     71 01:       Disconnected and idle.
     71 02:
     71 03:       Initialization completed successfully.  Normal operations.
     71 04:       Manual connection.
     71 FF:       Mode error.


8:    


9:     Board status information.
     See complete list in section:  "Board Status Information."

A: _____

B: _____

C: _____

D: _____

E: _____ Processor memory.
    Ex msb xx xx lsb yy . . .           Processor memory status for address specified.

F: _____

## AVT-718  URT  Mode  -  Commands

DANGER

       URT mode on the AVT-418 and AVT-718 is a  +12v  (V-Batt) signal.

       It is NOT compatible with previous older  +5v  signal versions.

       URT is a GM mode and is also known as:  UART;  8192 UART;  ALDL.

       URT mode uses the UBP/LIN physical layer harware.

*High nibble, bits b7 - b4:  Command type.*

0:      Transmit a message to the network.
       0x yy zz ...  x = count of bytes to follow;  yy zz ... message bytes.

1:      Transmit a message to the network, alternate header formats.
       11 tt yy zz ...  tt = count of bytes to follow;  yy zz ... message bytes.
       12 rr tt yy zz ...  rr tt = count of bytes to follow;  yy zz ... message bytes.
                  Maximum length = 172 or 173 bytes.

2:      Reset.

| | | |
|---|---|---|
| 21 01: | Reset HBCC. | [No response.] |
| 21 02: | Reset SCC. | [91 02] |
| 21 03: | Reset DLC. | [No response.] |
| 21 04: | Reset FIFO #1. | [91 0C] |
| 21 05: | Reset FIFO #2. | [91 0C] |
| 21 06: | Reset CAN. | [No response.] |

3:      Match table - Filtering.
       30:          Match status request, report match table contents.
       31 7B:      Match function off, clear table.
       32 xx yy:    Match table entry.
               xx - byte position;  yy - byte value.
       34 xx yy rr ss: Match table entry.
               xx - byte position;  yy - byte value.
                  // AND //
               rr - byte position;  ss - byte value.
       [The 5x 1F command determines function operation.]

4:

5:      Operational commands.
       51 01:      Checksum status request.
       52 01 00:   Suppress forwarding of checksum byte.
       52 01 01:   Forward the checksum byte.

--------------------
51 04:                    Request 'Keep-Alive' message.
5x 04 yy zz rr ss ...:    'Keep Alive' message.  {Default is none.}
                            [Use same format as transmit message:  yy zz rr ss ...]


--------------------
51 05:          Clear 'Keep Alive' message.


--------------------
51 06:          Request message forwarding status.
52 06 00:       Suppress messages 'from this device.'  {Default}
52 06 01:       Forward network messages 'from this device.'
                [Subject to message filtering;  match function.]


--------------------
51 07:          Request 'Keep Alive' message interval.
52 07 xx:       'Keep Alive' message transmission interval, in 0.0625 second intervals.
                {Default = $48 = 4.5 seconds}


--------------------
51 08:          Request message time stamp status.
52 08 00:       No time stamp.  {Default}
                *Msg order:  Header byte - Status byte - ID byte - msg. byte (MSB) - . . . - msg. byte (LSB)*
52 08 01:       Include time stamp.  Four bytes.  1.0 microsecond resolution.
                *Msg order:  Header byte - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -
                        ID byte - msg. byte (MSB) - . . . - msg. byte (LSB).*


--------------------
51 09:          Request network loading report status.
52 09 00:       Suppress network loading reports.  {Default}.
52 09 01:       Send network loading reports every specified interval.


--------------------
51 0A:                    Request network loading report interval.
55 0A ww xx yy zz:        Network loading report interval.
                            {Default = $07 A1 20 = 500 000 microseconds}
                            Interval range = 1 to $00 FF FF FF microseconds.


--------------------
51 16:          Timer alert status query.
52 16 00:       Disable timer alert.
52 16 01:       Enable timer alert.


--------------------
51 17:          Timer alert period query.
52 17 xx:       Timer alert period.  xx - period in 0.0625 second increments.
                {Default = $10 = 1 sec.}


---

--------------------
51 18:          Timer query.  Timer rollover:  $00 FF FF FF.


--------------------
51 19:          Transmit checksum status query.
52 19 00:       Disable transmit checksum.
52 19 01:       Enable transmit checksum.  {Default}


--------------------
51 1F:          Match function status query.
52 1F 00:       Match function control;  Match = forward message to the host.  {Default}
52 1F 01:       Match function control;  Match = discard the message.


--------------------
51 2B:              Request buffer expiration time.
55 2B rr ss tt vv:  Buffer expiration time to  rr ss tt vv  microseconds.
                    1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                    {Default = $00 00 59 D8 = 23 000 usec}


--------------------
51 3C:          Auto buffer termination (on transmit only), status query.
52 3C 00:       Auto buffer termination, function disabled.  {Default}
52 3C 01:       Auto buffer termination, function enabled.


--------------------
51 40:          Transmit acknowledgments status query.
52 40 00:       Disable transmit acknowledgments.
52 40 01:       Enable transmit acknowledgments.  {Default}


--------------------
51 50:          Baud rate query.
52 50 xx:       Baud rate command.
                    xx = 01 = 2400 baud.
                    xx = 02 = 9600 baud.  {Default}
                    xx = 03 = 19200 baud.
54 50 04 xx yy:  Baud rate command.  Baud rate divisor specified in xx yy bytes.
                 xx yy are hex digits;  maximum value = $1FFF.
                 Baud rate = 524288 (decimal) / xx yy  (early firmware versions).
                 Baud rate = 655360 (decimal) / xx yy  (firmware version 3.0 and above).


--------------------
51 51:          Network relay status query.
52 51 00:       Open network relay;  disconnect AVT-718 from the network.
52 51 01:       Shut network relay;  connect AVT-718 to the network.  {Default}

6:  ____

7: _____


8: _____


9:      Processor memory.
         96 01 msb xx yy lsb zz:       Processor write memory (byte), value = zz.
         96 02 msb xx yy lsb zz:       Processor read memory (byte), count = zz.
         97 03 msb xx yy lsb rr ss:    Processor write memory (word), value = rr ss.
         96 04 msb xx yy lsb zz:       Processor read memory (word), count = zz.


A: _____


B:      Firmware version.
         B0:             Request firmware version number.


C: _____


D:      Operational mode.
         D0:             Request operational mode report.


E:      Mode switch.
         E1 22:          Switch to UBP mode.  [91 14]
         E1 33:          Switch to VPW mode.  [91 07]
         E1 44:          Switch to LIN mode.  [91 19]
         E1 66:          Switch to KIE mode.  [91 1A]
         E1 77:          Switch to SDM mode.  [91 1B]
         E1 96:          Switch to FLASH programming mode.  [91 2E]
         E1 99:          Switch to CAN mode.  [91 10]
         E1 BB:          Switch to URT mode.  [91 0E]
         E1 CC:          Switch to PWM mode.  [91 06]
         E1 DD:          Switch to KWP 2000 mode.  [91 0F]


F:      Re-Start.
         F1 A5:          Reset and restart.


## AVT-718  URT  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*


0:      Message received from the network.
         0x ss yy zz ...  x = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.

1:       Message received from the network;  alternate header formats.
      11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.
      12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.


2:       Error notification.
      See complete list in section:  "Error Codes."


3:       Command error.
      31 xx:       xx = Header byte of command in error.


4:       Match function - Filtering.
      40:       Function off.
      41 B7:       Table full, entry ignored.
      42 xx yy:       Table entry report.
                    xx - byte position;  yy - byte value.
      44 xx yy rr ss: Table entry report.
                    xx - byte position;  yy - byte value.
                    // AND //
                    rr - byte position;  ss - byte value.


5:


6:       Operations reports.
      62 01 00:       Checksum byte is suppressed.
      62 01 01:       Checksum byte is forwarded to the host.


      --------------------
      6x 04 xx yy ...:       Keep Alive message.


      --------------------
      61 05:       Keep alive message length = 0, suppressed.


      --------------------
      62 06 00:       Disable forwarding network messages 'from this device.'
      62 06 01:       Enable forwarding network messages 'from this device.'


      --------------------
      62 07 xx:       'Keep Alive' message interval 0.0625 second increments.


      --------------------
      62 08 00:       Message time stamps are disabled.
      62 08 01:       Message time stamps are enabled.


      --------------------
      62 09 00:       Network loading reports enabled.

62 09 01:        Network loading reports disabled.


--------------------

65 0A ww xx yy zz:   Network loading report time interval in microseconds.


--------------------

63 0F xx yy:   Network loading report.


--------------------

62 16 00:        Timer alert disabled.
62 16 01:        Timer alert enabled.


--------------------

62 17 xx:        Timer alert period.  xx = period in 0.0625 sec. increments.


--------------------

65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  $00 FF FF FF.


--------------------

62 19 00:        Transmit checksum disabled.
62 19 01:        Transmit checksum enabled.


--------------------

62 1F 00:        Match function control;  Match = forward message to the host.
62 1F 01:        Match function control;  Match = discard the message.


--------------------

65 2B rr ss tt vv:       Buffer time out value ;  rr ss tt vv microseconds.


--------------------

62 3C 00:        Auto buffer termination, function disabled.
62 3C 01:        Auto buffer termination, function enabled.


--------------------

62 40 00:        Transmit acknowledgments disabled.
62 40 01:        Transmit acknowledgments enabled.  {Default}


--------------------

62 50 xx:        Baud rate response.
                        xx = 01 = 2400 baud.
                        xx = 02 = 9600 baud.  {Default}
                        xx = 03 = 19200 baud.
--------------------

64 50 04 xx yy:        Baud rate response.  Baud rate divisor specified in xx yy bytes.
                        xx yy are hex digits;  maximum value = $1FFF.


--------------------

62 51 00:     Network relay open;  AVT-718 disconnected from the network.
62 51 01:     Network relay shut;  AVT-718 connected to the network.

7: _____

8: _____

9: _____ Board status information.
          See complete list in section:  "Board Status Information."

A: _____

B: _____

C: _____

D: _____

E: _____ Processor memory.
          Ex msb xx xx lsb yy . . .                Processor memory status for address specified.

F: _____

## AVT-718  SDM  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*

0:      Transmit a message to the network.

      0x 0y rr ss tt ...

          x = count of bytes to follow.

          y = 00 when a Master.  (Master;  inverted bytes are not appended.)

          y = 01 when a Slave.  (Slave;  inverted bytes are automatically appended.)

          rr ss tt ... = message bytes.


1:      Alternate header format

      11 tt yy zz ...  tt = count of bytes to follow;  yy zz ... message bytes.


2:      Reset.

      21 01:          Reset HBCC.

      21 02:          Reset SCC.

      21 03:          Reset DLC.

      21 04:          Reset FIFO #1.

      21 05:          Reset FIFO #2.

      21 06:          Reset CAN.


3:


4:


5:      Operational commands.

      51 01:          Status request, forwarding of inverted bytes.

      52 01 00:       Suppress forwarding of inverted bytes.  {Default}

      52 01 01:       Forward the inverted bytes.

      --------------------

      51 04:          Request 'Periodic' message.

      5x 04 xx yy ...:'Periodic' message.  {Default:  Off}

      --------------------

      51 05:          Clear 'Periodic' message.

      --------------------

      51 06:          Request status of transmit echo.

      52 06 00:       Suppress messages 'from this device.'  {Default}

      52 06 01:       Forward network messages 'from this device.'

      --------------------

      51 08:          Request message time stamp status.

      52 08 00:       No time stamp.  {Default}

*Msg order:  Header byte(s) - Status byte - msg. byte (MSB) - . . . - msg. byte (LSB)*

52 08 01:      Include time stamp.  Four bytes.  1.0 microsecond resolution.
*Msg order:  Header byte(s) - Time (MSB) - Time( ) - Time( ) - Time (LSB) - Status byte -*
*msg. byte (MSB) - . . . - msg. byte (LSB).*

--------------------
51 09:      Request network loading report status.
52 09 00:      Suppress network loading reports.  {Default}
52 09 01:      Send network loading reports every specified interval.

--------------------
51 0A:      Request network loading report interval.
55 0A ww xx yy zz:      Network loading report interval.
      {Default = $07 A1 20 = 500 000 microseconds}
      Interval range = 1 to $00 FF FF FF microseconds.

--------------------
51 16:      Timer alert status query.
52 16 00:      Disable timer alert.
52 16 01:      Enable timer alert.

--------------------
51 17:      Timer alert period query.
52 17 xx:      Timer alert period.  xx - period in 0.0625 second increments.
      {Default = $10 = 1 sec.}

--------------------
51 18:      Timer query.  Timer rollover:  $00 FF FF FF.

--------------------
51 27:      Query for interbyte time.
55 27 vv ww xx yy:      Set the interbyte time, in microseconds.
      1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
      {Default = $00 00 01 F4 = 500 usec}

--------------------
51 2B:      Query for buffer expiration time.
55 2B vv ww xx yy:      Set the buffer expiration time, in microseconds.
      1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
      {Default = $00 00 09 C4 = 2,500 usec;  at 10.4 kbaud.}

--------------------
51 40:      Transmit acknowledgments status query.
52 40 00:      Disable transmit acknowledgments.
52 40 01:      Enable transmit acknowledgments.  {Default}

--------------------
51 4A:      Query for 'Periodic' message interval.

55 4A vv ww xx yy:   Set the 'Periodic' message interval time, in microseconds.
                                   1 microsecond increments.  Range = 1 to $00 FF FF FF microseconds.
                                   {Default = $00 01 86 A0 = 100,000 usec.}

--------------------
51 4F:           Query for baud rate.
52 4F 01:        Baud rate = 10.4 kbaud. {Default}
52 4F 02:        Baud rate = 1.2 kbaud.

--------------------
51 68:           Status request for SDM data;  non-inverted or inverted.
                    For data both "to" and "from" the network.
52 68 00:        SDM data is non-inverted.
52 68 01:        SDM data is inverted.  {Default}

6:          

7:          

8:          

9:      Processor memory.
        96 01 msb xx yy lsb zz:      Processor write memory (byte), value = zz.
        96 02 msb xx yy lsb zz:      Processor read memory (byte), count = zz.
        97 03 msb xx yy lsb rr ss:   Processor write memory (word), value = rr ss.
        96 04 msb xx yy lsb zz:      Processor read memory (word), count = zz.

A:          

B:      Firmware version.
        B0:              Request firmware version number.

C:          

D:      Operational mode.
        D0:              Request operational mode report.

E:      Mode switch.
        E1 22:           Switch to UBP mode.  [91 14]
        E1 33:           Switch to VPW mode.  [91 07]
        E1 44:           Switch to LIN mode.  [91 19]

E1 66:          Switch to KIE mode.  [91 1A]
E1 77:          Switch to SDM mode.  [91 1B]
E1 96:          Switch to FLASH programming mode.  [91 2E]
E1 99:          Switch to CAN mode.  [91 10]
E1 BB:          Switch to URT mode.  [91 0E]
E1 CC:          Switch to PWM mode.  [91 06]
E1 DD:          Switch to KWP 2000 mode.  [91 0F]


F:       Re-Start.
      F1 A5:          Reset and restart.


## AVT-718  SDM  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*


0:       Message received from the network.
      0x ss yy zz ...  x = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.


1:       Message received from the network;  alternate header formats.
      11 tt ss yy zz ...  tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.
      12 rr tt ss yy zz ...  rr tt = count of bytes to follow;  ss - receive status byte;  yy zz ... message bytes.


2:       Error notification.
      See complete list in section:  "Error Codes."


3:       Command error.
      31 xx:            xx = Header byte of command in error.


4:       


5:       


6:       Operations reports.
      62 01 00:       Inverted bytes of received messages are not forwarded to the host.
      62 01 01:       Inverted bytes of received messages are forwarded to the host.


      --------------------
      6x 04 xx yy ...:'Periodic' message.


      --------------------
      61 05:          'Periodic' message length = 0, deleted.


      --------------------
      62 06 00:       Disable forwarding network messages 'from this device.'

62 06 01:        Enable forwarding network messages 'from this device.'

--------------------
62 08 00:        Message time stamps are disabled.
62 08 01:        Message time stamps are enabled.

--------------------
62 09 00:        Network loading reports enabled.
62 09 01:        Network loading reports disabled.

--------------------
65 0A ww xx yy zz:   Network loading report time interval in microseconds.

--------------------
63 0F xx yy:   Network loading report.

--------------------
62 16 00:        Timer alert disabled.
62 16 01:        Timer alert enabled.

--------------------
62 17 xx:        Timer alert period.  xx = period in 0.0625 sec. increments.

--------------------
65 18 vv ww xx yy:   Timer value in microseconds.  Rollover  =  \$00 FF FF FF.

--------------------
65 27 rr ss tt vv:      Interbyte time:  rr ss tt vv microseconds.

--------------------
62 68 00:        SDM data is non-inverted.
62 68 01:        SDM data is inverted.

--------------------
65 2B rr ss tt vv:      Buffer expiration time:  rr ss tt vv microseconds.

--------------------
62 40 00:        Transmit acknowledgments disabled.
62 40 01:        Transmit acknowledgments enabled.  {Default}
65 4A rr ss tt vv:      'Periodic' message interval:  rr ss tt vv microseconds.

--------------------
62 4F 01:        Baud rate = 10.4 kbaud.
62 4F 02:        Baud rate = 1.2 kbaud.

7:    

8:

9:     Board status information.
       See complete list in section:  "Board Status Information."

A:

B:

C:

D:

E:     Processor memory.
       Ex msb xx xx lsb yy . . .              Processor memory status for address specified.

F:

## AVT-718  FLASH LOAD  Mode  -  Commands

*High nibble, bits b7 - b4:  Command type.*

0: _____

1: _____

2: _____

3: _____

4: _____

5: _____ Operational commands.

57 37 rr ss tt vv xx yy:     Memory dump command.
rr ss tt vv:     start address
xx yy:           byte count of memory to be dumped

57 3A rr ss tt vv xx yy  [bytes follow immediately:
FLASH programming command.
rr ss tt vv:     start address
must be on an even block.  e.g. vv = 00
xx yy:           byte count must be 01 00 = 256 bytes.

6: _____

7: _____

8: _____

9: _____

A: _____

B: _____ Firmware version.

B0:           Request firmware version number.

C: ____

D: Operational mode.
  D0: Request operational mode report.

E: ____

F: Re-Start.
  F1 A5: Reset and restart the processor.

## AVT-718  FLASH LOAD  Mode  -  Responses

*High nibble, bits b7 - b4:  Response type.*

0: ____

1: ____

2: Error notification.
  21 27: Time out waiting for FLASH device to complete programming cycle.

  21 28: Error in verification of FLASH contents following programming attempt.

  21 34 xx: Time out error waiting for block of bytes (programming command).
  xx - header byte of command that caused the error.

3: Command error.
  31 xx: xx = Header byte of command in error.

4: ____

5: ____

6: Operations reports.
  61 3A: FLASH programming complete and successful.

7: ____

8: ____

9:

    91 2E:         AVT-718 FLASH programming mode entered.
                          [LED flash rate changes to one second intervals.]

A:

B:

C:

D:

E:

F:

## Receive Status Byte - Bit definitions

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| VPW | Bad message or Error | From this node | Transmit success | Lost arbitration | IFR data | Break received | Incomplete message | CRC error |
| PWM HBCC | \|---- | ---- | ---- | ---- | ---- | ---- | ---- | Message number |
| PWM ZINGER | | Ack bytes follow | Transmit success | | | | | Buffer not open |
| ISO & K5V | | From this node | Transmit success | Lost arbitration | | | | Checksum error |
| KWP | | From this node | Transmit success | Lost arbitration | | P2 threshold exceeded | P1 threshold exceeded | Checksum error |
| 716 ALDL | | From this node | Transmit success | | | | | Checksum error |
| CCD | | From this node | Transmit success | | | | | Checksum error |
| UBP | Message length does not match format | From this node | Transmit success | Lost arbitration | Arb limit exceeded | Break received | Framing error | Checksum error |
| LIN | Message length does not match format | From this node | Message too short | Error decoding length code | Message received without break | | Time out error | Checksum error |
| KIE | New byte while waiting to echo. | From this node. | Buffer time out. | | Buffer time out waiting for echo. | Buffer forced closed. | Length error. | Last byte not ETX. |
| SDM | | From this node. | Success | Lost arbitration. | | Odd message length. | Parity error. | Inverted verification error. |
| 718 URT | | From this node | Transmit success | Lost arbitration | | Buffer time out | Length byte error. | Checksum error. |

Notes:

Receive Status Byte does not exist in CAN mode.

Bits not assigned are reserved and will return 0.

## Board Status Information  ($9x . . . )

00:
01:     Command Acknowledged.
02:     SCC initializations complete.
03:     HBCC initializations complete.
04:     Firmware version number follows.
05:     VPW operation  (Harris HIP7030A0).
06:     PWM operation  (Motorola).
07:     VPW operation  (Motorola).
08:     DLC initializations complete.
09:     VPW auto transmit mode  (Harris).
0A:     VPW operation  (Harris HIP 7010).
0B:     ISO 9141-2 operations.
0C:     FIFO reset.
0D:     CCD operations.
0E:     GM's ALDL  (8192 UART)  operations.
0F:     KeyWord Protocol 2000 operations.

10:     CAN operations.
11:     CAN device reset completed.
12:     Board at startup idle, awaiting mode switch command.
13:     Configuration NVRAM initialized.
14:     UBP operations.
15:     First byte received, time follows, two bytes, 0.5 millisecond resolution.
            (716 KWP only)
16:     VPW operations with BDLC.
17:     BDLC initialization complete.
18:     LIN pending transmit message purged.
19:     LIN operations  (using UBP resources).
1A:     KIE operations.  [K-line Inverted Echo]
1B:     SDM operations  (using UBP resources).  [In accordance with GM CM20324]
1C:     FIFO [x] test success.
1D:     Actual checksum report, during boot failure.
1E:     PPD operations.
1F:     CAN device reset and settings restored.

20:     Reset status register report.  Status register follows.
21:     FLASH load program is running (full capability version).
22:     SWIFT-CEC bridge mode is active.
23:     K5V operations  [5 volt K-line].
24:     CAN0 reset.
25:     CAN4 reset.
26:     Reserved.  [84x, 85x]
27:     AVT-85x idle state.
28:
29:
2A:     FLASH Block is empty.

2B

2B:    FLASH Block has been erased.  Flash status follows (1 byte).
2C:    FLASH load program is running; restricted version  (FL_PGM) - AVT-820 only.
2D:    FLASH load program is running, regular version  (LD_FIFO) - AVT-820 only.
2E:    FLASH load program is running.
2F:

30:    CHR operations  (716 special mode).
31:    PWM operations with ZINGER device.
32:    ZINGER initialization complete.
33:
34:    Default match table loaded.  (AVT-831, 832 only)
35:    EEPROM match table loaded.  (AVT-831, 832 only)
36:
37:    FIFO test status.
38:
39:
3A:
3B:
3C:
3D:
3E:
3F:

40:
41:    OSP mode.
42:
43:
44:
45:
46:
47:
48:

## Reset Commands  ($21 . . . )

01:    Reset HBCC device  [PWM device].
02:    Reset SCC device  [serial communications device].
03:    Reset DLC device  [VPW device].
04:    Reset FIFO #1  -  or  -  Reset both FIFOs.
05:    Reset FIFO #2.
06:    Reset CAN device.
               Restore baud rate setting and physical layer selection.
               Disable all objects, clear all objects, clear all masks.
07:    Reset ZINGER device.
08:    Reset the BDLC peripheral.
09:    LIN mode, purge pending transmit message.
0A:    Reset channel CAN0.
0B:    Reset channel CAN4.

0C:     Reset and restore CAN device.
             Restore all parameters and settings.


## Mode Switch Commands  ($E1 . . . )

E1 22:      Switch to UBP mode.  [91 14]
E1 33:      Switch to VPW mode.  [91 07]
E1 44:      Switch to LIN mode.  [91 19]
E1 55:      Switch to CCD mode.  [91 0D]
E1 66:      Switch to KIE mode.  [91 1A]
E1 77:      Switch to SDM mode.  [91 1B]
E1 88:      Switch to PPD mode.  [91 1E]
E1 92:      Switch to FLASH erase and load routine.  [FLASH2]
E1 94:      Switch to FLASH erase and load routine.  [FLASH3]
E1 96:      Switch to FLASH erase and load routine.  [91 2D  or  91 2E]
E1 99:      Switch to CAN mode.  [91 10]
E1 AA:      Switch to ISO mode.  [91 0B]
E1 BB:      Switch to ALDL mode.  (GM 8192 UART).  [91 0E]
E1 CC:      Switch to PWM mode.  [91 06]
E1 D5:      Switch to K5V mode.  [91 23]
E1 DD:      Switch to KWP 2000 mode.  [91 0F]
E1 EE:      OSP mode.  [91 41]


## Error Codes  ($2x . . . )

00:
01:     HBCC:  initialization error, response not = 01.
02:     HBCC:  No message received OK flag, from loopback test.
03:     HBCC:  No message transmitted OK flag, from loopback test.
04:     HBCC:  Test message byte #1 error, from loopback test.
05:     HBCC:  Test message byte #3 error, from loopback test.
06:     HBCC:  No IRQ detected.
07:
08:     HBCC:  IR1 error, IR1 byte follows.
09:     HBCC:  IR2 error, IR2 byte follows.
0A:     HBCC:  IR3 error, IR3 byte follows.
         [Refer to separate document for full explanations of error codes:  08, 09, and 0A.]
0B:     No buffer available, error bits follow.
0C:     Error detected, error bits follow.  [Walker1]
0D:     Transmit message too short.
0E:     Transmit message too long.
0F:     SCC:  FIFO #1 overflow.

10:     DLC:  Initialization failure, no interrupt.
11:     DLC:  Initialization failure, status byte error
12:     DLC:  Initialization failure, test byte #1 error.
13:     DLC:  Initialization failure, test byte #2 error.

14:     DLC:  Initialization failure, test byte #3 error.
15:     DLC:  Initialization failure, not 'completion code only'.
16:     DLC:  Initialization failure, completion code incorrect.
17:     DLC:  Receive FIFO overflow.
18:     DLC:  No buffers available.
19:     VPW - short to ground detected  (NETF bit).
1A:     VPW - short to high detected.
1B:     DLC:  Break received.
1C:     KIE mode error flags.  Two flag bytes follow.
    Byte #1
        b7:  rcv, passive listen, no buffer found
        b6:  xmit, state unknown
        b5:  rcv, not new byte, state unknown
        b4:  xmit, waiting for echo timeout
        b3:  xmit, echo byte error
        b2:  rcv, new byte, state unknown
        b1:  xmit, waiting for byte timeout
        b0:  rcv, echo error
    Byte #2
        b7:  xmit, rcv byte error
        b6:  new byte, no buffer found
        b5:  msg length is zero
        b4:  msg header byte is zero
        b3:  idle, no rcv buffer available
        b2:  xmit, new byte, waiting to send byte
        b1:  no state found in main loop processing
        b0:  short to ground detected
1D:     Configuration restore failed.
1E:     FIFO #1 test failure, error byte follows.
1F:     FIFO #2 test failure, error byte follows.


20:
21:     7010:  Initialization failure.
22:     7030:  No receive buffers available.
23:     7030:  Error occurred in SENDEC interrupt service routine;  SEDSR contents follow.
24:     CAN:  Error and status registers follow.
        [Refer to document "CAN_03x.PDF"  for detailed information.]
25:     CAN:  Message lost.  Object number follows.
26:     CAN:  CAN-B transceiver detected error condition.
27:     FLASH error;  time out waiting for programming.
28:     FLASH error;  verification error.
29:     Interrupt error, flag byte follows.
        b7:  unexpected SCC interrupt event.
        b6:  always 0
        b5:  always 0
        b4:  always 0
        b3:  always 0

b2: always 0
b1: NOP interrupt event.
b0: spurious interrupt event.

2A: ZINGER initialization ISB error.
2B: ZINGER initialization node address error.
2C: Operational and error flags.
2D: AVT-832 ZINGER ISR flags #1.
2E: AVT-832 ZINGER ISR flags #2.
2F: AVT-832 ZINGER exception bytes #1 and #2, in order.


30:
31: Received a watch dog time-out.  [AVT-715 PWM only].
32: Block mode abort  [AVT-716 / 820 / 921  VPW only].
33: Unknown IRQ source  [AVT-931 only].

34:* Read command time out.  Header byte of offending command follows.
34:* Read time out for 11 xx command.  [84x]

35:* EEPROM read error.  [831, 832]
35:* Read time out for 12 xx yy command.  [84x]

36:* EEPROM write error.  [831, 832]
36:* Time out waiting to store a block.  [84x]

37:* EEPROM match table is full.  [831, 832]
37:* Block transmit abort.  DLC status byte follows.  [84x]

38:* EEPROM error in erase all.  [831, 832]
38:* Block transmit time out.  DLC status byte follows.  [84x]

39: EEPROM contents invalid.  [831, 832]
3A: EEPROM empty.  [AVT-831, 832 only]
3B: Requested read count > $06.  [831, 832]
3C: Requested read count > $0D.  [ATI-B Simulator]
3D: TSM message with zero length.  [ATI-B Simulator]
3E: TSM message with invalid product code.  [ATI-B Simulator]
3F: EEPROM error flags.  [ATI-B Simulator]


40:
41: ISO mode error byte follows.
b7: always 0
b6: always 0
b5: always 0
b4: always 0
b3: always 0
b2: invalid state or state 8 stuck
b1: short to ground detected

b0: no buffer available to open

41: UBP mode error byte follows.

    b7: always 0
    b6: always 0
    b5: always 0
    b4: transmit pending time out.
    b3: SCI unknown interrupt source.
    b2: SCI receiver overrun detected.
    b1: short to ground detected.
    b0: no buffer available to open.

42: HBCC read register error.  Byte count > $0D  [AVT-716 / 820 only].

43: HBCC read RAM error.  Byte count > $0D  [AVT-716 / 820 only].

44: Undefined slot address  xx yy;  transmit "EE" in that slot.  [ATI-B Simulator]

45: KWP mode error byte follows.

    b7: always 0
    b6: always 0
    b5: always 0
    b4: stuck in state 08 or illegal state
    b3: transmit attempt time out
    b2: TPU00 overflow during initialization attempt
    b1: short to ground detected
    b0: no buffer available to open

46: KWP: CARB initialization error, error byte follows  [AVT-820 only].

47: KWP: 5-Baud initialization error, error byte follows  [AVT-820 only].

48: KWP: Fast initialization error, error byte follows  [AVT-820 only].

49: KWP: Message of length 0 received.

4A: KWP: Message of length 1 received.  The one byte follows.

4B: LIN error report, two bit mapped bytes follow.

Byte #1

    b7: short to ground detected
    b6: no buffer available
    b5: break received, buffer not idle
    b4: error decoding buffer status
    b3: synch byte incorrect value
    b2: SCI receiver noise detected
    b1: SCI receiver overrun detected
    b0: SCI ISR unknown cause

Byte #2

    b7: byte in progress watchdog time out
    b6: LIN_mstr_state timer failure
    b5: LIN_xmit_mode timer failure
    b4: error decoding LIN_mstr_state
    b3: rx does not equal tx, message discarded
    b2: error decoding LIN_mstr_state
    b1: transmit message too short to be slave
    b0: transmit message too short

4C: Error initializing object from EEPROM - object number follows.

4D:    Received command content error.

4E:    New command does not equal 'in-process' command.  In-process command follows.

4F:    SDM mode error bytes follow.

        Byte #1

                b7:  Illegal transmit state.

                b6:  Transmit in-progress watchdog time out.

                b5:  Byte loaded watchdog time out.

                b4:  No receive buffers available.

                b3:  Undefined / unknown SCI interrupt.

                b2:  Framing error.

                b1:  Noise error.

                b0:  Overrun error.

        Byte #2

                b7:

                b6:

                b5:

                b4:

                b3:

                b2:

                b1:  Invalid receive state.

                b0:  Bus stuck high.

50:    CCD:  No receive buffers available.

51:    GPS:  Error byte follows.

52:    FIFO [x] test failure.

53:*   Receive block too big.

53:*   Receive block error.  [84x]

        Rx_blk_count_hi, Rx_blk_count_low, Rx_status information follows.

54:    KWP initialization failure, failure code follows.

        Failure code depends on initialization mode attempted.

                00:  not used

                01:  retry interval not expired

                02:  K-line too active

                03:  fail to receive 5-baud address echo

                04:  5-baud address echo not equal to what was transmitted

                05:  synch byte not received

                06:  synch byte not equal to $55

                07:  keybyte #1 not received

                08:  keybyte #2 not received

                09:  inverted keybyte #2 echo not received

                0A:  inverted keybyte #2 echo not equal to what was transmitted

                0B:  inverted address not received

                0C:  inverted address not correct

                0D:  TPU no success

                0E:  synch byte not received

0F:  not used
10:  25 msec break failure
11:  start comm message invalid
12:  T-wakeup (wakeup time) failure
13:  send start comm message failure
14:  start comm message echo failure
15:  interbyte time failure
16:  receive message failure

55:     ISO 15765 processing error.  Error code follows.
01:  Receive mode;  buffer time out, buffer number follows.
02:  Receive mode;  PCI frame type error
03:  Receive mode;  PCI byte count greater than or equal to CFG byte count.
04:  Receive mode;  first frame received, no small buffers available.
05:  Receive mode;  flow control frame transmit attempt time out.
06:  Receive mode;  flow control frame, data field too short.
07:  Receive mode;  consecutive frame, buffer assigned but not in-use.
08:  Receive mode;  consecutive frame, sequence number error.
09:  Receive mode;  flow control frame, separation time invalid.
0A:  Receive mode;  DLC > 7 in single frame processing.
0B:  Receive mode;  DLC > 6 in single frame processing.
0C:  Receive mode;  DLC > 6 in first frame processing.
0D:  Receive mode;  DLC = 0.
0E:  Receive mode;  DLC = 1 with extended addressing enabled.
0F:  Time out forwarding message to host.
10:  Receive mode;  FFDL = 0.
11:  Transmit mode;  buffer time out.
12:  Transmit mode;  error decoding op mode flags.
13:  Transmit mode;  buffer underrun on first frame.
                 Buffer and object numbers follow.
14:  Transmit mode;  invalid flow status received, operation aborted.
                 Buffer and object numbers follow.
15:  Transmit mode;  flow status = 2 received, operation aborted.
                 Buffer and object numbers follow.
16:  Transmit mode;  flow status = 1, wait count max, operation aborted.
                 Buffer and object numbers follow.
17:  Transmit mode;  buffer count = 0 on first frame, operation aborted.
                 Buffer and object numbers follow.
18:  Buffer manager;  buffer mode value wrong.
19:  Receive mode;  first frame DLC too short.
1A:  Received a flow control frame, not expecting one.
20:  [Buffer time out;  op flag bit 0 set;  long msg first frame waiting.]
21:  [Buffer time out;  op flag bit 1 set;  waiting for flow control frame.]
22:  [Buffer time out;  op flag bit 2 set;  consecutive frames are in-progress.]
23:  [Buffer time out;  op flag bit 3 set;  flow control frame received.]
24:  [Buffer time out;  op flag bit 4 set;  flow control frame waiting to be
         loaded.]
25:  [Buffer time out;  op flag bit 5 set;  transmit object triggered.]

26: [Buffer time out;  op flag bit 6 set;  not used.]
27: [Buffer time out;  op flag bit 7 set;  not used.]
28: [Buffer time out;  no op flags found.]
29: Receive mode;  first frame received, large buffer not available.
2A:  Consecutive frame;  buffer not assigned.
2B:  Consecutive frame;  buffer number not valid.
2C:  Flow control frame;  buffer not assigned.
2D:  Flow control frame;  buffer number not valid.
2E:  Buffer service counter failure;  zero.
2F:  Buffer service counter failure;  not valid.
30:  Transmit service counter failure;  zero.
31:  Transmit service counter failure;  not valid.
32:  Time out flushing TX1 command.
33:  TX1 command pending timed out.
34:  TX0 command pending timed out.
35:  Time out flushing 1X command.
36:  Buffer time out;  buffer number, mode byte, and flag byte follow.

56: PPD error.  Error byte follows.
57: Transmit watchdog time out.  Two bytes follow.
Transmit buffer mode.
Transmit mode.
58: URT error report;  two bit mapped bytes follow.
Byte #1
b7:  short to ground detected
b6:  no buffer available
b5:  break received, buffer not idle
b4:  error decoding buffer status
b3:  synch byte incorrect value
b2:  SCI receiver noise detected
b1:  SCI receiver overrun detected
b0:  SCI ISR unknown cause
Byte #2
b7:  always 0
b6:  LIN_mstr_state timer failure
b5:  LIN_xmit_mode timer failure
b4:  error decoding LIN_mstr_state
b3:  rx does not equal tx, message discarded
b2:  error decoding LIN_mstr_state
b1:  transmit message too short to be slave
b0:  transmit message too short
59: CAN frame with invalid data length code (greater than 8).

5A:*  Block too short.
5A:*  Fewer than 3 bytes in FIFOX.  [84x]

5B: Time out trying to send block to host.
5C: Error during init. Error flag byte follows.

5D: URT error report; one bit mapped byte follows.
        b7: 0
        b6: 0
        b5: 0
        b4: 0
        b3: framing error
        b2: byte in progress watchdog time out
        b1: short to ground detected
        b0: no buffer available to open.

5E: UBP mode error byte follows.
        b7: 0
        b6: 0
        b5: 0
        b4: transmit pending time out.
        b3: SCI unknown interrupt source.
        b2: byte in progress watchdog time out.  [AVT-717]
           SCI receiver overrun detected.  [AVT-718]
        b1: short to ground detected.
        b0: no buffer available to open.

5F: ISO 15765 processing error codes.  [84x]
        Details in separate document.


60:
61: TPU overflow on synch byte.
62:
63: TPU RAM data bus test error;  walking one word follows.
64: TPU RAM address bus test error;  walking one word follows.
65: TPU RAM memory content test error;  address of first failure follows.
66: External RAM data bus test error;  walking one byte follows.
67: External RAM address bus test error;  walking one word follows.
68: External RAM memory content test error;  address of first failure follows.
69:
6A: CEC - reserved.  [717]
6B: CEC - reserved.  [717]
6C: CEC - reserved.  [717]
6D: CEC - reserved.  [717]
6E: CEC - reserved.  [717]
6F: CEC - reserved.  [717]

70: Reserved.  [84x]
71:* Reserved.  [84x]

71:* K5V mode operational errors.  [716]
    Error byte and SCI status bytes follow  (in that order).
    Error byte
        b7:
        b6:

b5: byte loaded time out
b4: transmit mode illegal state
b3: transmit attempt time out
b2:
b1:
b0: no buffer available

SCI status byte
b7: transmit complete
b6: receive data register full
b5: receive active
b4: idle line detected
b3: overrun flag  (error condition)
b2: noise flag  (error condition)
b1: framing error  (error condition)
b0: parity error  (error condition)

72: reFLASH routine:  erase row;  or
EEPROM routines:  mass erase  or  erase sector  or  program sector
CBEIF and CCIF not set.
73: reFLASH routine;  erase row error detected;  FSTAT follows.
74: reFLASH routine;  blank check failed
EEPROM routine;  mass erase blank check failed;  xx yy = error count
EEPROM routine;  erase sector;  blank check failed.
75: reFLASH routine;  program row;  CBEIF and CCIF not set.
76: reFLASH routine;  program row;  error detected;  FSTAT follows.
77: Idle mode;  mode switch to VPW verification error;  error code follows.
78: Idle mode;  mode switch to CAN verification error;  error code follows.
79: Unimplemented instruction trap;  stack dump follows.
7A: COP fail trap.
7B: Clock monitor reset trap.
7C: User space is protected.
7D: User space mass erase error;  FSTAT follows.
User space erase sector error;  FSTAT follows.
7E: User space program sector error;  FSTAT follows.
7F: CAN transmit processing error;  error code follows.
    01: Return from CAN0 code error.
    02: Return from CAN4 code error.
    03: Invalid CAN channel number.
    04: CAN0 channel not configured to transmit.
    05: CAN0 transmit buffer time out.  Message flushed.
    06: CAN0 transmit command too short;  11-bit.
    07: CAN0 transmit command too long;  11-bit.
    08: CAN0 transmit command too short;  29-bit.
    09: CAN0 transmit command too long;  29-bit.
    0A:
    0B:
    0C:

0D:
0E:
0F:

10:

20:

30:

40:
41:
42:
43:
44:    CAN4 channel not configured to transmit.
45:    CAN4 transmit buffer time out.  Message flushed.
46:    CAN4 transmit command too short;  11-bit.
47:    CAN4 transmit command too long;  11-bit.
48:    CAN4 transmit command too short;  29-bit.
49:    CAN4 transmit command too long;  29-bit.
4A:

51:    ID / Mask status does not equal mode, CAN0, 7x 2B.
52:    ID / Mask status does not equal mode, CAN4, 7x 2B.
53:    ID / Mask status does not equal mode, 72 2B xx.
54:    Report IDs, mode error.
55:    Report all masks, mode error.
56:    Invalid CAN channel,  7x 2C.
57:    Invalid CAN channel,  7x 2C.
58:    Invalid mask number for the mode,  7x 2C.
59:    Mask mode error,  7x 2C.
5A:    Invalid mask number for mode, CAN0,  7x 2C.
5B:    Invalid mask number for mode, CAN4,  7x 2C.
5C:    Invalid CAN channel,  7x 2C.
5D:    Invalid header for mode;  mode 2, 11-bit,  7x 2C.
5E:    Invalid header for mode;  mode 2, 29-bit,  7x 2C.
5F:    Invalid header for mode;  mode 4,  7x 2C.

60:    Invalid header for mode;  mode 8,  7x 2C.
61:    ID / Mask mode error,  7x 2C.
62:
63:
64:
65:
66:
67:
68:

69:
6A:
6B:     Invalid CAN channel.
6C:     Invalid CAN channel.
6D:     Invalid ID number for current mode.
6E:     ID / Mask mode error.
6F:     Invalid ID number for current mode.

70:     Invalid ID number for current mode.
71:     Invalid CAN channel.
72:     Invalid header byte for ID length (11-bit), mode 2.
73:     Invalid header byte for ID length (29-bit), mode 2.
74:     Invalid header byte for ID length mode 4.
75:     Invalid header byte for ID length mode 2.
76:     ID / Mask mode error.
77:
78:
79:
7A:
7B:
7C:
7D:
7E:
7F:

80:

81:*    CAN streaming data timeout error.  [418, 718]
81:*    CAN0 errors.  CAN0_error1, CAN0_error2 bit maps follow.  [84x]

82:     CAN4 errors.  CAN4_error1, CAN4_error2 bit maps follow.  [84x]
83:     VPW errors.  VPW_error1 and VPW_error2 bit maps follow.  [84x]

84:*    Command buffer mode fault.  [84x]
84:*    Bad timer bits in 'Can_timer_select'.  [418. 718]

85:     KWP errors.  KWP_error1, KWP_error2, and Sci1_error bit maps follow.  [84x]

86:*    SDM mode long slave message error.  [418, 718]
86:*    ABIC error codes.  [84x]

87:     CAN0 ABX transmit manager error.  [84x]
88:     CAN4 ABX transmit manager error.  [84x]
89:     FLASH sector verify error.  [84x]
8A:     OSP error.
8B:     FIFO test error reports.
8C:

8D:
8E:
8F:

## <u>Counter / Timer  -  Baud Rate Formula</u>

The baud rate of the K-line (ISO and KWP modes only) can be changed through the $53 $03 $xx $yy command.  The bytes $xx and $yy are the upper and lower bytes, respectively, of a timer load.  This can be calculated according to the following formula.  The default timer load is $00 $0B for a default baud rate of 10.4 kbps.

$$Timer\_Load = \frac{3.6864 \bullet 10^6}{2 \bullet 16 \bullet Baud\_Rate}$$

## Special Commands  (hidden, test, and other)

AVT-716 Only

Command:    Test millisecond timer
      51 11:                              Test the on-board millisecond timer.

      Response
          63 11 xx yy:           Timer test results.
                                        Should be 36 +/- 1 for success;  16 kHz clock source.

Command:    Generate programmed pulse  (ISO mode only)
      C1 xx:                              Generate a 'high' pulse on Port F0, for duration xx
                                        (in 0.5 millisecond increments).
                                        (Resolution is 0.5 milliseconds.)

      Response
          None.

Command:    Trigger function  (VPW mode only)
      51 41:                              Status request.
      52 41 00:                       Function disabled.
      52 41 01:                       Function enabled.

      Response
          62 41 00:                  Function disabled.
          62 41 01:                  Function enabled.

Command:    Mask bytes
      51 42:                              Report mask bytes.
      5x 42 xx yy ... :          Enter mask bytes, maximum of 6 bytes.

      Response
          6x 42 xx yy ... :     Mask bytes.

Command:    Match bytes
      51 43:                              Report match bytes.
      5x 43 xx yy ... :          Enter match bytes, maximum of 6 bytes.

      Response
          6x 43 xx yy ... :     Match bytes.

Command:    Trigger function Status/Reset
      51 44:                              Report status.
      52 44 00:                       Reset trigger output.
      52 44 01:                       Set trigger output.

<u>Response</u>

    62 44 00:               Trigger output is low.

    62 44 01:               Trigger output is high.

<u>Command</u>

    73 13 xx yy           CAN burst message.

    xx:  object number

    yy:  number of iterations, $00 to $FF

    [User must set up object for transmit, enable for transmit, enter data (optional)].

<u>Response</u>

    83 13 xx yy

## Reserved Commands

These commands are reserved for special units, unique applications, and for other reasons.

**AVT-820**  (custom board)

Memory Dump

| | |
|---|---|
| 59 37 aa bb cc dd ww xx yy zz | Dump memory contents. |
| aa bb cc dd | Start address. |
| ww xx yy zz | Byte count. |

Response

61 37
Requested number of data bytes follow immediately.

Erase FLASH

| | |
|---|---|
| 55 38 ww xx yy zz | Erase FLASH block containing specified address. |
| ww xx yy zz | Address. |

Response

| | |
|---|---|
| 92 2B xx | FLASH block erased. |
| Xx | FLASH status register. |

Program FLASH

| | |
|---|---|
| 56 3A ww xx yy zz aa bb | Program FLASH starting at specified address. |
| ww xx yy zz | Starting address. |
| aa bb | Byte count of data to follow. |
| Data follows immediately. | |

Response

| | |
|---|---|
| 62 3A xx | FLASH program attempted. |
| xx | FLASH status byte. |

Command


Response

## 5x Command Summary

5x 01:        Checksum byte reporting;  received message.
*[5x 01:        HBCC write register.  AVT-931 PWM only.]*

5x 02:        Buffer expiration time.  [UBP:  Wait_RxNACK]
*[5x 02:        HBCC write RAM.  AVT-931 PWM only.]*

5x 03:        Counter/Timer function.

5x 04:        'Keep Alive' message.

5x 05:        Clear 'Keep Alive' message.

5x 06:        Forwarding messages 'from this device.'

5x 07:        'Keep Alive' message interval control.

5x 08:        Message time stamping.

5x 09:        Network loading reports.

5x 0A:        Network loading reporting interval.

5x 0B:        Reserved.  [838, 84x]

5x 0C:        Enter "Pass Through" mode #1.

5x 0D:        Enter "Pass Through" mode #2.

5x 0E:        Auto time notification | Alarm clock.

5x 0F:        {Not available, 6x 0F is network loading report.}

5x 10:        Playback mode.  [716 VPW]

5x 11:        Timer test.  Query only.

5x 12:        Special receive message handling.  [716 ISO]

5x 13:        5-baud initialization address.

5x 14:        'Look Alike' mode.  [820]

5x 15:        Save current configuration.  [716]

5x 16:        Timer alert.

TIMER0 alert.  [820]

5x 17:      Timer alert interval.
            TIMER0 alert period.  [820]

5x 18:      Timer query.
            TIMER0 query.  [820]

5x 19:      Transmit checksum on/off.  Transmit ETX on/off.

5x 1A:      Time between messages  [T_rb].

5x 1B:      Reduced Transmit Wait time  [Red_Tx_wait].

5x 1C:      Maximum Idle time  [Max_idle].

5x 1D:      Break time  [Break_time]  in bit intervals.

5x 1E:      Wait Transmit Nack time  [Wait_TxNACK].

5x 1F:      Match function control.  Match = forward or Match = discard.  [418, 718]

5x 20:      Enter block transmit mode.

5x 21:      Block transfer echo/no-echo.

5x 22:      Auto Nack generation.  Disable / Enable.

5x 23:      Auto Nack echo.  Disable / Enable.

5x 24:      Connect / Disconnect from the VPW network.
            Disable / Enable receive network messages.

5x 25:      Checksum control.

5x 26:      115 kbaud K-line communications.

5x 27:      P4_min.

5x 28:      Format byte processing of received message.

5x 29:      Select TIMER0 or TIMER1.  [716 unit only, version 5.1, hardware revision F]

5x 2A: *    Set P3_min, 0.5 millisecond resolution.  [716 KWP]

5x 2A: *    Set receive byte time out value  (ABIC message in LIN mode).  [418, 718]

---

5x 2B:  *     Buffer time out, 0.5 millisecond resolution.  [716 KWP]
              (Same as the 5x 02 command;  different resolution.)

5x 2B:  *     ABIC strobe duration.  [418, 718]

5x 2C:        Query for Key Words.

5x 2D:        First byte notification.

5x 2E:        Host interrupt.  Disable / Enable.  [512]

5x 2F:        Disconnect time interval.

5x 31:        Short to ground status.

5x 32:        Short to high status.

5x 33:        DLC standby (sleep) control.

5x 34:  *     DLC abort transmission command.
                    [921, 931 VPW].

5x 34:  *     Send error notifications.
                    [715 VPW only;  version 2.7x  never released.]

5x 35:        Direct communications with DLC device.

5x 36:        Send Break symbol.  [921, 931 VPW]

5x 37:        Memory dump.

5x 38:        Erase FLASH block.

5x 39:        Programming voltage.  Disable / Enable.

5x 3A:        Program FLASH.

5x 3B:        TIMER1 functions.  [820]

5x 3C:        Receive buffer auto termination function.

5x 3D:        P1/P2 threshold checking.

5x 3E:        P1 threshold value.

5x 3F:        P2 threshold value.

5x 40:      Disable / Enable transmit acknowledgments.

5x 41:      Trigger function control.  [716 VPW]

5x 42:      Trigger mask bytes.  [716 VPW]

5x 43:      Trigger match bytes.  [716 VPW]

5x 44:      Trigger status/reset.  [716 VPW]

5x 45:      Change node address.  [832, 837]

5x 46:      T0_min;  KWP,  Special Mode #1.  KIE initialization;  T0_min.

5x 47:      T1_max;  KWP,  Special Mode #1.  KIE initialization;  T_r1.

5x 48:      T2_max;  KWP,  Special Mode #1.  KIE initialization;  T_r2.

5x 49:      T3_max;  KWP,  Special Mode #1.  KIE initialization;  T_r3.

5x 4A:      T4_min;  KWP,  Special Mode #1.  KIE initialization;  T_r4.

5x 4B:      2's complemented checksum control.

5x 4C:      Pause while processing commands.

5x 4D:      High speed mode (2x).  Disable / Enable.

5x 4E:      Manual L-line relay control (open/shut).

5x 4F:      Set SDM baud rate.

5x 50:      Set LIN baud rate.

5x 51:      Open/Shut network relay.

5x 52:      LIN maximum frame time.

5x 53:      Synch Break delimiter time.

5x 54:      Request serial numbers.  (1, 2, 3).  [838, 84x]

5x 55:      Normal operations.  Disable / Enable.  [Simulator] - ever used ??.

5x 56:      Select match table filtering function:  "OR" / "AND"
            [Only in AVT-718 version 5.6A - never in a general release.]

5x 57:        KWP communications;  no parity;  odd parity;  even parity.

5x 58:        Read ADC specified channel.

5x 59:        Periodic ADC reports.

5x 5A:        LIN mode 'classic' or 'enhanced' checksum.

5x 5B:        Destination match byte.

5x 5C:        Source match byte.

5x 5D:        LIN mode auto respond messages.

5x 5E:        Mass erase user space.  [84x]

5x 5F:        Select receive message source, KWP, CAN, ...  [418, 718]

5x 60:        Reserved.  [84x]

5x 61:        Read user space.  [84x]

5x 62:        Write user space.  [84x]

5x 63:        Low / High rate select.  [837]
              Set base clock rate or interval.  [838, 84x]

5x 64:        Adjust W2_Max

5x 65:        Adjust W3_Max

5x 66:        Enable/Disable one-byte messages  [84x  LIN mode]

5x 67:        Query/Set host baud rate.  [84x]

5x 68: *      SDM data inversion control.  [418, 718]

5x 68: *      Reserved.  [84x]

5x 69:        Select secondary operational mode;  LIN or KWP.  [84x]

5x 6A:        LED blink control  {default = $01}.  [84x]

5x 6B:        Send break.  55 6B rr ss tt vv.  "rr ss tt vv" is break time in microseconds.  [418, 718]
              Send break.  53 6B rr ss.  "rr ss" is break time in microseconds.  [84x]

5x 6C:        KWP fast transmit {default = $00, disabled}.  [84x]

5x 6D:        KWP loop timer.  [84x test only, version 4.2A, not in released firmware ??].

5x 6E:        Query for external resonator value, 4 or 8 MHz.  [84x]

5x 6F:

5x 70:        Query / set delay timers, OSP mode.  [84x]

5x 71:        Query / set frame sync timer, OSP mode.  [84x]

5x 72:        Query / set interbyte timer, OSP mode.  [84x]

5x 73:        Query / set EEPROM "read" address range.  [84x, 85x]

5x 74:        Read EEPROM, not secure.  [84x, 85x]

5x 75:        Query / set mask bytes;  MMR function.  [84x, 85x]

5x 76:        Query / set match bytes;  MMR function.  [84x, 85x]

51 77:        Disable MMR function (sets match length = 0).  [84x, 85x]

5x 78:        Query / set MMR response.  [84x, 85x]

5x 79:        Fifo test mode.  [512 only]

5x 7A:

5x 7B:

5x 7C:

5x 7D:

5x 7E:

5x 7F:

5x 80:

5x 81:

5x 82:

5x 83:

---

5x 84:

## 6x Command Summary

60:             Request ISO or KWP mode status.

61 01:          Disconnect.

61 02:          Initialize.  [716]

61 03:          *Not available, 71 03 is successful connection report.*

61 04:          Force a network connection.

61 11:          Initialize using "CARB" method.  (KWP mode only)

61 12:          Initialize using "5-Baud" method.  (KWP mode only)

6x 13 xx yy:    Initialize using "Fast Initialization" method;  xx yy .. is the initialization message.
                (KWP mode only)

6x 14:          Initialize using Special Mode #1.  [418, 718]

6x 15 xx yy:    Initialize using Special Mode #2.  [418, 718]

6x 16:          Initialize using Special Mode #3.  [418, 718]

6x 17:          Initialize using Special Mode # 4.  [418, 718]

6x 18:

6x 19:

6x 1A:

6x 1B:

6x 1C:

6x 1D:

6x 1E:

6x 1F:

63 20 rr ss:    Read word(s) from EEPROM, by address.

64 21 xx rr ss: Write a word to the EEPROM, by address.

61 22:            Clear and initialize the EEPROM.

63 23 rr ss:    Add a table entry to the EEPROM.

61 24:            Report number of entries in EEPROM.

62 25 xx:        Read EEPROM table entry, by entry number.

61 26:            Report number of entries in default table.

62 27 xx:        Read default table entry, by entry number.

61 28:            Report number of entries in RAM table.

62 29 xx:        Read RAM table entry, by entry number.

6x 2A:            Write block to EEPROM, by address.

## 7x Command Summary  (CAN Mode)

7x 01:          Global mask, 11-bit.

7x 02:          Global mask, 29-bit.

7x 03:          Object 15 mask;  29-bit.

7x 04:          Object control/status.

7x 05:          Object setup.

7x 06:          Object data.

7x 07:          Object transmit.

7x 08:          Object transmit report control.

7x 09:          Not available.

7x 0A:          Baud rate select, fixed rates.

7x 0B:          Direct read / write to bit timing registers.

7x 0C:          Disable / Enable sequential periodic messages, groups 1 and 2.

7x 0D:          Disable / Enable delay for empty slots, Type2 periodic messages.

7x 0E:          Query / Set ISO 15765 outbound flow control ST_MIN value.

7x 0F:          Query / Set ISO 15765 outbound flow control ID with optional {AE} byte.

7x 10:          Read and clear the CAN-B error latch.

7x 11:          Select operational mode.

7x 12:          SWC transceiver mode.

7x 13:          Fast message generation.  [test function only]

7x 14:          Disable / Enable Type0 periodic message.

7x 15:          Type0 periodic message timer.

7x 16:          Type0 periodic messages, disable all.

7x 17:          SWC transceiver mode.  [84x, 85x;  CAN0 only]

7x 18:          Type1 and Type2 periodic message setup.

7x 19:          Type1 and Type2 periodic message data setup.

7x 1A:          Disable / Enable Type1 and Type 2 periodic messages.
                (Individual messages or mask access.)

7x 1B:          Type1 and Type2 periodic message timer or interval setup.

7x 1C:          Type1 and Type2 periodic messages, disable all.

7x 1D:          Enable / Disable rolling nibble function for periodic messages 10 and 20.
                [AVT-418, 718 version 6.9B only]

7x 1E:          Select timer increment for  Type0, Type1, and Type2  periodic messages.
                {Default = 10 milliseconds}

7x 1F:

7x 20:          Setup command for Auto Respond #0.

7x 21:          Setup command for Auto Respond #1.

7x 22:          Setup command for Auto Respond #2.

7x 23:          Setup command for Auto Respond #3.

7x 24:          Setup command for VPW mode, Type1 Periodic Messages.

7x 25:          Delay command for auto response functions.

7x 26:          Disable / Enable ISO 15765 processing.

7x 27:          Disable / Enable ISO 15765 message padding.

7x 28:          ISO 15765 object pairing command.

7x 29:

7x 2A:          Set CAN receive ID.

7x 2B:          Set CAN receive mask mode.

7x 2C:          Set CAN receive mask.

7x 2D: *        Disable / Enable data field match function.  [418, 718]

7x 2D: *        Acceptance registers direct read / write.  [84x]

7x 2E: *        Query / Set data field match value.

7x 2E: *        Mask registers direct read / write.  [84x]

7x 2F:          Query / Set data field mask value.  [84x]

7x 30:          Query / Set "AE" byte.  [84x]

7x 31:          Disable / enable ISO15765 Mode1 operations.  [85x]

7x 32:          Query / Set first frame size.  [84x]

7x 33: *        Stream CAN data to the network.  [418, 718].

7x 33: *        CAN ISO15765 receive buffer timeout value.  [84x]

7x 34:          CAN ISO15765 flow control separation time.  [84x]

7x 35:          CAN ISO15765 transmit (to the network) pacing timer.  [84x, 85x]

7x 36:          ABX separation time.  [84x]

7x 37:          ABX message ID.  [84x]

7x 38:          ABX data.  [84x]

7x 39:          ABX byte count.  [84x]

7x 3A:          ABX control.  [84x]

7x 3B:          CAN channel activity flag control.  [84x]

7x 3C:          CAN channel activity flag read.  [84x]

7x 3D:          CAN periodic message CAN4 first.  [85x]

7x 3E:          CAN periodic message / FLASH functions.  [85x]

7x 3F:

7x 40:

7x 41:          Disable / enable "read ATD" function.  [85x]

7x 42:          Read and clear the "read ATD" min/max/count values.  [85x]

7x 43:          Query / set "read ATD" expected ID.  [85x]

7x 44:          Query / set "read ATD" expected data bytes.  [85x]

7x 45:

7x 46:

7x 47:

7x 48:

7x 49:

7x 4A:

7x 4B:

7x 4C:

7x 4D:

7x 4E:

7x 4F:

Change Record  (Master18):

Added the 5x 34 command to the AVT-715 VPW section.

Added the 5x 06 command to the AVT-931 VPW section.

Added CCD capabilities to the AVT-716.


Change Record  (Master19):

AVT-001 (special) is now designated the AVT-820 unit.

Added CAN code for AVT-820.

Added special message handling for ISO mode  [custom modification].

Updated reset codes, status codes, and error codes.

Added Save Configuration command.

Added configuration error notification.

Added configuration initialization status report.

Added new commands for the AVT-820:  5x 16,  5x 17,  5x 18.

Added the AVT-717 CAN/UBP interface unit.

Updated the CAN receive message format.

Updated the AVT-717 CAN/UBP sections.  Updated error list and 5x yy command summary.


Change Record  (Master20):

Corrected mode error  48.

Mode errors  46, 47, 48 are AVT-820 only.

Updated AVT-717 command 7x 0A  (added 08 and 09).

Added AVT-717 command 7x 12.


Change Record  (Master21):

Added everything related to the AVT-820.

Added 5x 3B TIMER1 command for AVT-820.

AVT-820 modes VPW, PWM, and CAN now use TIMER1 as the source for message time stamps.

Added time stamp function and command to AVT-931.

Changed "UART" to "ALDL"  (an attempt to be more consistent with other documentation).

Change Record  (Master22):

Added the 5x 3C command for the AVT-716 ISO and KWP modes.

Added the 5x 25 command for checksum include/exclude in KWP mode.

Added the 5x 26 command for 115 kbaud (K-line comm's) in KWP mode.

Added the 5x 27 command to change timing value P4_min in KWP mode.

Added the 5x 28 command to disable / enable format byte processing in KWP mode.

Added error codes for received message of length = 0 and length = 1 in KWP mode.


Change Record  (Master23):

Added error code 51 for GPS error flag byte.

Corrected the 5x 34 command as used on the 715 unit.

Corrected the 21 4A error to include the one byte from the message.

Added the 5x 29 command to select between TIMER0 and TIMER1.
(Refer to AVT-716 firmware version 5.1 engineering notice about the
use of TIMER0 and TIMER1.)

Added the 5x 2A command for P3_min in KWP mode.

Added the 5x 2B command for receive buffer time out in 0.5 millisecond resolution.

Added the 5x 2C query for the Keywords from initialization.

Added the 5x 2D command for first byte notification.

Changed all times to 0.5 millisecond resolution.
(Two exceptions to this change, 5x 02 and VPW playback were not changed.)

Change Record  (Master24):

Added the 5x 13 command to the AVT-716 ISO and KWP sections.
(The function was there, but the command wasn't documented.)

Added the 5x 3D command to disable / enable threshold checking functions;  KWP mode.

Added the 5x 3E command to set the P1 threshold value;  KWP mode.

Added the 5x 3F command to set the P2 threshold value;  KWP mode.

Documented the fact that buffer time out is actually the P1_max time interval;  KWP, ISO modes.

Change Record  (Master25):

NOTE:  All AVT-716 timing parameters have been changed to 0.5 millisecond increments.

NOTE:  All commands using 1.0 millisecond increments are not recommended for new designs.

NOTE:  All units will ignore a header byte of value $00.

Changed the format of the Receive Status byte table - to reflect conventional bit/byte diagrams.

Corrections to the 716 KWP section;  included the 5x 2D command;  corrected the 63 2C response.

Added the formula relating Counter/Timer load value to K-line baud rate.

Added the entire AVT-718 section and all related AVT-718 status and error codes.

Change Record  (Master26):

Now using the 5x 0B command for the AVT-718, special firmware only (TC&C).

Added AVT-718 (and 512) memory test error codes.

Added the entire AVT-512 section.

Added the host interrupt enable command  (5x 2E).

Corrected the 5x 0A commands and responses in the 718 section.

Added the "Keep Alive" message function to the AVT-512, VPW mode.

Added the "Keep Alive" message function to the AVT-718, VPW mode.

Change Record  (Master27):

Added the CAN periodic message commands for the AVT-717 unit.

Added a summary list of CAN 7x commands at the end of the document.

Change Record  (Master28):

Added the CAN periodic message commands for the AVT-718 and AVT-512 units.

## Change Record  (Master29):

Moved AVT-815 commands and responses in proper location.  All models are now listed in model number order.

Added sections for AVT-831 (low cost VPW device) and AVT-832 (low cost PWM device).

Added status and error codes for AVT-831 and AVT-832.

AVT-717 and 718:  Changed references to periodic messages to "Type0" periodic messages.

AVT-717 and 718:  Added new commands for Type1 periodic messages.

## Change Record  (Master30):

Updated commands for AVT-820.  Added TIMER1 support command (5x 3B) for ISO, KWP, and CCD modes.

## Change Record  (Master31):

Updated AVT-718 commands to support CAN-B hardware interface.

Updated Error codes for CAN-B error condition.

## Change Record  (Master32):

Changed all header fonts for easier reading in PDF format.

Added headers for several sections near the end of the document.

Moved the change record to the end of the document.

Added a 6x command summary section.

Added all the 6x commands for the AVT-831, under development.

Added the 5x 24 command to manually connect and disconnect from the VPW network.

      (Originally added to the AVT-715 to support a special customer requirement.)

Added AVT-718  KWP mode  "61 14" command;  initialize using Special Mode #1.

Added AVT-718  KWP mode time commands to support Special Mode #1 initializations.

## Change Record  (Master33):

Added the forward/discard command for the match function in the AVT-718 unit.

Implemented the 5x 1F command.  Default is match = forward the message to the host.

Added the AVT-835 section.  (AVT-835 is a custom unit.)

Added the LIN mode commands to the AVT-718 section.

## Change Record  (Master34):

Corrected the AVT-831 and AVT-832 command set.

AVT-718 Changes:

Updated the 7x 20 command.  It is for CAN Auto Respond #0.

Added the 7x 21 command for Auto Respond #1.

Added the 7x 22 command for Auto Respond #2.

Added the 7x 23 command for Auto Respond #3.

Added the 5x 2F 'Disconnect' time-out command for KWP mode.

Added the 5x 40 command to Disable / Enable transmit acknowledgments for AVT-718 VPW, KWP, UBP, and LIN modes.


Change Record  (Master35):

Added the 5x command for 2's complemented checksum for AVT-718 modes:  KWP.

Corrections and clarifications to CAN mode commands for AVT-718.

Added the 5x 45 command for the AVT-832, change node address.

Added the 5x 4C command - pause while processing commands.

Added the 6x 2A command for block write to EEPROM.

Added error codes for AVT-717 version 1.8 project:  4C;  4D;  4E.

Added all of the 718 KIE mode commands.


Change Record  (Master36):

Updated the commands for AVT-718 KIE mode.


Change Record  (Master37):

Added multiple periodic messages function to 718 VPW mode.


Change Record  (Master38):

Added the 7x 25 command to AVT-718 CAN mode;  to add auto response delay function.

Updated and corrected a few commands in AVT-718 LIN mode.

Other general corrections.


Change Record  (Master39):

Added AVT-837 (custom unit) section.

Added 5x 39 command (programming voltage).

Added 5x 4D command (high speed, 2x mode).

Added 5x 4E command (manual L-line relay control).

Updated font size to 12 for all of the AVT-718 sections.

Updated font size to 12 for "Receive Status Byte" section and all sections after that.

Added AVT-718 SDM mode and all related commands and responses.

Removed the AVT-815 entry.  [That unit is now obsolete.]

Removed the AVT-820. [It was a custom unit.  Support for that unit is currently minimal.]

Removed all entries for AVT-83x units.  [Some were never developed, some are custom, etc.]

Change Record  (Master40):

Added full bit map descriptions for error notifications.

Added new CAN commands 7x 26 and 7x 27 for ISO 15765 messaging support.

Changed/updated CAN terminology to be consistent with ISO 15765.

> Arbitration fields - which are message IDs - are refered to as 11-bit or 29-bit only.

> Address extension byte only exists and is only used with reference to ISO 15765 messaging support.

Change Record  (Master41):

Added PPD mode switch command, response, and error notification.

Updated AVT-512 information to reflect version 1.3 firmware upgrade.

Change Record  (Master42):

Added the 5x 56 command for match table "OR" / "AND" function selection.

Cleaned up and clarified the ISO and KWP "61 04" command.

Added AVT-718 "34 xx yy rr ss" match table command.

Cleaned up the AVT-718 match table commands.

Added the AVT-512 and 718 KWP mode "6x 15" special mode #2 command.

Added the AVT-716 ISO mode "5x 12" Ford ISO command.

Change Record  (Master43):

Added the 5x 57 command for AVT-718 KWP operations, odd parity selection.

Added the 5x 58 command to read specified ADC channel  (AVT-838 only).

Updated the AVT-718 7x 27 command to be able to specify the pad byte value.

Change Record  (Master44):

Added the 5x 59 command for AVT-838 units.

Added the 7x 28 command for new CAN ISO15765 functions.

Updated the 22 55 error for CAN ISO15765 mode.

Changed all CAN references from "Message Object" to just "Object."

CAN "objects" are used to transmit or receive CAN "messages."

Changed the language to be more clear and consistent.

Updated the 21 41 UBP error.

Added the 5x 5A command for LIN mode 'classic' or 'enhanced' checksum selection.

Change Record  (Master45):

Added AVT-418/718 URT mode.

A GM only mode, also known as:  UART;  8192 UART;  ALDL.

Corrected AVT-418/718 VPW mode:

      Removed the 5x 56 command, not in general release.

      Added the 5x 24 command.

AVT-418/718:  Corrected the 7x 03 command to permit setting either an 11-bit mask or a 29-bit mask.


## Change Record  (Master46):

The 5x 0B command is reserved for the AVT-838 unit.

Added the 5C error code for AVT-838 init routines.

Added 5x 0C command to enter "Pass Through" mode #1;  AVT-718 KWP mode.

Added 5x 0D command to enter "Pass Through" mode #1;  AVT-718 KWP mode.

Updated all modes and commands for AVT-717 for firmware version 2.2.


## Change Record  (Master47):

Deleted the 5x 1A command from AVT-418/718 UBP mode.  It was never used.

Updated the 5x 26 command for AVT-418/718 KWP mode.

Corrected the 7x 11 command.

Updated the 7x 1A command for AVT-418/718 CAN mode.

Added the 5x 5D command for AVT-418/718 LIN mode.

Added the 5x 5F command for AVT-418/718 KWP mode.

Added the 62 16 xx command for AVT-418/718 KWP mode.

Added the 7x 0C command for AVT-418/718 CAN mode.

Added the 7x 0D command for AVT-418/718 CAN mode.

Updated SDM mode for AVT-418/718.

Updated the 23 4F error message bit definitions.

Added 73 13 command for AVT-418/718 CAN mode.

Added the 62 16 command for AVT-418/718 KWP mode.

Added the SDM mode switch command to all modes.


## Change Record  (Master48):

Added the new AVT-716 "K5V" mode.

Added AVT-841 error codes and new 7x CAN commands.

Updated and corrected a some other items throughout the document.


## Change Record  (Master49):

Added and updated error codes.

Updated the 5x command summary section.

Updated the 7x command summary section.

AVT-718 section:

      Added 5x 64 command.

Added 5x 65 command.

Added 7x 0E command.

Added 71 10 command.

Added 7x 2D command.

Added 7x 2E command.

Added 7x 2F command.

## Change Record  (Master50):

Added 52 54 03 command in 5x command section.

Added some 7x commands for AVT-841.

Added 7x 1D command for AVT-718.

Made some corrections in various locations.

Not released.

## Change Record  (Master51):

Removed all sections for "old" products.  "Old" products are those that have not had any updates for a long time.  Refer to "Master version 51" for detailed information about those products.

Model numbers of affected products:

AVT-512

AVT-715

AVT-716

AVT-717

AVT-921

AVT-931

Added many new commands.

Updated descriptions of many commands.

Updated the "5x" and "7x" lists at the end.

Updated status codes.

Updated error codes.

## Change Record  (Master52):

Added 5x 28 command to LIN mode.

Added 5x 2A command to LIN mode.

Added 5x 2B command to LIN mode.

Added 53 6B command to LIN mode.

Updated error codes.

Updated both 5x and 7x command summaries;  mostly for AVT-84x commands.

SDM mode:  Changed to accommodate messages up to 120 bytes long.

SDM mode:  Added the "11 xx" alternate header format.

SDM mode:  Added the 21 86,  21 0D,  and  21 0E  error codes.

KWP mode:  Added the 7x 06,  7x 07,  and  7x 08 CAN commands.

LIN mode:  Added ABIC operations support and related commands.

LIN mode:  Changed default P4_min value to 104 microseconds.

LIN mode:  Changed ABIC watchdog reset to 1 second.

CAN mode:  Changed the maximum number of Type1 and Type2 periodic messages to $20.

The range is now:  $01 to $20 for a maximum of 32 Type1 and/or Type2 periodic messages.

Group #1 are numbered:  $01 to $10

Group #2 are numbered:  $11 to $20

Other minor corrections.

Updated the "5x" and "7x" summary sections for 84x and 85x commands.


Removed all fixed page breaks.  Section breaks were left in-place.