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CAN mode Auto Response with Programmable Delay

This document describes the CAN mode Auto Response function. It has been updated to include the associated programmable delay feature. The Auto Response feature was first introduced in AVT-718 firmware version 2.5. It was upgraded in version 3.0 by adding three additional Auto Response objects and enumerating them: 0, 1, 2, and 3. All four Auto Response objects are identical and independent. The programmable delay function was introduced in firmware version 4.1.

CAN mode offers an Auto Response function that was designed to support segmented message operations. Reference ISO standard 15765-2 for more detailed information.

The Auto Response function permits the user to set up the AVT CAN interface in preparation for receiving a segmented message. When properly set up the AVT CAN interface will automatically respond to a received "First Frame (FF)" with a "Flow Control (FC)" frame.

Auto Response

Auto Response object #0 is described on the following pages. All four objects are identical and independent. They are controlled and configured through unique a command assigned to each Auto Response object.

The 7x 20 command is associated to Auto Response object #0.

The pattern follows for the 7x 21, 7x 22 and 7x 23 commands for Auto Response objects #1, #2 and #3.

Programmable Delay

The programmable delay feature is controlled with one command. It is described in detail following the Auto Response discussion. The delay for each Auto Response object is independent of the others.

A full description of the commands, responses and details of operation follow.

Command Description

Auto Response object #0 is controlled and configured solely by the 7x 20 command. Details follow.

The 7x 20 command can take several forms. All are described here.
All numbers are hex.

- 71 20:   Status request.

- 72 20 00:   Disable the function. (Default is function disabled.)

- 72 20 01:   Enable the function.

- 7x 20 KK LL MM NN PP RR xx yy zz ...

    7x: 'x' is the count of bytes to follow.

    20: command number.

    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.

The responses are of the form:
    82 20 00
    82 20 01
    8x 20 KK LL MM NN PP RR xx yy zz ...

The response received depends on the form of the command.

Using the Auto Response Function

To use this function the user is responsible for the following:

- Enter CAN mode, select the baud rate, and physical layer.
    CAN mode: E1 99 command.
    Baud rate: 72 0A xx command.
    Physical layer: 72 11 xx command.

- Set up and enable the receive object.
    Set up: 7x 05 command.
    Enable: 73 04 command.

- Set up and enable the transmit object.
  - Set up: 7x 05 command.
  - Data: 7x 06 command (optional).
  - Enable: 73 04 command.

When the receive and transmit objects are set up, the Auto Response function can be set up and enabled. Use the command explanations, above, as a reference when constructing the command. Note the following:

- The function can be set up without enabling it.

- The data field is optional and of variable length.

- If no data is entered, the user must have initialized the data in the transmit object beforehand.

- If no data is entered, whatever data and length of data was in the transmit object will be left as-is and transmitted as-is.

- The function can be set up, enabled, disabled, and re-enabled without destroying the set up data.

- Once enabled, the Auto Response function remains enabled until it is disabled.

- Unless disabled (via the 7x 08 command), transmission of the Auto Response message object will result in a transmission report: 82 09 xx.

- Empirical test data indicates a response time of approximately 580 microseconds (750 microseconds for version 4.1 and later. (Tested at 250 kbaud and 8 bytes of data. Time varies according to baud rate, amount of data to load, and network loading. Response time can be approximately 100 microseconds faster with no data to load. The response time may be faster with versions 3.0 to 4.0 firmware.)

Operation

The Auto Response function, when enabled, operates as described here.

- Every received message is checked to see if it is from the message object designated as the receive message object as specified in the set up command ("MM").

- If the receive object number matches, byte "NN" in the receive data field is extracted.

- The extracted data byte is logically "ANDed" with the mask value ("PP").

- The result is then compared to the match value ("RR").

- If the two are equal, the optional data field ("xx yy zz ... ") is loaded into the designated transmit object ("LL") and that object is set to transmit.

Programmable Delay - Description

In firmware version 4.1 a programmable delay function was added. This function permits the user to set the delay time from receipt of the trigger message to actual transmission of the Auto Response message.

The programmable delay for each Auto Response object is independent of the others.

There are four modes of operation for the programmable delay. The modes are named 00 to 03. They are described in detail here.

Delay Mode 00

> Mode 00 is no delay. This is the default condition. Testing indicates that in this mode the delay time from receipt of a trigger message to transmission of the Auto Response message is approximately 750 microseconds (due to processing time internal to the AVT-718).

Delay Mode 01

> Mode 01 is fixed delay. The user can set the delay time from receipt of a trigger message to transmission of the Auto Response message from $01 to $FF (255) milliseconds (not microseconds). Internal processing delay in the AVT-718 is compensated for. The delay accuracy is -0 to +1 millisecond.

Delay Mode 02

> In mode 02 the delay time is controlled by a specified byte in the received trigger message data field. The user specifies a byte (by byte position) in the received message data field. The AVT-718 reads that byte and then delays transmission of the Auto Response by that many milliseconds. The delay accuracy is -0 to +1 millisecond.

Delay Mode 03

> Mode 03 is a combination of modes 01 and 02. The transmission of the Auto Response is delayed by the total of the time indicated by a byte in the received message data field and the specified delay time. The delay accuracy is -0 to +1 millisecond.

Programmable Delay - Commands and Responses

The various forms of the Programmable Delay command are described here.

Command - Query

72 25 xx: Status query where 'xx' is the Auto Response object
                       of interest. 'xx' = 00 to 03.

Responses

The response form will vary depending on the mode of the Auto Response object
of interest. Response forms are:

Mode 00:
83 25 xx 00:   'xx' is the Auto Response object.

Mode 01:
84 25 xx 01 yy: 'xx' is the Auto Response object.
                       'yy' is fixed delay time, in milliseconds.

Mode 02:
84 25 xx 02 yy: 'xx' is the Auto Response object.
                       'yy' is the byte position of the received message data
                       field that will be read to determine delay time,
                       in milliseconds. Note: byte position is 00 to 07.

Mode 03:
85 25 xx 03 yy zz: 'xx' is the Auto Response object.
                       'yy' is the byte position of the received message data
                       field that will be read to determine delay time,
                       in milliseconds. Note: byte position is 00 to 07.
                       'zz' is the fixed delay time, in milliseconds.

Command - Mode 00

73 25 xx 00:   Set Auto Response object 'xx' to mode 00, no delay.
                       'xx' = 00 to 03.

Response

83 25 xx 00:   'xx' is the Auto Response object.

Command - Mode 01

74 25 xx 01 yy: Set Auto Response object 'xx' to mode 01.
                       'xx' = 00 to 03.
                       'yy' is the fixed delay time in milliseconds.

Response

84 25 xx 01 yy: 'xx' is the Auto Response object.
                       'yy' is the fixed delay time in milliseconds.

<u>Command - Mode 02</u>

74 25 xx 02 yy: Set Auto Response object 'xx' to mode 02.
'xx' = 00 to 03.
'yy' is the byte position in the received message data field read to specify the wait time in milliseconds.
Byte position is 00 to 07.

<u>Response</u>

84 25 xx 02 yy: 'xx' is the Auto Response object.
'yy' is the byte position, 00 to 07.

<u>Command - Mode 03</u>

75 25 xx 03 yy zz: Set Auto Response object 'xx' to mode 03.
'xx' = 00 to 03.
'yy' is the byte position in the received message data field read to specify the wait time in milliseconds.
Byte position is 00 to 07.
'zz' is the fixed delay time in milliseconds.

<u>Response</u>

85 25 xx 03 yy zz: 'xx' is the Auto Response object.
'yy' is the byte position, 00 to 07.
'zz' is the fixed delay time in milliseconds.

Notes

Setting the delay for an Auto Response object to mode 01 and the delay time to 00 causes the AVT-718 unit to revert to and respond with mode 00 - the same thing.

Setting the delay for an Auto Response object to mode 03 and the delay time to 00 causes the AVT-718 unit to revert to and respond with mode 02 - the same thing.

Example #1

Auto Response object #2 is set up for use. The user wants the AVT-718 to transmit the Auto Response immediately upon receipt of trigger message.
Send Command: 73 25 02 00
"73" indicates a "7" command with three bytes to follow.
"25" indicates the Programmable Delay command.
"02" is the Auto Response object.
"00" sets the delay to mode 00, immediate response.

Example #2

Auto Response object #3 is set up for use. The user wants a fixed delay of 18 milliseconds from receipt of the trigger message to transmission of the Auto Response.
Send Command: 74 25 03 01 12
"74" indicates a "7" command with four bytes to follow.
"25" indicates the Programmable Delay command.
"03" is the Auto Response object.
"01" sets the delay to mode 01, fixed delay.
"12" is hex value for 18, the number of milliseconds to wait.

Example #3

Auto Response object #1 is set up for use. The user wants to use the value of the third byte of the received message as the delay time.
Send Command: 74 25 01 02 02
"74" indicates a "7" command with four bytes to follow.
"25" indicates the Programmable Delay command.
"01" is the Auto Response object.
"02" sets the delay to mode 02, received byte sets delay time.
"02" is byte position 02, the third byte of the message; zero based counting is used.

Example #4

Auto Response object #0 is set up for use. The user wants the fifth byte of the received message to be used to determine the delay time; plus a fixed delay of 22 milliseconds.
Send Command: 75 25 00 03 03 16
"75" indicates a "7" command with five bytes to follow.
"25" indicates the Programmable Delay command.
"00" is the Auto Response object.
"03" sets the delay to mode 03, received byte sets delay with added fixed delay.
"04" is byte position 04, the fifth byte of the received message.
"16" is hex value for 22, the number of milliseconds to wait.

Notes of Caution

The CAN controller used on most AVT interface products (Intel 82527) is a powerful and flexible device. There are many possible ways to configure it and some are more desirable than others.

Improper configuration of the CAN controller can result in a significant reduction in network functionality and, in extreme cases, complete failure of the network.

The Auto Response function could be set up to perform a Remote Transmission Request (RTR). If done improperly this could result in high bus loading and a significant reduction in network performance.

As in all operations, use caution when setting up the global masks and arbitration fields of transmit and receive objects. If done improperly the "babbling idiot" phenomenon could occur.