

SSI Technologies - Application Note AT-AN7

Acu-Trac™ Ultrasonic Fuel Level Transmitters

J1708 Mode Messaging (J1587 Messages)

General

SSI's Acu-Trac™ ultrasonic fuel level transmitters broadcast and receive commands over the SAE J1708 serial data link enabling the level transmitters to communicate and share data with other modules located on the bus.

The level transmitter messages can be loosely organized to three categories as follows:

- 1) Standard PIDs
- 2) Transport Protocol Messages
- 3) Data Link Escape Messages

The Standard PID's are used to pull data from the link such as odometer reading, road speed, % engine load and the like as well as to provide data to other modules located on the link.

The Transport Protocol Messages are used to report and route fuel data through off vehicle communications equipment such as Qualcomm.

The Data Link Escape Messages are used to program parameters into the level transmitter and to provide a simple alternative means to acquire fuel data over the J1708 data link.

Standard PID's

PID 84 Road Speed	Request Response	None Automated PID 84 J1587 Standard Broadcast Purpose, Data used by the level transmitter to determine if the vehicle has stopped.
PID 89 Power Take Off Status	Request Response	None Automated PID 89 J1587 Standard Broadcast Purpose, Data used by the level transmitter to determine if the PTO option is engaged.
PID 92 Percent Engine Load	Request Response	None Automated PID 89 J1587 Standard Broadcast Purpose, Data is used by the level transmitter to determine if fuel is being used for PTO purposes or if the additional fuel is being used while idling.
PID 96 Fuel Level	Request Response	Automated PID 96 J1587 Standard Broadcast 143 96 D1 chk Where D1 Fuel level as a % of total Capacity at 0.5%/bit



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Standard PIDs Continued:

PID 194 Diagnostic Status Request PID 194 J1587 Standard Request/Broadcast
 Response no faults 143 194 0 chk
 Response w faults 143 194 2 96 D1 chk
 Response low fuel 143 194 2 96 D2 chk

Where
 D1 Diagnostic data byte, 44 active fault, 98 inactive fault
 D2 Low Fuel diagnostic data byte 33

PID 234 Software PN & Revision Level Request PID 234 J1587 Standard Request
 Response 143 234 14 143 D1-D13 chk
 Where
 D1 D6 Measurement Processor Software PN & Rev level
 D7 Delimiter ascii "***"
 Communications Processor
 D8 D13 Software PN & Rev level

PID243 Make Model & Serial Number Request PID 243 J1587 Standard Request
 Response 143 243 17 143 D1-D16 chk
 Where
 D1 D5 Make ascii "FLS12"
 D6 Delimiter ascii "***"
 D7 Revision ascii "0"
 D8 Delimiter ascii "***"
 D9 D16 Ascii Serial Number

PID245 Total Vehicle Distance Request PID 245 J1587 Standard Request directed to MID 128
 Response PID 245 J1587 Standard Response Purpose,
 Data used by the level transmitter to calculate average MPG & distance to empty.

PID250 Total Fuel Used Request PID 250 J1587 Standard Request directed to MID 128
 Response PID 250 J1587 Standard Response Purpose,
 Data used by the level transmitter to calculate how much fuel was burned through the engine for cumulative Idle/PTO, Fuel Loss and Fill measurements.



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Transport Protocol Messages

Setup and programming command messages are defined below.

PID 197 Connection Management	Request	J1587 Standard Transport Protocol transfer mechanism										
	Response	J1587 Standard RTS, CTS, EOM, Abort as req'd										
	Purpose,	To facilitate off vehicle messaging.										
Analog Gauge Drive	Read Command	MID	198	7	143	1	D1	---	D3	crch	crcl	chk
	Write Command	MID	198	15	143	1	D1	---	D11	crch	crcl	chk
	Response	143	198	15	MID	1	D1	---	D11	crch	crcl	chk

Where

- D1 Reserved Always 0
- D2 Level transmitter MID Always 143
- D3 Message Header Always 130
- D4, D5 16 bit DAC Output Voltage @ Capacity Maximum Limit @ 10.04 mv per bit, (msb first lsb last)
- D6, D7 16 bit DAC Output Voltage @ Capacity Minimum Limit @ 10.04 mv per bit, (msb first lsb last)
- D8, D9 16 bit Capacity Maximum Limit 0.125% per bit, (msb first lsb last)
- D10, D11 16 bit Capacity Minimum Limit 0.125% per bit, (msb first lsb last)
- crch High byte of the 16 bit crc performed on message bytes D1 - D11
- crcl Low byte of the 16 bit crc performed on message bytes D1 - D11

Tank Capacity	Read Command	MID	198	7	143	1	D1	---	D3	crch	crcl	chk
	Write Command	MID	198	11	143	1	D1	---	D5	crch	crcl	chk
	Response	143	198	11	MID	1	D1	---	D5	crch	crcl	chk

Where

- D1 Reserved Always 0
- D2 Level transmitter MID Always 143
- D3 Message Header Always 123
- D4, D5 16 bit Tank volume in gallons, (msb first lsb last)
- crch High byte of the 16 bit crc performed on message bytes D1 – D5
- crcl Low byte of the 16 bit crc performed on message bytes D1 – D5



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Transport Protocol Messages Continued:

Tank Size, Shape and Measurement Operation	Read Command	MID	198	7	143	1	D1	---	D3	crch	crcl	chk
	Write Cmd Seg 1	MID	198	13	143	1	D1	---	D11	chk		
	Write Cmd Seg 2	MID	198	9	143	2	D12	---	D16	crch	crcl	chk
	Response Seg 1	143	198	13	MID	1	D1	---	D11	chk		
	Response Seg 2	143	198	9	MID	2	D12	---	D16	crch	crcl	chk

Where

D1 Reserved Always 0

D2 Level transmitter MID Always 143

D3 Message Header Always 123

D4-D7 Tank Diameter/Depth 4 byte floating point value in inches, (msb first lsb last)

D8-D11 Tank full level 4 byte floating point value in inches, (msb first lsb last)

D12-D15 Tank width 4 byte floating point value in inches, (msb first lsb last)

D16 Measurement operation mode selection where,

High Nibble Analog output selection 1 = Voltage, 2 = Current loop, 4 = Linear Output & 8 = Non Linear Output

Low Nibble Measurement mode, 0 = Linear distance, 1 = Cylindrical level & 2 = Rectilinear level

crch High byte of the 16 bit crc performed on message bytes D1 - D16

crcl Low byte of the 16 bit crc performed on message bytes D1 - D16



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Transport Protocol Messages Continued:

Configure Idle/Satellite Communications Parameter	Read Command	MID	198	7	143	1	D1	---	D3	crch	crcl	chk
	Write Command	MID	198	11	143	1	D1	---	D7	crch	crcl	chk
Response	143	198	11	MID	1	D1	---	D7	crch	crcl	chk	

Where

- D1 Reserved Always 0
- D2 Level transmitter MID Always 143
- D3 Message Header Always 125
- D4 8 bit Communication option parameter where,
 - b0 Reset accumulations to 0 after sending fuel data.
 - b1 Generate a minimized Fuel Data message upon selected events.
 - b2 Generate an automated fuel message when idle fuel consumed is in excess of the idle fuel notification parameter.
 - b3 Generate an automated fuel message when PTO fuel consumed is in excess of the PTO fuel notification parameter.
 - b4 Generate an automated fuel message fuel was removed from the tank is in excess of the loss notification quantity.
 - b5 Generate an automated fuel message fuel was added in excess of the fill notification quantity.
 - b6 Generate an automatic Fuel Data message when the level transmitter/data link is disabled and the fuel consumed is in excess of the sensor disabled fuel change notification quantity or if the level transmitter and/or ecm have been exchanged.
 - b7 Generate an automated fuel message when the fuel quantity is less than the low fuel level notification quantity.
- D5 8 bit Fill Loss Notification Parameter
 - High Nibble Tank Fill notification quantity @ 10 gallons per bit
 - Low Nibble Fuel Loss notification quantity @ 10 gallons per bit
- D6 8 bit Idle/PTO Notification Parameter
 - High Nibble Idle fuel consumed notification quantity @ 1 gallon per bit
 - Low Nibble PTO fuel consumed notification quantity @ 1 gallon per bit
- D7 8 bit Disabled/Low Fuel Notification Parameter
 - High Nibble Level transmitter disabled fuel change notification quantity @ 1 gallon per bit
 - Low Nibble Low fuel level notification quantity @ 1 gallon per bit
- crch High byte of the 16 bit crc performed on message bytes D1 - D7
- crcl Low byte of the 16 bit crc performed on message bytes D1 - D7



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Transport Protocol Messages Continued:

Fuel Data	Request	MID	198	7	143	1	0	143	205	207	209	chk	
	Segment 1 Response	143	198	17	MID	1	D1	D2	---	D15	chk		
	Segment 2 Response	143	198	17	MID	2	D16	D17	---	D28	crch	crcl	chk

Where

- D1 Reserved Always 0
- D2, D3 16 bit Fuel Quantity @ 1/8 gallon/bit, (msb first lsb last)
- D4, D5 16 bit Tank volume @ 1 gallon/bit, (msb first lsb last)
- D6, D7 16 bit MPG @ 1/256 mpg/bit, (msb first lsb last)
- D8, D9 16 bit Cumm Idle Fuel Consumed @ 1/8 gallon/bit, (msb first lsb last)
- D10, D11 16 bit Cumm PTO Fuel Consumed @ 1/8 gallon/bit, (msb first lsb last)
- D12, D13 16 bit Cumm Tamper Fuel Consumed w No Data Link @ 1/8 gallon/bit, (msb first lsb last)
- D14, D15 16 bit Cumm Fuel Lost from the Tank @ 1/8 gallon/bit, (msb first lsb last)
- D16, D17 16 bit Cumm Fuel Added to the Tank @ 1/8 gallon/bit, (msb first lsb last)
- D18 8 bit Transmit Reason
 - Where
 - b0 Cumulative idle fuel consumed exceeded automated transmit parameter
 - b1 Cumulative PTO fuel consumed exceeded automated transmit parameter
 - b2 Cumulative tamper fuel consumed while sensor communications was disabled exceeded automated transmit parameter
 - b3 Cumulative fuel lost from the tank exceeded automated transmit parameter
 - b4 Cumulative fuel added to the tank exceeded automated transmit parameter
 - b5 Fuel level fell below preset
 - b6 Level transmitter and/or the ECM were exchanged during the stop
 - b7 Host system request
- D19 8 bit Fuel Temperature (msb, first lsb last) D20,
- D23 32 bit Life to Date Total Fuel (msb, first lsb last)
- D24, D27 32 bit Life to Date Total Distance (msb, first lsb last)
- D28 unused always 0
- D29 crch High byte of the 16 bit crc performed on message bytes D1 - D28
- D29 crcl Low byte of the 16 bit crc performed on message bytes D1 - D28



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Data Link Escape Messages

Analog Gauge Drive Transfer Function Parameters	Read Command	MID	254	143	3	192	1	130	chk				
	Write Command	MID	254	143	11	192	9	130	D1	D2	---	D8	chk
	Response	143	254	MID	11	192	9	130	D1	D2	---	D8	chk
		Where											
		D1-D2	16 bit DAC Output Voltage @ Capacity Maximum Limit @ 10.04 mv per bit, (msb first lsb last)										
		D3-D4	16 bit DAC Output Voltage @ Capacity Minimum Limit @ 10.04 mv per bit, (msb first lsb last)										
		D5-D6	16 bit Capacity Maximum Limit 0.125% per bit, (msb first lsb last)										
		D7-D8	16 bit Capacity Minimum Limit 0.125% per bit, (msb first lsb last)										
Distance to Empty Data	Request	MID	254	143	3	192	1	207	chk				
	Response	143	254	MID	8	207	6	D1	D2	---	D6	chk	
		Where											
		D1-D2	16 bit Distance to empty @ 1 mile/bit, (msb first lsb last)										
		D3-D4	16 bit Fuel Quantity @ 1/8 gallon/bit, (msb first lsb last)										
		D5-D6	16 bit MPG @ 1/256 mpg/bit, (msb first lsb last)										
Fuel Optimization Data	Request	MID	254	143	3	192	1	205	chk				
	Response	143	254	MID	8	205	6	D1	D2	---	D6	chk	
		Where											
		D1-D2	16 bit Tank volume @ 1 gallon/bit, (msb first lsb last)										
		D3-D4	16 bit Fuel Quantity @ 1/8 gallon/bit, (msb first lsb last)										
		D5-D6	16 bit MPG @ 1/256 mpg/bit, (msb first lsb last)										
Fuel Tank Capacity	Read Command	MID	254	143	3	192	1	123	chk				
	Write Command	MID	254	143	7	192	7	123	D1	D2	chk		
	Response	143	254	MID	6	193	6	D1	D2	chk			
		Where											
		D1-D2	16 bit Tank volume in gallons, (msb first lsb last)										
		D3-D4	Unused										



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Data Link Escape Messages Continued:

Idle/PTO/Fill/Loss Data	Request	MID	254	143	3	192	1	206	chk				
	Response	143	254	MID	14	206	12	D1	D2	---	D12	chk	
		Where											
		D1-D2	16 bit Cumm Idle Fuel Consumed @ 1/8 gallon/bit, (msb first lsb last)										
		D3-D4	16 bit Cumm PTO Fuel Consumed @ 1/8 gallon/bit, (msb first lsb last)										
		D5-D6	16 bit Cumm Fuel Consumed w No Data Link @ 1/8 gallon/bit, (msb first lsb last)										
		D7-D8	16 bit Cumm Fuel Removed from the Tank @ 1/8 gallon/bit, (msb first lsb last)										
		D9-D10	16 bit Cumm Fuel Added to the Tank @ 1/8 gallon/bit, (msb first lsb last)										
		D11-D12	16 bit spare always 0, (msb first lsb last)										
Idle/PTO Parameters Programming	Read Command	MID	254	143	3	192	1	125	chk				
	Write Command	MID	254	143	6	192	4	125	D1	D2	D3	D4	chk
	Response	143	254	143	6	192	4	125	D1	D2	D3	D4	chk
		Where,											
	D1	8 bit Communication option parameter where,											
		b0 Reset accumulations to 0 after sending fuel data.											
		b1 Generate an automatic Fuel Data message upon selected events.											
		b2 Generate an automated fuel message when idle fuel consumed is in excess of the idle fuel notification parameter.											
		b3 Generate an automated fuel message when PTO fuel consumed is in excess of the PTO fuel notification parameter.											
		b4 Generate an automated fuel message fuel was removed from the tank is in excess of the loss notification quantity.											
		b5 Generate an automated fuel message fuel was added in excess of the fill notification quantity.											
		b6 Generate an automatic Fuel Data message when the sensor/data link is disabled and the fuel consumed is in excess of the sensor disabled fuel change notification quantity or if the sensor and/or ecm have been exchanged.											
		b7 Generate an automated fuel message when the fuel quantity is less than the low fuel level notification quantity.											
	D2	8 bit Fill Loss Notification Parameter											
		High Nibble Tank Fill notification quantity @ 10 gallons per bit											
		Low Nibble Fuel Loss notification quantity @ 10 gallons per bit											
	D3	8 bit Idle/PTO Notification Parameter											
		High Nibble Idle fuel consumed notification quantity @ 1 gallon per bit											
		Low Nibble PTO fuel consumed notification quantity @ 1 gallon per bit											
	D4	8 bit Disabled/Low Fuel Notification Parameter											
		High Nibble Level transmitter disabled fuel change notification quantity @ 1 gallon per bit											
		Low Nibble Low fuel level notification quantity @ 1 gallon per bit											



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Data Link Escape Messages Continued:

Measurement Filter Timer Constant	Read Command	MID	254	143	3	192	1	131	chk				
	Write Command	MID	254	143	11	192	9	131	D1	chk			
	Response	143	254	MID	11	192	9	131	D1	chk			
		Where											
		D1	Measurement Filter Time Constant at 0.8 seconds/bit										
Fuel Tank Size, Shape & Measurement Operation Parameters	Read Command	MID	254	143	3	192	1	129	chk				
	Write Command	MID	254	143	16	192	14	129	D1	D2	---	D13	chk
	Response	143	254	MID	16	192	14	129	D1	D2	---	D13	chk
		Where											
		D1-D4	Tank Diameter/Depth 4 byte floating point value in inches, (msb first lsb last)										
		D5-D8	Tank Air Gap 4 byte floating point value in inches, (msb first lsb last)										
		D9-D12	Tank width 4 byte floating point value in inches, (msb first lsb last)										
		D13	Measurement operation mode selection where,										
		High Nibble	Analog output selection 1 = Voltage, 2 = Current loop, 4 = Linear Output & 8 = Non Linear Output										
		Low Nibble	Measurement mode, 0 = Linear distance, 1 = Cylindrical level & 2 = Rectilinear level										

