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Configurations for J1939 ECU Simulation

Part No. BW4031

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Pyramid Solutions, Inc.

30200 Telegraph Road, Suite 440

Bingham Farms, MI 48025

www.pyramidsolutions.com | P: 248.549.1200 | F: 248.549.1400

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Overview

The J1939 ECU simulator configurations allow a BridgeWay 2.0 module to be used to emulate an engine or transmission ECU. The intent of the configurations is to provide a means to test a BridgeWay monitoring application without requiring the real-world equipment.

Configurations

The collection of configurations provides a set of files for each type of BridgeWay. This allows selection based on the type of BridgeWay that is on hand as well as the type of controller or program that is available to monitor and set the simulated data.

The specific parameters that are available in the configurations are listed in the Produced and Consumed Parameter Data sections at the end of this document.

The following table lists the simulator configuration files and the type of BridgeWay and controller that is required by each.

Configuration File	Description	BW Type	Controller Type
ESimEIP.cfg	Engine simulator for EtherNet/IP	BW4031	ControlLogix, Pyramid Solutions EIPScan, or other EtherNet/IP Scanner
TSimEIP.cfg	Transmission simulator for EtherNet/IP		
ESimTCP.cfg	Engine simulator for Modbus TCP	BW4031	Modbus TCP Master (ethernet)
TSimTCP.cfg	Transmission simulator for Modbus TCP		
ESimRTU.cfg	Engine simulator for Modbus RTU	BW2031	Modbus RTU Master (rs485)
TSimRTU.cfg	Transmission simulator for Modbus RTU		

Running the Simulator

Running a J1939 ECU simulator is as simple as loading the configuration into a BridgeWay module and establishing communications to it from the required controller.

Configure the BridgeWay Module

1. Power on the BridgeWay module.
2. Connect a USB configuration cable to your PC and the BridgeWay 2.0 module and start BWConfig 2.0.
3. Load the desired configuration file into BWConfig 2.0 using the File->Open menu.
4. Set the network configuration of the BridgeWay to enable the Scanner / Master ("controller") device being used for the simulation to communicate with the BridgeWay module.
5. Download the configuration into the BridgeWay.

Connect the BridgeWay to the Controller

1. Make any network connections required to attach the BridgeWay to the controller network (EtherNet/IP, Modbus TCP, or Modbus RTU).
2. Establish communications with the BridgeWay from the controller. Refer to the *Interfacing to J1939 with... .pdf* document for examples and tips on how to set up communications for the controller that is being used.
3. Using the controller, set the produced parameter data in the data table to desired simulation values.

Connect the BridgeWay to the J1939 Network

1. Make the network connections required to attach the BridgeWay to the J1939 network.
2. Verify that the module is online with no errors (Green J1939 status LED and no errors shown in BWConfig).

Monitoring and Controlling the Simulation

1. Using the controller, monitor the input data at the data table locations or register addresses specified in the Consumed Parameter Data section below. This will be the data that has been transmitted in the associated PGN messages by other devices on the J1939 network.
2. Using the controller, change the output data at the data table locations or register addresses specified in the Produced Parameter Data section below. This will control the data that is being transmitted by the BridgeWay (simulated ECU) on the J1939 network.

Simulator NAMEs and Addresses

The J1939 NAME and address is set in the configuration to closely mimic a real-world engine or transmission ECU. The NAME has been set to a large enough value that it should lose an address contention if it accidentally gets added to a network with an actual ECU.

Engine Address Configuration

NAME

Industry Group	0 (Global)
Function	0 (Engine)
Function Instance	1
Vehicle System	0
Vehicle System Instance	1
ECU Instance	1
Manufacturer Code	2047
Identity Number	255
Arbitrary Address Capable	No

Network Address

0

Transmission Address Configuration

NAME

Industry Group	0 (Global)
Function	3 (Transmission)
Function Instance	1
Vehicle System	0
Vehicle System Instance	1
ECU Instance	1
Manufacturer Code	2047
Identity Number	255
Arbitrary Address Capable	No

Network Address

3

Transmitted Parameter Data

The Common Parameters configuration does not include any transmitted parameters.

Received Parameter Data

The following table lists the parameters that will be received by the Common Parameters configuration along with the data table locations and register addresses where the parameter data can be monitored by the various controllers.

Engine ECU Simulator Transmitted Parameters

Parameter	Modbus Register BW2031	Modbus Register BW4031	Data Table Offset BW4031 (bytes)	PGN	Offset (byte.bit)	Length (byte.bit)	Tx Rate	Scaling
EEC2 (Engine Controller) Status	40001	41029	4	61443	0.0	0.6	50ms	6-bit bitstring
Accelerator Pedal Position	40002	41030	6	61443	1.0	1.0	50ms	0.4 %/bit 0 % offset
Percent Load at Current Speed	40003	41031	8	61443	2.0	1.0	50ms	1 %/bit 0 % offset
Remote Accelerator	40004	41032	10	61443	3.0	1.0	50ms	0.4 %/bit 0 % offset
61443 Message Padding	40120	41148	242.0	61443	7.7	0.1	50ms	
EEC1 (Engine Controller) Status	40005	41033	12	61444	0.0	0.4	20ms	4-bit bitstring
Actual Engine Percent Torque	40006	41034	14	61444	2.0	1.0	20ms	1 %/bit -125 % offset
Engine Speed	40007	41035	16	61444	3.0	2.0	20ms	0.125 RPM/bit 0 RPM offset
Engine Controlling Device Address	40008	41036	18	61444	5.0	1.0	20ms	J1939 address
61444 Message Padding	40120	41148	242.1	61444	7.7	0.1	20ms	
Estimated Percent Fan Speed	40009	41037	20	65213	0.0	1.0	1s	0.4 %/bit 0 % offset
Fan Drive State	40010	41038	22	65213	1.0	0.4	1s	4-bit bitstring

65213 Message Padding	40120	41148	242.2	65213	7.7	0.1	1s	
Injection Control Pressure	40011	41039	24	65243	0.0	2.0	500ms	1/256 MPa/bit 0 MPa offset
Injector Metering Rail 1 Pressure	40012	41040	26	65243	2.0	2.0	500ms	1/256 MPa/bit 0 MPa offset
Injector Timing Rail 1 Pressure	40013	41041	28	65243	4.0	2.0	500ms	1/256 MPa/bit 0 MPa offset
Injector Metering Rail 2 Pressure	40014	41042	30	65243	6.0	2.0	500ms	1/256 MPa/bit 0 MPa offset
Total Engine Hours	40015-40016	41043-41044	32	65253	0.0	4.0	On Req	0.05 hours/bit 0 hours offset
Total Engine Revolutions	40017-40018	41045-41046	36	65253	4.0	4.0	On Req	1000 rev/bit 0 rev offset
Trip Fuel	40019-40020	41047-41048	40	65257	0.0	4.0	On Req	0.5 L/bit 0 L offset
Total Fuel Used	40021-40022	41049-41050	44	65257	4.0	4.0	On Req	0.5 L/bit 0 L offset
Engine Coolant Temperature	40023	41051	48	65262	0.0	1.0	1s	1 DegC/bit -40 DegC offset
Fuel Temperature	40024	41052	50	65262	1.0	1.0	1s	1 DegC/bit -40 DegC offset
Engine Oil Temperature	40025	41053	52	65262	2.0	2.0	1s	0.03125 DegC/bit -273 DegC offset
Turbo Oil Temperature	40026	41054	54	65262	4.0	2.0	1s	0.03125 DegC/bit -273 DegC offset
Engine Intercooler Temperature	40027	41055	56	65262	6.0	1.0	1s	1 DegC/bit -40 DegC offset
Engine Intercooler Thermostate Opening	40028	41056	58	65262	7.0	1.0	1s	0.4 %/bit 0 % offset
Fuel Delivery Pressure	40029	41057	60	65263	0.0	1.0	500ms	4 kPa/bit 0 kPa offset
Extended Crankcase Blow-by Pressure	40030	41058	62	65263	1.0	1.0	500ms	0.05 kPa/bit 0 kPa offset
Engine Oil Level	40031	41059	64	65263	2.0	1.0	500ms	0.4 %/bit 0 % offset

Engine Oil Pressure	40032	41060	66	65263	3.0	1.0	500ms	4 kPa/bit 0 kPa offset
Crankcase Pressure	40033	41061	68	65263	4.0	2.0	500ms	0.0078125 kPa/bit -250 kPa offset
Coolant Pressure	40034	41062	70	65263	6.0	1.0	500ms	2 kPa/bit 0 kPa offset
Coolant Level	40035	41063	72	65263	7.0	1.0	500ms	0.4 %/bit 0 % offset
Fuel Rate	40036	41064	74	65266	0.0	2.0	100ms	0.05 L/hr / bit 0 L/hr offset
Instantaneous Fuel Economy	40037	41065	76	65266	2.0	2.0	100ms	1/512 km/L / bit 0 km/L offset
Average Fuel Economy	40038	41066	78	65266	4.0	2.0	100ms	1/512 km/L / bit 0 km/L offset
Throttle Position	40039	41067	80	65266	6.0	1.0	100ms	0.4 %/bit 0 % offset
65266 Message Padding	40120	41148	242.3	65266	7.7	0.1	100ms	
Barometric Pressure	40040	41068	82	65269	0.0	1.0	1s	0.5 kPa/bit 0 kPa offset
Cab Interior Temperature	40041	41069	84	65269	1.0	2.0	1s	0.03125 DegC/bit -273 DegC offset
Ambient Air Temperature	40042	41070	86	65269	3.0	2.0	1s	0.03125 DegC/bit -273 DegC offset
Air Inlet Temperature	40043	41071	88	65269	5.0	1.0	1s	1 DegC/bit -40 DegC offset
Road Surface Temperature	40044	41072	90	65269	6.0	2.0	1s	0.03125 DegC/bit -273 DegC offset
Particulate Trap Inlet Pressure	40045	41073	92	65270	0.0	1.0	500ms	0.5 kPa/bit 0 kPa offset
Boost Pressure	40046	41074	94	65270	1.0	1.0	500ms	2 kPa/bit 0 kPa offset
Intake Manifold 1 Temperature	40047	41075	96	65270	2.0	1.0	500ms	1 DegC/bit -40 DegC offset
Air Inlet Pressure	40048	41076	98	65270	3.0	1.0	500ms	2 kPa/bit 0 kPa offset

Air Filter Differential Pressure	40049	41077	100	65270	4.0	1.0	500ms	0.05 kPa/bit 0 kPa offset
Exhaust Gas Temperature	40050	41078	102	65270	5.0	2.0	500ms	0.03125 DegC/bit -273 DegC offset
Coolant Filter Differential Pressure	40051	41079	104	65270	7.0	1.0	500ms	0.5 kPa/bit 0 kPa offset
Net Battery Current	40052	41080	106	65271	0.0	1.0	1s	1 A/bit -125 A offset
Alternator Current	40053	41081	108	65271	1.0	1.0	1s	1 A/bit -125 A offset
Alternator Potential Voltage	40054	41082	110	65271	2.0	2.0	1s	0.05 V/bit 0 V offset
Electrical Potential Voltage	40055	41083	112	65271	4.0	2.0	1s	0.05 V/bit 0 V offset
Battery Potential Voltage Switched	40056	41084	114	65271	6.0	2.0	1s	0.05 V/bit 0 V offset
Water in Fuel Indicator	40057	41085	116	65279	0.0	0.2	10s	00 No 01 Yes
65279 Message Padding	40120	41148	242.4	65279	7.7	0.1	10s	
Auxiliary Temperature 1	40058	41086	118	65164	0.0	1.0	On Req	1 DegC/bit -40 DegC offset
Auxiliary Temperature 2	40059	41087	120	65164	1.0	1.0	On Req	1 DegC/bit -40 DegC offset
Auxiliary Pressure 1	40060	41088	122	65164	2.0	1.0	On Req	16 kPa/bit 0 kPa offset
Auxiliary Pressure 2	40061	41089	124	65164	3.0	1.0	On Req	16 kPa/bit 0 kPa offset
65164 Message Padding	40120	41148	242.5	65164	7.7	0.1	On Req	
Diagnostic Data								
Active Diagnostics	40063-40087	41091-41115	128	65226	0.0	50.0	On Req	
Previously Active Diagnostics	40088-40112	41116-41140	178	65227	0.0	50.0	On Req	

Transmission ECU Simulator Transmitted Parameters

Parameter	Modbus Register BW2031	Modbus Register BW4031	Data Table Offset BW4031 (bytes)	PGN	Offset (byte.bit)	Length (byte.bit)	Tx Rate	Scaling
ETC1 (Transmission Controller) Status	40001	41029	4	61442	0.0	0.6	10ms	6-bit bitstring
Output Shaft Speed	40002	41030	6	61442	1.0	2.0	10ms	0.125 RPM/bit 0 RPM offset
Percent Clutch Slip	40003	41031	8	61442	3.0	1.0	10ms	0.4 %/bit 0 % offset
Input Shaft Speed	40004	41032	10	61442	5.0	2.0	10ms	0.125 RPM/bit 0 RPM offset
Transmission Controlling Device Address	40005	41033	12	61442	7.0	1.0	10ms	J1939 address
Selected Gear	40006	41034	14	61445	0.0	1.0	100ms	1 gear/bit -125 gear offset
Actual Gear Ratio	40007	41035	16	61445	1.0	2.0	100ms	0.001 / bit 0 offset
Current Gear	40008	41036	18	61445	3.0	1.0	100ms	1 gear/bit -125 gear offset
Transmission Requested Range	40009	41037	20	61445	4.0	2.0	100ms	ASCII characters
Transmission Current Range	40010	41038	22	61445	6.0	2.0	100ms	ASCII characters
Clutch Pressure	40011	41039	24	65272	0.0	1.0	1s	16 kPa/bit 0 kPa offset
Transmission Oil Level	40012	41040	26	65272	1.0	1.0	1s	0.4 %/bit 0 % offset
Transmission Filter Differential Pressure	40013	41041	28	65272	2.0	1.0	1s	2 kPa/bit 0 kPa offset
Transmission Oil Pressure	40014	41042	30	65272	3.0	1.0	1s	16 kPa/bit 0 kPa offset
Transmission Oil Temperature	40015	41043	32	65272	4.0	2.0	1s	0.03125 DegC/bit -273 DegC offset
65272 Message Padding	40120	41148	242.0	65272	7.7	0.1	1s	
Diagnostic Data								

Active Diagnostics	40063-40087	41091-41115	128	65226	0.0	50.0	On Req	
Previously Active Diagnostics	40088-40112	41116-41140	178	65227	0.0	50.0	On Req	

Transmitted Data Notes

The data table offsets are set up on 16-bit word boundaries to line up easily with Modbus register addresses. Parameter data that is less than 2 bytes in length will be stored in the first byte of the word. Parameter data less than 1 byte in length will be stored in the low order bits of the first byte.

Parameters described as “Message Padding” are used to set the last bit in messages that require padding to fill them out to the full message size for transmission. All Message Padding parameters are mapped to the same data table location. Only the first bit at the data table location is used and should be set to 1 to correctly fill in the entire end of the message with 1’s.

There is enough room in the diagnostic table areas to hold 12 DTCs in the Active and Previously Active diagnostic tables. There is no way to have the BridgeWay change the size of a message it’s producing; hence the message will always be 50 bytes long and look like it has 12 DTCs in it.

Received Parameter Data

The following table lists the parameters that will be received by the simulator BridgeWay along with the data table locations and register addresses where the parameter data can be monitored by the various controllers.

Engine ECU Simulator Received Parameters

Parameter	Modbus Register BW2031	Modbus Register BW4031	Data Table Offset BW4031 (bytes)	PGN	Offset (byte.bit)	Length (byte.bit)	Rx Timeout	Scaling
Torque/Speed Control Bits	30001	30003	4	00000	0.0	0.6	0	6-bit bitstring

Requested Speed / Speed Limit	30002	30004	6	00000	1.0	2.0	0	0.125 RPM/bit 0 RPM offset
Requested Torque / Torque Limit	30003	30005	8	00000	3.0	1.0	0	1 %/bit -125 % offset

Transmission ECU Simulator Received Parameters

Parameter	Modbus Register BW2031	Modbus Register BW4031	Data Table Offset BW4031 (bytes)	PGN	Offset (byte.bit)	Length (byte.bit)	Rx Timeout	Scaling
Transmission Control Bits	30001	30003	4	00256	0.0	0.6	0	6-bit bitstring
Requested Percent Clutch Slip	30002	30004	6	00256	1.0	1.0	0	0.4 %/bit 0 % offset
Requested Gear	30003	30005	8	00256	2.0	1.0	0	1 gear/bit -125 gear offset
Disengage Differential Lock 1 Bits	30004	30006	10	00256	3.0	1.0	0	8-bit bitstring
Disengage Differential Lock 2 Bits	30005	30007	12	00256	4.0	0.6	0	6-bit bitstring

Received Data Notes

The data table offsets are set up on 16-bit word boundaries to line up easily with Modbus register addresses. Parameter data that is less than 2 bytes in length will be stored in the first byte of the word. Parameter data less than 1 byte in length will be stored in the low order bits of the first byte.

The parameter data will hold the last value that was received from the J1939 network. If the associated PGN message has not been received, the data will remain at 0.

The Rx Timeout field was purposely set to 0 for the simulator configuration. Although a non-zero value would provide an indication that the associated PGN message has not been received, it also causes the BridgeWay to transmit Requests for the PGN, which is not a typical ECU behavior.

Support

Technical Product Assistance

If you require BridgeWay product technical support by phone:

- Call 248-549-1200
- Dial 0 for the Operator
- Ask for BridgeWay Support

If you require support by email:

- productsupport@pyramidsolutions.com
- Subject: "BW4031 Support Request"
- Provide a detailed explanation of your question or issue in the email text.

You can also obtain BW4031 files and information online at the following URL:

<http://pyramidsolutions.com/support/network-connectivity-support/>

Contact Information

Pyramid Solutions, Inc.
30200 Telegraph Road
Suite 440
Bingham Farms, Michigan 48025

Phone: 1-248-549-1200
Toll free: 1-888-PYRASOL
Fax: 1-248-549-1400
Website: www.pyramidsolutions.com