USER MANUAL UMAX130760
Version 1.0.5

1 Analog Output Controller with CAN Controller

USER MANUAL

P/N: AX130760

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VERSION HISTORY

Version	Date	Author	Modification
1.0.0	July, 2023	Weixin Kong	Initial Draft
1.0.1	August 11, 2023	M Ejaz	Fixed legacy issues Updated dimensional drawing
1.0.2	August 24, 2023	Weixin Kong	Updated Tables and Figures
1.0.3	August 30, 2023		
1.0.4	December 5, 2023	M Ejaz	Updated technical specifications
1.0.5	December 12, 2023	M Ejaz	Updated technical specifications

ACRONYMS

ACK	Positive Acknowledgement (from SAE J1939 standard)
BATT +/-	Battery positive (a.k.a. Vps) or Battery Negative (a.k.a. GND)
DIN	Digital Input used to measure active high or low signals
DM	Diagnostic Message (from SAE J1939 standard)
DTC	Diagnostic Trouble Code (from SAE J1939 standard)
EA	Axiomatic Electronic Assistant (A Service Tool for Axiomatic ECUs)
ECU	Electronic Control Unit (from SAE J1939 standard)
GND	Ground reference (a.k.a. BATT-)
I/O	Inputs and Outputs
MAP	Memory Access Protocol
NAK	Negative Acknowledgement (from SAE J1939 standard)
PDU1	A format for messages that are to be sent to a destination address, either specific or global (from SAE J1939 standard)
PDU2	A format used to send information that has been labeled using the Group Extension technique, and does not contain a destination address.
PGN	Parameter Group Number (from SAE J1939 standard)
PropA	Message that uses the Proprietary A PGN for peer-to-peer communication
PropB	Message that uses a Proprietary B PGN for broadcast communication
PWM	Pulse Width Modulation
RPM	Rotations per Minute
SPN	Suspect Parameter Number (from SAE J1939 standard)
TP	Transport Protocol
UIN	Universal input used to measure voltage, current, frequency or digital inputs
Vps	Voltage Power Supply (a.k.a. BATT+)
%dc	Percent Duty Cycle (Measured from a PWM input)

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REFERENCES

J1939	Recommended Practice for a Serial Control and Communications Vehicle Network, SAE, April 2011
J1939/21	Data Link Layer, SAE, December 2010
J1939/71	Vehicle Application Layer, SAE, March 2011
J1939/73	Application Layer-Diagnostics, SAE, February 2010
J1939/81	Network Management, SAE, March 2017
TDAX130760	Technical Datasheet, Axiomatic Technologies 2023
UMAX07050x	User Manual, Axiomatic Electronic Assistant and USB-CAN, Axiomatic Technologies, July 2023

This document assumes the reader is familiar with the SAE J1939 standard. Terminology from the standard is used, but not described in this document.

NOTE: This product is supported by Axiomatic Electronic Assistant V4.10.78.0 and higher.

1. OVERVIEW OF CONTROLLER

This User Manual describes the architecture and functionality of the CAN to 1 Analog Output Controller (CAN-1AOUT). It accepts power supply voltages from 9 to 36 VDC. All logical function blocks on the unit are inherently independent from one another but can be configured to interact with each other. All parameters are configurable using Axiomatic Electronic Assistant. Figure 1 below shows the hardware features. The J1939 CAN network can operate at standard 250 and 500kbit/s and non-standard 667kbit/s and 1Mbit/s baud rates. The required baud rate is detected automatically upon connection to the CAN network.

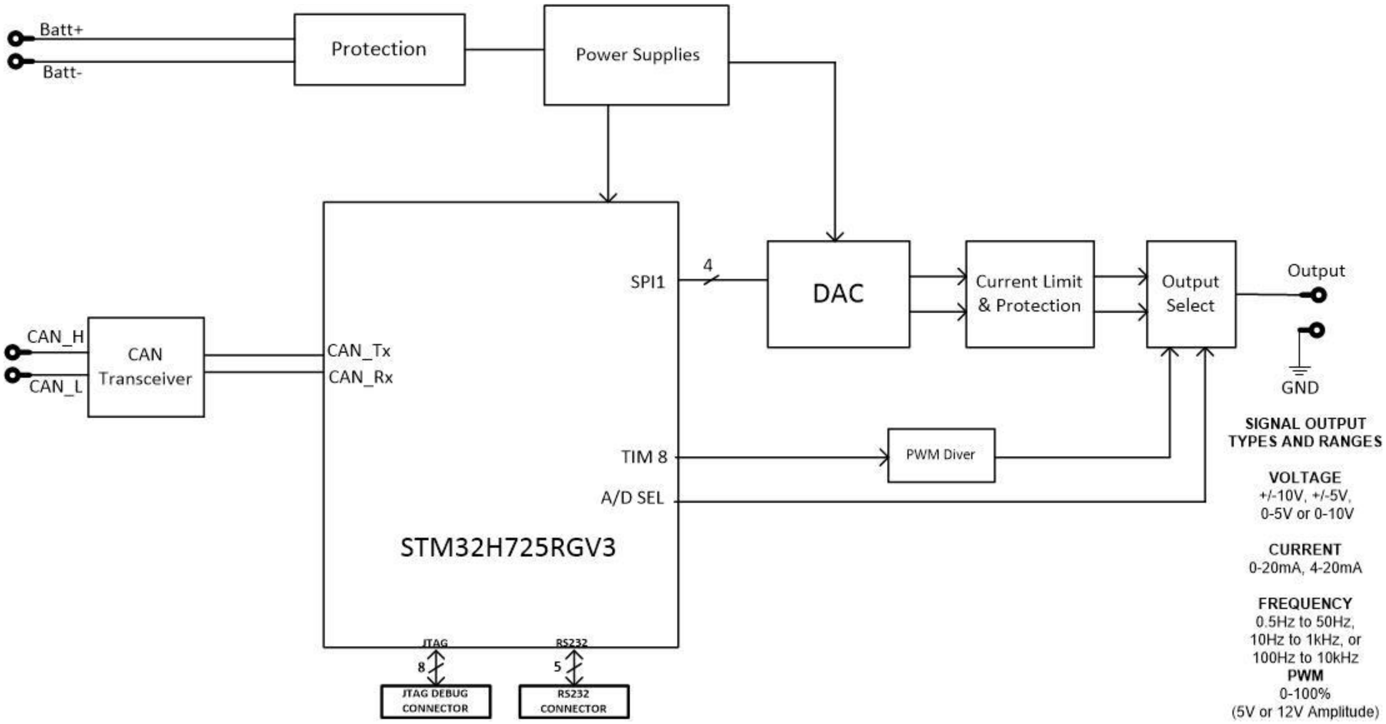


Figure 1 The ECU Flowchart

This controller is designed for versatile control of CAN bus to 1 analog/digital output. The control algorithms/function blocks allow the user to configure the controller for a wide range of applications without the need for custom firmware. The various function blocks supported by this controller are outlined in the following sections. The hardware design allows for the controller to have a wide range of output types: *Analog Current, Analog Voltage, Digital PWM, Digital Frequency and Digital ON/OFF.* Output Blocks are described in more detail in section 1.1.

1.1. Output Function Block

The CAN-4AOUT controller has 1 analog/digital output that can be configured. The “Output Type” parameter determines what kind of signal the output produces. Changing this parameter will update other parameters in the group to match the selected type. For this reason, it should be the first parameter to be changed. The supported output types by the controller are listed in Table 1 below. By default, outputs are configured as ‘2, Analog Voltage’ type.

Value	**Meaning**
0	*Output Not Used*
1	*Analog Current*
2	***Analog Voltage***
3	*Digital PWM*
4	*Digital Frequency*
5	*Digital ON/OFF*

Table 1 - Analog Output Type Options

The control signal of the outputs will have associated with it a minimum and maximum values. Besides type ‘Digital ON/OFF’, all the other output types are always responding in a linear fashion to changes in the control source per the calculation in Figure 2.

$$y = mx + a$$

$$m = \frac{Y\max - Y\min}{X\max - X\min}$$

$$a = Y\min - m * X\min$$

Figure 2 - Linear Slope Calculations

Where X and Y are defined as:

X_{min} = Control Input Minimum Y_{min} = “Output At Minimum Command”

X_{max} = Control Input Maximum Y_{max} = “Output At Maximum Command”

In all cases, while the X-axis has the constraint that $X_{min} < X_{max}$, there is no such limitation on the Y-axis. This allows for a negative slope so that as the control input signal increases, the target output value decreases. Or it allows output to follow control signal inversely.

By default, when the outputs are in Current/Voltage mode, outputs are driven with a high frequency 25kHz signal. It can be changed through the setpoint “Fixed Frequency/Duty Cycle”. However, this value should not be lowered under these two modes without taking into consideration how this affects the accuracy and stability of the outputs. When the outputs are in PWM mode, this setpoint can be used to change the desired frequency of the waveform while when in Frequency mode, it is used to change the duty cycle of the output waveform. Since all four outputs are connected to independent timers, this parameter can be changed at any time for each output without affecting the other.

1.1.1. Analog Current/Analog Voltage

Current Outputs can be configured to different ranges as 0-20mA, 4-20mA and +/- 20mA and Voltage Outputs can be configured to 0-5V, 0-10V, +/-5V and +/-10V. Simply setting the "**Output at Minimum Command**" and "**Output at Maximum Command**" to corresponding value in each range will drive the output to different range options. The unit of measurement for current output variables is milliamps [mA] and volts [V] for voltage outputs.

1.1.2. Digital PWM/Digital Frequency

Pulse Width Modulated outputs use a fixed frequency determined by the value in the "**Fixed Frequency/Duty Cycle**" setpoint and frequency outputs use a fixed duty cycle as selected by this setpoint. The "**Digital Type VPS range**" setpoint determines if the signal will toggle between 0V and +5V or +12V. This setpoint is unavailable for current/voltage type. The unit of measurement for PWM output variables is percentage [%] and Hertz [Hz] for the frequency outputs.

1.1.3. Digital ON/OFF

The **"Digital Type VPS range"** setpoint determines if the output is at *+5V* or *+12V* when ON. If a non-digital control is selected for this type, the command state will be OFF at or below the minimum input, ON at or above the maximum input, and it will not change in between those points. In other words, the input has its built-in hysteresis, as shown in Figure 3. This relationship is true for any function block that has a non-digital input mapped to a digital control.

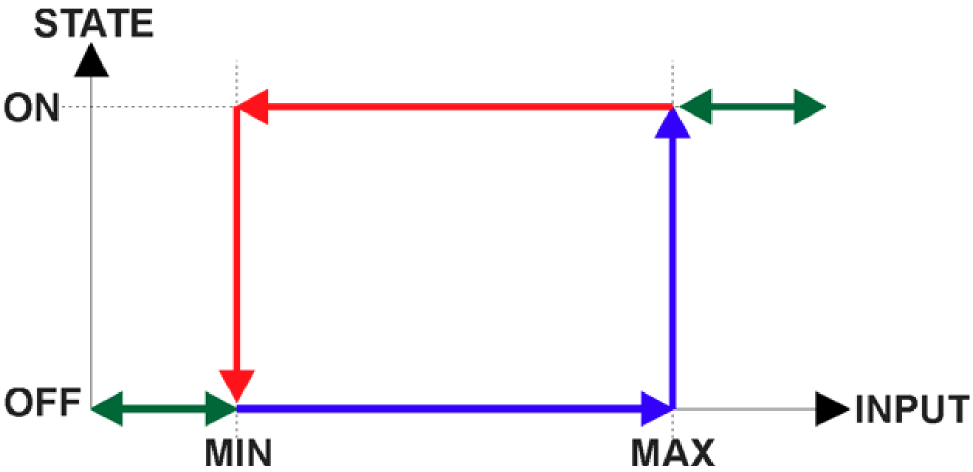


Figure 3 - Analog to Digital Input

Only when a *'Digital ON/OFF'* type has been selected will the **"Digital Control Response"** setpoint be enabled as shown in Table 2

Value	**Meaning**
0	***Normal Logic***
1	*Inverse Logic*
2	*Latched Logic*
3	*Blinking Logic*

Table 2 - Digital Control Response Options

When the outputs are being driven by the Control Input, the state is logically set to OFF when the Control Input is zero and is set to ON whenever a non-zero value is written. By default, '*Normal Logic'* is used. The resulting Drive State will depend on the "**Digital Control Response**" as per Table 3.

Value	**Meaning**	**Logic State**	**Drive State**
0	***Normal Logic***	OFF	OFF
		ON	ON
1	*Inverse Logic*	OFF	ON
		ON	OFF
2	*Latched Logic*	ON to OFF	No change
		OFF to ON	State change (i.e., OFF to ON or ON to OFF)
3	*Blinking Logic*	OFF	OFF
		ON	Toggling OFF and ON at the rate defined in setpoint "**Digital Blink Rate**" (in ms)

Table 3 - Digital ON/OFF Logic

1.1.4. Common Parameters

In order to prevent abrupt changes at the output due to sudden changes in the command input, the user can choose to use the independent up or down ramps to smooth out the response. The **"Ramp Up (Min to Max)"** and **"Ramp Down (Max to Min)"** parameters are in milliseconds, and the step size of the output change will be determined by taking the absolute value of the output range and dividing it by the ramp time. However, these setpoints are set to zero by default since in most signal conversion applications, fast response times are desired.

By default, the **"Control Source"** is setup to be *'CAN Receive Message'* In other words, all the outputs will response in a linear fashion to the corresponding CAN received command data.

The **"Control Source"** together with **"Control Number"** parameter determine which signal is used to drive the output. For example, setting **"Control Source"** to *'CAN Receive Message'* and **"Control Number"** to '*1'* will connect signal measured from CAN Receive 1 to the output in question. The options for **"Control Sources"** and available **"Control Number"** are listed in Table 4.

Control Source	**Number Range**	**Notes**
0: Control Not Used	N/A	When this is selected, it disables all other setpoints associated with the signal in question.
1: Received CAN Message	1 to 10	
2: Lookup Table	1 to 10	
3: Programmable Logic	1 to 4	
4: Math Logic	1 to 5	
5: Conditional Logic	1 to 10	
6: Set-Reset Latch	1 to 5	
7: Constant Data	1 to 15	
8: Power Supply Measured	0 to 255	Measured power supply value in Volts. The Parameter sets the threshold in Volts to compare with.
9: Processor Temperature Measured	0 to 255	Measured processor temperature in °C. The Parameter sets the threshold in Celsius to compare with.
10: CAN Reception Timeout	1 to 10	
11: DTC React	1 to 16	

Table 4 - Control Sources and Numbers

In addition to the Control input, the function block also supports an enable input which can be setup as either an enable or disable signal.

When an Enable input is used, the output will be shutoff as per the **"Enable Response"** in Table 5. If the response is selected as a disable signal (3 or 4), when the enable input is ON, the output will be shut off.

Value	**Meaning**
0	*Enable When On, Else Shutoff*
1	*Enable When On, Else Rampoff*
2	*Enable When On, Else Keep Last Value*
3	***Enable When Off, Else Shutoff***
4	*Enable When Off, Else Rampoff*
5	*Enable When Off, Else Keep Last Value*

Table 5 - Enable Response Options

The Override option allows the user to choose whether or not to drive the output with the override input being engaged/disengaged, depending on the logic selected in **"Override Response."** The options for **"Override Response"** listed in Table 6. When override is active, the output will be driven to the value in "**Output at Override Command**" regardless of the value of the Control input.

Value	Meaning
0	***Override When ON***
1	*Override When OFF*

Table 6 - Override Response Options

The options for both **“Enable Source”** and **“Override Source”** are same as sources listed in Table 4.

1.2. Diagnostic Function Blocks

1.2.1. Description

The ECU supports diagnostic messaging. DM1 message is a message, containing Active Diagnostic Trouble Codes (DTC) that is sent to the J1939 network in case a fault has been detected. A Diagnostic Trouble Code is defined by the J1939 standard as a four byte value which is a combination of:

SPN	Suspect Parameter Number	(user defined)
FMI	Failure Mode Identifier	(see Table 9)
CM	Conversion Method	(always set to 0)
OC	Occurrence Count	(number of times the fault has happened)

In addition to supporting the DM1 message, the ECU Input also supports:

DM2	Previously Active Diagnostic Trouble Codes	Sent only on request
DM3	Diagnostic Data Clear/Reset of Previously Active DTCs	Done only on request
DM11	Diagnostic Data Clear/Reset for Active DTCs	Done only on request

Fault detection and reaction is a standalone functionality that can be configured to monitor and report diagnostics of various controller parameters.
By default, the monitoring of operating voltage, CPU temperature and receive message timeouts is configured to diagnostics blocks 1, 2 and 3., In case any of these three diagnostics blocks are needed for some other use, the default settings can be adjusted by the user to suit the application.
There are 4 fault types that can be used, *“Minimum and maximum error”, “Absolute value error”, “State error”* and *“Double minimum and maximum error”.*
“Minimum and maximum error” has two thresholds, *“MIN Shutdown”* and *“MAX Shutdown”* that have configurable, independent diagnostics parameters (SPN, FMI, Generate DTCs, delay before flagging status). In case the parameter to monitor stays between these two thresholds, the diagnostic is not flagged.

Absolute value error has one configurable threshold with configurable parameters. In case the parameter to monitor stays below this threshold, the diagnostic is not flagged.
State error is similar to the Absolute value error, the only difference is that State error does not allow the user to specify specific threshold values; thresholds ‘1’ and ‘0’ are used instead. This is ideal for monitoring state information, such as received message timeouts.

Double minimum and maximum error lets user to specify four thresholds, each with independent diagnostic parameters. The diagnostic status and threshold values is determined and expected as show in Figure 4 below.

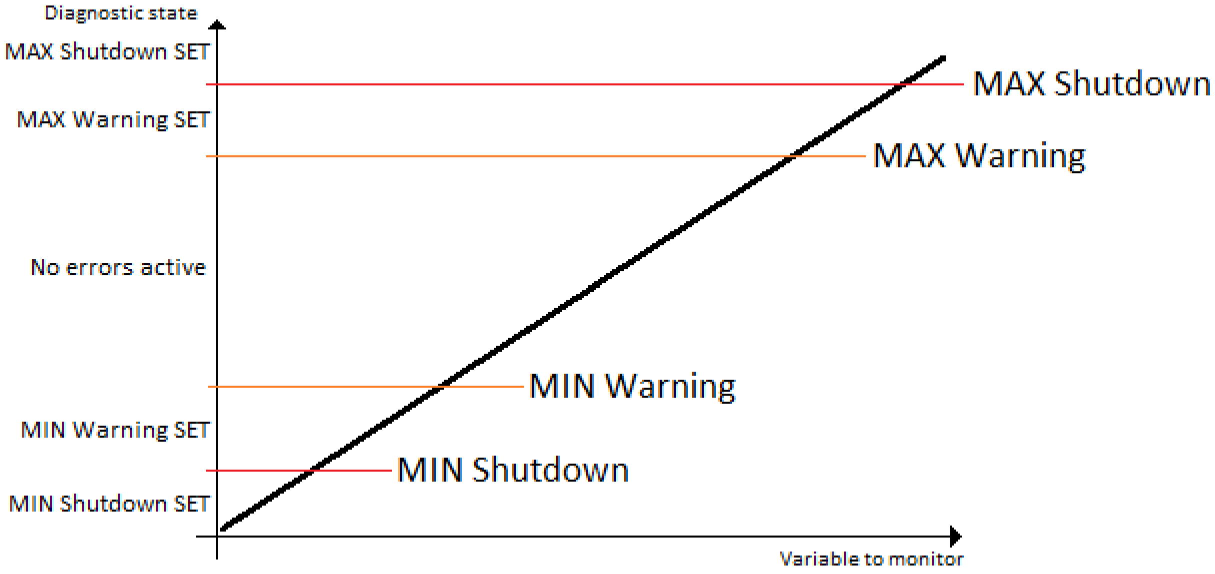


Figure 4 - Double Minimum and Maximum Error Thresholds

In case any of the Diagnostics blocks is configured to monitor Output Current Feedback, there is an internal error status flag maintained automatically for that particular output. This internal flag can be used for driving the particular output to a specified state in case of diagnostic event using Proportional Current Output setpoints ***"Control Fault Response"***, ***"Output in Fault Mode"*** and ***"Fault Detection Enabled"***.

There is also built in error status flags for power supply and CPU temperature monitoring. In case any of the diagnostics blocks is measuring these two parameters, the corresponding internal error status flags can be used for shutting down the unit in case of failure. The setpoints *"**Power Fault Disables Outputs**" and "**Over Temperature Shutdown**"* can be used for enabling the shutdown of the unit (shutdown == output driving is turned off).

While there are no active DTCs, the ECU will send "No Active Faults" message. If a previously inactive DTC becomes active, a DM1 will be sent immediately to reflect this. As soon as the last active DTC goes inactive, a DM1 indicating that there are no more active DTCs will be sent.

If there is more than one active DTC at any given time, the regular DM1 message will be sent using a multipacket message to the Requester Address using the Transport Protocol (TP).

At power up, the DM1 message will not be broadcasted until after 5 second delay. This is done to prevent any power up or initialization conditions from being flagged as an active error on the network.

When the fault is linked to a DTC, a non-volatile log of the occurrence count (OC) is kept. As soon as the controller detects a new (previously inactive) fault, it will start decrementing the *"**Delay Before Event is Flagged**"* timer for that Diagnostic function block. If the fault has remained present during the delay time, then the controller will set the DTC to active, and will increment the OC in the log. A DM1 will immediately be generated that includes the new DTC. The timer is provided so that intermittent faults do not overwhelm the network as the fault comes and goes, since a DM1 message would be sent every time the fault shows up or goes away.

By default, the fault flag is cleared when error condition that has caused it goes away. The DTC is made Previously Active and is it is no longer included in the DM1 message. To identify a fault having happened, even if the condition that has caused is one away, the "**Event Cleared only by DM11**" setpoint can be set to '*True*'. This configuration enables DTC to stay Active, even after the fault flag has been cleared, and be included in DM1 message until a Diagnostic Data Clear/Reset for Active DTCs (DM11) has been requested.

As defined by J1939 Standard the first byte of the DM1 message reflects the Lamp status. ***"Lamp Set by Event"*** setpoint determines the lamp type set in this byte of DTC. ***"Lamp Set by Event"*** setpoint options are listed in Table 7. By default, the '*Amber, Warning'* lamp is typically the one set be any active fault.

Table 7 – Lamp Set by Event in DM1 Options

0	*Protect*
1	*Amber Warning*
2	*Red Stop*
3	*Malfunction*

"SPN for Event" defines suspect parameter number used as part of DTC. The default value zero is not allowed by the standard, thus no DM will be sent unless ***"SPN for Event"*** in is configured to be different from zero. **It is user's responsibility to select SPN that will not violate J1939 standard.** When the ***"SPN for Event"*** is changed, the OC of the associated error log is automatically reset to zero.

Table 8 – FMI for Event Options

0	*Data Valid But Above Normal Operational Range - Most Severe Level*
1	*Data Valid But Below Normal Operational Range - Most Severe Level*
2	*Data Intermittent*
3	*Voltage Above Normal, Or Shorted To High Source*
4	*Voltage Below Normal, Or Shorted To Low Source*
5	*Current Below Normal Or Open Circuit*
6	*Current Above Normal Or Grounded Circuit*
7	*Mechanical Error*
8	*Abnormal Frequency Or Pulse Width Or Period*
9	*Abnormal Update Rate*
10	*Abnormal Rate Of Change*
11	*Root Cause Not Known*
12	*Bad Component*
13	*Out Of Calibration*
14	*Special Instructions*
15	*Data Valid But Above Normal Operating Range – Least Severe Level*
16	*Data Valid But Above Normal Operating Range – Moderately Severe Level*
17	*Data Valid But Below Normal Operating Range – Least Severe Level*
18	*Data Valid But Below Normal Operating Range – Moderately Severe Level*
19	*Network Error*
20	*Data Drifted High*
21	*Data Drifted Low*
31	*Condition Exists*

Every fault has associated a default FMI with them. The used FMI can be configured with ***"FMI for Event"*** setpoint, presented in Table 8. When an FMI is selected from Low Fault FMIs in Table 9 for a fault that can be flagged either high or low occurrence, it is recommended that the user would select the high occurrence FMI from the right column of Table 9. There is no automatic setting of High and Low FMIs in the firmware, the user can configure these freely.

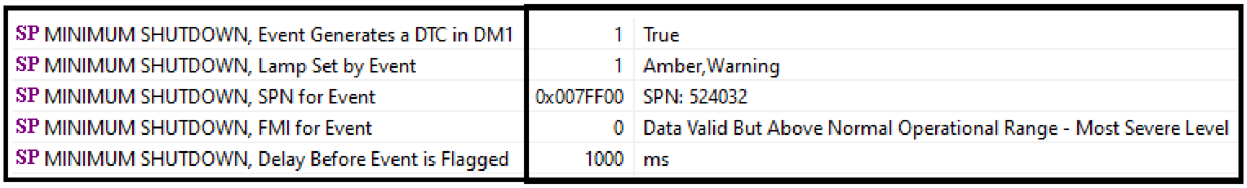
Table 9 – Low Fault FMIs and corresponding High Fault FMIs

Low Fault FMIs	High Fault FMIs
FMI=1, Data Valid But Below Normal Operation Range – Most Severe Level	*FMI=0, Data Valid But Above Normal Operational Range – Most Severe Level*
FMI=4, Voltage Below Normal, Or Shorted to Low Source	*FMI=3, Voltage Above Normal, Or Shorted To High Source*
FMI=5, Current Below Normal Or Open Circuit	*FMI=6, Current Above Normal Or Grounded Circuit*
FMI=17, Data Valid But Below Normal Operating Range – Least Severe Level	*FMI=15, Data Valid But Above Normal Operating Range – Least Severe Level*
FMI=18, Data Valid But Below Normal Operating Level – Moderately Severe Level	*FMI=16, Data Valid But Above Normal Operating Range – Moderately Severe Level*
FMI=21, Data Drifted Low	*FMI=20, Data Drifted High*

1.2.2. Example

In this example the Diagnostic Function Block is configured to monitor the power supply voltage level and send the DM1 message if the voltage level drops under 11V.

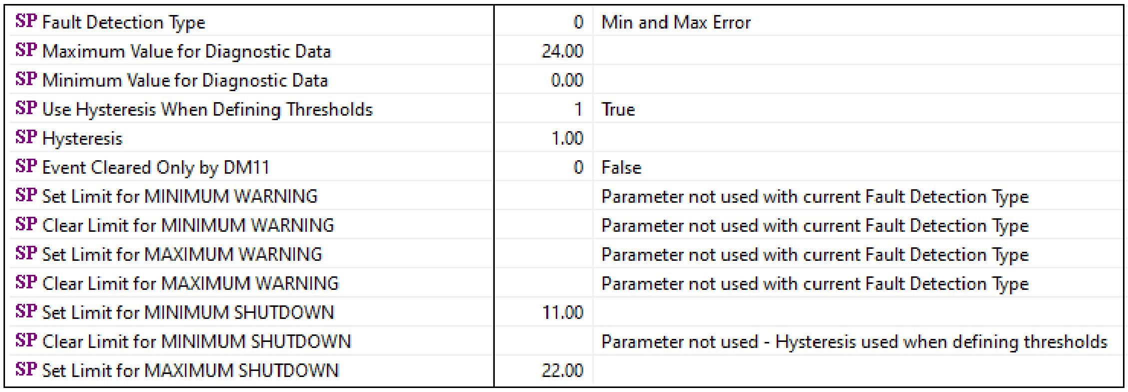
Here is the DM1 message configuration:



SP MINIMUM SHUTDOWN, Event Generates a DTC in DM1	1	True
SP MINIMUM SHUTDOWN, Lamp Set by Event	1	Amber,Warning
SP MINIMUM SHUTDOWN, SPN for Event	0x007FF00	SPN: 524032
SP MINIMUM SHUTDOWN, FMI for Event	0	Data Valid But Above Normal Operational Range - Most Severe Level
SP MINIMUM SHUTDOWN, Delay Before Event is Flagged	1000	ms

*Please note: even though the Diagnostics Function Block is configured as **"Min and Max Error"**, only he low limit will be monitored. Thus a **"Event Generates a DTC in DM1"** setpoint for a maximum shutdown limit is set to 0, False.*

To monitor the supply voltage, the ***"Function Type to Monitor*"** setpoint is set to *'Power Supply Measured'.* The rest of configurations are shown on the Figure 5.

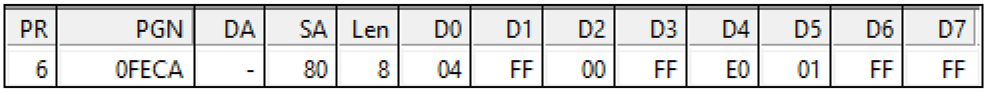


SP Fault Detection Type	0	Min and Max Error
SP Maximum Value for Diagnostic Data	24.00	
SP Minimum Value for Diagnostic Data	0.00	
SP Use Hysteresis When Defining Thresholds	1	True
SP Hysteresis	1.00	
SP Event Cleared Only by DM11	0	False
SP Set Limit for MINIMUM WARNING		Parameter not used with current Fault Detection Type
SP Clear Limit for MINIMUM WARNING		Parameter not used with current Fault Detection Type
SP Set Limit for MAXIMUM WARNING		Parameter not used with current Fault Detection Type
SP Clear Limit for MAXIMUM WARNING		Parameter not used with current Fault Detection Type
SP Set Limit for MINIMUM SHUTDOWN	11.00	
SP Clear Limit for MINIMUM SHUTDOWN		Parameter not used - Hysteresis used when defining thresholds
SP Set Limit for MAXIMUM SHUTDOWN	22.00	

Figure 5. The Diagnostics Configuration

With this configuration, when the power supply voltage measured drops below ***"Set Limit for MINIMUM SHUTDOWN"***, the DM1 message with a fault information will be broadcasted after a programmed in ***"Delay Before Event is Flagged"*** value in milliseconds.

The example of the DM1 message is shown below.



PR	PGN	DA	SA	Len	D0	D1	D2	D3	D4	D5	D6	D7
6	0FECA	-	80	8	04	FF	00	FF	E0	01	FF	FF

Figure 6. The Example of DM1 Message

1.3. Math Function Block

1.3.1. Description

There are five mathematical function blocks that allow the user to define basic algorithms. A math function block can take up to six input signals. Each input is then scaled according to the associated limit and scaling setpoints.

Inputs are converted into percentage value based on the ***“Input X Minimum”*** and “Input X Maximum” values selected. For additional control the user can also adjust the “Input X Gain” setpoint to increase the resolution of the input data and the min and max values.

A mathematical function block includes three selectable functions, in which each implements equation A operator B, where A and B are function inputs and operator is function selected with a setpoint ***“Math Function X”***. Setpoint options are presented in Table 10. The functions are connected together, so that result of the preceding function goes into Input A of the next function. Thus, Function 1 has both Input A and Input B selectable with setpoints, where Functions 2 to 4 have only Input B selectable. Input is selected by setting ***“Function X Input Y Source”*** and ***“Function X Input Y Number”***. If ***“Function X Input B Source”*** is set to 0 *‘Control not used’* signal goes through function unchanged.

$$Math\ Block\ Output = \Big(\big((A1\ op1\ B1)op2\ B2\big)op3\ B3\Big)op4\ B4$$

Table 10. Math function X Operator Options

0	=, True when InA equals InB
1	!=, True when InA not equal InB
2	>, True when InA greater than InB
3	>=, True when InA greater than or equal InB
4	<, True when InA less than InB
5	<=, True when InA less than or equal InB
6	OR, True when InA or InB is True
7	AND, True when InA and InB are True
8	XOR, True when either InA or InB is True, but not both
9	+, Result = InA plus InB
10	-, Result = InA minus InB
11	x, Result = InA times InB
12	/, Result = InA divided by InB
13	MIN, Result = Smallest of InA and InB
14	MAX, Result = Largest of InA and InB

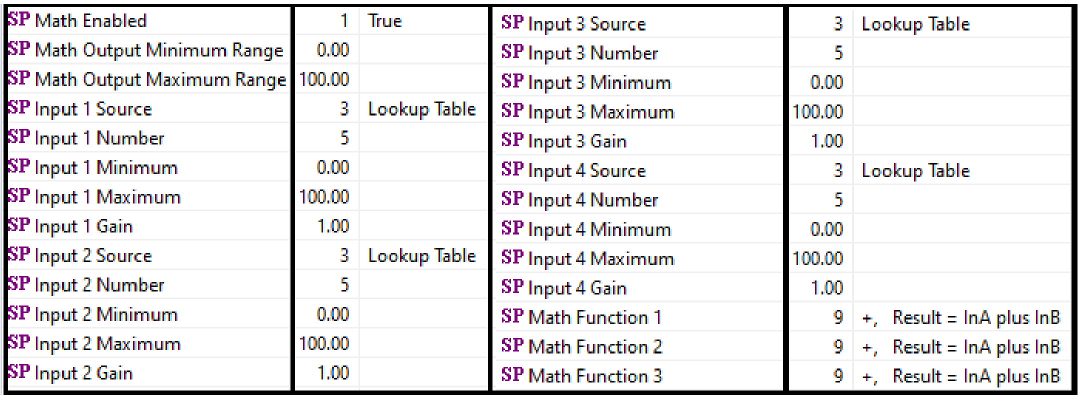
For logic operations (6, 7, and 8) scaled input greater than or equal to 1 is treated as TRUE. For logic operations (0 to 8), the result of the function will always be 0 (FALSE) of 1 (TRUE). For the arithmetic functions (9 to 14), it is recommended to scale the data such that the resulting operation will not exceed full scale (0 to 100%) and saturate the output result.

When dividing, a zero divider will always result in a 100% output value for the associated function.

Lastly the resulting mathematical calculation, presented as a percentage value, can be scaled into the appropriate physical units using the ***“Math Output Minimum Range”*** and ***“Math Output Maximum Range”*** setpoints. These values are also used as the limits when the Math Function is selected as the input source for another function block.

1.3.2. Example

This example shows the Math Function Block configured to provide a 4x times the input. There are multiple ways to configure Math Block to do it. One of them is shown below.



SP Math Enabled	1	True	SP Input 3 Source	3	Lookup Table
SP Math Output Minimum Range	0.00		SP Input 3 Number	5	
SP Math Output Maximum Range	100.00		SP Input 3 Minimum	0.00	
SP Input 1 Source	3	Lookup Table	SP Input 3 Maximum	100.00	
SP Input 1 Number	5		SP Input 3 Gain	1.00	
SP Input 1 Minimum	0.00		SP Input 4 Source	3	Lookup Table
SP Input 1 Maximum	100.00		SP Input 4 Number	5	
SP Input 1 Gain	1.00		SP Input 4 Minimum	0.00	
SP Input 2 Source	3	Lookup Table	SP Input 4 Maximum	100.00	
SP Input 2 Number	5		SP Input 4 Gain	1.00	
SP Input 2 Minimum	0.00		SP Math Function 1	9	+, Result = InA plus InB
SP Input 2 Maximum	100.00		SP Math Function 2	9	+, Result = InA plus InB
SP Input 2 Gain	1.00		SP Math Function 3	9	+, Result = InA plus InB

Figure 7. Math Configuration

As an input source the Lookup Table in Time Response mode is used. It ramps the data from 0 to 20 within 5 seconds, thus the Math Output is ranging from 0 to 80. The Math output is on the right with a scale of 10 per 1 square. On the left side there is the LUT output with a scale of 2 per 1 square.

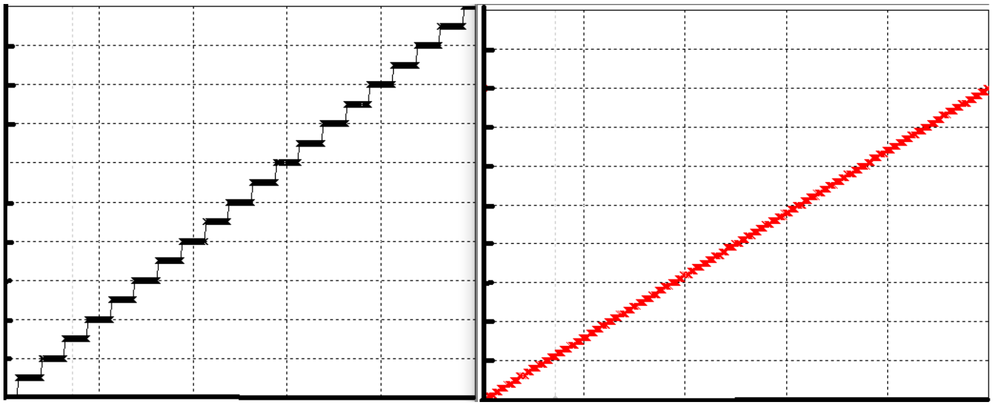


Figure 8. The Math Function Block Output

1.4. Conditional Block

1.4.1. Description

The Conditional Block compares up to four different input sources with different logical or relational operators. The result of each block can therefore only be true (1) or false (0). Figure 9 demonstrates the connections between all parameters.

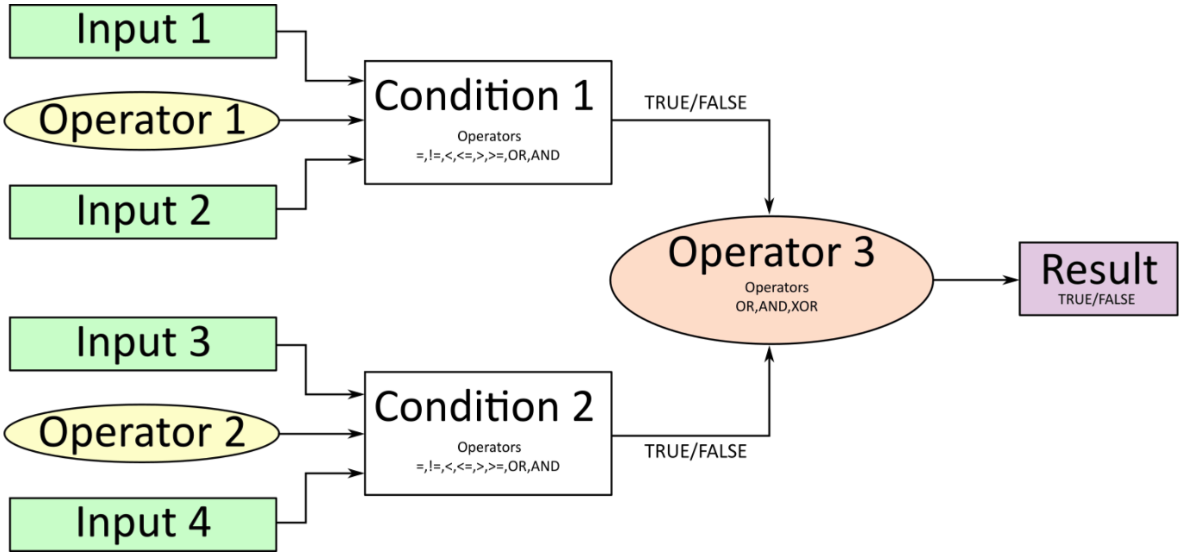


Figure 9: Conditional Block Diagram

Each Conditional Block offers two conditions. Both compare two inputs, which can hold a logical value or an integer value. The output of the conditions can only be true or false and will be compared by Operator 3 with a logical operator. This comparison is the result of the Conditional Block and can control any output source.

Value of each source will then be compared to each other with an operator of Table 11. If no source is selected, the output value of an Input will be zero.

Table 11. Input Operator Options

Value	Meaning
0	==, True when Argument 1 is equal to Argument 2
1	!=, True when Argument 1 is not equal to Argument 2
2	>, True when Argument 1 is greater than Argument 2
3	>=, True when Argument 1 is greater than Argument 2
4	<, True when Argument 1 is less than Argument 2
5	<=, True when Argument 1 is less than or equal Argument 2
6	OR, True when Argument 1 or Argument 2 is True
7	AND, True when Argument 1 and Argument 2 are True

Operator 1 and Operator 2 are configured to OR by default. The table above cannot be used for comparing the conditions because they can only be compared with logical operators, which are listed in Table 12.

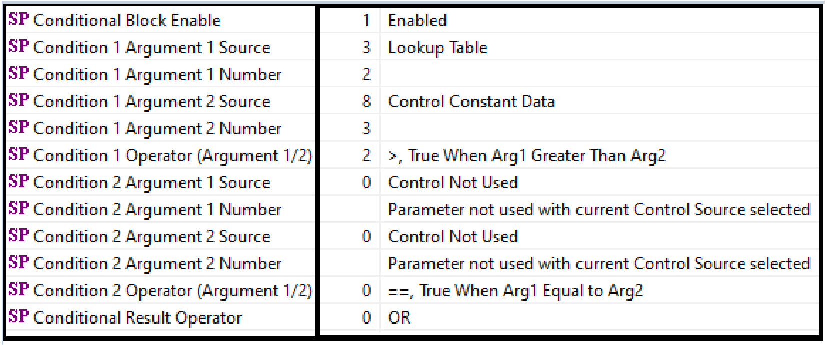
Table 12. Condition Operator Options

Value	Meaning
0	OR, True when Argument 1 or Argument 2 is True
1	AND, True when Argument 1 and Argument 2 are True
2	XOR, True when Argument 1 is not equal to Argument 2

If only one condition is used, it is to make sure that Operator 3 is set to OR so that the result is based solely on the condition which has been chosen.

1.4.2. Example

This example shows the Conditional Logic Block configured to set the output to 1, True if the input data is more than 50. The configuration is shown below.



SP Conditional Block Enable	1	Enabled
SP Condition 1 Argument 1 Source	3	Lookup Table
SP Condition 1 Argument 1 Number	2	
SP Condition 1 Argument 2 Source	8	Control Constant Data
SP Condition 1 Argument 2 Number	3	
SP Condition 1 Operator (Argument 1/2)	2	>, True When Arg1 Greater Than Arg2
SP Condition 2 Argument 1 Source	0	Control Not Used
SP Condition 2 Argument 1 Number		Parameter not used with current Control Source selected
SP Condition 2 Argument 2 Source	0	Control Not Used
SP Condition 2 Argument 2 Number		Parameter not used with current Control Source selected
SP Condition 2 Operator (Argument 1/2)	0	==, True When Arg1 Equal to Arg2
SP Conditional Result Operator	0	OR

As a control source, the Lookup Table output is used. The LUT is program to ramp the output from 0 to 100 and it is shown on the left of the picture below. The Conditional logic output is shown on the right side of the figure.

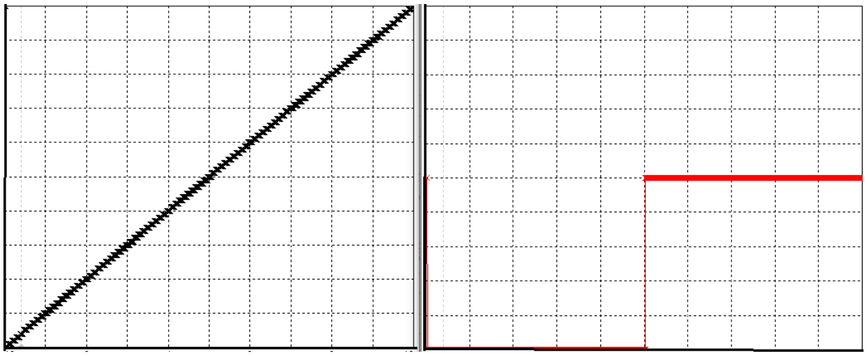


Figure 10. The conditional Logic Block's Output

1.5. Set / Reset Latch Function Block

Set-Reset Block consists of only 2 control sources: Reset Source and Set Source. The purpose of these blocks is to simulate a modified latching function in which the ‘Reset Signal’ has more precedence. The ‘latching’ function works as per the Table 13 below.

Table 13. Set-Reset Function block operation

‘Set Signal’	‘Reset Signal’	‘Set-Reset Block Output’ (Initial State: OFF)
OFF	OFF	Latched State
OFF	ON	OFF
ON	OFF	ON
ON	ON	OFF

The Reset and Set sources have associated with them a minimum and maximum threshold values which determine the ON and OFF state. For the Reset Source are Reset Minimum Threshold and Reset Maximum Threshold. Similarly, for the Set Source are Set Minimum Threshold and Set Maximum Threshold. These setpoints also allow to have a dead band in between ON/OFF states and they are in terms of percentage of input selected.

As seen in Table 13 above, the ‘Reset Signal’ has more precedence over the ‘Set Signal’ - if the state of ‘Reset Signal’ is ON, the state of ‘Set-Reset Block Output’ will be OFF. To create an ON state in ‘Set-Reset Block Output’ the state of ‘Reset Signal’ must be OFF while the state of ‘Set Signal’ is ON. In this case, the state of ‘Set-Reset Block Output’ will remain ON even if ‘Set Signal’ turns OFF as long as ‘Reset Signal’ remains OFF. As soon as the ‘Reset Signal’ turns ON the ‘Set-Reset Block Output’ will turn OFF regardless of the state of ‘Set Signal’.

1.6. Lookup Table Function Block

1.6.1. Description

Lookup Tables are used to give output response up to 10 slopes per input. If more than 10 slopes are required, A Programmable Logic Block can be used to combine up to three tables to get 30 slopes as described in Section 1.7.

Lookup tables have two differing modes defined by ***“X-Axis Type”*** setpoint, given in Table 14. Option ‘*0 – Data Response*’ is the normal mode where block input signal is selected with the ***“X-Axis Source”*** and ***“X-Axis Number”*** setpoints and X values present directly input signal values. With option *‘1 – Time Response’* the input signal is time and X values present time in milliseconds. And selected input signal is used as digital enable.

Table 14. X-Axis Type Options

0	Data Response
1	Time Response

The ***“Auto Repeat”*** setpoint determines either lookup table’s output cycle is repeated after reaching the last configured ***“Point Y#”***. This setpoint is used only if **“*X-Axis Type*”** is set to *‘1 – Time Response’*, and doesn’t affect the output in if it set to ‘*0 - Data Response*’ mode.

The slopes are defined with (x, y) points and associated point response. X value presents input signal value and Y value corresponding Lookup Table output value. “***Response #***” setpoint defines type of the slope from preceding point to the point in question. Response options are given in Table 15. ‘*Ramp To’* gives a linearized slope between points, whereas ‘Jump to’ gives a point-to-point response, where any input value between XN-1 and XN will result Lookup Table output being YN. ***“Response 0”*** is always *‘Jump To’* and cannot be edited. Choosing *‘Ignored’* response causes associated point and all the following points to be ignored.

Table 15. Response # Options

0	Ignore
1	Ramp To
2	Jump To

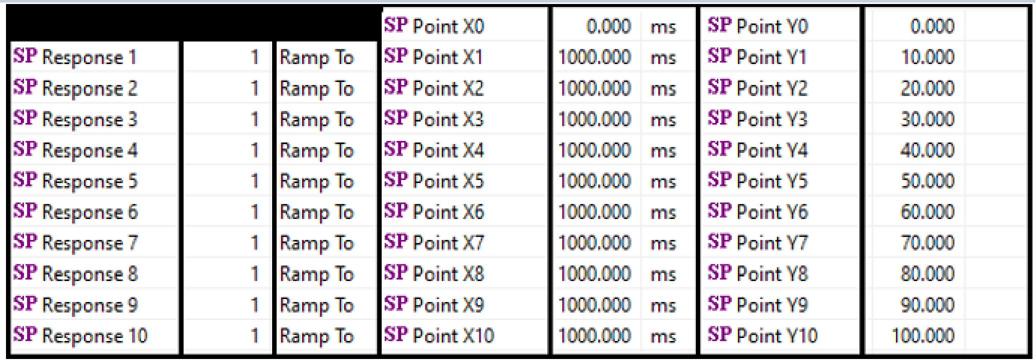
The X-Axis is constraint to be in rising order, thus value of the next index is greater than or equal to preceding one. Therefore, when adjusting the X-Axis data, it is recommended that X10 is changed first, then lower indexes in descending order.

$$Xmin <= X_0 <= X_1 <= X_2 <= X_3 <= X_4 <= X_5 <= X_6 <= X_7 <= X_8 <= X_9 <= X_{10} <= Xmax$$

The Y-Axis has no constraints on the data it presents, thus inverse, decreasing, increasing or other response can be easily established. The Smallest of the Y-Axis values is used as Lookup Table output min and the largest of the Y-Axis values is used as Lookup Table output max (i.e. used as Xmin and Xmax values in linear calculation.). Ignored points are not considered for min and max values.

1.6.2. Example

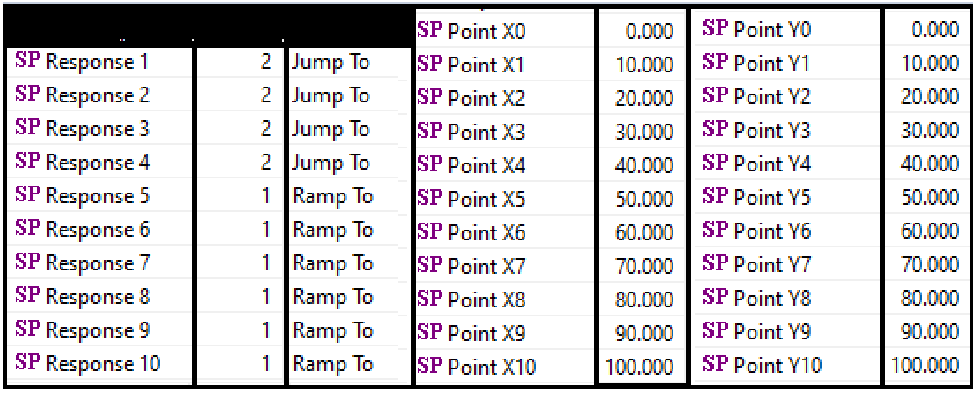
This example is designed to represent the Lookup Table function block in various modes. First lookup table is configured as Time Response with all responses set to ‘*1 – Ramp To*’. The **“*X-Axis Type*”** is set to *‘1 – Time Response’*, and the ***“Auto Repeat”*** *setpoint is set to ’1 – True’.* The control source is set to the ’*Control Constant Data*’ with a value of 1 to be constantly active. The configuration of other setpoints is shown below.



			SP Point X0	0.000	ms	SP Point Y0	0.000
SP Response 1	1	Ramp To	SP Point X1	1000.000	ms	SP Point Y1	10.000
SP Response 2	1	Ramp To	SP Point X2	1000.000	ms	SP Point Y2	20.000
SP Response 3	1	Ramp To	SP Point X3	1000.000	ms	SP Point Y3	30.000
SP Response 4	1	Ramp To	SP Point X4	1000.000	ms	SP Point Y4	40.000
SP Response 5	1	Ramp To	SP Point X5	1000.000	ms	SP Point Y5	50.000
SP Response 6	1	Ramp To	SP Point X6	1000.000	ms	SP Point Y6	60.000
SP Response 7	1	Ramp To	SP Point X7	1000.000	ms	SP Point Y7	70.000
SP Response 8	1	Ramp To	SP Point X8	1000.000	ms	SP Point Y8	80.000
SP Response 9	1	Ramp To	SP Point X9	1000.000	ms	SP Point Y9	90.000
SP Response 10	1	Ramp To	SP Point X10	1000.000	ms	SP Point Y10	100.000

Figure 11.First Lookup Table Response Configuration

The second lookup table is configured to provide output in data response mode and controlled by the first lookup table. The rest of configuration is shown on the Figure 12 below.



			SP Point X0	0.000	SP Point Y0	0.000
SP Response 1	2	Jump To	SP Point X1	10.000	SP Point Y1	10.000
SP Response 2	2	Jump To	SP Point X2	20.000	SP Point Y2	20.000
SP Response 3	2	Jump To	SP Point X3	30.000	SP Point Y3	30.000
SP Response 4	2	Jump To	SP Point X4	40.000	SP Point Y4	40.000
SP Response 5	1	Ramp To	SP Point X5	50.000	SP Point Y5	50.000
SP Response 6	1	Ramp To	SP Point X6	60.000	SP Point Y6	60.000
SP Response 7	1	Ramp To	SP Point X7	70.000	SP Point Y7	70.000
SP Response 8	1	Ramp To	SP Point X8	80.000	SP Point Y8	80.000
SP Response 9	1	Ramp To	SP Point X9	90.000	SP Point Y9	90.000
SP Response 10	1	Ramp To	SP Point X10	100.000	SP Point Y10	100.000

Figure 12. Second Lookup Table Response Configuration

With such a configuration the second lookup table will jump from 0 to 40 and then ramp to 100. The graphical representation of lookup tables output is shown below. On the left graph the time response lookup table, and on the left is a controlled table. The X axis represents the time with a resolution of 1 second per square. The Y axis is the LUT output with a resolution of 10 per square.

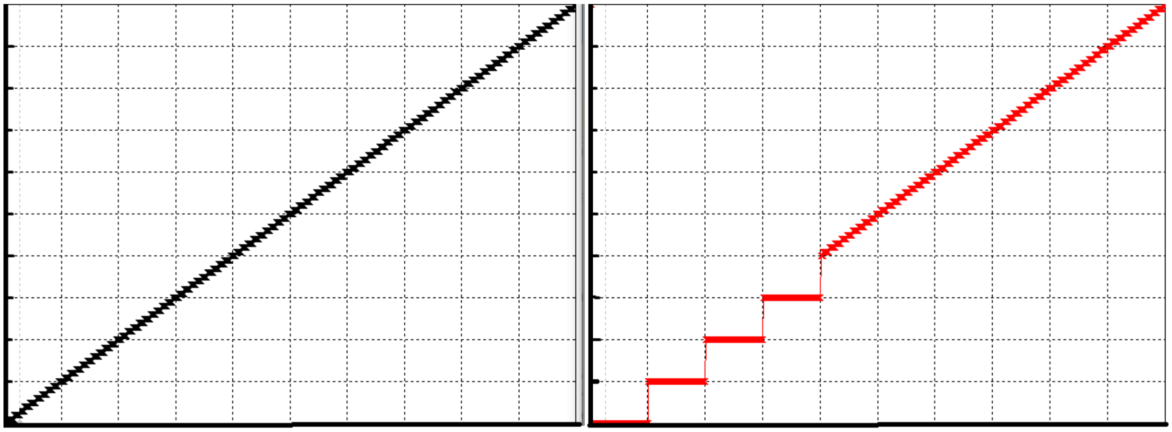


Figure 13. Graphical Representation of the Lookup Table Example

1.7. Programmable Logic Function Block

1.7.1. Description

The Programmable Logic Function Block is a powerful tool. Programmable Logic can be linked to up to three Lookup Tables, any of which would be selected only under given conditions. Thus, the output of a Programmable Logic at any given time will be the output of the Lookup Table selected by the defined logic. Therefore, up to three different responses to the same input, or three different responses to different inputs, can become the input to another function block.

In order to enable any one of the Programmable Logic blocks, the ***"Logic Enabled"*** setpoint must be set to *'True'*. By default, all Logic blocks are disabled.

The three associated tables are selected by setting ***"Table Number X***" setpoint to desired Lookup Table number, for example selecting 1 would set Lookup Table 1 as TableX.

For each TableX there are three conditions that define the logic to select the associated Lookup Table as Logic output. Each condition implements function $Argument1\ Operator\ Argument2$ where Operator is logical operator defined by setpoint ***"Table X – Condition Y Operator".*** Setpoint options are listed in Table 16. Condition arguments are selected with ***"Table X – Condition Y Argument Z Source"*** and ***"Table X – Condition Y Argument Z Number"*** setpoints. If *'0 – Control not Used'* option is selected as ***"Table x – Condition Y Argument Z Source"*** the argument is interpreted as 0.

Table 16. Table X – Condition Y Operator Options

0	=, Equal
1	!=, Not Equal
2	>, Greater Than
3	>=, Greater Than or Equal
4	<, Less Than
5	<=, Less Than or Equal

The three conditions are evaluated and if the result satisfies logical operation defined with ***"Logical Operator X"*** setpoint, given in Table 17, the associated Lookup Table is selected as output of the Logical block. Option *'0 – Default Table'* selects associated Lookup Table in all conditions.

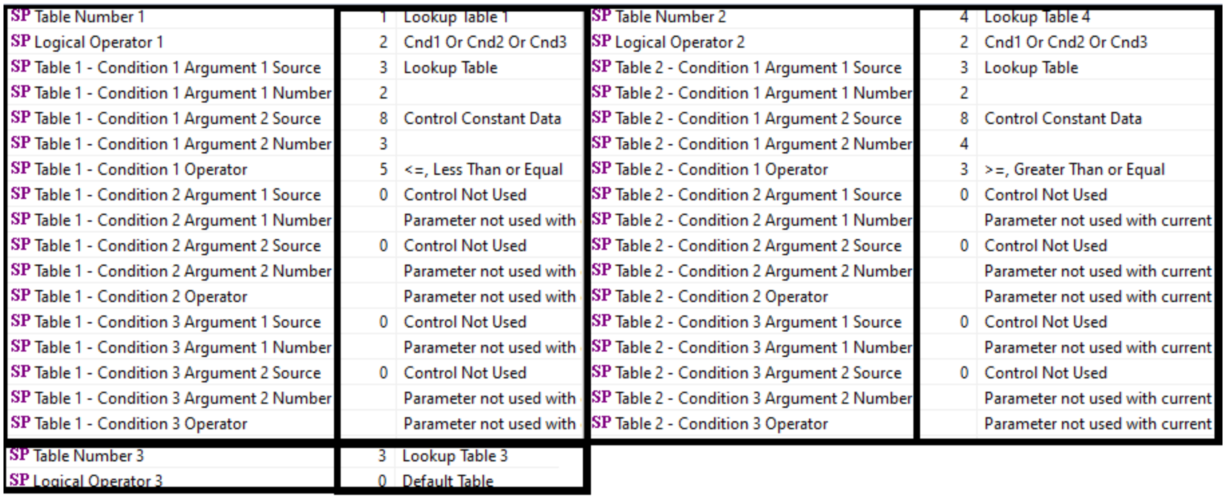
Table 17. Table X – Conditions Logical Operator Options

0	Default Table (Table1)
1	Cnd1 And Cnd2 And Cnd3
2	Cnd1 Or Cnd2 Or Cnd3
3	(Cnd1 And Cnd2) Or Cnd3
4	(Cnd1 Or Cnd2) And Cnd3

The three logical operations are evaluated in order and the first to satisfy gets selected, thus if Table1 logical operation is satisfied, the Lookup Table associated with Table1 gets selected regardless of two other logical operations. In addition, if none of the logical operations is satisfied the Lookup Table associated with Table1 gets selected.

1.7.2. Example

This example will show how to use 4 Lookup Tables by using the simplest configuration of Programmable Logic Block (PLB). One LUT is configured to jump from 0 to 100 with a step of 10. The second table ramps the output from 0 to 100 and the third one provides a constant output of 50. The last table configured to control previous tables. The PLB uses table 1 if fourth table's output is below 40, table 2 if it is grater than 60, and table 3 otherwise. The configuration of the Programmable Logic Block is shown below.



SP Table Number 1	1	Lookup Table 1	SP Table Number 2	4	Lookup Table 4
SP Logical Operator 1	2	Cnd1 Or Cnd2 Or Cnd3	SP Logical Operator 2	2	Cnd1 Or Cnd2 Or Cnd3
SP Table 1 - Condition 1 Argument 1 Source	3	Lookup Table	SP Table 2 - Condition 1 Argument 1 Source	3	Lookup Table
SP Table 1 - Condition 1 Argument 1 Number	2		SP Table 2 - Condition 1 Argument 1 Number	2	
SP Table 1 - Condition 1 Argument 2 Source	8	Control Constant Data	SP Table 2 - Condition 1 Argument 2 Source	8	Control Constant Data
SP Table 1 - Condition 1 Argument 2 Number	3		SP Table 2 - Condition 1 Argument 2 Number	4	
SP Table 1 - Condition 1 Operator	5	<=, Less Than or Equal	SP Table 2 - Condition 1 Operator	3	>=, Greater Than or Equal
SP Table 1 - Condition 2 Argument 1 Source	0	Control Not Used	SP Table 2 - Condition 2 Argument 1 Source	0	Control Not Used
SP Table 1 - Condition 2 Argument 1 Number		Parameter not used with	SP Table 2 - Condition 2 Argument 1 Number		Parameter not used with current
SP Table 1 - Condition 2 Argument 2 Source	0	Control Not Used	SP Table 2 - Condition 2 Argument 2 Source	0	Control Not Used
SP Table 1 - Condition 2 Argument 2 Number		Parameter not used with	SP Table 2 - Condition 2 Argument 2 Number		Parameter not used with current
SP Table 1 - Condition 2 Operator		Parameter not used with	SP Table 2 - Condition 2 Operator		Parameter not used with current
SP Table 1 - Condition 3 Argument 1 Source	0	Control Not Used	SP Table 2 - Condition 3 Argument 1 Source	0	Control Not Used
SP Table 1 - Condition 3 Argument 1 Number		Parameter not used with	SP Table 2 - Condition 3 Argument 1 Number		Parameter not used with current
SP Table 1 - Condition 3 Argument 2 Source	0	Control Not Used	SP Table 2 - Condition 3 Argument 2 Source	0	Control Not Used
SP Table 1 - Condition 3 Argument 2 Number		Parameter not used with	SP Table 2 - Condition 3 Argument 2 Number		Parameter not used with current
SP Table 1 - Condition 3 Operator		Parameter not used with	SP Table 2 - Condition 3 Operator		Parameter not used with current
SP Table Number 3	3	Lookup Table 3			
SP Logical Operator 3	0	Default Table			

Figure 14. Programmable Logic Block Configuration

With the current configuration the PLB will ramp from 0 to 40, then stay at 50, and after will jump from 60 to 100. The picture below captures the PLB output. On the left, the Lookup Table output and to the left there is a PLB corresponding output.

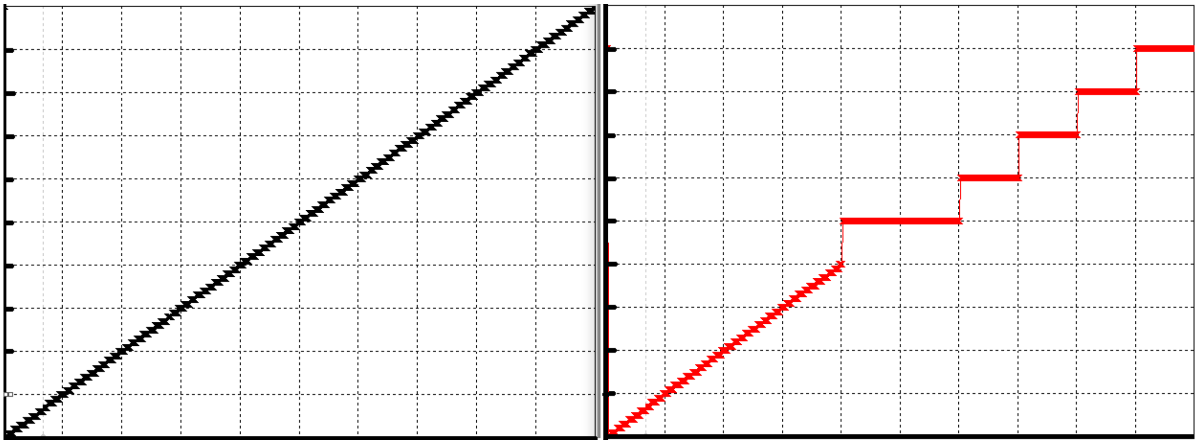


Figure 15. The Programmable Logic Block Output

1.8. Constant Data

The Constant Data Block contains 2 fixed (False/True) and 13 configurable constant data setpoints which can be used as a control source for other functions. While they are available as a control source to all functions, it is recommended not to use constant data as a control source for the Set-Reset Latch Block.

1.9. DTC React

DTC React is a function block that allows the ECU to receive and process the DM1 messages. There are 16 separated function blocks that can capture up to 16 different DM1 messages. Each DTC React has two mandatory and 2 optional parameters. The mandatory parameters are the

SPN and FMI. If only these parameters are used, the output will be set to high if the DM1 message with the combination of selected SPN and FMI. The state will remain high for five seconds and will be set if the DM1 message will be received again.

Among optional parameters there are lamp setting and the source address. To enable them, the "**Lamp Used to Trigger Reaction**" and "**Source Address Used to Trigger Reaction**" should be set to 1, *True*. In this case, beside SPN and FMI the ECU will compare the Lamp Setting and/or Source Address of the received message.

The exceptions are the following SPN:

- SPN 1213 and Lamp Status 0x40;
- SPN623 and Lamp Status 0x10;
- SPN624 and Lamp Status 0x04;

In case if the SPNs above are chosen, the DTC React function block will set the output to HIGH if SPN and Lamp Status matches even if FMI doesn't match. However, if the "**Source Address Used to Trigger Reaction**" is set to 1, *True* and selected address doesn't match, the DTC React output will be set to FALSE.

1.10. CAN Transmit Message Function Block

The CAN Transmit function block is used to send any output from another function block (i.e. input, CAN receive) to the J1939 network. The AX130760 ECU has eleven CAN Transmit Messages and each message has four completely user defined signals.

1.10.1. CAN Transmit Message Setpoints

Each CAN Transmit Message setpoint group includes setpoints that effect the whole message and are thus mutual for all signals of the message. These setpoints are presented in this section. The setpoints that configure an individual signal are presented in next section.

The "**Transmit PGN**" setpoint sets PGN used with the message. **User should be familiar with the SAE J1939 standard, and select values for PGN/SPN combinations as appropriate from section J1939/71**.

"**Repetition Rate**" setpoint defines the interval used to send the message to the J1939 network. If the "**Repetition Rate**" is set to zero, the message is disabled unless it shares its PGN with another message. In case of a shared PGN repetition rate of the LOWEST numbered message are used to send the message 'bundle'.

At power up, transmitted message will not be broadcasted until after a 5 second delay. This is done to prevent any power up or initialization conditions from creating problems on the network.

By default, all messages are sent on Proprietary B PGNs as broadcast messages. Thus "**Transmit Message Priority**" is always initialized to 6 (low priority) and the "**Destination Address**" setpoint is not used. This setpoint is only valid when a PDU1 PGN has been selected, and it can be set either to the Global Address (0xFF) for broadcasts, or sent to a specific address as setup by the user.

1.10.2. CAN Transmit Signal Setpoints

Each CAN transmit message has four associated signals, which define data inside the Transmit message. "**Control Source**" setpoint together with "**Control Number**" setpoint define the signal source of the message. "**Control Source**" and "**Control Number**" options are listed in Table 4. Setting "**Control Source**" to '*Control Not Used'* disables the signal.

"**Transmit Data Size**" setpoint determines how many bits signal reserves from the message. "**Transmit Data Index in Array**" determines in which of 8 bytes of the CAN message LSB of the signal is located. Similarly "**Transmit Bit Index in Byte**" determines in which of 8 bits of a byte the LSB is located. These setpoints are freely configurable, thus **it is the user's responsibility to ensure that signals do not overlap and mask each other**.

"**Transmit Data Resolution**" setpoint determines the scaling done on the signal data before it is sent to the bus. "**Transmit data Offset**" setpoint determines the value that is subtracted from the signal data before it is scaled. Offset and Resolution are interpreted in units of the selected source signal.

1.11. CAN Receive Function Block

The CAN Receive function block is designed to take any SPN from the J1939 network, and use it as an input to another function block (i.e. Outputs).

"**CAN Interface**" setpoint is used to define from which of the two CAN Interfaces the message in question is received.

The "**Receive Message Enabled**" is the most important setpoint associated with this function block and it should be selected first. Changing it will result in other setpoints being enabled/disabled as appropriate. By default ALL receive messages are disabled.

Once a message has been enabled, a Lost Communication fault will be flagged if that message is not received off the bud within the "**Receive Message Timeout**" period. This could trigger a Lost Communication event as described in section 1.2. In order to avoid timeouts on a heavily saturated network, it is recommended to set the period at least three times longer than the expected update rate. To disable the timeout feature, simply set this value to zero, in which case the received message will never trigger a Lost Communication fault.

By default, all control messages are expected to be sent to the AX130760 on Proprietary B PGNs. However, should a PDU1 message be selected, the AX130760 can be setup to receive it from any ECU by setting the "**PGN From Specific Address**" to False (0x00). If a specific address is selected instead, then any other ECU data on the PGN will be ignored.

The "**Receive Data Size**", "**Receive Data Index in Array (LSB)**", "**Receive Bit Index in Byte (LSB)**", "**Receive Resolution**" and "**Receive Offset**" can all be used to map any SPN supported by the J1939 standard to the output data of the Received function block.

As mentioned earlier, a CAN receive function clock can be selected as the source of the control input for the output function blocks. When this is case, the “**Received Data Min (Off Threshold)**” and “**Received Data Max (On Threshold)**” setpoints determine the minimum and maximum values of the control signal. As the names imply, they are also used as the On/Off thesholds for digital output types. These values are in whatever units the data is AFTER the resolution and offset is applied to CAN receive signal.

The AX130760 supports up to nine unique CAN Receive Messages. Defaults setpoint values are listed in section 4.11.

2. INSTALLATION INSTRUCTIONS

2.1. Dimensions and Pinout

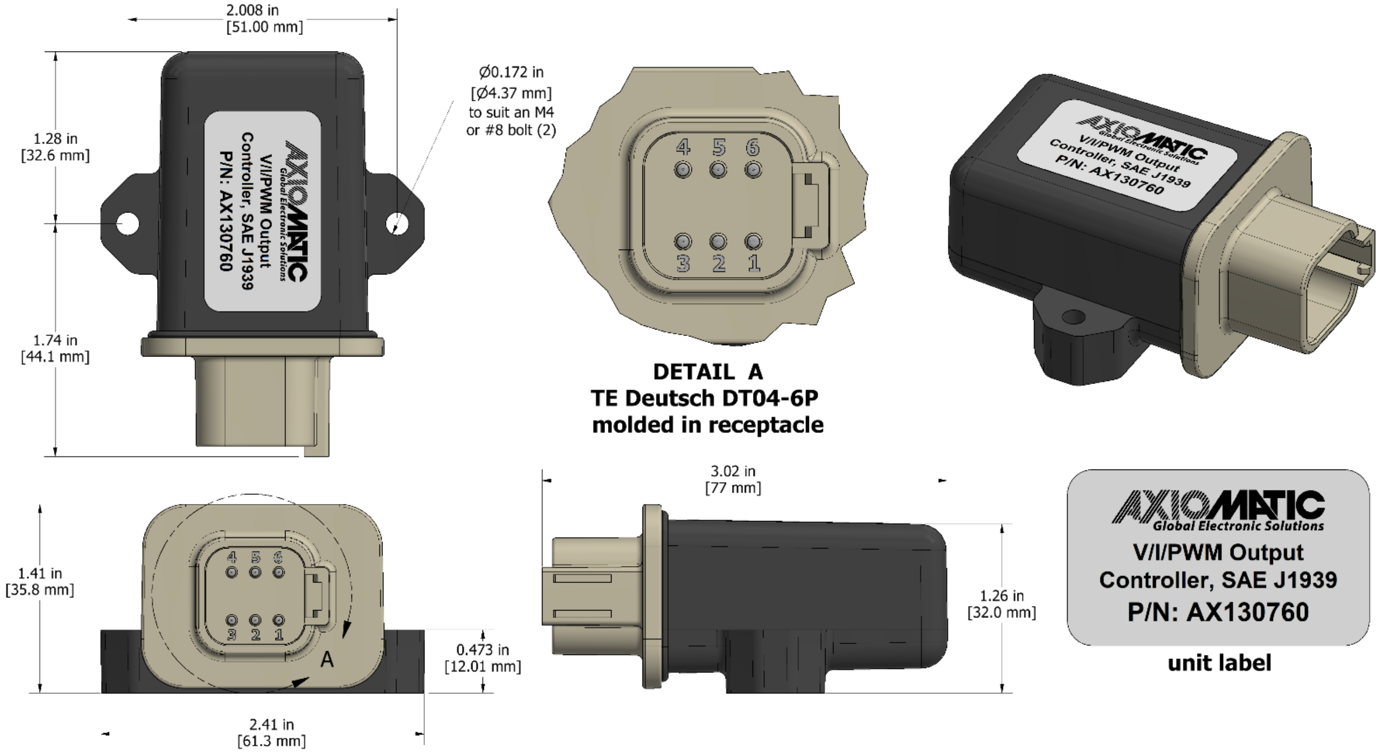


Figure 16 – AX130760 Dimensional Drawing

Table 18 – AX130760 Connector Pinout

CAN and I/O Connector	
Pin #	Function
1	BATT+
2	BATT-
3	GND
4	Signal Output
5	CAN_L
6	CAN_H

3. OVERVIEW OF J1939 FEATURES

The software was designed to provide flexibility to the user with respect to messages sent from the ECU by providing:

- Configurable ECU Instance in the NAME (to allow multiple ECUs on the same network)
- Configurable Input Parameters
- Configurable PGN and Data Parameters
- Configurable Diagnostic Messaging Parameters, as required
- Diagnostic Log, maintained in non-volatile memory

3.1. Introduction to Supported Messages

The ECU is compliant with the standard SAE J1939, and supports following PGNs from the standard.

From J1939-21 – Data Link Layer

Request		59904	0x00EA00
Acknowledgement		59392	0x00E800
Transport Protocol – Connection Management		60416	0x00EC00
Transport Protocol – Data Transfer Message		60160	0x00EB00
Proprietary B	from	65280	0x00FF00
	to	65535	0x00FFFF

From J1939-73 – Diagnostics

DM1 – Active Diagnostic Trouble Codes	65226	0x00FECA
DM2 – Previously Active Diagnostic Trouble Codes	65227	0x00FECB
DM3 – Diagnostic Data Clear/Reset for Previously Active DTCs	65228	0x00FECC
DM11 – Diagnostic Data Clear/Reset for Active DTCs	65235	0x00FED3

From J1939-81 – Network Management

Address Claimed/Cannot Claim	60928	0x00EE00
Commanded Address	65240	0x00FED8

From J1939-71 – Vehicle Application Layer

Software Identification	65242	0x00FEDA
Software Identification	65242	0x00FEDA
Component Identification	65259	0x00FEEB

None of the application layer PGNs are supported as part of the default configurations, but they can be selected as desired for transmit function blocks.

Setpoints are accessed using standard Memory Access Protocol (MAP) with proprietary addresses. The Axiomatic Electronic Assistant (EA) allows for quick and easy configuration of the unit over CAN network.

3.2. NAME, Address and Software ID

The AX130760 ECU has the following default for the J1939 NAME. The user should refer to the SAE J1939/81 standard for more information on these parameters and their ranges.

Arbitrary Address Capable	Yes
Industry Group	0, Global
Vehicle System Instance	0
Vehicle System	0, Non-specific system
Function	127, I/O Controller
Function Instance	16, Axiomatic AX130760
ECU Instance	0, First Instance
Manufacture Code	162, Axiomatic Technologies
Identity Number	Unique ECU network ID number

The ECU Instance is a configurable setpoint associated with the NAME. Changing this value will allow multiple ECUs of this type to be distinguishable from one another when they are connected on the same network.

The default value of the "ECU Address" setpoint is 128 (0x80), which is the preferred starting address for self-configurable ECUs as set by the SAE in J1939 tables B3 and B7. The EA will allow the selection of any address between 0 and 253. ***It is user's responsibility to select an address that complies with the standard***. The user must also be aware that since the unit is arbitrary address capable, if another ECU with a higher priority NAME contends for the selected address, the AX130760 will continue select the next highest address until it finds one that it can claim. See J1939/81 for more details about address claiming.

ECU Identification Information

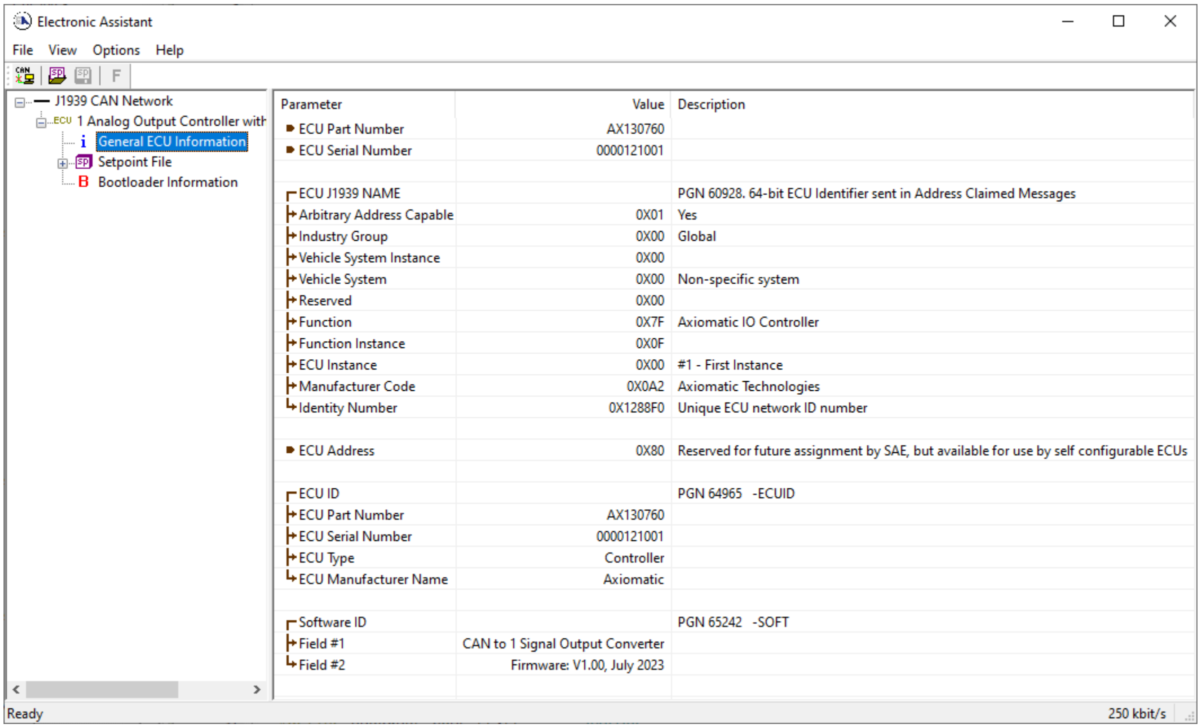
PGN 64965 ECU Identification Information -ECUID

Transmission Repetition Rate: On request

Data Length: Variable
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 197 PGN Supporting Information:
Default Priority: 6
Parameter Group Number: 64965 (0x00FDC5)

Start Position	Length	Parameter Name	SPN
a	Variable	ECU Part Number, Delimiter (ASCII "*")	2901
b	Variable	ECU Serial Number, Delimiter (ASCII "*")	2902
c	Variable	ECU Location, Delimiter (ASCII "*")	2903
d	Variable	ECU Type, Delimiter (ASCII "*")	2904
e	Variable	ECU Manufacturer Name, Delimiter (ASCII "*")	4304

(a)*(b)*(c)*(d)*(e)
*



Parameter	Value	Description
ECU Part Number	AX130760	
ECU Serial Number	0000121001	
ECU J1939 NAME		PGN 60928. 64-bit ECU Identifier sent in Address Claimed Messages
Arbitrary Address Capable	0X01	Yes
Industry Group	0X00	Global
Vehicle System Instance	0X00	
Vehicle System	0X00	Non-specific system
Reserved	0X00	
Function	0X7F	Axiomatic IO Controller
Function Instance	0X0F	
ECU Instance	0X00	#1 - First Instance
Manufacturer Code	0X0A2	Axiomatic Technologies
Identity Number	0X1288F0	Unique ECU network ID number
ECU Address	0X80	Reserved for future assignment by SAE, but available for use by self configurable ECUs
ECU ID		PGN 64965 -ECUID
ECU Part Number	AX130760	
ECU Serial Number	0000121001	
ECU Type	Controller	
ECU Manufacturer Name	Axiomatic	
Software ID		PGN 65242 -SOFT
Field #1	CAN to 1 Signal Output Converter	
Field #2	Firmware: V1.00, July 2023	

Figure 17 – General ECU Information

Software Identifier

PGN 65242		Software Identification	- SOFT
Transmission Repetition Rate:		On request	
Data Length:		Variable	
Extended Data Page:		0	
Data Page:		0	
PDU Format:		254	
PDU Specific:		218 PGN Supporting Information:	
Default Priority:		6	
Parameter Group Number:		65242 (0xFEDA)	
Start Position	Length	Parameter Name	SPN
1	1 Byte	Number of software identification fields	965
2-n	Variable	Software identification(s), Delimiter (ASCII "*")	234

For the AX130760 ECU, Byte 1 is set to 5, and the identification fields are as follows.

(Part Number)*(Version)*(Date)*(Owner)*(Description)

The EA shows all this information in "General ECU Information", as shown below.

Note: The information provided in the Software ID is available for any J1939 service tool which supports the PGN -SOFT.

Component Identification

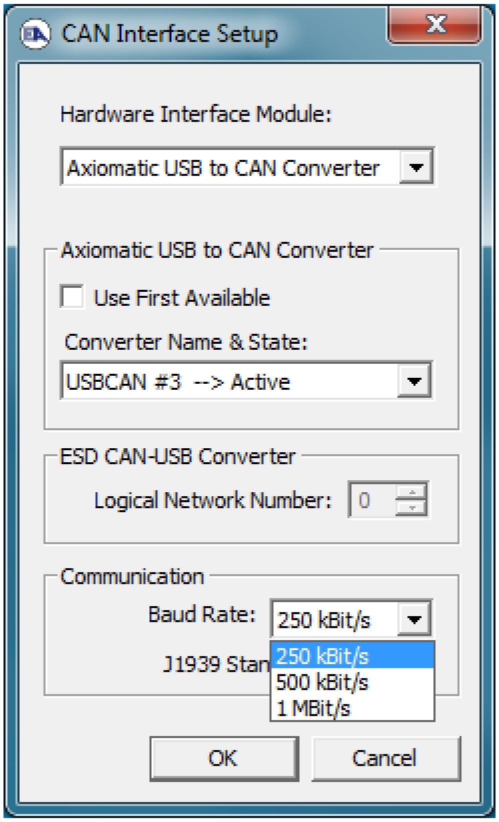
PGN 65259		Component Identification	-CI
Transmission Repetition Rate:		On request	
Data Length:		Variable	
Extended Data Page:		0	
Data Page:		0	
PDU Format:		254	
PDU Specific:		235 PGN Supporting Information:	
Default Priority:		6	
Parameter Group Number:		65259 (0x00FEEB)	
Start Position	Length	Parameter Name	SPN
a	1-5 Byte	Make, Delimiter (ASCII "*")	586
b	Variable	Model, Delimiter (ASCII "*")	587
c	Variable	Serial Number, Delimiter (ASCII "*")	588
d	Variable	Unit Number (Power Unit), Delimiter (ASCII "*")	233
(a)*(b)*(c)*(d)*(e)*			

4. ECU SETPOINTS ACCESSED WITH AXIOMATIC ELECTRONIC ASSISTANT

This section describes in detail each setpoint, and their default and ranges. The setpoints are divided into setpoint groups as they are shown in EA. For more information on how each setpoins, refer to the relevant section in this user manual.

4.1. Accessing the ECU Using Axiomatic Electronic Assistant

ECU with P/N AX130760 does not need any specific setup for EA. In order to access the high speed versions the CAN bus Baud Rate needs to be set accordingly. The CAN Interface Setup can be found from "Options" menu in EA. Please refer UMAX07050x **Connecting to the J1939 Bus** section for Axiomatic Electronic Assistant CAN Interface Setup instructions.



CAN Interface Setup

Hardware Interface Module: Axiomatic USB to CAN Converter

Axiomatic USB to CAN Converter

☐ Use First Available

Converter Name & State: USBCAN #3 --> Active

ESD CAN-USB Converter

Logical Network Number: 0

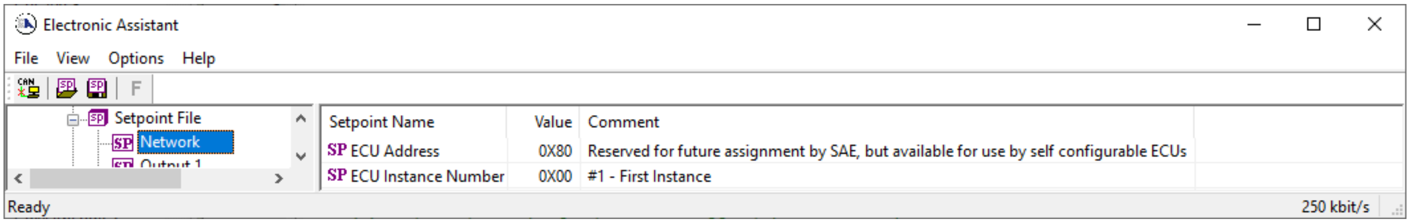
Communication

Baud Rate: 250 kBit/s

J1939 Stan

4.2. J1939 Network Parameters

“ECU Instance Number” and “ECU Address” setpoints and their effect are defined in section 3.2.



Setpoint Name	Value	Comment
SP ECU Address	0X80	Reserved for future assignment by SAE, but available for use by self configurable ECUs
SP ECU Instance Number	0X00	#1 - First Instance

Figure 18 – Screen Capture of J1939 Setpoints

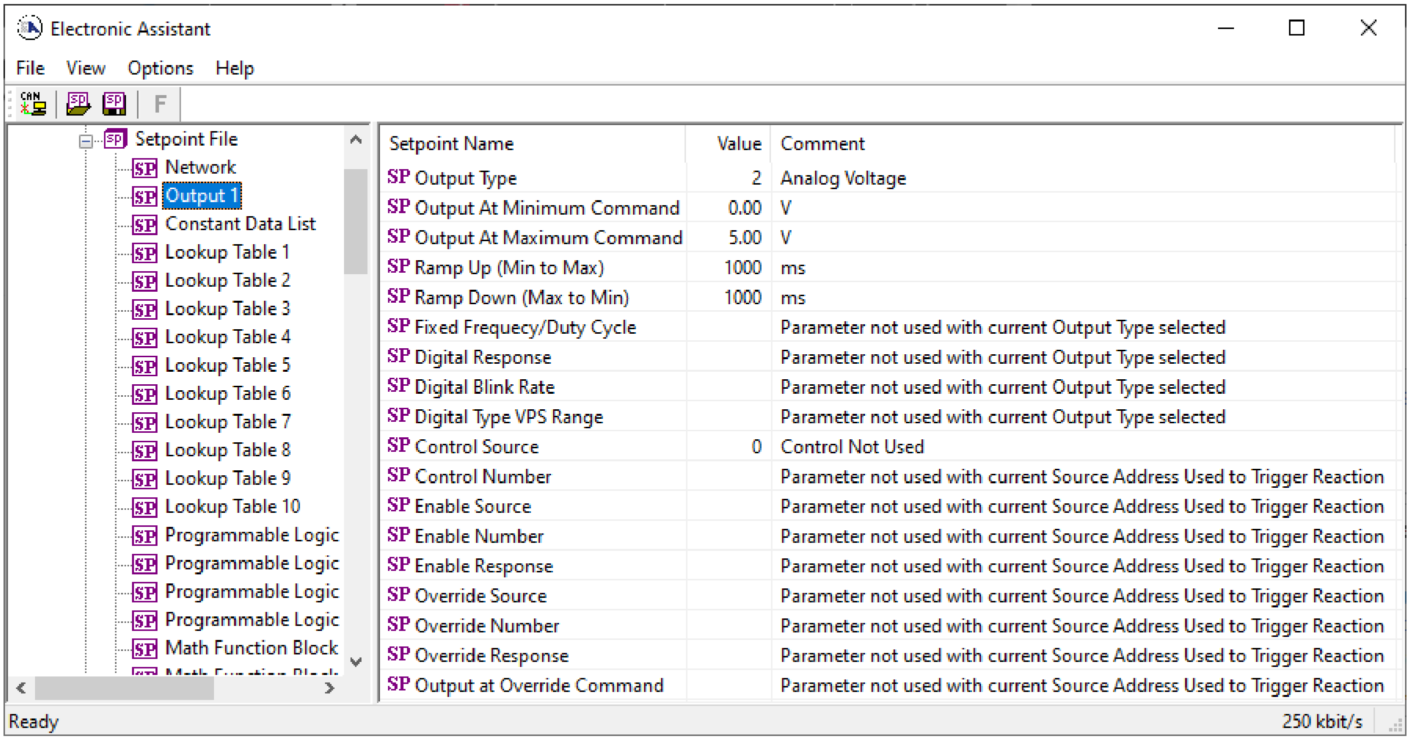
Table 19 – J1939 Network Setpoints

Name	Range	Default	Notes
ECU Address	0x80	0-253	Preferred address for a self-configurable ECU
ECU Instance	0-7	0x00	Per J1939-81

If non-default values for the **“ECU Instance Number”** or **“ECU Address”** are used, they will be mirrored during a setpoint file flashing, and will only take effect once the entire file has been downloaded to the unit. After the setpoint flashing is complete, the unit will claim the new address and/or re-claim the address with the new NAME. If these setpoints are changing, it is recommended to close and re-open the CAN connection on EA after the file is loaded so that only the new NAME and address are showing in the J1939 CAN Network ECU list.

4.3. Output Setpoints

The Outputs are defined in sections 1.1.



Setpoint Name	Value	Comment
Output Type	2	Analog Voltage
Output At Minimum Command	0.00	V
Output At Maximum Command	5.00	V
Ramp Up (Min to Max)	1000	ms
Ramp Down (Max to Min)	1000	ms
Fixed Frequecy/Duty Cycle		Parameter not used with current Output Type selected
Digital Response		Parameter not used with current Output Type selected
Digital Blink Rate		Parameter not used with current Output Type selected
Digital Type VPS Range		Parameter not used with current Output Type selected
Control Source	0	Control Not Used
Control Number		Parameter not used with current Source Address Used to Trigger Reaction
Enable Source		Parameter not used with current Source Address Used to Trigger Reaction
Enable Number		Parameter not used with current Source Address Used to Trigger Reaction
Enable Response		Parameter not used with current Source Address Used to Trigger Reaction
Override Source		Parameter not used with current Source Address Used to Trigger Reaction
Override Number		Parameter not used with current Source Address Used to Trigger Reaction
Override Response		Parameter not used with current Source Address Used to Trigger Reaction
Output at Override Command		Parameter not used with current Source Address Used to Trigger Reaction

Figure 19 – Screen Capture of Output Setpoints

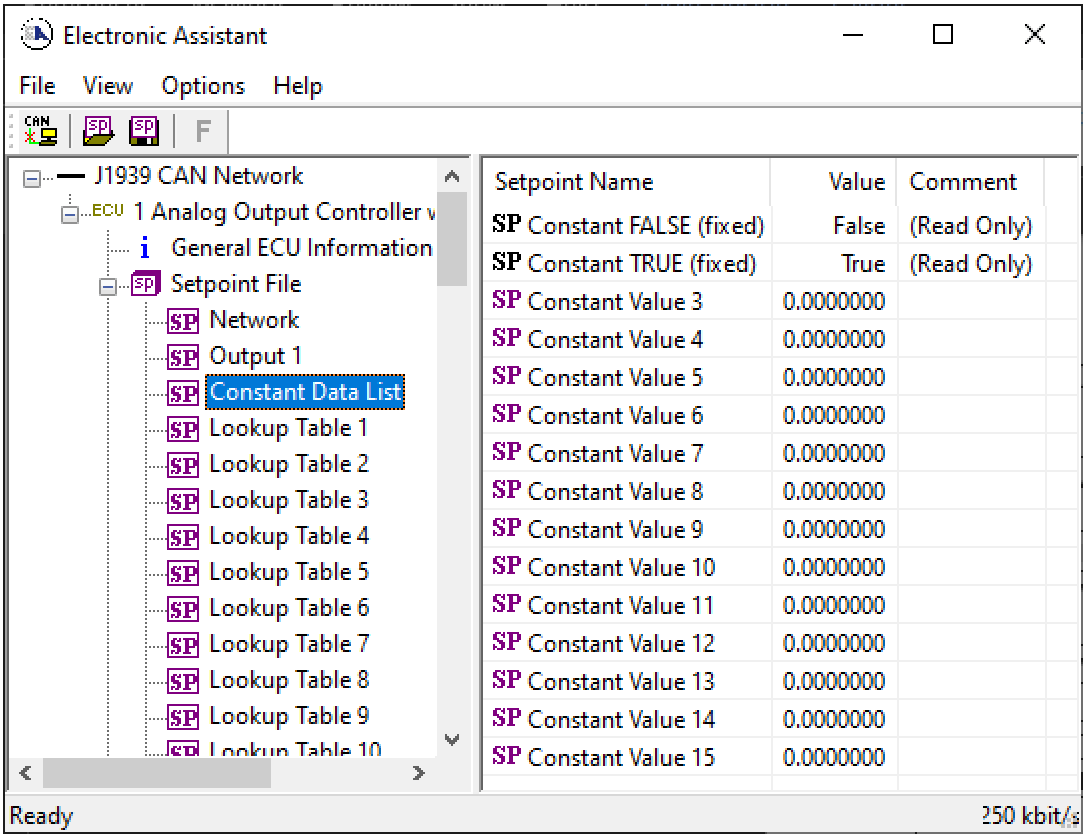
Table 20 –Output Setpoints

Name	Range	Default	Notes
Output Type	Drop List	Analog Voltage	See Table 1
Output At Minimum Command	0 to Limit	0V	
Output At Maximum Command	0 to Limit	5.00V	
Ramp Up (Min to Max)	0 to 10 000ms	1000ms	
Ramp Down (Max to Min)	0 to 10 000ms	1000ms	
Fixed Frequecy/Duty Cycle	0Hz to 50 000Hz	25000Hz	
Digital Response	Drop List	Normal On/Off	See Table 2
Digital Blink Rate	100 to 5000ms	500ms	
Digital Type VPS Range	Drop List	0 to 12V	
Control Source	Drop List	Not Used	See Table 4
Control Number	Depends on control source	1	See Table 4
Enable Source	Drop List	Control not used	See Table 4
Enable Number	Depends on enable source	1	See Table 4
Enable Response	Drop List	Enable When On, Else Shutoff	See Table 5
Override Source	Drop List	Control not used	See Table 4
Override Number	Depends on enable source	1	See Table 4
Override Response	Drop List	Override When On, Else Shutoff	See Table 6
Output at Override Command	0 to Limit	0	

4.4. Constant Data List

The Constant Data List Function Block is provided to allow the user to select values as desired for various logic block functions.

The first two constants are fixed values of 0 (False) and 1 (True) for use in binary logic. The remaining 13 constants are fully user programmable to any value between +/. 1 000 000. The default values (shown in Figure 20) are arbitrary and should be configured by the user as appropriate for their application.

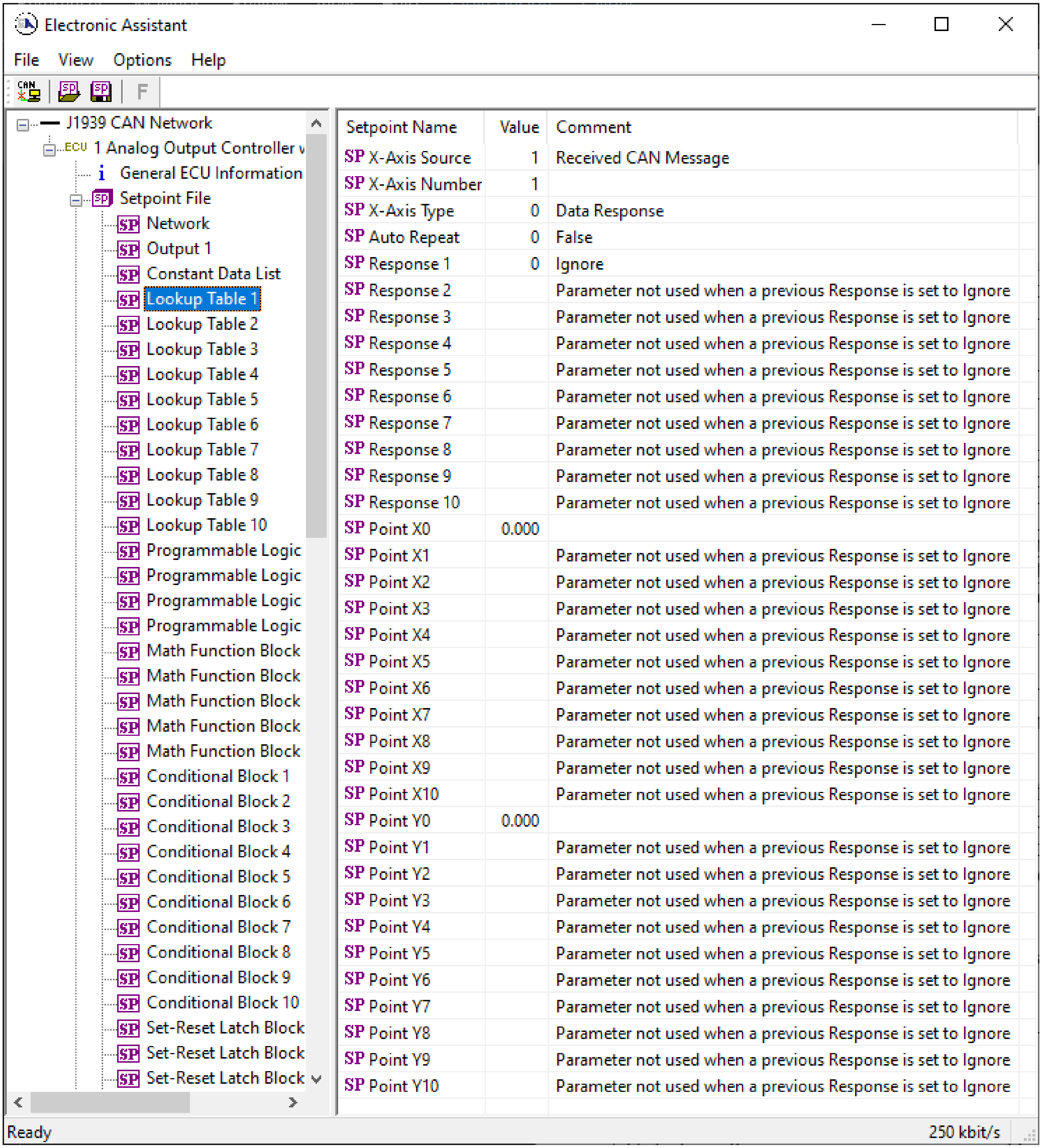


Setpoint Name	Value	Comment
SP Constant FALSE (fixed)	False	(Read Only)
SP Constant TRUE (fixed)	True	(Read Only)
SP Constant Value 3	0.0000000	
SP Constant Value 4	0.0000000	
SP Constant Value 5	0.0000000	
SP Constant Value 6	0.0000000	
SP Constant Value 7	0.0000000	
SP Constant Value 8	0.0000000	
SP Constant Value 9	0.0000000	
SP Constant Value 10	0.0000000	
SP Constant Value 11	0.0000000	
SP Constant Value 12	0.0000000	
SP Constant Value 13	0.0000000	
SP Constant Value 14	0.0000000	
SP Constant Value 15	0.0000000	

Figure 20 – Screen Capture of Constant Data List Setpoints

4.5. Lookup Table

The Lookup Table Function Block is defined in Section 1.6 Please refer there for detailed information about how all these setpoints are used. "**X-Axis Source**" is set to '*Control Not Used*' by default. To enable a Lookup Table select appropriate "**X-Axis Source**".



Setpoint Name	Value	Comment
SP X-Axis Source	1	Received CAN Message
SP X-Axis Number	1	
SP X-Axis Type	0	Data Response
SP Auto Repeat	0	False
SP Response 1	0	Ignore
SP Response 2		Parameter not used when a previous Response is set to Ignore
SP Response 3		Parameter not used when a previous Response is set to Ignore
SP Response 4		Parameter not used when a previous Response is set to Ignore
SP Response 5		Parameter not used when a previous Response is set to Ignore
SP Response 6		Parameter not used when a previous Response is set to Ignore
SP Response 7		Parameter not used when a previous Response is set to Ignore
SP Response 8		Parameter not used when a previous Response is set to Ignore
SP Response 9		Parameter not used when a previous Response is set to Ignore
SP Response 10		Parameter not used when a previous Response is set to Ignore
SP Point X0	0.000	
SP Point X1		Parameter not used when a previous Response is set to Ignore
SP Point X2		Parameter not used when a previous Response is set to Ignore
SP Point X3		Parameter not used when a previous Response is set to Ignore
SP Point X4		Parameter not used when a previous Response is set to Ignore
SP Point X5		Parameter not used when a previous Response is set to Ignore
SP Point X6		Parameter not used when a previous Response is set to Ignore
SP Point X7		Parameter not used when a previous Response is set to Ignore
SP Point X8		Parameter not used when a previous Response is set to Ignore
SP Point X9		Parameter not used when a previous Response is set to Ignore
SP Point X10		Parameter not used when a previous Response is set to Ignore
SP Point Y0	0.000	
SP Point Y1		Parameter not used when a previous Response is set to Ignore
SP Point Y2		Parameter not used when a previous Response is set to Ignore
SP Point Y3		Parameter not used when a previous Response is set to Ignore
SP Point Y4		Parameter not used when a previous Response is set to Ignore
SP Point Y5		Parameter not used when a previous Response is set to Ignore
SP Point Y6		Parameter not used when a previous Response is set to Ignore
SP Point Y7		Parameter not used when a previous Response is set to Ignore
SP Point Y8		Parameter not used when a previous Response is set to Ignore
SP Point Y9		Parameter not used when a previous Response is set to Ignore
SP Point Y10		Parameter not used when a previous Response is set to Ignore

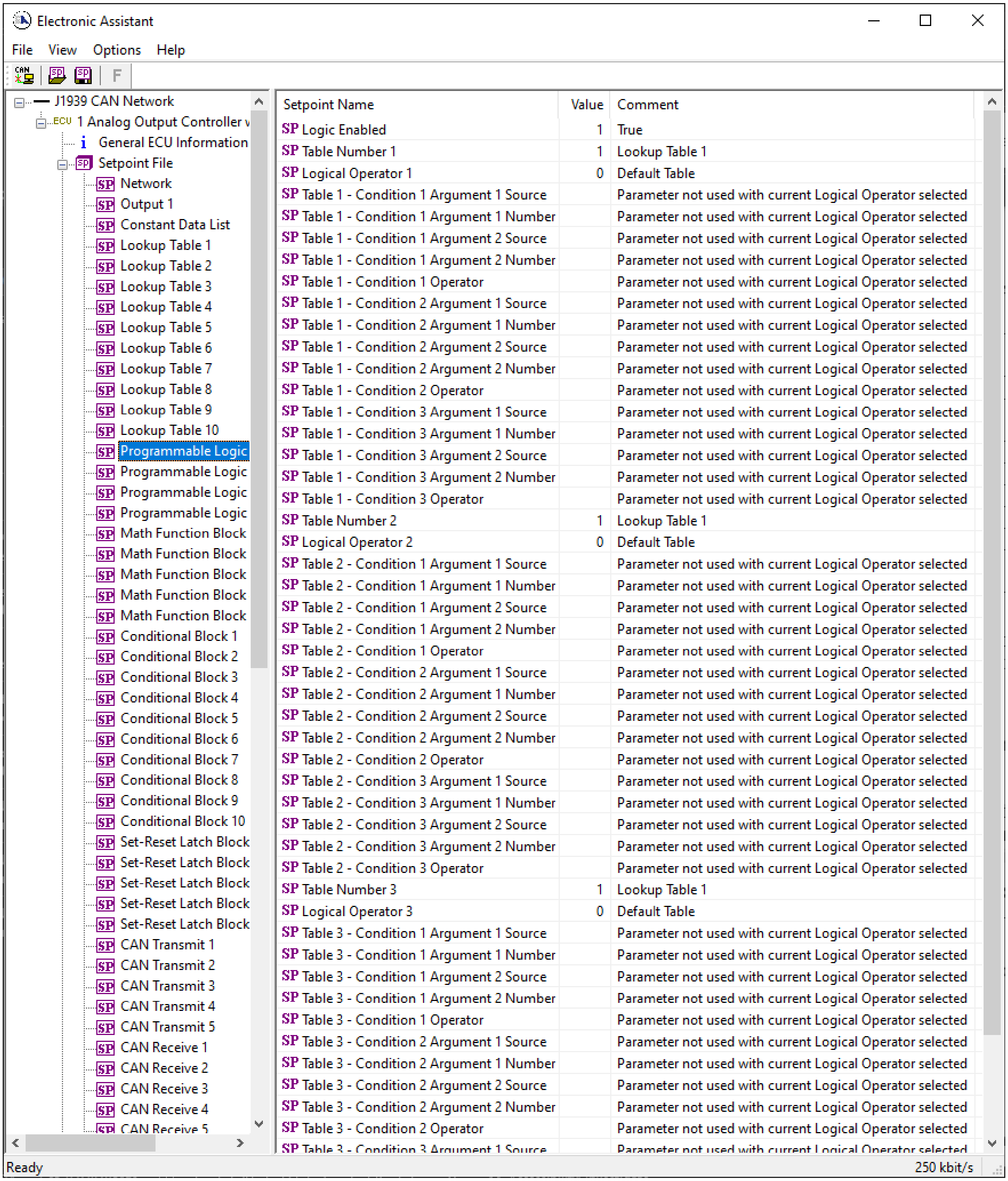
Figure 21 – Screen Capture of Lookup table Setpoints

Table 21 – Lookup Table Setpoints

Name	**Range**	**Default**	**Notes**
X-Axis Source	Drop List	Control Not Used	See **Table 4**
X-Axis Number	Depends on control source	1	See **Table 4**
X-Axis Type	Drop List	Data Response	See Table 14
Table Auto-Cycle	Drop List	0	
Point 1 - Response	Drop List	Ramp To	See Table 15
Point 2 - Response	Drop List	Ramp To	See Table 15
Point 3 - Response	Drop List	Ramp To	See Table 15
Point 4 - Response	Drop List	Ramp To	See Table 15
Point 5 - Response	Drop List	Ramp To	See Table 15
Point 6 - Response	Drop List	Ramp To	See Table 15
Point 7 - Response	Drop List	Ramp To	See Table 15
Point 8 - Response	Drop List	Ramp To	See Table 15
Point 9 - Response	Drop List	Ramp To	See Table 15
Point 10 - Response	Drop List	Ramp To	See Table 15
Point 0 - X Value	From X-Axis source minimum	X-Axis source minimum 0.000	See Section 1.6
Point 1 - X Value	From X-Axis source minimum to Point 1 - X Value	0.500	See Section 1.6
Point 2 - X Value	From Point 0 - X Value to Point 2 - X Value	1.000	See Section 1.6
Point 3 - X Value	From Point 1 - X Value to Point 3 - X Value	1.500	See Section 1.6
Point 4 - X Value	From Point 2 - X Value to Point 4 - X Value	2.000	See Section 1.6
Point 5 - X Value	From Point 3 - X Value to Point 5 - X Value source	2.500	See Section 1.6
Point 6 - X Value	From Point 4 - X Value to Point 6 - X Value	3.000	See Section 1.6
Point 7 - X Value	From Point 5 - X Value to Point 7 - X Value	3.500	See Section 1.6
Point 8 - X Value	From Point 6 - X Value to Point 8 - X Value	4.000	See Section 1.6
Point 9 - X Value	From Point 7 - X Value to Point 9 - X Value	4.500	See Section 1.6
Point 10 - X Value	From Point 8 - X Value to Point 10 - X Value	5.000	See Section 1.6
Point 0 - Y Value	-10^6 to 10^6	0.000	
Point 1 - Y Value	-10^6 to 10^6	10.000	
Point 2 - Y Value	-10^6 to 10^6	20.000	
Point 3 - Y Value	-10^6 to 10^6	30.000	
Point 4 - Y Value	-10^6 to 10^6	40.000	
Point 5 - Y Value	-10^6 to 10^6	50.000	
Point 6 - Y Value	-10^6 to 10^6	60.000	
Point 7 - Y Value	-10^6 to 10^6	70.000	
Point 8 - Y Value	-10^6 to 10^6	80.000	
Point 9 - Y Value	-10^6 to 10^6	90.000	
Point 10 - Y Value	-10^6 to 10^6	100.000	

4.6. Programmable Logic

The Programmable Logic function block is defined in Section 1.7. Please refer there for detailed information about how all these setpoints are used. “**Programmable Logic Enabled**” is ‘*False*’ by default. To enable Logic set “**Programmable Logic Enabled**” to ‘*True*’ and select appropriate “**Argument Source**”.



Setpoint Name	Value	Comment
SP Logic Enabled	1	True
SP Table Number 1	1	Lookup Table 1
SP Logical Operator 1	0	Default Table
SP Table 1 - Condition 1 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 1 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 1 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 1 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 1 Operator		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 2 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 2 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 2 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 2 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 2 Operator		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 3 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 3 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 3 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 3 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 1 - Condition 3 Operator		Parameter not used with current Logical Operator selected
SP Table Number 2	1	Lookup Table 1
SP Logical Operator 2	0	Default Table
SP Table 2 - Condition 1 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 1 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 1 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 1 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 1 Operator		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 2 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 2 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 2 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 2 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 2 Operator		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 3 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 3 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 3 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 3 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 2 - Condition 3 Operator		Parameter not used with current Logical Operator selected
SP Table Number 3	1	Lookup Table 1
SP Logical Operator 3	0	Default Table
SP Table 3 - Condition 1 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 1 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 1 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 1 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 1 Operator		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 2 Argument 1 Source		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 2 Argument 1 Number		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 2 Argument 2 Source		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 2 Argument 2 Number		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 2 Operator		Parameter not used with current Logical Operator selected
SP Table 3 - Condition 3 Argument 1 Source		Parameter not used with current Logical Operator selected

Figure 22 – Screen Capture of Programmable Logic Setpoints

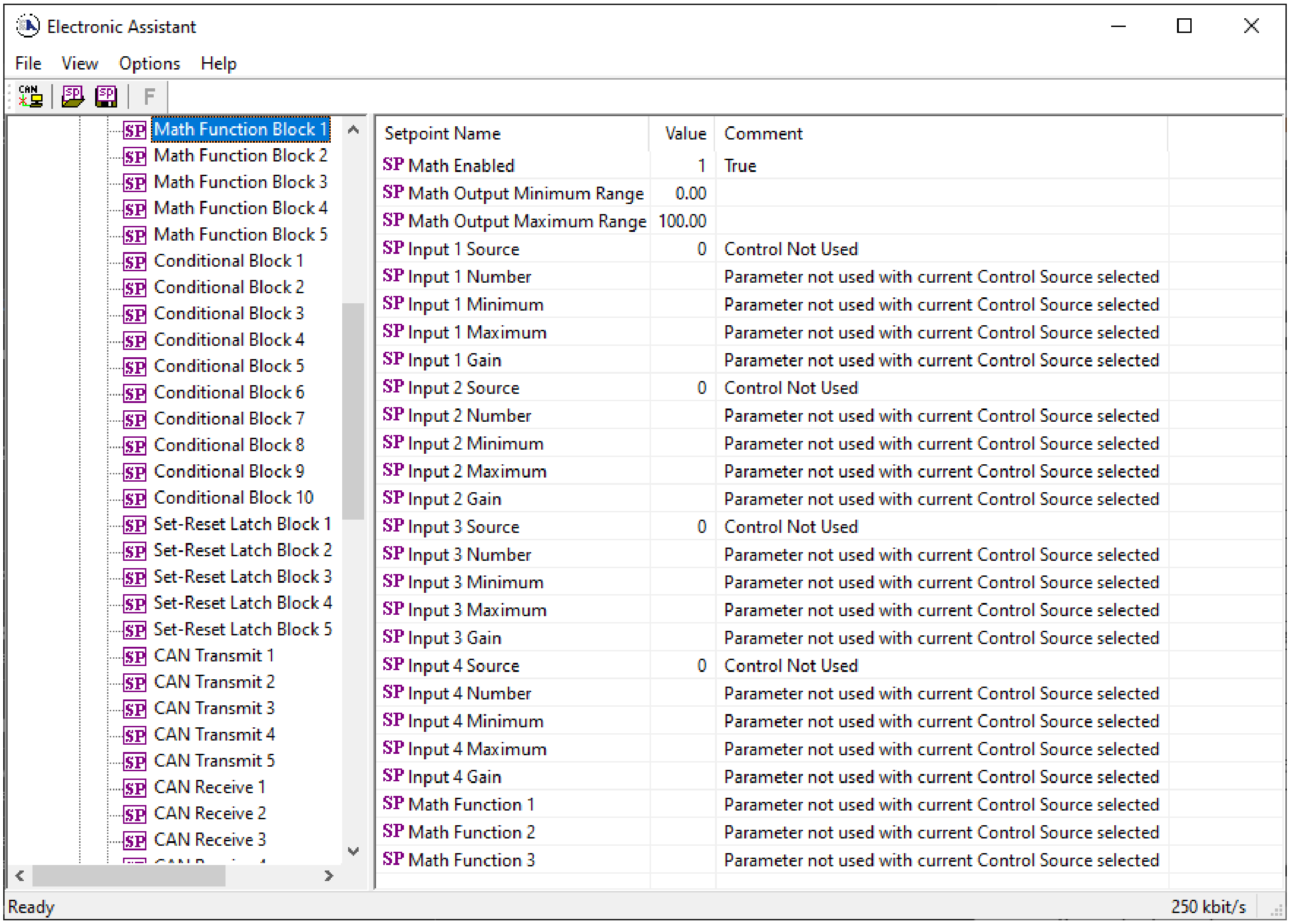
Setpoint ranges and default values for Programmable Logic Blocks are listed in Table 22. Only "**Table1**" setpoint are listed, because other "**TableX**" setpoints are similar, except for the default value of the "**Lookup Table Block Number**" setpoint, which is X for "**TableX**".

Table 22 – Programmable Logic Setpoints

Name	Range	Default	Notes
Programmable Logic Enabled	Drop List	False	
Table1 - Lookup Table Block Number	1 to 8	Look up Table 1	
Table1 - Conditions Logical Operation	Drop List	Default Table	See Table 4
Table1 - Condition1, Argument 1 Source	Drop List	Control Not Used	See Table 4
Table1 - Condition1, Argument 1 Number	Depends on control source	1	See Table 4
Table1 - Condition1, Operator	Drop List	=, Equal	See Table 16
Table1 - Condition1, Argument 2 Source	Drop List	Control Not Used	See Table 4
Table1 - Condition1, Argument 2 Number	Depends on control source	1	See Table 4
Table1 - Condition2, Argument 1 Source	Drop List	Control Not Used	See Table 4
Table1 - Condition2, Argument 1 Number	Depends on control source	1	See Table 4
Table1 - Condition2, Operator	Drop List	=, Equal	See Table 16
Table1 - Condition2, Argument 2 Source	Drop List	Control Not Used	See Table 4
Table1 - Condition2, Argument 2 Number	Depends on control source	1	See Table 4
Table1 - Condition3, Argument 1 Source	Drop List	Control Not Used	See Table 4
Table1 - Condition3, Argument 1 Number	Depends on control source	1	See Table 4
Table1 - Condition3, Operator	Drop List	=, Equal	See Table 16
Table1 - Condition3, Argument 2 Source	Drop List	Control Not Used	See Table 4
Table1 - Condition3, Argument 2 Number	Depends on control source	1	See Table 4

4.7. Math Function Block

The Math Function Block is defined in Section 1.3. Please refer there for detailed information about how all these setpoints are used. “**Math Function Enabled**” is ‘False’ by default. To enable a Math function Block, set “**Math Function Enabled**” to ‘True’ and select appropriate “**Input Source**”.



Setpoint Name	Value	Comment
Math Enabled	1	True
Math Output Minimum Range	0.00	
Math Output Maximum Range	100.00	
Input 1 Source	0	Control Not Used
Input 1 Number		Parameter not used with current Control Source selected
Input 1 Minimum		Parameter not used with current Control Source selected
Input 1 Maximum		Parameter not used with current Control Source selected
Input 1 Gain		Parameter not used with current Control Source selected
Input 2 Source	0	Control Not Used
Input 2 Number		Parameter not used with current Control Source selected
Input 2 Minimum		Parameter not used with current Control Source selected
Input 2 Maximum		Parameter not used with current Control Source selected
Input 2 Gain		Parameter not used with current Control Source selected
Input 3 Source	0	Control Not Used
Input 3 Number		Parameter not used with current Control Source selected
Input 3 Minimum		Parameter not used with current Control Source selected
Input 3 Maximum		Parameter not used with current Control Source selected
Input 3 Gain		Parameter not used with current Control Source selected
Input 4 Source	0	Control Not Used
Input 4 Number		Parameter not used with current Control Source selected
Input 4 Minimum		Parameter not used with current Control Source selected
Input 4 Maximum		Parameter not used with current Control Source selected
Input 4 Gain		Parameter not used with current Control Source selected
Math Function 1		Parameter not used with current Control Source selected
Math Function 2		Parameter not used with current Control Source selected
Math Function 3		Parameter not used with current Control Source selected

Figure 23 – Screen Capture of Math Function Block Setpoints

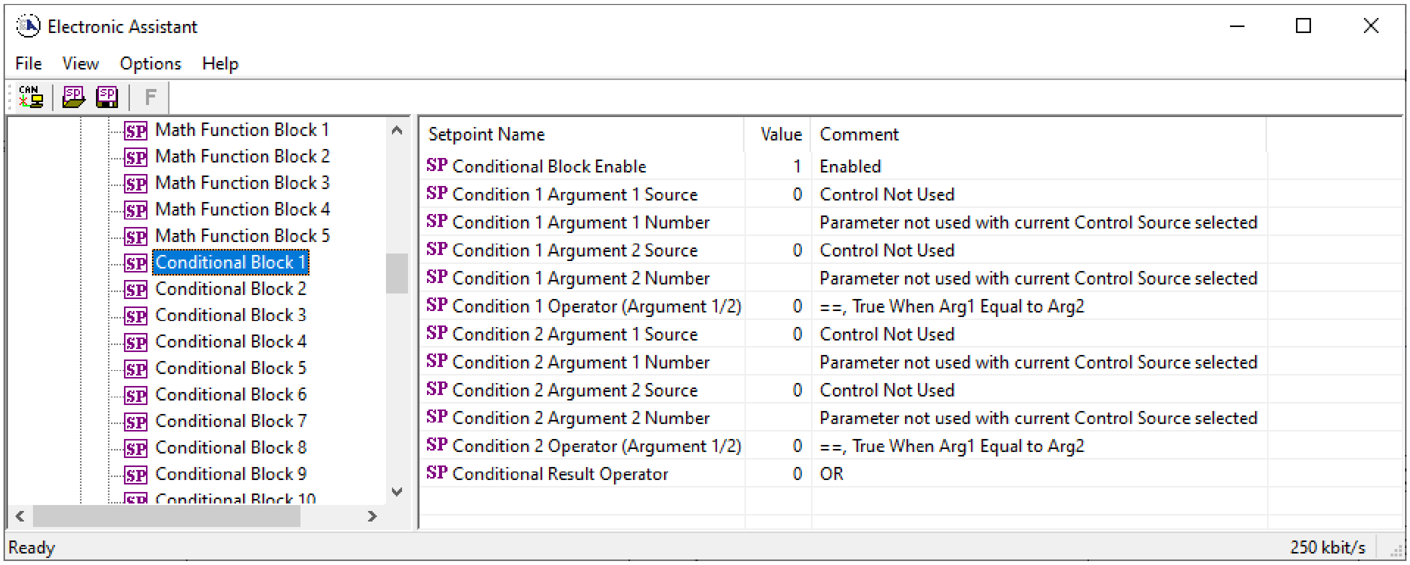
Table 23 – Math Function Setpoints

Name	**Range**	**Default**	**Notes**
Math Function Enabled	Drop List	False	
Function 1 Input A Source	Drop List	Control not used	See Table 4
Function 1 Input A Number	Depends on control source	1	See Table 4
Function 1 Input A Minimum	-10^6 to 10^6	0.0	
Function 1 Input A Maximum	-10^6 to 10^6	100.0	
Function 1 Input A Scaler	-100 to 100	1.00	
Function 1 Input B Source	Drop List	Control not used	See Table 4
Function 1 Input B Number	Depends on control source	1	See Table 4
Function 1 Input B Minimum	-10^6 to 10^6	0.0	
Function 1 Input B Maximum	-10^6 to 10^6	100.0	
Function 1 Input B Scaler	-100 to 100	1.00	
Math Function 1 Operation	Drop List	=, True when InA Equals InB	See Table 16
Function 2 Input B Source	Drop List	Control not used	See Table 4

Function 2 Input B Number	Depends on control source	1	See Table 4
Function 2 Input B Minimum	-10^6 to 10^6	0.0	
Function 2 Input B Maximum	-10^6 to 10^6	100.0	
Function 2 Input B Scaler	-1.00 to 1.00	1.00	
Math Function 3 Operation	Drop List	=, True when InA Equals InB	See Table 16
Function 3 Input B Source	Drop List	Control not used	See Table 4
Function 3 Input B Number	Depends on control source	1	See Table 4
Function 3 Input B Minimum	-10^6 to 10^6	0.0	
Function 3 Input B Maximum	-10^6 to 10^6	100.0	
Function 3 Input B Scaler	-1.00 to 1.00	1.00	
Math Function 3 Operation	Drop List	=, True when InA Equals InB	See Table 16
Function 4 Input B Source	Drop List	Control not used	See Table 4
Function 4 Input B Number	Depends on control source	1	See Table 4
Function 4 Input B Minimum	-10^6 to 10^6	0.0	
Function 4 Input B Maximum	-10^6 to 10^6	100.0	
Function 4 Input B Scaler	-1.00 to 1.00	1.00	
Math Function 4 Operation	Drop List	=, True when InA Equals InB	See Table 16
Math Output Minimum Range	-10^6 to 10^6	0.0	
Math Outptu Maximum Range	-10^6 to 10^6	100.0	

4.8. Conditional Logic Block Setpoints

The Conditional Block setpoints are defined in Section 1.4. Refer to that section for detailed information on how these setpoints are used. The screen capture in Figure 24 displays the available setpoints for each of the Conditional Blocks. The table below the screen capture highlights the allowable ranges for each setpoint.



Setpoint Name	Value	Comment
Conditional Block Enable	1	Enabled
Condition 1 Argument 1 Source	0	Control Not Used
Condition 1 Argument 1 Number		Parameter not used with current Control Source selected
Condition 1 Argument 2 Source	0	Control Not Used
Condition 1 Argument 2 Number		Parameter not used with current Control Source selected
Condition 1 Operator (Argument 1/2)	0	==, True When Arg1 Equal to Arg2
Condition 2 Argument 1 Source	0	Control Not Used
Condition 2 Argument 1 Number		Parameter not used with current Control Source selected
Condition 2 Argument 2 Source	0	Control Not Used
Condition 2 Argument 2 Number		Parameter not used with current Control Source selected
Condition 2 Operator (Argument 1/2)	0	==, True When Arg1 Equal to Arg2
Conditional Result Operator	0	OR

Figure 24: Screen Capture of Conditional Block Setpoints

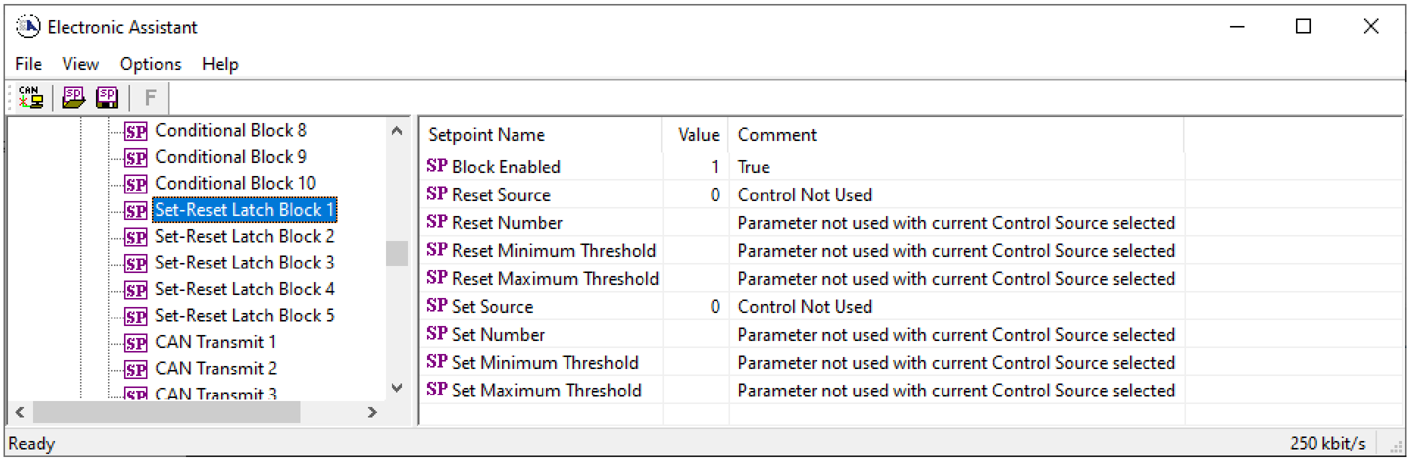
Table 24. Default Conditional Block Setpoints

Name	Range	Default	Notes
Conditional Function Enabled	Drop List	Disabled	
Condition 1 Argument 1 Source	Drop List	Digital Input	See **Table 4**

Condition 1 Argument 1 Number	Depends on Source Selected	0	See **Table 4**
Condition 1 Argument 2 Source	Drop List	Digital Input	See **Table 4**
Condition 1 Argument 2 Number	Depends on Source Selected	0	See **Table 4**
Condition 1 Operator (Argument 1/2)	Drop List	0	Refer to Table 11
Condition 2 Argument 1 Source	Drop List	Digital Input	See **Table 4**
Condition 2 Argument 1 Number	Depends on Source Selected	0	See **Table 4**
Condition 2 Argument 2 Source	Drop List	Digital Input	See **Table 4**
Condition 2 Argument 2 Number	Depends on Source Selected	0	See **Table 4**
Condition 2 Operator (Argument 1/2)	Drop List	0	Refer to Table 11
Conditional Result Operator	Drop List	OR	Refer to Table 12

4.9. Set-Reset Latch Block

The Set-Reset Latch Block setpoints are defined in Section 1.5. Refer to that section for detailed information on how these setpoints are used. The screen capture in Figure 25 displays the available setpoints for each of the Set-Reset Latch Blocks. The table below the screen capture highlights the allowable ranges for each setpoint.



Setpoint Name	Value	Comment
Block Enabled	1	True
Reset Source	0	Control Not Used
Reset Number		Parameter not used with current Control Source selected
Reset Minimum Threshold		Parameter not used with current Control Source selected
Reset Maximum Threshold		Parameter not used with current Control Source selected
Set Source	0	Control Not Used
Set Number		Parameter not used with current Control Source selected
Set Minimum Threshold		Parameter not used with current Control Source selected
Set Maximum Threshold		Parameter not used with current Control Source selected

Figure 25: Screen Capture of Set-Reset Latch Block Setpoints

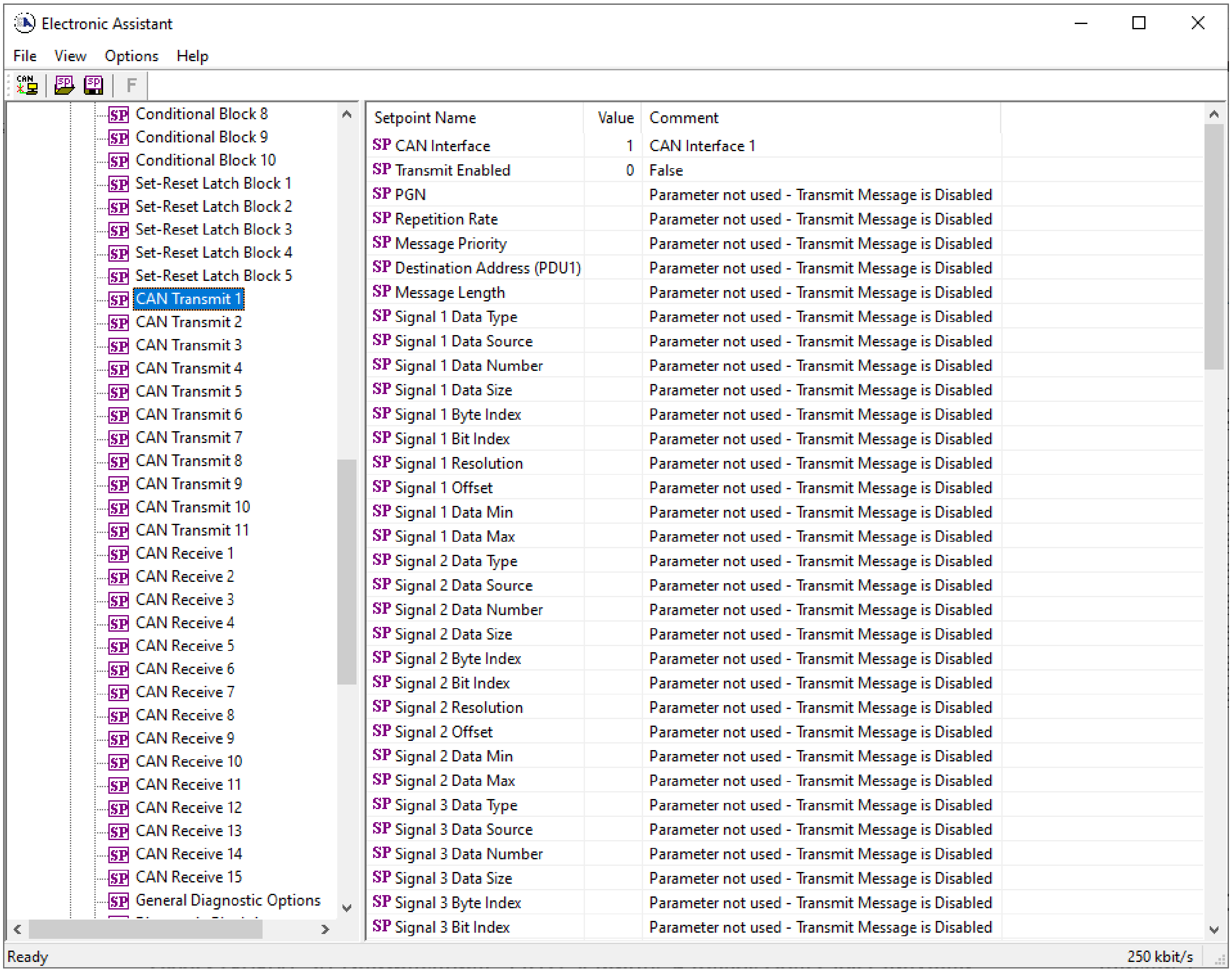
Table 25. Default Set-Reset Latch Block Setpoints

Name	**Range**	**Default**	**Notes**
Block Enabled	Drop List	False	
Reset Source	Drop List	Control Not Used	See **Table 4**

Reset Number	Depends on Source Selected	1	See **Table 4**
Reset Minimum Threshold	Drop List	0%	Refer to Section 1.5
Reset Maximum Threshold	Depends on Source Selected	100%	Refer to Section 1.5
Set Source	Drop List	Control Not Used	See **Table 4**
Set Number	Drop List	1	See **Table 4**
Set Minimum Threshold	Depends on Source Selected	0%	Refer to Section 1.5
Set Maximum Threshold	Drop List	100%	Refer to Section 1.5

4.10. CAN Transmit Setpoints

CAN Transmit Message Function Block is presented in section 1.10. Please refer there for detailed information how these setpoints are used. “**Transmit Repetition Rate**” is 0ms by default, thus no message will be sent.



Setpoint Name	Value	Comment
CAN Interface	1	CAN Interface 1
Transmit Enabled	0	False
PGN		Parameter not used - Transmit Message is Disabled
Repetition Rate		Parameter not used - Transmit Message is Disabled
Message Priority		Parameter not used - Transmit Message is Disabled
Destination Address (PDU1)		Parameter not used - Transmit Message is Disabled
Message Length		Parameter not used - Transmit Message is Disabled
Signal 1 Data Type		Parameter not used - Transmit Message is Disabled
Signal 1 Data Source		Parameter not used - Transmit Message is Disabled
Signal 1 Data Number		Parameter not used - Transmit Message is Disabled
Signal 1 Data Size		Parameter not used - Transmit Message is Disabled
Signal 1 Byte Index		Parameter not used - Transmit Message is Disabled
Signal 1 Bit Index		Parameter not used - Transmit Message is Disabled
Signal 1 Resolution		Parameter not used - Transmit Message is Disabled
Signal 1 Offset		Parameter not used - Transmit Message is Disabled
Signal 1 Data Min		Parameter not used - Transmit Message is Disabled
Signal 1 Data Max		Parameter not used - Transmit Message is Disabled
Signal 2 Data Type		Parameter not used - Transmit Message is Disabled
Signal 2 Data Source		Parameter not used - Transmit Message is Disabled
Signal 2 Data Number		Parameter not used - Transmit Message is Disabled
Signal 2 Data Size		Parameter not used - Transmit Message is Disabled
Signal 2 Byte Index		Parameter not used - Transmit Message is Disabled
Signal 2 Bit Index		Parameter not used - Transmit Message is Disabled
Signal 2 Resolution		Parameter not used - Transmit Message is Disabled
Signal 2 Offset		Parameter not used - Transmit Message is Disabled
Signal 2 Data Min		Parameter not used - Transmit Message is Disabled
Signal 2 Data Max		Parameter not used - Transmit Message is Disabled
Signal 3 Data Type		Parameter not used - Transmit Message is Disabled
Signal 3 Data Source		Parameter not used - Transmit Message is Disabled
Signal 3 Data Number		Parameter not used - Transmit Message is Disabled
Signal 3 Data Size		Parameter not used - Transmit Message is Disabled
Signal 3 Byte Index		Parameter not used - Transmit Message is Disabled
Signal 3 Bit Index		Parameter not used - Transmit Message is Disabled

Figure 26 – Screen Capture of CAN Transmit Message Setpoints

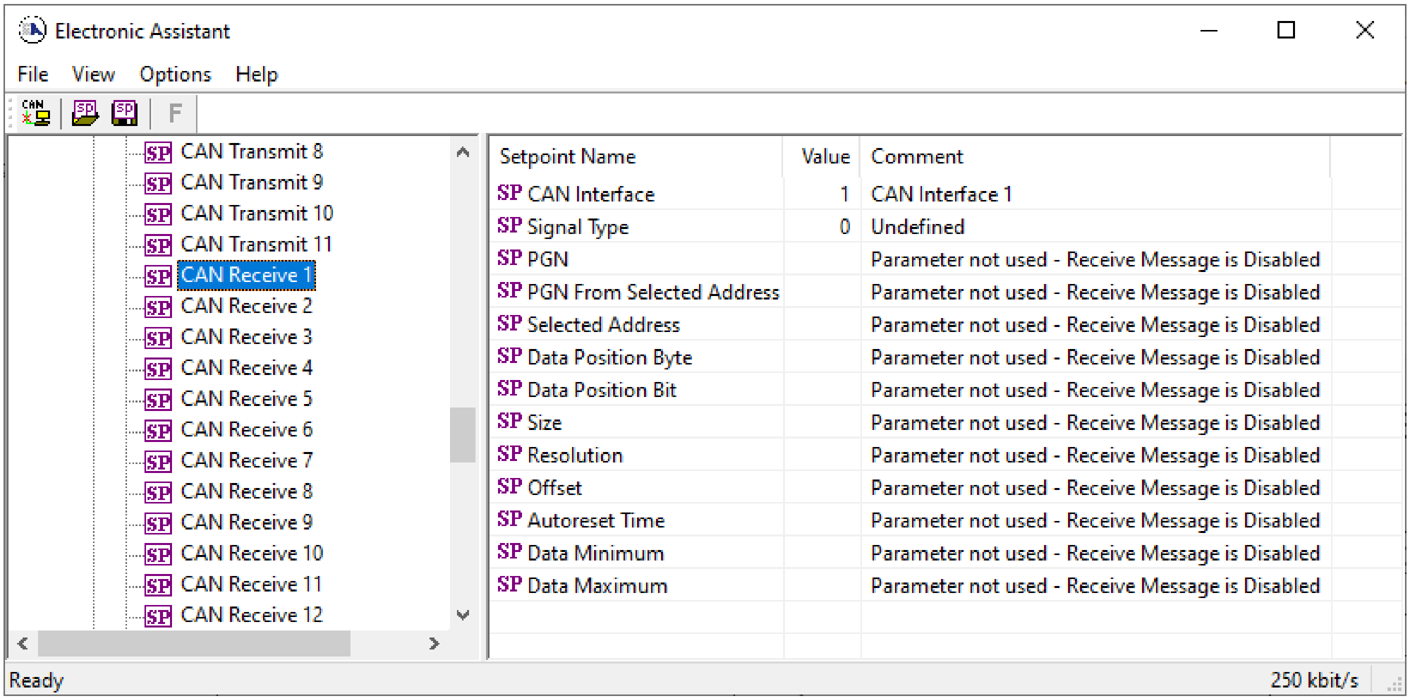
Table 26 – CAN Transmit Message Setpoints

Name	**Range**	**Default**	**Notes**
CAN Interface	Drop List	CAN Interface #1	
Transmit Enabled	Drop List	0, False	
Transmit PGN	0xff00 … 0xffff	Different for each	See section 1.10.1
Transmit Repetition Rate	0 … 65000 ms	0ms	0ms disables transmit
Transmit Message Priority	0...7	6	Proprietary B Priority
Destination Address	0...255	255	Not used by default
Signal X Control Source	Drop List	Different for each	See Table 4
Signal X Control Number	Drop List	Different for each	See 1.10.2
Signal X Transmit Data Size	Drop List	2 bytes	
Signal X Transmit Data Index in Array	0-7	0	
Signal X Transmit Bit Index In Byte	0-7	0	
Signal X Transmit Data Resolution	-100000.0 to 100000	1/bits	
Signal X Transmit Data Offset	-10000 to 10000	0.0	

Signal X Transmit Data Minimum	-100000.0 to 100000	0.0	
Signal X Transmit Data Maximum	-100000.0 to 100000	65535.0	

4.11. CAN Receive Setpoints

The CAN Receive Block is defined in section 1.11. Please refer there for detailed information about how these setpoints are used. “**Receive Message Timeout**” is set to 0ms by default. To enable Receive message set “**Receive Message Timeout**” that differs from zero.



Setpoint Name	Value	Comment
SP CAN Interface	1	CAN Interface 1
SP Signal Type	0	Undefined
SP PGN		Parameter not used - Receive Message is Disabled
SP PGN From Selected Address		Parameter not used - Receive Message is Disabled
SP Selected Address		Parameter not used - Receive Message is Disabled
SP Data Position Byte		Parameter not used - Receive Message is Disabled
SP Data Position Bit		Parameter not used - Receive Message is Disabled
SP Size		Parameter not used - Receive Message is Disabled
SP Resolution		Parameter not used - Receive Message is Disabled
SP Offset		Parameter not used - Receive Message is Disabled
SP Autoreset Time		Parameter not used - Receive Message is Disabled
SP Data Minimum		Parameter not used - Receive Message is Disabled
SP Data Maximum		Parameter not used - Receive Message is Disabled

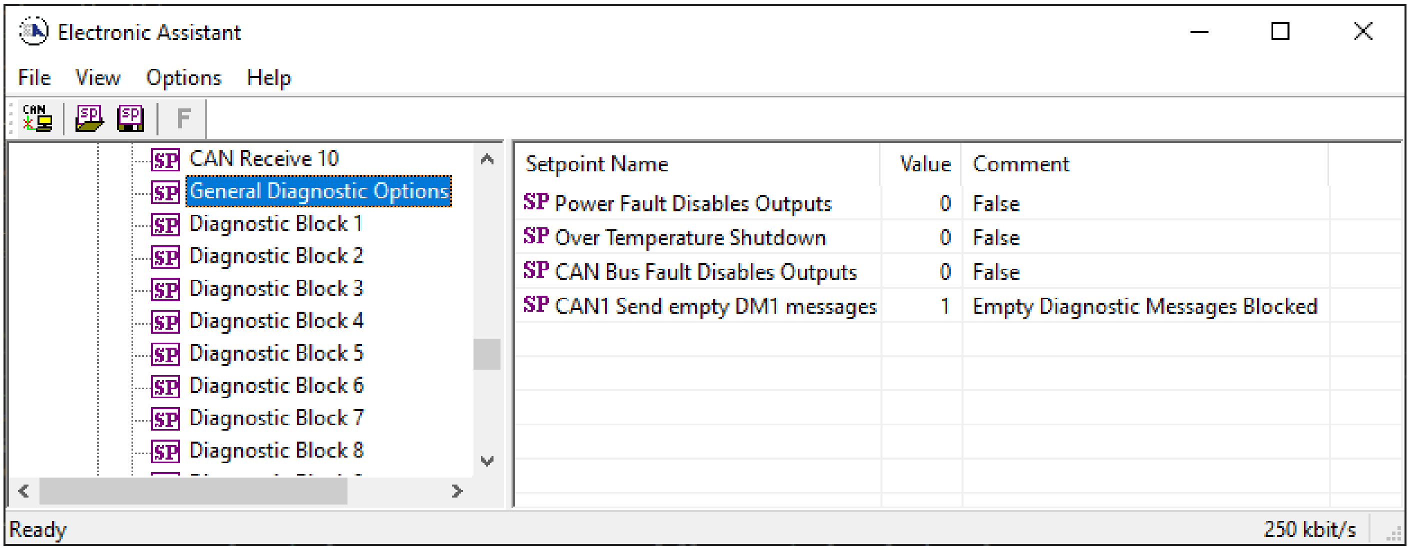
Figure 27 – Screen Capture of CAN Receive Message Setpoints

Table 27 – CAN Receive Setpoints

Name	**Range**	**Default**	**Notes**
CAN Interface	Drop List	CAN Interface #1	
Received Message Enabled	Drop List	False	
Received PGN	0 to 65536	Different for each	
Received Message Timeout	0 to 60 000 ms	0ms	
Specific Address that sends PGN	0 to 255	254 (0xFE, Null Addr)	
Receive Transmit Data Size	Drop List	2 bytes	
Receive Transmit Data Index in Array	0-7	4	
Receive Transmit Bit Index In Byte	0-7	0	
Receive Transmit Data Resolution	-100000.0 to 100000	0.001	
Receive Transmit Data Offset	-10000 to 10000	0.0	
Receive Data Min (Off Threshold)	-1000000 to Max	0.0	
Receive Data Max (On Threshold)	-100000 to 100000	2.0	

4.12. General Diagnostics Options

These setpoints control the shutdown of the ECU in case of a power supply or CPU temperature related errors. Refer to section 1.2 for more info.



Setpoint Name	Value	Comment
SP Power Fault Disables Outputs	0	False
SP Over Temperature Shutdown	0	False
SP CAN Bus Fault Disables Outputs	0	False
SP CAN1 Send empty DM1 messages	1	Empty Diagnostic Messages Blocked

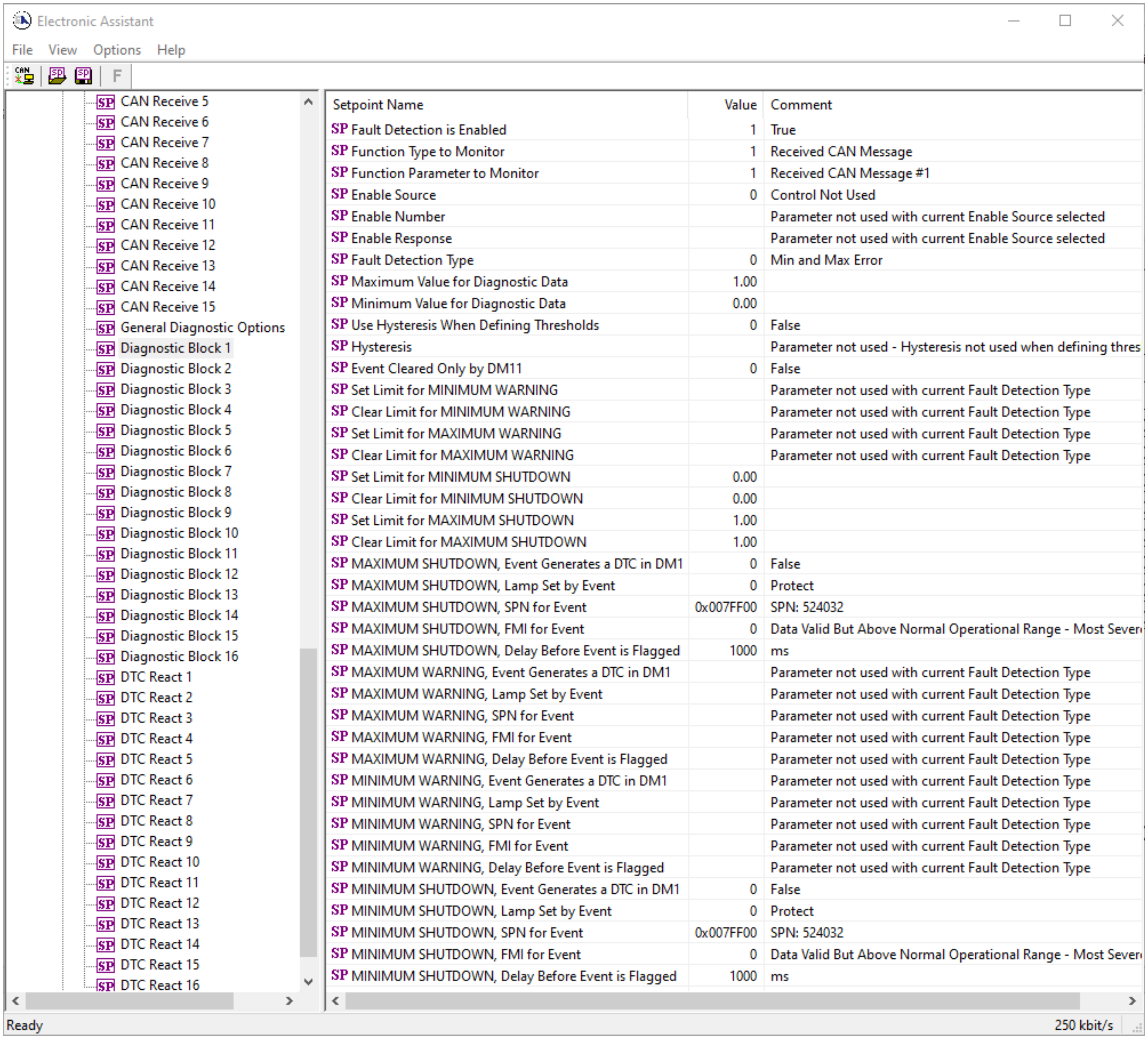
Figure 28 – Screen Capture of General Diagnostics Options Setpoints

Table 28 – General Diagnostics Options Setpoints

Name	Range	Default	Notes
Power Fault Disables Outputs	Drop List	0	
Over Temperature Shutdown	Drop List	0	
CAN Bus Fault Disables Outputs	Drop List	0	
CAN1 Send empty DM1 messages	Drop List	0	

4.13. Diagnostics Blocks

There are 16 Diagnostics blocks that can be configured to monitor various parameters of the Controller. The Diagnostic Function Block is defined in section 1.2. Please refer there for detailed information how these setpoints are used.



Setpoint Name	Value	Comment
SP Fault Detection is Enabled	1	True
SP Function Type to Monitor	1	Received CAN Message
SP Function Parameter to Monitor	1	Received CAN Message #1
SP Enable Source	0	Control Not Used
SP Enable Number		Parameter not used with current Enable Source selected
SP Enable Response		Parameter not used with current Enable Source selected
SP Fault Detection Type	0	Min and Max Error
SP Maximum Value for Diagnostic Data	1.00	
SP Minimum Value for Diagnostic Data	0.00	
SP Use Hysteresis When Defining Thresholds	0	False
SP Hysteresis		Parameter not used - Hysteresis not used when defining thres
SP Event Cleared Only by DM11	0	False
SP Set Limit for MINIMUM WARNING		Parameter not used with current Fault Detection Type
SP Clear Limit for MINIMUM WARNING		Parameter not used with current Fault Detection Type
SP Set Limit for MAXIMUM WARNING		Parameter not used with current Fault Detection Type
SP Clear Limit for MAXIMUM WARNING		Parameter not used with current Fault Detection Type
SP Set Limit for MINIMUM SHUTDOWN	0.00	
SP Clear Limit for MINIMUM SHUTDOWN	0.00	
SP Set Limit for MAXIMUM SHUTDOWN	1.00	
SP Clear Limit for MAXIMUM SHUTDOWN	1.00	
SP MAXIMUM SHUTDOWN, Event Generates a DTC in DM1	0	False
SP MAXIMUM SHUTDOWN, Lamp Set by Event	0	Protect
SP MAXIMUM SHUTDOWN, SPN for Event	0x007FF00	SPN: 524032
SP MAXIMUM SHUTDOWN, FMI for Event	0	Data Valid But Above Normal Operational Range - Most Sever
SP MAXIMUM SHUTDOWN, Delay Before Event is Flagged	1000	ms
SP MAXIMUM WARNING, Event Generates a DTC in DM1		Parameter not used with current Fault Detection Type
SP MAXIMUM WARNING, Lamp Set by Event		Parameter not used with current Fault Detection Type
SP MAXIMUM WARNING, SPN for Event		Parameter not used with current Fault Detection Type
SP MAXIMUM WARNING, FMI for Event		Parameter not used with current Fault Detection Type
SP MAXIMUM WARNING, Delay Before Event is Flagged		Parameter not used with current Fault Detection Type
SP MINIMUM WARNING, Event Generates a DTC in DM1		Parameter not used with current Fault Detection Type
SP MINIMUM WARNING, Lamp Set by Event		Parameter not used with current Fault Detection Type
SP MINIMUM WARNING, SPN for Event		Parameter not used with current Fault Detection Type
SP MINIMUM WARNING, FMI for Event		Parameter not used with current Fault Detection Type
SP MINIMUM WARNING, Delay Before Event is Flagged		Parameter not used with current Fault Detection Type
SP MINIMUM SHUTDOWN, Event Generates a DTC in DM1	0	False
SP MINIMUM SHUTDOWN, Lamp Set by Event	0	Protect
SP MINIMUM SHUTDOWN, SPN for Event	0x007FF00	SPN: 524032
SP MINIMUM SHUTDOWN, FMI for Event	0	Data Valid But Above Normal Operational Range - Most Sever
SP MINIMUM SHUTDOWN, Delay Before Event is Flagged	1000	ms

Figure 29 – Screen Capture of Diagnostic Block Setpoints

Table 29 – Diagnostic Block Setpoints

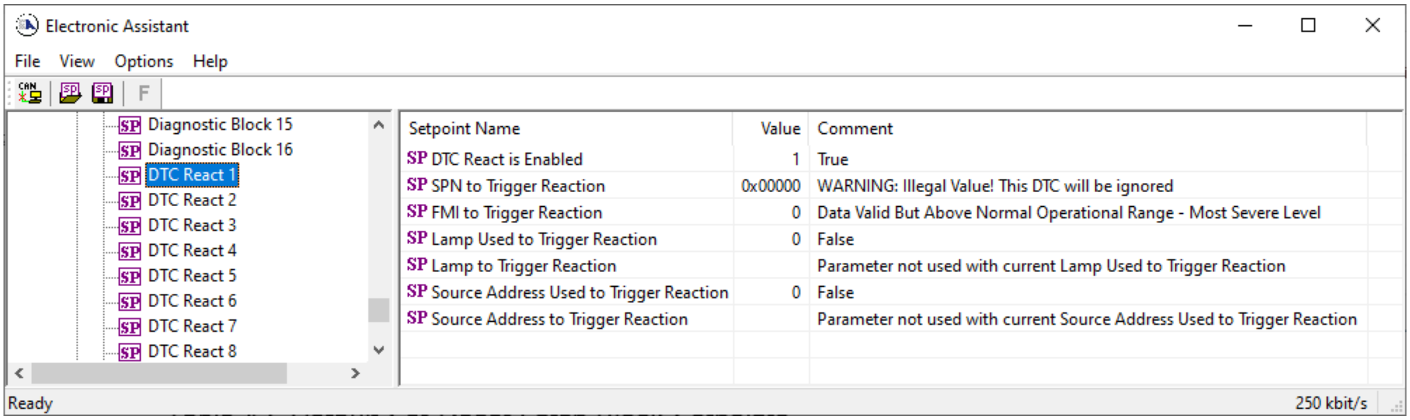
Name	**Range**	**Default**	**Notes**
Fault Detection is Enabled	Drop List	False	
Function Type to Monitor	Drop List	0 – Control not used	
Function parameter to Monitor	Drop List	0 – No selection	
Fault Detection Type	Drop List	0 – Min and Max Error	See section 1.2

Maximum Value for Diagnostic Data	Minimum Value for Diagnostic Data … $4.28e^9$	5.0	
Minimum Value for Diagnostic Data	0.0 … Maximum Value for Diagnostic Data	0.0	
Use Hysteresis When Defining Thresholds	Drop List	False	
Hysteresis	0.0 … Maximum Value for Diagnostic Data	0.0	
Event Cleared only by DM11	Drop List	False	
Set Limit for MAXIMUM SHUTDOWN	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	4.8	
Clear Limit for MAXIMUM SHUTDOWN	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	4.6	
Set Limit for MAXIMUM WARNING	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	0.0	
Clear Limit for MAXIMUM WARNING	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	0.0	
Clear Limit for MINIMUM WARNING	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	0.0	
Set Limit for MINIMUM WARNING	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	0.0	
Clear Limit for MINIMUM SHUTDOWN	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	0.4	
Set Limit for MINIMUM SHUTDOWN	Minimum Value for Diagnostic Data … Maximum Value for Diagnostics Data	0.2	
MAXIMUM SHUTDOWN, Event Generates a DTC in DM1	Drop List	True	
MAXIMUM SHUTDOWN, Lamp Set by Event	Drop List	0 – Protect	See Table 7
MAXIMUM SHUTDOWN, SPN for Event	0…524287	520448 ($7F100)	It is the user's responsibility to select an SPN that will not violate the J1939 standard.
MAXIMUM SHUTDOWN, FMI for Event	Drop List	3, Voltage Above Normal	See Table 8
MAXIMUM SHUTDOWN, Delay Before Event is Flagged	0…60000 ms	1000	
MAXIMUM WARNING, Event Generates a DTC in DM1	Drop List	True	

MAXIMUM WARNING, Lamp Set by Event	Drop List	0 – Protect	See Table 7
MAXIMUM WARNING, SPN for Event	0…524287	520704 ($7F200)	It is the user's responsibility to select an SPN that will not violate the J1939 standard.
MAXIMUM WARNING, FMI for Event	Drop List	3, Voltage Above Normal	See Table 8
MAXIMUM WARNING, Delay Before Event is Flagged	0…60000 ms	1000	
MINIMUM WARNING, Event Generates a DTC in DM1	Drop List	True	
MINIMUM WARNING, Lamp Set by Event	Drop List	0 – Protect	See Table 7
MAXIMUM WARNING, SPN for Event	0…524287	520960 ($7F300)	It is the user's responsibility to select an SPN that will not violate the J1939 standard.
MINIMUM WARNING, FMI for Event	Drop List	4, Voltage Below Normal	See Table 8
MINIMUM WARNING, Delay Before Event is Flagged	0…60000 ms	1000	
MINIMUM SHUTDOWN, Event Generates a DTC in DM1	Drop List	True	
MINIMUM SHUTDOWN, Lamp Set by Event	Drop List	Amber Warning	See Table 7
MINIMUM SHUTDOWN, SPN for Event	0…524287	521216 ($7F400)	It is the user's responsibility to select an SPN that will not violate the J1939 standard.
MINIMUM SHUTDOWN, FMI for Event	Drop List	4, Voltage Below Normal	See Table 8
MINIMUM SHUTDOWN, Delay Before Event is Flagged	0…60000 ms	1000	

4.14. DTC React Function Block

The DTC React function block is described in Section 1.9. The Figure below shows the DTC React function block setpoints. The Table below show the default values. Please note: *The setpoint “DTC React is Enabled” was changed to 1, True.*



Setpoint Name	Value	Comment
SP DTC React is Enabled	1	True
SP SPN to Trigger Reaction	0x00000	WARNING: Illegal Value! This DTC will be ignored
SP FMI to Trigger Reaction	0	Data Valid But Above Normal Operational Range - Most Severe Level
SP Lamp Used to Trigger Reaction	0	False
SP Lamp to Trigger Reaction		Parameter not used with current Lamp Used to Trigger Reaction
SP Source Address Used to Trigger Reaction	0	False
SP Source Address to Trigger Reaction		Parameter not used with current Source Address Used to Trigger Reaction

Figure 30 DTC React Setpoints

Table 30 – DTC React Setpoints

Name	**Range**	**Default**	**Notes**
DTC React is Enabled	Drop List	0, False	
SPN to Trigger Reaction	0x00 to 0x3FFFF	0	
FMI to Trigger Reaction	Drop List	0	
Lamp Used to Trigger Reaction	Drop list	0, False	
Lamp to Trigger Reaction	Drop List	0, Protect	
Source Address Used to Trigger Reaction	Drop list	0, False	
Source Address to Trigger Reaction	0x00 to 0xFF	0	

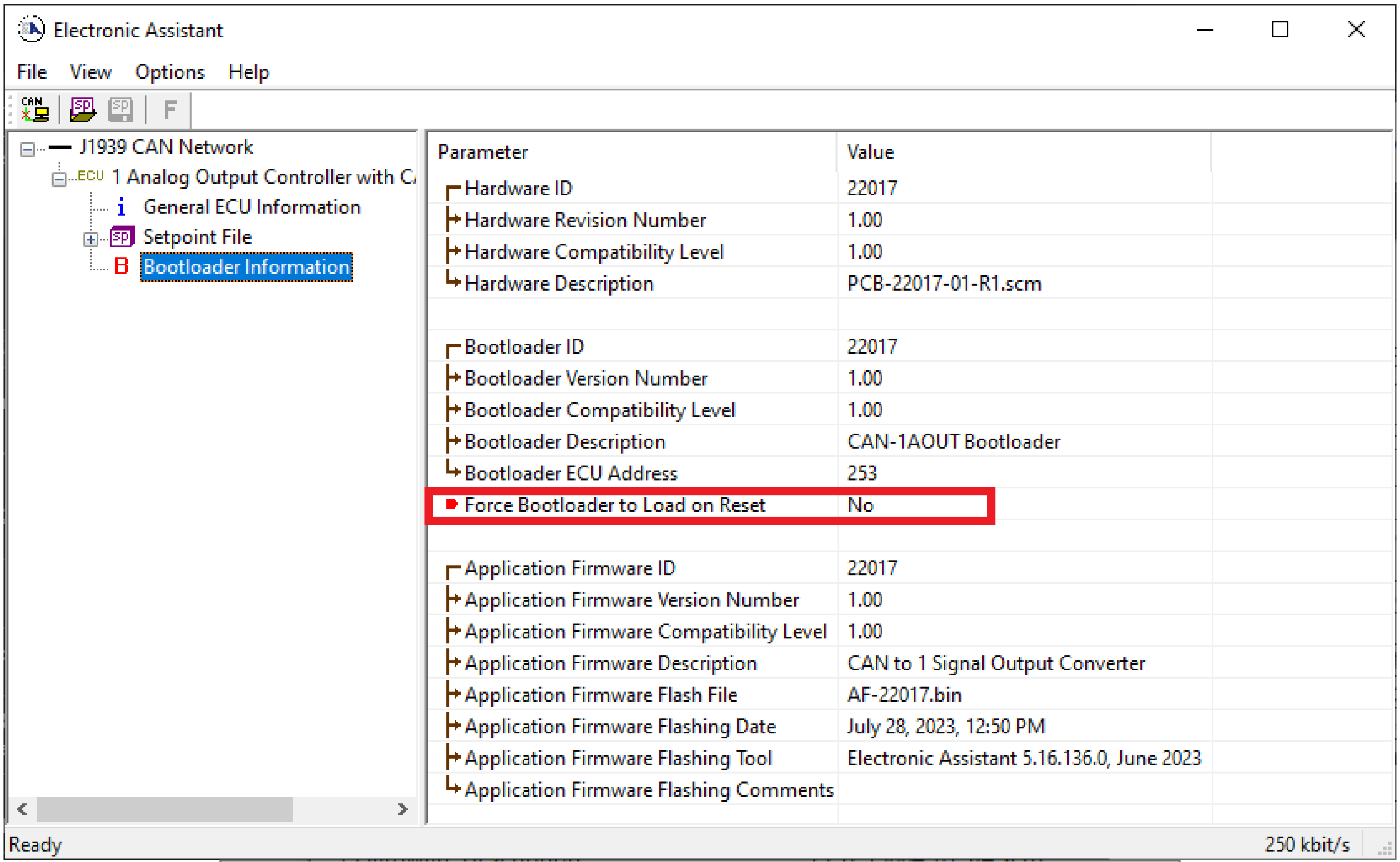
5. REFLASHING OVER CAN WITH EA BOOTLOADER

The AX130760 can be upgraded with new application firmware using the **Bootloader Information** section. This section details the simple step-by-step instructions to upload new firmware provided by Axiomatic onto the unit via CAN, without requiring it to be disconnected from the J1939 network.

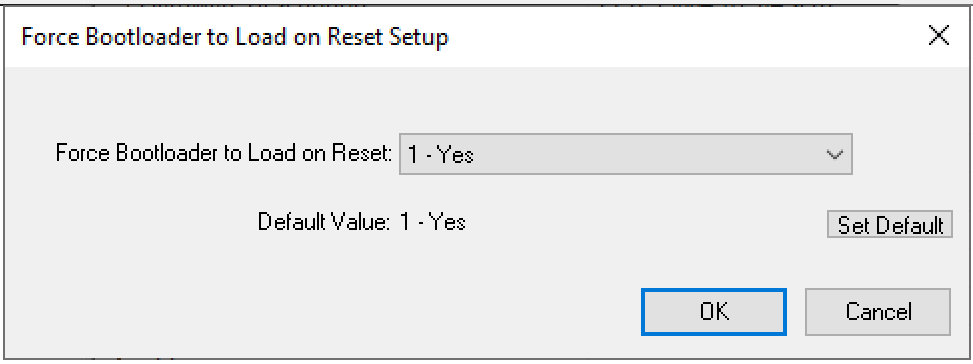
Note: To upgrade the firmware use Axiomatic Electronic Assistant V4.5.53.0 or higher.

1. When EA first connects to the ECU, the **Bootloader Information** section will display the following information.

2. To use the bootloader to upgrade the firmware running on the ECU, change the variable **"Force Bootloader To Load on Reset**" to *Yes.*



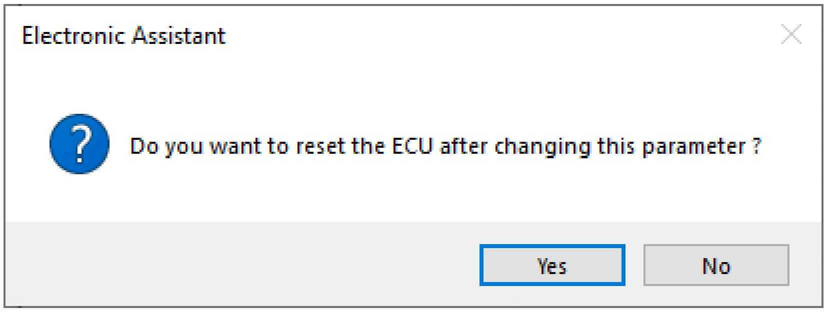
Parameter	Value
Hardware ID	22017
Hardware Revision Number	1.00
Hardware Compatibility Level	1.00
Hardware Description	PCB-22017-01-R1.scm
Bootloader ID	22017
Bootloader Version Number	1.00
Bootloader Compatibility Level	1.00
Bootloader Description	CAN-1AOUT Bootloader
Bootloader ECU Address	253
Force Bootloader to Load on Reset	No
Application Firmware ID	22017
Application Firmware Version Number	1.00
Application Firmware Compatibility Level	1.00
Application Firmware Description	CAN to 1 Signal Output Converter
Application Firmware Flash File	AF-22017.bin
Application Firmware Flashing Date	July 28, 2023, 12:50 PM
Application Firmware Flashing Tool	Electronic Assistant 5.16.136.0, June 2023
Application Firmware Flashing Comments	



Force Bootloader to Load on Reset: 1 - Yes

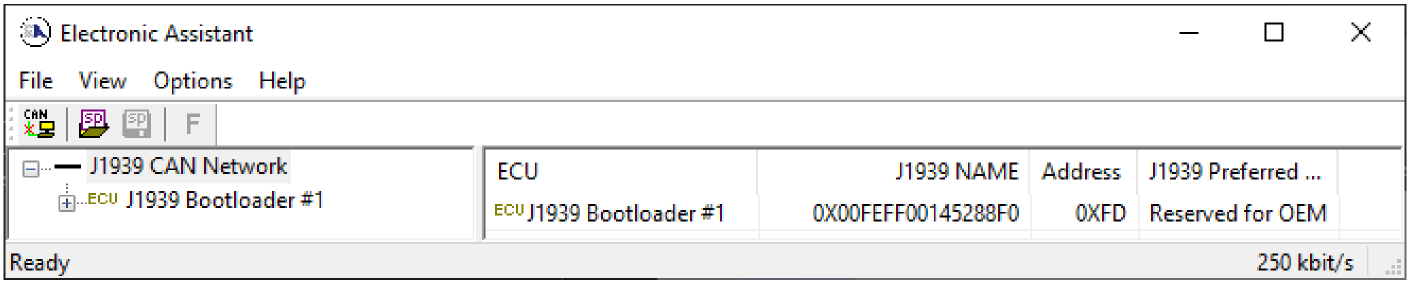
Default Value: 1 - Yes

3. When the prompt box asks if you want to reset the ECU, select *Yes*.

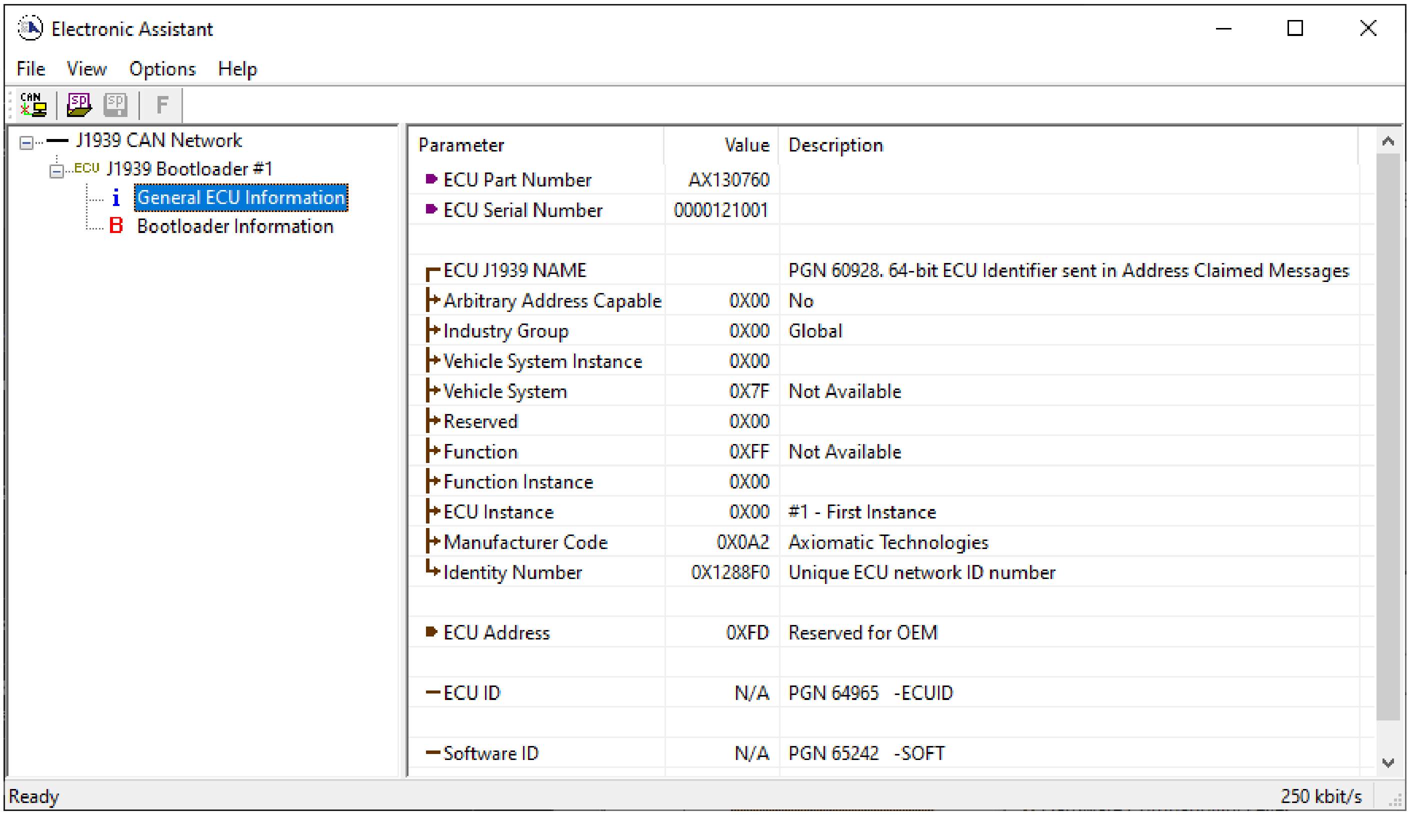


Do you want to reset the ECU after changing this parameter ?

4. Upon reset, the ECU will no longer show up on the J1939 network as an AX130760 but rather as **J1939 Bootloader #1**.



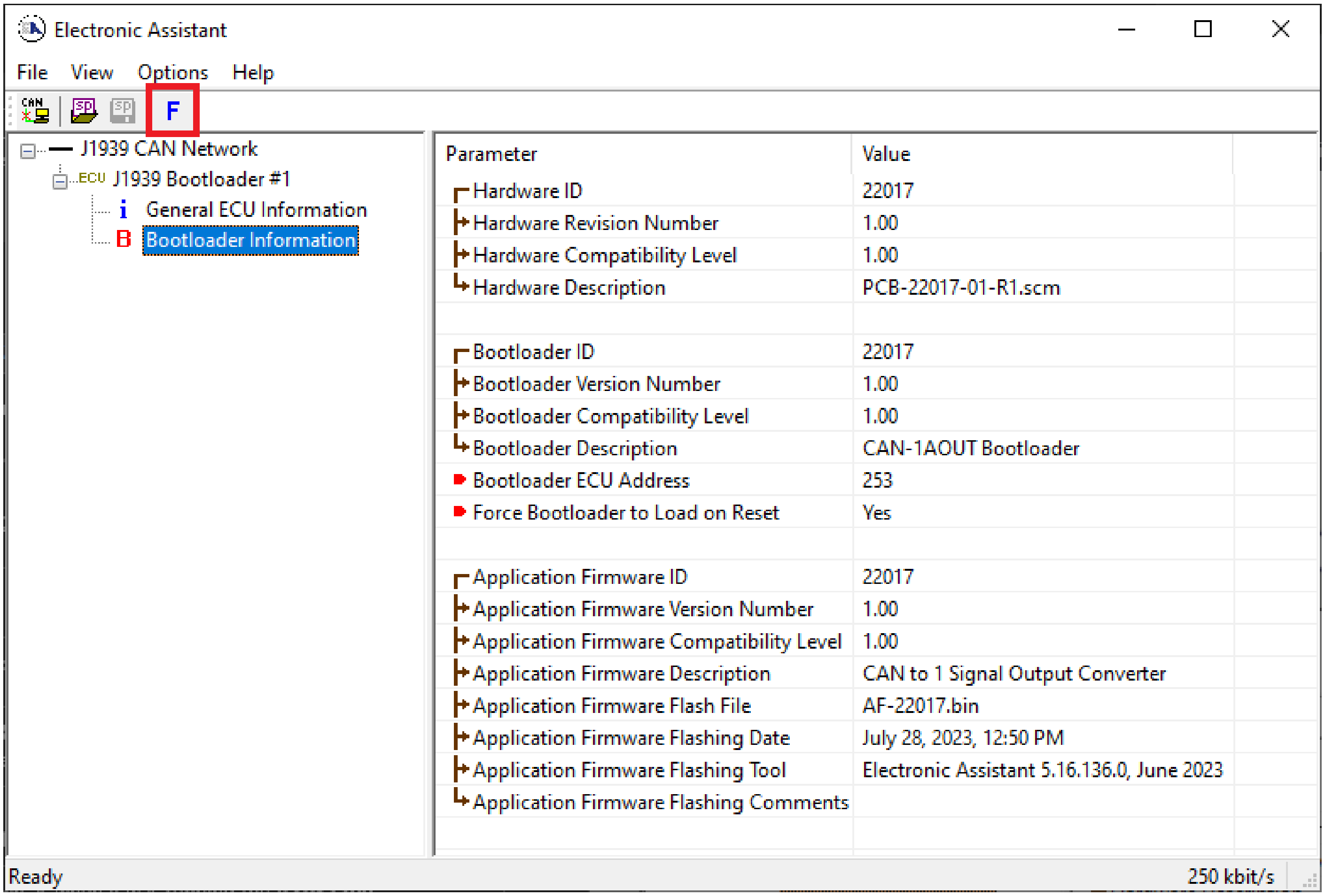
ECU	J1939 NAME	Address	J1939 Preferred ...
J1939 Bootloader #1	0X00FEFF00145288F0	0XFD	Reserved for OEM



Parameter	Value	Description
ECU Part Number	AX130760	
ECU Serial Number	0000121001	
ECU J1939 NAME		PGN 60928. 64-bit ECU Identifier sent in Address Claimed Messages
Arbitrary Address Capable	0X00	No
Industry Group	0X00	Global
Vehicle System Instance	0X00	
Vehicle System	0X7F	Not Available
Reserved	0X00	
Function	0XFF	Not Available
Function Instance	0X00	
ECU Instance	0X00	#1 - First Instance
Manufacturer Code	0X0A2	Axiomatic Technologies
Identity Number	0X1288F0	Unique ECU network ID number
ECU Address	0XFD	Reserved for OEM
ECU ID	N/A	PGN 64965 -ECUID
Software ID	N/A	PGN 65242 -SOFT

Note that the bootloader is NOT Arbitrary Address Capable. This means that if you want to have multiple bootloaders running simultaneously (not recommended) you would have to manually change the address for each one before activating the next, or there will be address conflicts. And only one ECU would show up as the bootloader. Once the 'active' bootloader returns to regular functionality, the other ECU(s) would have to be power cycled to re-activate the bootloader feature.

5. When the **Bootloader Information** section is selected, the same information is shown as when it was running the AX130760 firmware, but in this case the <u>F</u>lashing feature has been enabled.

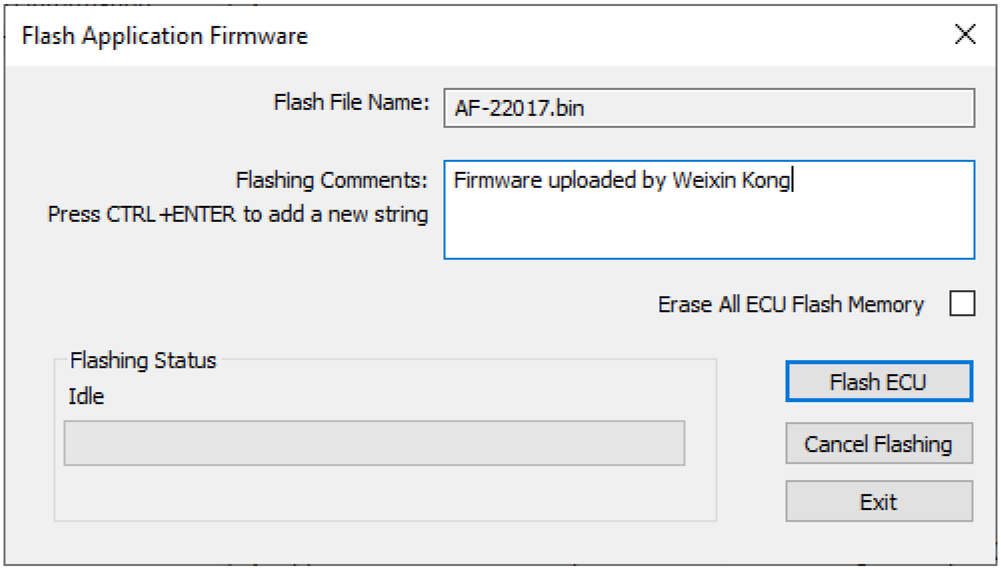


Parameter	Value
Hardware ID	22017
Hardware Revision Number	1.00
Hardware Compatibility Level	1.00
Hardware Description	PCB-22017-01-R1.scm
Bootloader ID	22017
Bootloader Version Number	1.00
Bootloader Compatibility Level	1.00
Bootloader Description	CAN-1AOUT Bootloader
Bootloader ECU Address	253
Force Bootloader to Load on Reset	Yes
Application Firmware ID	22017
Application Firmware Version Number	1.00
Application Firmware Compatibility Level	1.00
Application Firmware Description	CAN to 1 Signal Output Converter
Application Firmware Flash File	AF-22017.bin
Application Firmware Flashing Date	July 28, 2023, 12:50 PM
Application Firmware Flashing Tool	Electronic Assistant 5.16.136.0, June 2023
Application Firmware Flashing Comments	

6. Select the <u>F</u>lashing button and navigate to where you had saved the **AF-22017-VX.XX.bin** file sent from Axiomatic. (Note: only binary (.bin) files can be flashed using the EA tool.)

7. Once the Flash Application Firmware window opens, you can enter comments such as “Firmware upgraded by [Name]” if you so desire. This is not required, and you can leave the field blank if you do not want to use it.

   Note: You do not have to date/time-stamp the file, as this is done automatically by the EA tool when you upload the new firmware.



Flash Application Firmware

Flash File Name: AF-22017.bin

Flashing Comments: Firmware uploaded by Weixin Kong

Press CTRL+ENTER to add a new string

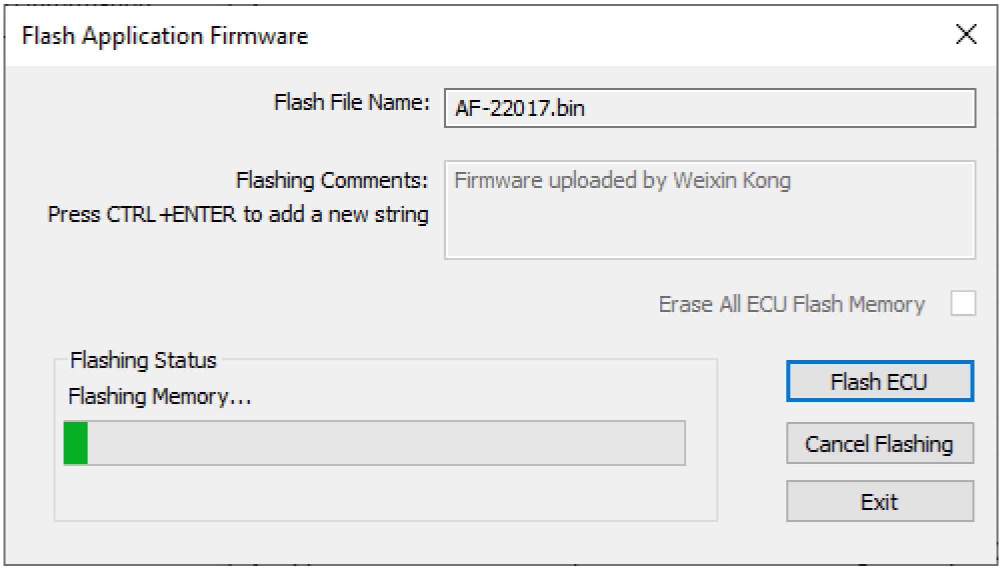
Erase All ECU Flash Memory ☐

Flashing Status

Idle

WARNING: Do not check the “Erase All ECU Flash Memory” box unless instructed to do so by your Axiomatic contact. Selecting this will erased ALL data stored in non-volatile flash, including the calibration done by Axiomatic during factory testing. It will also erase any configuration of the setpoints that might have been done to the ECU and reset all setpoints to their factory defaults. By leaving this box unchecked, none of the setpoints will be changed when the new firmware is uploaded.

A progress bar will show how much of the firmware has been sent as the upload progresses. The more traffic there is on the J1939 network, the longer the upload process will take.



Flash Application Firmware

Flash File Name: AF-22017.bin

Flashing Comments: Firmware uploaded by Weixin Kong

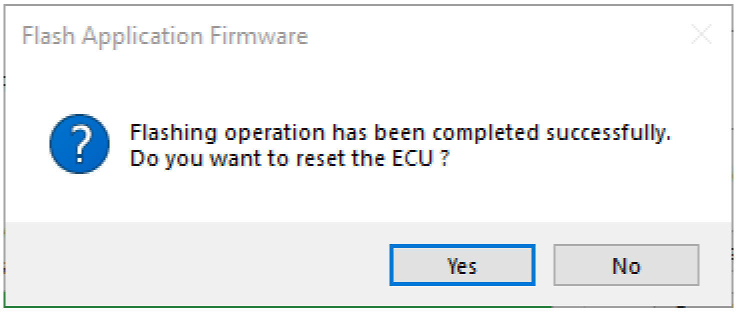
Press CTRL+ENTER to add a new string

Erase All ECU Flash Memory ☐

Flashing Status

Flashing Memory…

Once the firmware has finished uploading, a message will pop up indicating the successful operation. If you select to reset the ECU, the new version of the AX130760 application will start running, and the ECU will be identified as such by EA. Otherwise, The next time the ECU is power-cycled, the AX130760 application will run rather than the bootloader function.



Flashing operation has been completed successfully.
Do you want to reset the ECU ?

Note: If at any time during the upload the process is interrupted, the data is corrupted (bad checksum) or for any other reason the new firmware is not correct, i.e. bootloader detects that the file loaded was not designed to run on the hardware platform, the bad or corrupted application will not run. Rather, when the ECU is reset or power-cycled the **J1939 Bootloader** will continue to be the default application until valid firmware has been successfully uploaded into the unit.

APPENDIX A - TECHNICAL SPECIFICATION

Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application.
All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/ Limitations and Return Materials Process as described on https://www.axiomatic.com/service/.

Power

Power Supply Input	12 or 24 VDC nominal (9 to 36 VDC)
Quiescent Current	52.6 mA @ 12 V and 28.4 mA @ 24 V
Surge and Transient Protection	Provided
Reverse Polarity Protection	Provided
Under-Voltage Protection	Provided (hardware shutdown at 8V)
Over-Voltage Protection	Provided (hardware shutdown at 38V)

Output

<table>
<tr>
<td>Output</td>
<td>
1 signal output selectable as: Voltage, Current, or PWM

12-bit digital to analog
Protected against shorts to GND or +Vcc

<u>Voltage Types</u>:
Resolution: 12-bit
Maximum Load: 25 mA
<table>
<tr><th>Range (V)</th><th>Accuracy (%)</th></tr>
<tr><td>0-5</td><td>0.25</td></tr>
<tr><td>0-10</td><td>0.4</td></tr>
<tr><td>±5</td><td>0.25</td></tr>
<tr><td>±10</td><td>0.5</td></tr>
</table>

<u>Current Types</u>:
Resolution: 12-bit
Maximum Load: 500 Ω
<table>
<tr><th>Range (mA)</th><th>Accuracy (%)</th></tr>
<tr><td>0-20</td><td>0.5</td></tr>
<tr><td>4-20</td><td>0.2</td></tr>
</table>

<u>PWM Type</u>:
PWM Duty Cycle: 0-100%
Frequency Range: 0 Hz to 5 kHz
Amplitude: 5 V or 12 V

Maximum Load: 20 mA
<table>
<tr><th>Range (Hz)</th><th>Accuracy (%)</th></tr>
<tr><td>0-500</td><td>0.01</td></tr>
<tr><td>501-1000</td><td>0.08</td></tr>
<tr><td>1001-5000</td><td>0.4</td></tr>
</table>
</td>
</tr>
</table>

Control Logic

Control Logic	The CAN to 1 Signal Output Converter comes pre-programmed with standard logic.

Specifications

Microcontroller	STM32H725RGV3; 32-bit, 1Mbyte Flash Program Memory
CAN Port	1 CAN (SAE J1939)
User Interface, Reflashing	Axiomatic Electronic Assistant KIT - P/N: **AX070502**, or **AX070506K**
Compliance	RoHS, REACH
Vibration	Pending (MIL-STD-202G, Test 204D and 214A (Sine and Random) 10 g peak (Sine); 7.86 Grms peak (Random))
Shock	Pending (MIL-STD-202G, Test 213B, 50 g)
Operating Conditions	-40 to 85°C (-40 to 185°F)
Storage Temperature	-50 to 125 °C
Weight	0.1 lbs. (0.0454 kg)
Protection	IP67

<table>
<tr><td>Enclosure and Dimensions</td><td>Plastic Enclosure, Nylon 6-6 with 30% glass fill
Laser welded
Integral connector equivalent to 6-pin TE Deutsch connector
Refer to dimensional drawing.</td></tr>
<tr><td>Electrical Connections</td><td>6 pin equivalent TE Deutsch connector P/N: DT04-6P
A mating plug kit is available as Axiomatic P/N: **AX070119** (includes 1 Plug DT06-6S, 6 Contacts 0462-201-16141, and 1 Wedgelock W6S)
<table>
<tr><th colspan="2">CAN and I/O Connector</th></tr>
<tr><th>Pin #</th><th>Description</th></tr>
<tr><td>1</td><td>BATT+</td></tr>
<tr><td>2</td><td>BATT-</td></tr>
<tr><td>3</td><td>GND</td></tr>
<tr><td>4</td><td>Signal Output</td></tr>
<tr><td>5</td><td>CAN_L</td></tr>
<tr><td>6</td><td>CAN_H</td></tr>
</table></td></tr>
<tr><td>Mounting</td><td>Mounting holes sized for #8 or M4 bolts. The bolt length will be determined by the end-user’s mounting plate thickness. The mounting flange of the controller is 0.17 inches (4.4 mm) thick.

If the module is mounted without an enclosure, it should be mounted to reduce the likelihood of moisture entry. Install the unit with appropriate space available for servicing and for adequate wire harness access (6 inches or 15 cm) and strain relief (12 inches or 30 cm). The CAN wiring is considered intrinsically safe. The power wires are not considered intrinsically safe and so in hazardous locations, they need to be located in conduit or conduit trays at all times. The module must be mounted in an enclosure in hazardous locations for this purpose.

All field wiring should be suitable for the operating temperature range of the module.</td></tr>
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