USER MANUAL UMAX184300
Version 1.0.2

Pt100 RTD, 1 Signal Inputs CAN Controller, SAE J1939

USER MANUAL

P/N: AX184300

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ACCRONYMS

ACK	Positive Acknowledgement	(from SAE J1939 standard)
AOUT	Analog Output: Current, Voltage, Digital, PWM or frequency type	
DM	Diagnostic Message	(from SAE J1939 standard)
DOUT	Digital Output	
DTC	Diagnostic Trouble Code	(from SAE J1939 standard)
EA	Axiomatic Electronic Assistant	(A tool for Axiomatic ECUs)
ECU	Electronic Control Unit	(from SAE J1939 standard)
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	
SPN	Suspect Parameter Number	(from SAE J1939 standard)

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
TDAX184300	Technical Datasheet, 2 RTD Input with 1 Universal Input CAN Controller
UMAX07050x	User Manual, Axiomatic Electronic Assistant and USB-CAN, Axiomatic Technologies

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

NOTE: When a description is in "**double-quotes**" and bolded, this refers to the name of a user configurable setpoint (variable). If it is in '*single-quotes*' and italicized, it refers to an option for the associated setpoint.

For example: "**Output Type**" set to *'Analog Current'*

This product uses the Axiomatic Electronic Assistant to program the setpoints for application specific requirements. After configuration, the setpoints can be saved in a file which could then be flashed into other AX184300 controllers over the CAN network.

1. OVERVIEW OF CONTROLLER

1.1. 2 RTD Input with 1 Universal Input CAN Controller

This User Manual describes the architecture and functionality of the AX184300 Controller, SAE J1939, (2RTD-1UIN-CAN). It can read two 3-wire Pt100 RTD sensors and one universal signal input. The universal input can be configured to read voltage, current, frequency, PWM, or digital signals.

The device accepts power supply voltages from 6 to 62 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 the 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.

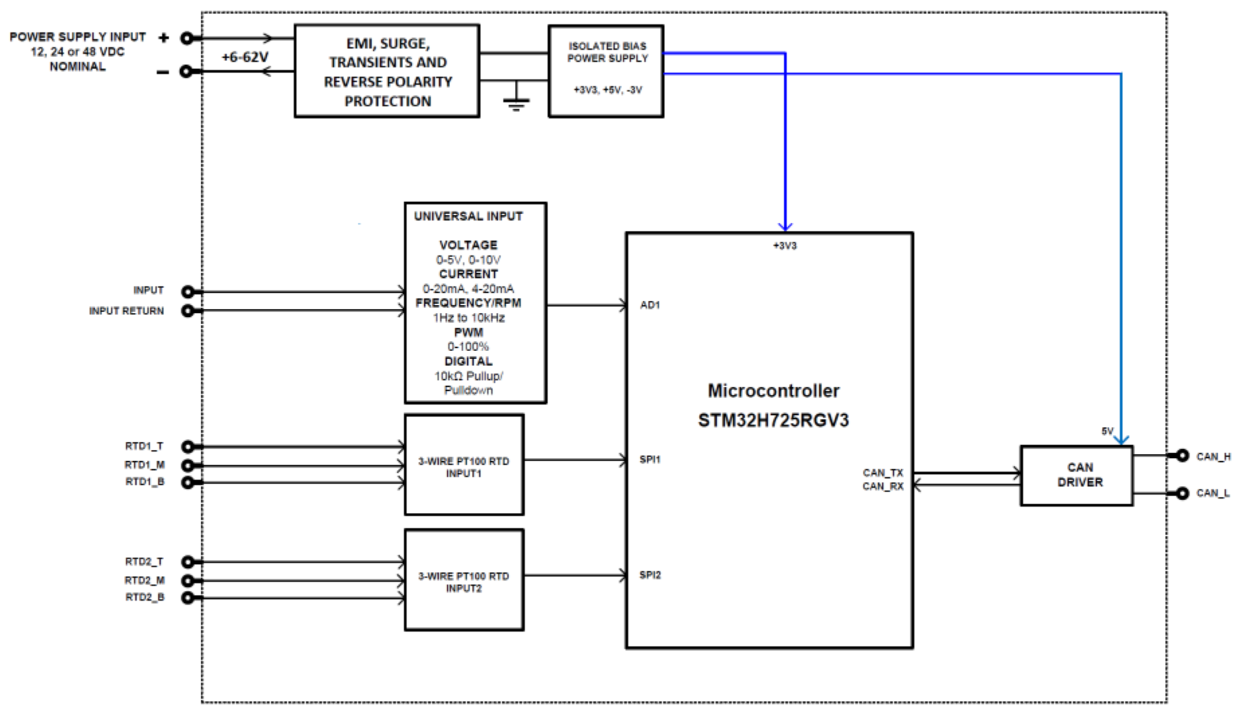


Figure 1 - Hardware Functional Block Diagram

1.2. Available Control Source

The controller output signal sources of all function blocks and source numbers are presented in the table below.

Signal Source Number	Signal Name	Signal Type	Source Number
0	Not Connected	Undefined	0
1	Universal Input	Discrete or Continuous[1]	[1…4]
2	RTD Temperature Input	Any[2]	[1…2]
3	RTD Resistance Input	Any[2]	[1…2]
4	RTD Input Raw Data	Any[2]	[1…2]
5	CAN Input Signal	Any[2]	[1…3]
6	Math Function	Any[2]	[1…5]
7	Conditional Logic	Any[2]	[1…10]
8	Set-Reset Latch	Any[2]	[1…5]
9	Lookup Table	Any[2]	[1…10]
10	Programmable Logic	Any[2]	[1…3]
11	Global Continuous Constant Signal	Continuous	1
12	Global Discrete Constant Signal	Discrete	1
13	Supply Voltage	Continuous	1
14	Microcontroller Temperature	Continuous	1

Table 1 - Controller Signal Sources

[1] Depends on the *Input Parameter*.
[2] Depends on the *Signal Type* configuration parameter.

1.3. Universal Input

The Universal Input block is a versatile interface supporting multiple input types, including voltage, current, PWM, frequency, and digital signals. It offers 12-bit analog-to-digital conversion for precise measurements across voltage and current, with built-in protection against shorts to GND or +V_{supply}. The voltage input supports ranges of 0-5V and 0-10V with input impedances of 204kΩ and 136kΩ, respectively. The current input offers ranges of 0-20mA with an input impedance of 124Ω. Additionally, the frequency input provides a range of 1 to 10,000 Hz, while the PWM input handles frequencies from 1 to 10,000 Hz with a duty cycle from 0% to 100%. The digital input is configurable as active high or low, with built-in 10kΩ pull-up or pull-down resistors, supporting amplitudes up to 36V. This comprehensive input flexibility ensures reliable performance across diverse applications.

Input Parameter	Type	Units
Voltage	Continuous	V
Current	Continuous	mA
Discrete Voltage Level	Discrete	{0,1}
Frequency	Continuous	Hz
PWM Duty Cycle	Continuous	%

Table 2 - Universal Input Types

Each Universal Input function block has the following configuration parameters.

Parameter	Default Value	Range	Units	Description
Input Type	0 - Input Disabled	0 – Input Disabled, 1 – Voltage, 2 – Current, 3 – Discrete, 4 – Frequency, 5 – PWM Duty Cycle,	–	Defines the input physical parameter that will be measured by the function block.
Input Voltage Range	0 - 0…5V	0 - 0…5 V, 1 - 0…10 V	V	Used in the "Voltage" mode
Input Current Range	0 - 0…20 mA	0 - 0…20mA,	mA	Used in the "Current" mode
Input Range Min	0	0…100	-	Depends on the Input Parameter. Used for diagnostic purposes
Input Range Max	5	0…100	-	Depends on the Input Parameter. Used for diagnostic purposes
Analog Input Filter	0 - None	0 - None, 1 - 50Hz Noise Rejection, 2 - 60Hz Noise Rejection, 3 - Both: 60Hz and 50Hz Noise Rejection	–	Noise Rejection in "Voltage", "Current" modes
Pull-Up/Pull-Down Resistor	0 - Disabled	0 - Disabled, 1 - 10kOhm Pull-Up, 2 - 10kOhm Pull-Down	–	Used in "Discrete Voltage Level", "Frequency", and "PWM Duty Cycle" modes.
Input Polarity	0 - Active High	0 - Active High, 1 - Active Low	–	Used in "Discrete Voltage Level", "Frequency", and "PWM Duty Cycle" modes.
Discrete Input Debounce Time	50ms	0…1000	ms	Used in "Discrete Voltage Level" mode. If 0 - no debouncing.
Frequency Range	0 - 1Hz…10kHz	0 - 1Hz…10kHz,	Hz	A 16-bit counter is used. Used in "Frequency", and "PWM Duty Cycle" modes.
Frequency/PWM Debounce Filter3	0 - Disabled	0 - Disabled, 1 - 142ns, 2 - 1.14us, 3 - 6.10us	–	Used in "Frequency", and "PWM Duty Cycle" modes.
Frequency/PWM Averaging	0 - No Averaging	0 - No Averaging, 1 - 3 Readings, 2 - 5 Readings, 3 - 10 Readings	–	Defines a moving average filer used in "Frequency", and "PWM Duty Cycle" modes.

Table 3 - Universal Input Function Block Configuration Parameters

1.3.1. Voltage/Current Measurement

Universal Inputs can measure voltages or current in voltage ranges set by the Voltage Range configuration parameter, allowing for flexible selection between 0-5V and 0-10V for voltage inputs. For current measurements, the input supports ranges of 0-20mA, providing adaptability for various sensor and process control applications.

The user can set the Analog Input Filter configuration parameter to reduce noise in voltage and other analog signal measurements. The filter is designed to suppress noise from industrial offline voltages. Even when the analog input filter is disabled, the minimum signal filtering is performed by the function block. The parameters of the analog input filter are presented below.

Analog Input Filter	**Cut-off Frequency (at -3dB)**	**Settling Time (to 100% of Final Value)**	**Output Signal Update Rate**
Disabled1	70Hz	10ms	1.67ms
50Hz Noise Rejection	12Hz	76.7ms	3.33ms
60Hz Noise Rejection	14Hz	63.3ms	3.33ms
Both: 60Hz and 50Hz Noise Rejection	2.3Hz	396.7ms	16.67ms

Table 4 - Universal Input Analog Input Filter Parameters

1.3.2. Discrete Voltage Level

Universal Inputs can accept discrete voltage levels. The user should specify the input polarity and define whether the pull-up/pull-down resistor is necessary on the input.

When the “10kOhm Pull-Up” is selected, the pull-up resistor is connected to the internal +14V power supply.

The input states are sampled every 1ms. If debouncing is required, it is set by the Discrete Input Debounce Time configuration parameter. If the Discrete Input Debounce Time is zero, the discrete voltage level input is not debounced.

1.3.3. Frequency and PWM

The frequency and PWM duty cycle measurements are performed by counting high-frequency internal clock pulses on every period of the input signal. The universal input channels have different internal organization due to limited hardware resources. All universal inputs use 16-bit counters with the constant frequency range of 1...10kHz

Function Block	Counter	Frequency Range	Counter Base	Shared Input	Frequency Range and Debounce Filter Setting
Universal Input #1	16-bit	1Hz…10kHz,	Dedicated	N/A	Same input

Table 5 - Universal Input Function Block Counters

To measure frequency or PWM duty cycle, the user should first select the Frequency Range parameter and then define how the Pull-Up/Pull-Down Resistor, Frequency/PWM Debounce Filter, and the Frequency/PWM Averaging parameters should be set.

The Input Polarity defines the active edge of the input signal. The Pull-Up/Pull-Down Resistor can be used to pull the input to a no-signal state to avoid an undefined input condition when the signal source is disconnected. The Input Polarity and Pull-Up/Pull-Down Resistor are normally set the following way.

Input Polarity	Pull-Up/Pull-Down Resistor
Active High	"Disabled" or "10kOhm Pull-Down"
Active Low	"Disabled" or "10kOhm Pull-Up"

Table 6 - Setting Pull-Up/Pull-Down Resistor for Selected Input Polarity. Universal Inputs

The frequency/PWM debounce filter is used to filter out parasitic spikes that can be present in a noisy input signal. It can be helpful to prevent the input from going into the Recovery state (see Section 1.3.4 Special Conditions) when, for example, mechanical switches are used to commutate the input signal.

The debounce filter should be used with caution since it can reduce the accuracy and resolution of frequency and PWM measurements if the debouncing time is not significantly less than the period of the input signal.

When a frequency or PWM signal presents a slowly changing parameter, setting an additional moving average filter using the Frequency/PWM Averaging configuration parameter can be helpful in smoothing the results of the input measurements.

1.3.4. Special Conditions

Frequencies below the Minimum Frequency value will be measured as zero and frequencies above the Maximum Frequency value will saturate at the Maximum Frequency value for the Frequency Range, see Table 7 and Table 8.

Frequency Range	Counter	Minimum Frequency	Maximum Frequency	Maximum Recovery Time
1Hz…10kHz	16-Bit	0.9155Hz	12.5kHz	10.9ms

Table 7 - Maximum, Minimum Frequencies and Maximum Recovery Time for Universal Inputs

Frequencies above the Maximum Frequency value will switch the input to the Recovery state. The input will stay in the Recovery state until the upcoming counter saturation event when the frequency will be measured again. The input will leave the Recovery state if the measured frequency value is below the Maximum Frequency.

Input Mode	Signal Frequency (F_s)			
	$F_s = 0$ Zero Frequency (DC)	$0 < F_s < F_{min}$ Below Minimum Frequency F_{min}	$F_{min} \le F_s \le F_{max}$ Working Frequency	$F_s > F_{max}$ Above Maximum Frequency F_{max}
Measured Frequency F_m	$F_m = 0$	$F_m = 0$	$F_m = F_s$	$F_m = F_{max}$ Recovery state
Measured PWM Duty Cycle D_m	$D_m = \{0, 100\}$	Undefined (not allowed)	$D_m = D_s$, D_s – signal duty cycle	$D_m = 0$ Recovery state

Table 8 - Frequency and PWM Measurements for Universal Inputs. Special Conditions

The time between two consequent counter saturation events defines the Maximum Recovery Time, see Table 7. This time is the maximum transient time when the measured frequency will stay equal to the Maximum Frequency value.

When the PWM signal is absent, the duty cycle is measured as 0 or 100% based on the voltage level on the input and the selected Input Polarity. The voltage level is sampled on the counter saturation events until the PWM signal is back on the input.

The transient time between the PWM signal duty cycle and the duty cycle of the DC level when the signal disappears can be up to the Maximum Recovery Time. During the transient time, the measured value will stay equal to the last measured value of the PWM signal duty cycle.

The PWM input signal with a frequency above zero but below the Minimum Frequency value is not allowed. The duty cycle will not be measured, instead, it will be jumping between 0% and 100% depending on the voltage level at the input on the counter saturation events.

When the PWM input signal frequency exceeds the Maximum Frequency value, the input goes into the Recovery state and the PWM duty cycle is measured as 0%. Similar to frequency measurements, the input will stay in the Recovery state for up to the Maximum Recovery Time before the duty cycle is measured again.

1.4. RTD Input

The RTD Input Function Block reads analog signals from two RTD sensor inputs and converts them into temperature data.

Users can configure the sensor connection type (either 2-wire or 3-wire) and set approximation parameters for each sensor through the Axiomatic EA software. These configuration parameters are stored in the non-volatile memory of the RTD unit and automatically load upon power-up.

In addition to temperature diagnostics, the ECU can output data in Ohms or as raw hexadecimal data directly from the RTD chip. The AX184300 supports PT100 sensors in both 2-wire and 3-wire configurations, with supported sensor connections detailed in the table below.

Value	Description
0	RTD Disabled
1	Two Wires
2	**Three Wires**

Table 9 - The Types of RTD Connections

1.4.1. RTD Coefficients

The customer can set the specific coefficients within ranges. By default, the values for Callendar - Van Dusen Coefficient A, B, and C are standard (IEC 0.00385), and can be seen on the table below.

Name	Default Value	Range	Units	Description
Callendar – Van Dusen coefficient A	3.908300	-100…100	–	Callendar – Van Dusen coefficient A for the selected standard coefficient set. Editable, if the coefficient set is “User Defined”.
Callendar – Van Dusen coefficient B	-5.77500	-100…100	–	Callendar – Van Dusen coefficient B for the selected standard coefficient set. Editable, if the coefficient set is “User Defined”.
Callendar – Van Dusen coefficient C	-4.183010	-100…100	–	Callendar – Van Dusen coefficient C for the selected standard coefficient set. Editable, if the coefficient set is “User Defined”.

Table 10 - The Default Value of Coefficients

If these values need to be changed, the user can change them via EA.

1.4.2. Warning and Shutdown Limits

The AX184300 has High and Low Limits for all types of output: °C, Ohm, and Raw Data. Also, there is High and Low Shutdown Limit for Shutdown Temperature Fault Diagnostics. Even though only temperature reading is used for the diagnostics, the customer can use the voltage and raw data reading as control sources (See Table 1). The user can set the value for limits via EA or Modbus. The default setpoints can be found in Section 4.3

1.5. Lookup Table Function Block

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 1.6.

Lookup tables have two differing modes defined by “X-Axis Type” setpoint, given in Table 11. 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.

Value	X-Axis Type
0	Data Response
1	Time Response

Table 11 - X-Axis Type Options

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. “PointN – Response” setpoint defines type of the slope from preceding point to the point in question. Response options are given in Table 12. ‘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. “Point0 – Response” is always ‘Jump To’ and cannot be edited. Choosing ‘Ignored’ response causes associated point and all the following points to be ignored.

Value	Response
0	Ignore
1	Ramp To
2	Jump To

Table 12 - PointN – Response Options

The X values are limited by minimum and maximum range of the selected input source if the source is a Math Function Block. For the fore mentioned sources X-Axis data will be redefined when ranges are changed, therefore inputs should be adjusted before changing X-Axis values. For other sources Xmin and Xmax are -100000 and 1000000. 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. Programmable Logic Function Block

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 13. 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.

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

Table 13 - Table X – Condition Y Operator Options

The three conditions are evaluated and if the result satisfies logical operation defined with “Logical Operator X” setpoint, given in Table 14, the associated Lookup Table is selected as output of the Logical block. Option ‘0 – Default Table’ selects associated Lookup Table in all conditions.

Value	Logical Operator
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

Table 14 - Table X – Conditions Logical Operator Options

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. 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 for all functions, it is recommended not to use constant data as a control source for the Set-Reset Latch Block.

1.8. Math Function Block

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 15. 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.

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

Value	Meaning
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

Table 15 - Math function X Operator Options

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.

1.9. Conditional Block

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 1 demonstrates the connections between all parameters.

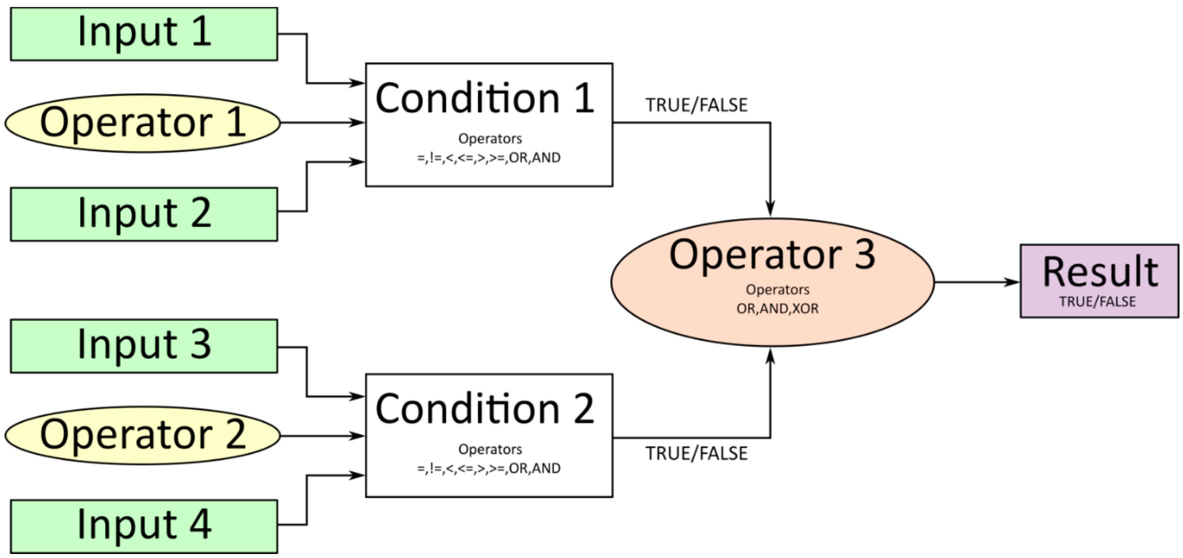


Figure 1: Conditional Block Diagram

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 16. If no source is selected, the output value of an Input will be zero.

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

Table 16 - Input Operator Options

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 17.

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

Table 17 - Condition Operator Options

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.

1.10. 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 18 below.

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

Table 18 - Set-Reset Function block operation.

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 18 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'.

1.11. Diagnostic Function Block

This 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 21)
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 CAN Controller 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. The CAN Controller supports 16 Diagnostics Definitions, each freely configurable by the user.

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 2 below.

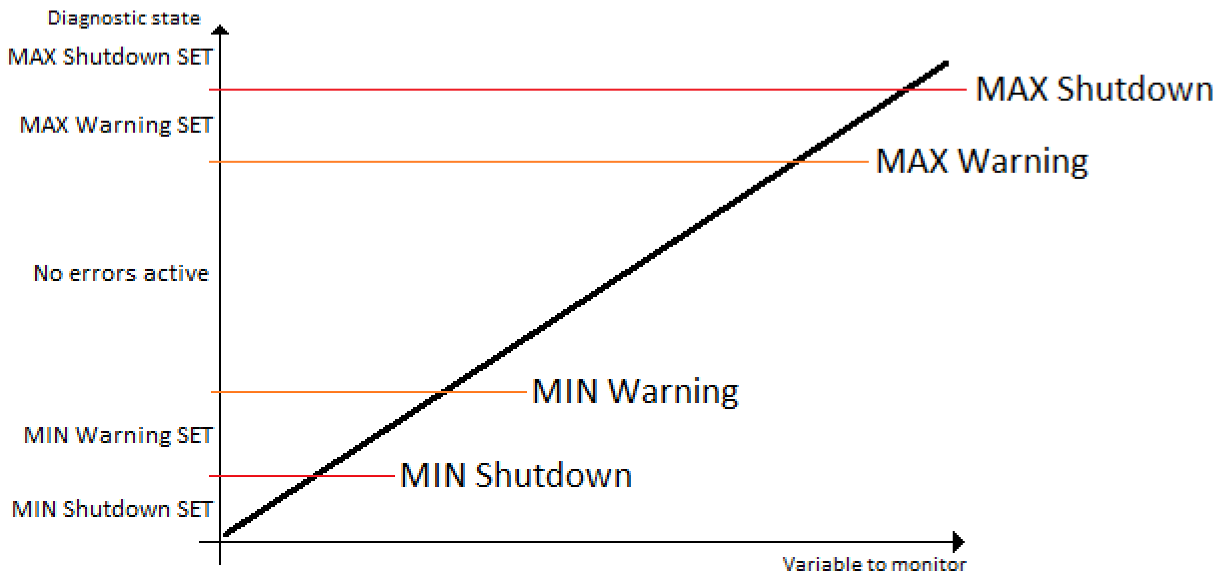


Figure 2 – Double Minimum and Maximum Error Thresholds

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 CAN Controller 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).

ℹ	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 19. By default, the ‘*Amber, Warning’* lamp is typically the one set be any active fault.

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

Table 19 - Lamp Set by Event in DM1 Options

“**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**” is configured to be different from zero. **It is the 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.

Value	*Option*
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*

Table 20 - FMI for Event Options

Every fault has associated a default FMI with them. The used FMI can be configured with "**FMI for Event**" setpoint, presented in Table 20. When an FMI is selected from Low Fault FMIs in Table 21 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 21. There is no automatic setting of High and Low FMIs in the firmware, the user can configure these freely.

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*

Table 21 - Low Fault FMIs and corresponding High Fault FMIs

1.12. 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.
- SPN624 and Lamp Status 0x01.

In case if the SPNs above are chosen, the DTC React function block will set the output to HIGH if SPN and Lamp Status match 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.

1.13. 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 1.11. 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 this controller on Proprietary B PGNs. However, should a PDU1 message be selected, this Controller can be set up to receive it from any ECU by setting the "**Specific Address that sends the PGN**" to the Global Address (0xFF). 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 thresholds for digital output types. These values are in whatever units the data is AFTER the resolution and offset is applied to CAN receive signal.

This Controller supports up to Ten unique CAN Receive Messages. Defaults setpoint values are listed in section 4.11.

1.14. CAN Transmit 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 AX020600 ECU has eleven CAN Transmit Messages, and each message has four completely user defined signals.

1.14.1. CAN Transmit Signal 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.

1.14.2. 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 1. 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.

2. Installation Instructions

2.1 Dimensions and Pinout

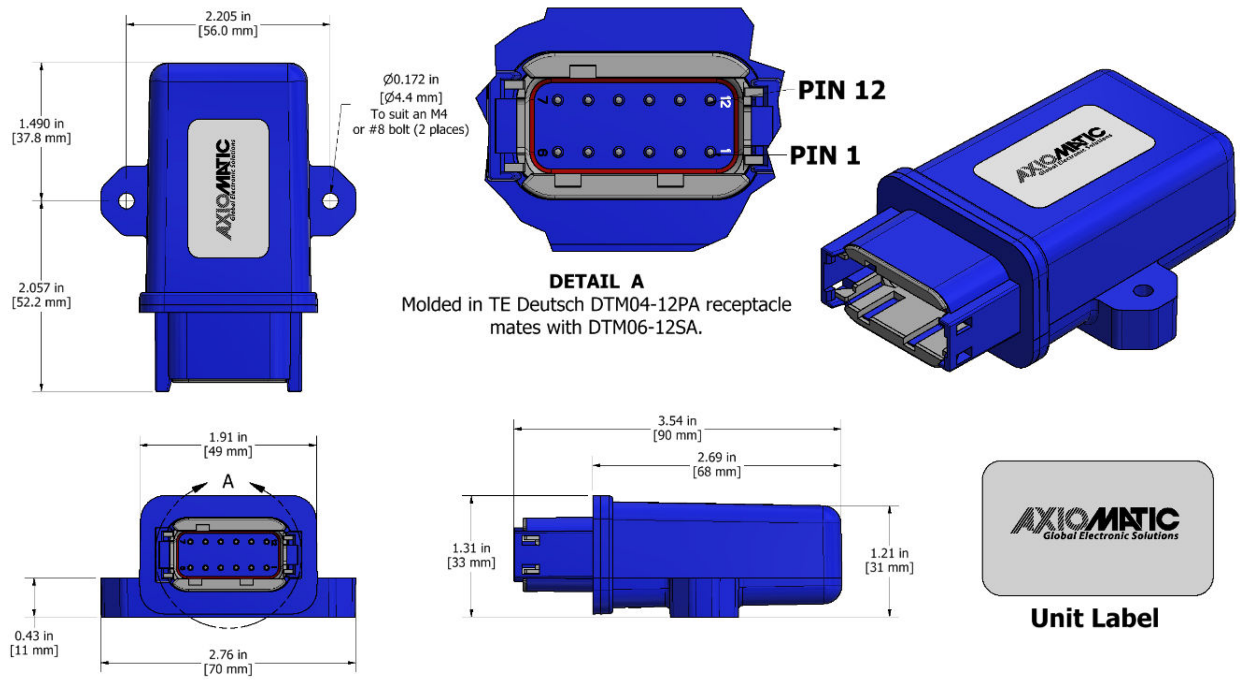


Figure 16 –Dimensional Drawing

Pin #	Description
1	Battery +
2	CAN_H
3	RTD1_T
4	RTD2_T
5	RTB2_B
6	Input
7	Input Ground
8	RTD2_M
9	RTD1_B
10	RTD1_M
11	CAN_L
12	Battery -

Table 19 – Connector Pinout

3. OVERVIEW OF J1939 FEATURES

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

- Configurable ECU Instance in the NAME (to allow multiple ECUs on the same network)
- Configurable Transmit PGN and SPN Parameters
- Configurable Receive PGN and SPN Parameters
- Sending DM1 Diagnostic Message Parameters
- Reading and reacting to DM1 messages sent by other ECUs
- Diagnostic Log, maintained in non-volatile memory, for sending DM2 messages

3.1. Introduction To Supported Messages

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

From J1939-21 - Data Link Layer

- Request 59904 ($00EA00)
- Acknowledgment 59392 ($00E800)
- Transport Protocol – Connection Management 60416($00EC00)
- Transport Protocol – Data Transfer Message 60160 ($00EB00)
- PropB Receive, Default Output Control Data Message 65408 ($00FF80)

Note: Any Proprietary B PGN in the range 65280 to 65535 ($00FF00 to $00FFFF) can be selected

Note: The Proprietary A PGN 61184 ($00EF00) can also be selected for any of the messages

From J1939-73 - Diagnostics

a) DM1 – Active Diagnostic Trouble Codes 65226 ($00FECA)
b) DM2 – Previously Active Diagnostic Trouble Codes 65227 ($00FECB)
c) DM3 – Diagnostic Data Clear/Reset for Previously Active DTCs 65228 ($00FECC)
d) DM11 - Diagnostic Data Clear/Reset for Active DTCs 65235 ($00FED3)
e) DM14 – Memory Access Request 55552 ($00D900)
f) DM15 – Memory Access Response 55296 ($00D800)
g) DM16 – Binary Data Transfer 55040 ($00D700)

From J1939-81 - Network Management

- Address Claimed/Cannot Claim 60928 ($00EE00)
- Commanded Address 65240 ($00FED8)

From J1939-71 – Vehicle Application Layer

- Software Identification 65242 ($00FEDA)

None of the application layer PGNs are supported as part of the default configurations, but they can be selected as desired for either transmit or received 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 the CAN network.

3.2. Name, Address and Software ID

3.2.1. J1939 Name

The unit has the following defaults 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	126, Axiomatic I/O Controller
Function Instance	29, Axiomatic AX184300, CAN to 4 Analog Outputs Controller
ECU Instance	**0, First Instance**
Manufacture Code	162, Axiomatic Technologies Corporation
Identity Number	Variable, uniquely assigned during factory programming for each ECU

The ECU Instance is a configurable setpoint associated with the NAME. Changing this value will allow multiple ECUs of this type to be distinguishable by other ECUs (including the Axiomatic Electronic Assistant) when they are all connected on the same network.

3.2.2. ECU Address

The default value of this setpoint is 128 (0x80), which is the preferred starting address for self-configurable ECUs as set by the SAE in J1939 tables B3 to B7. The Axiomatic EA will allow the selection of any address between 0 to 253, and ***it is the 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 unit will continue select the next highest address until it finds one that it can claim. See J1939/81 for more details about address claiming.

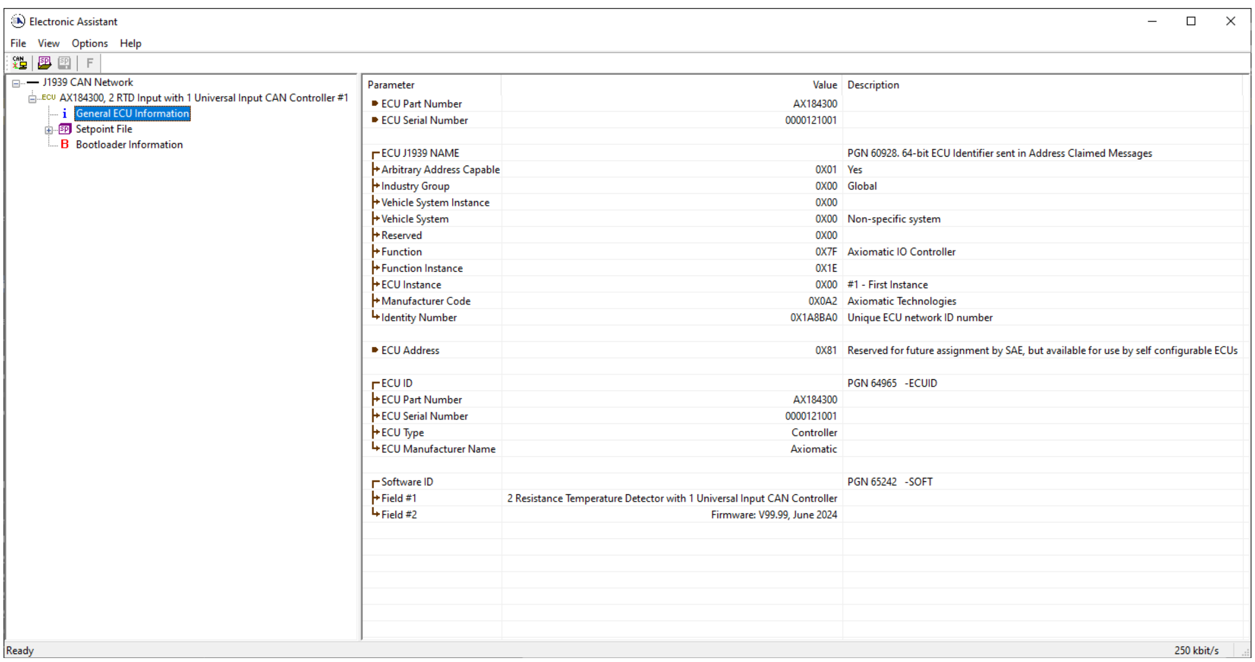
3.2.3. Software Identifier

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 this unit, Byte 1 is set to 1, and the identification fields are as follows

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

The Axiomatic EA shows all this information in “General ECU Information”, as shown below:



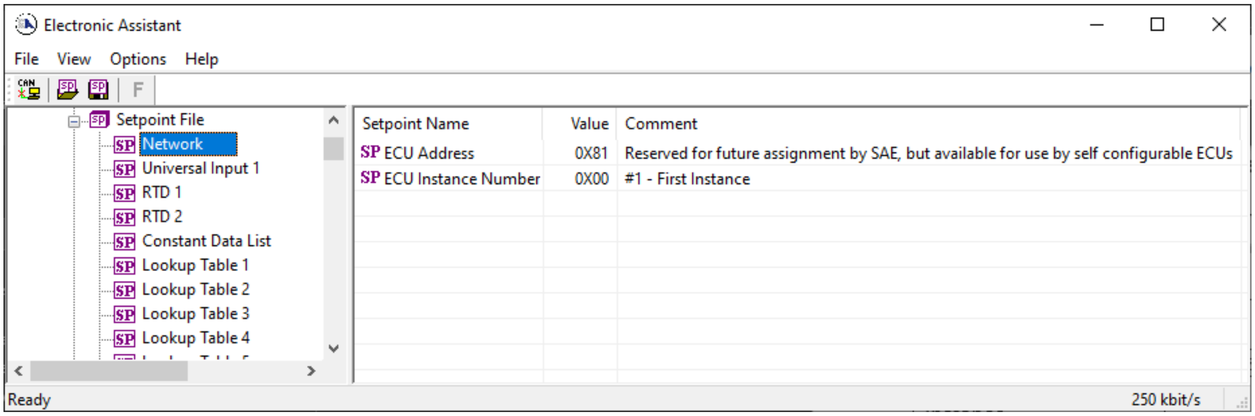
Note: The information provided in the Software ID is available for any J1939 service tool which supports the PGN -SOFT

4. ECU SETPOINTS ACCESSED WITH THE AXIOMATIC ELECTRONIC ASSISTANT

Many setpoints have been referenced throughout this manual. This section describes in detail each setpoint, and their defaults and ranges. For more information on how each setpoint is used by the controller, refer to the relevant section of the User Manual.

4.1. Network Setpoints

The Network setpoints primarily deal with the CAN Network. Refer to the notes for more information about each setpoint.



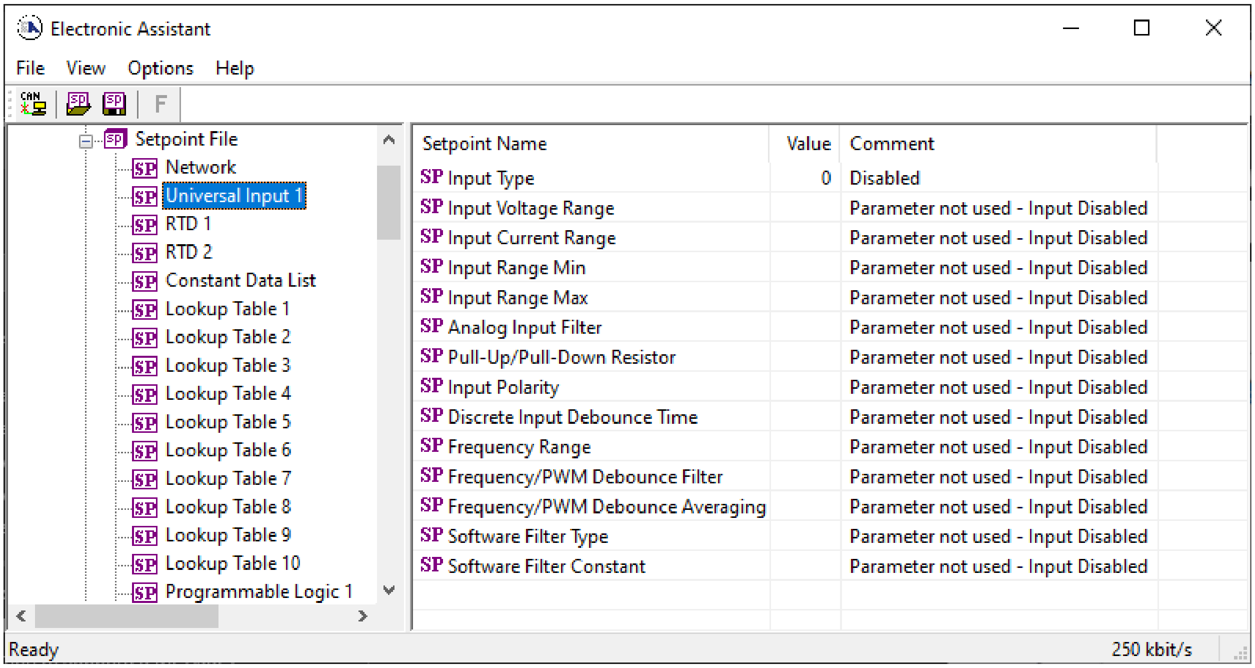
Screen Capture of Default Miscellaneous Setpoints

Name	Range	Default	Notes
ECU Instance Number	Drop List	0, #1 – First Instance	Per J1939-81
ECU Address	0 to 253	128 (0x80)	Preferred address for a self-configurable ECU

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 the Axiomatic EA after the file is loaded, such that only the new NAME and address appear in the J1939 CAN Network ECU list.

4.2. Universal Input Setpoints

The Universal Inputs are defined in section in Section 1.3. Please refer there for detailed information about how all these setpoints are used.



Screen Capture of Default Analog Output Setpoints

Name	Range	Default	Notes
Input Type	Drop List	Input Disabled	See Section 1.3
Input Voltage Range	Drop List	0, 0-5V Analog Input	See Section 1.3
Input Current Range	Drop List	0, 0-20mA Current Input	See Section 1.3
Input Range Min	0..100	0	See Section 1.3
Input Range Max	0..100	5	See Section 1.3
Analog Input Filter	Drop List	0, Off	See Section 1.3
Pullup/Pulldown Resistor	Drop List	0, No Pull	See Section 1.3
Input Polarity	Drop List	0, Active High	See Section 1.3
Discrete Input Debounce Time	0..60000	50 ms	See Section 1.3
Frequency Range	Read only	1Hz to 10kHz	See Section 1.3
Frequency/PWM Debounce Filter	Drop List	0, No Filter	See Section 1.3
Frequency/PWM Debounce Averaging	Drop List	0, No Averaging	See Section 1.3
Software Filter Type	Drop List	0, Disabled	See Section 1.3
Software Filter Constant	0…60000	10	See Section 1.3

4.3. RTD Input Setpoints

The RTD Input setpoints are defined in Section 1.4. Refer to that section for detailed information on how these setpoints are used. The screen capture below displays the available setpoints for each of the RTD Inputs.

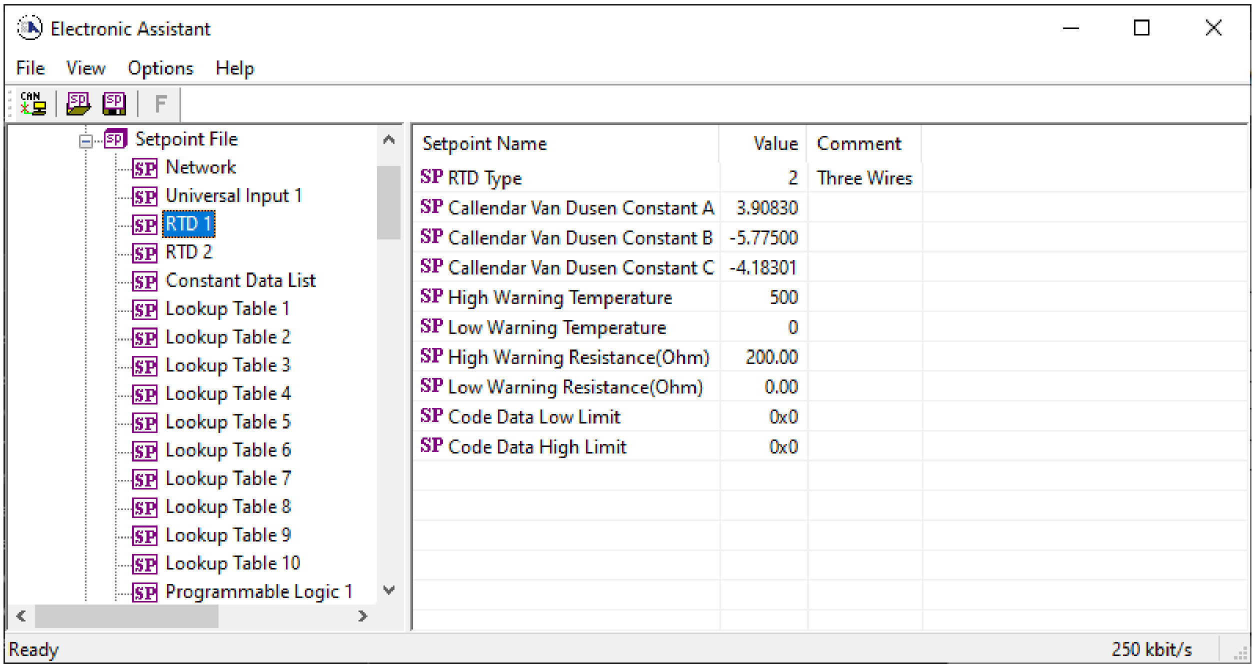


Figure 3 - Screen Capture of Default RTD Input Setpoints

Name	Range	Default	Notes
RTD Type	Drop List	2, Three Wires	Refer to Section 1.4
Callendar Van Dusen Constant A	-100...100	3.90830	Refer to Section 1.4.1
Callendar Van Dusen Constant B	-100...100	-5.77500	Refer to Section 1.4.1
Callendar Van Dusen Constant C	-100...100	-4.18301	Refer to Section 1.4.1
High Warning Temperature	-2000...2000	500	Refer to Section 1.4.2
Low Warning Temperature	-2000...2000	0	Refer to Section 1.4.2
High Warning Resistance	-20...200	200	Refer to Section 1.4.2
Low Warning Resistance	-20...200	0	Refer to Section 1.4.2
High Warning Code	0x00...0xFFFFFF	0	Refer to Section 1.4.2
Low Warning Code	0x00...0xFFFFFF	0	Refer to Section 1.4.2

Table 22 - Default RTD Setpoints

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 4) are arbitrary and should be configured by the user as appropriate for their application.

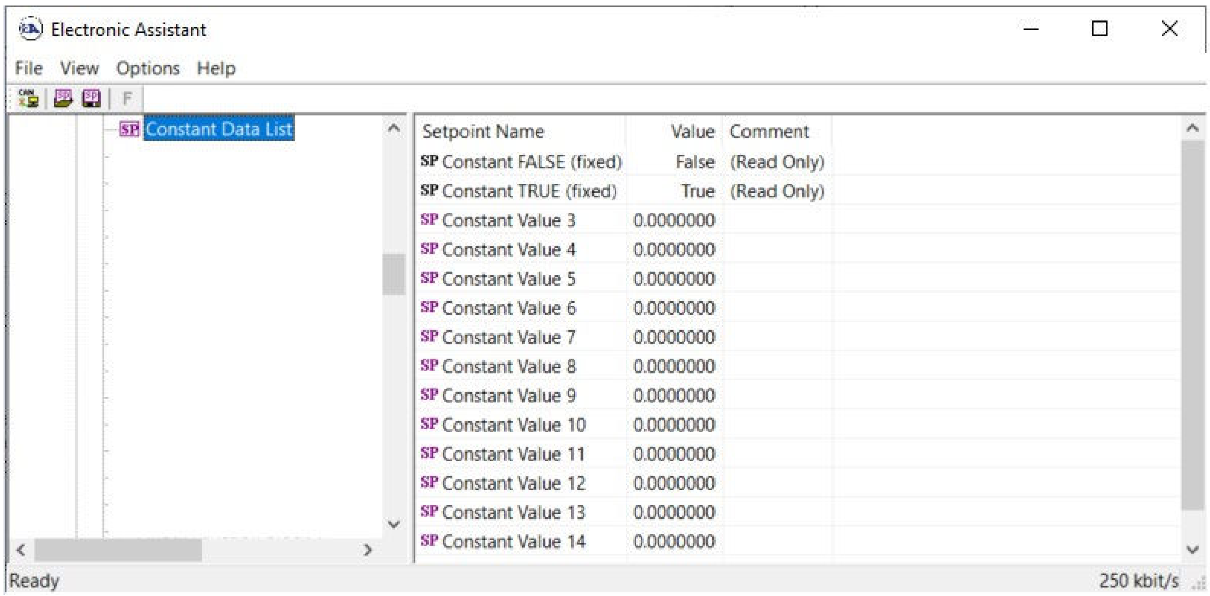


Figure 4 – Screen Capture of Constant Data List Setpoints

4.5. Lookup Table

The Lookup Table Function Block is defined in Section 14. 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**".

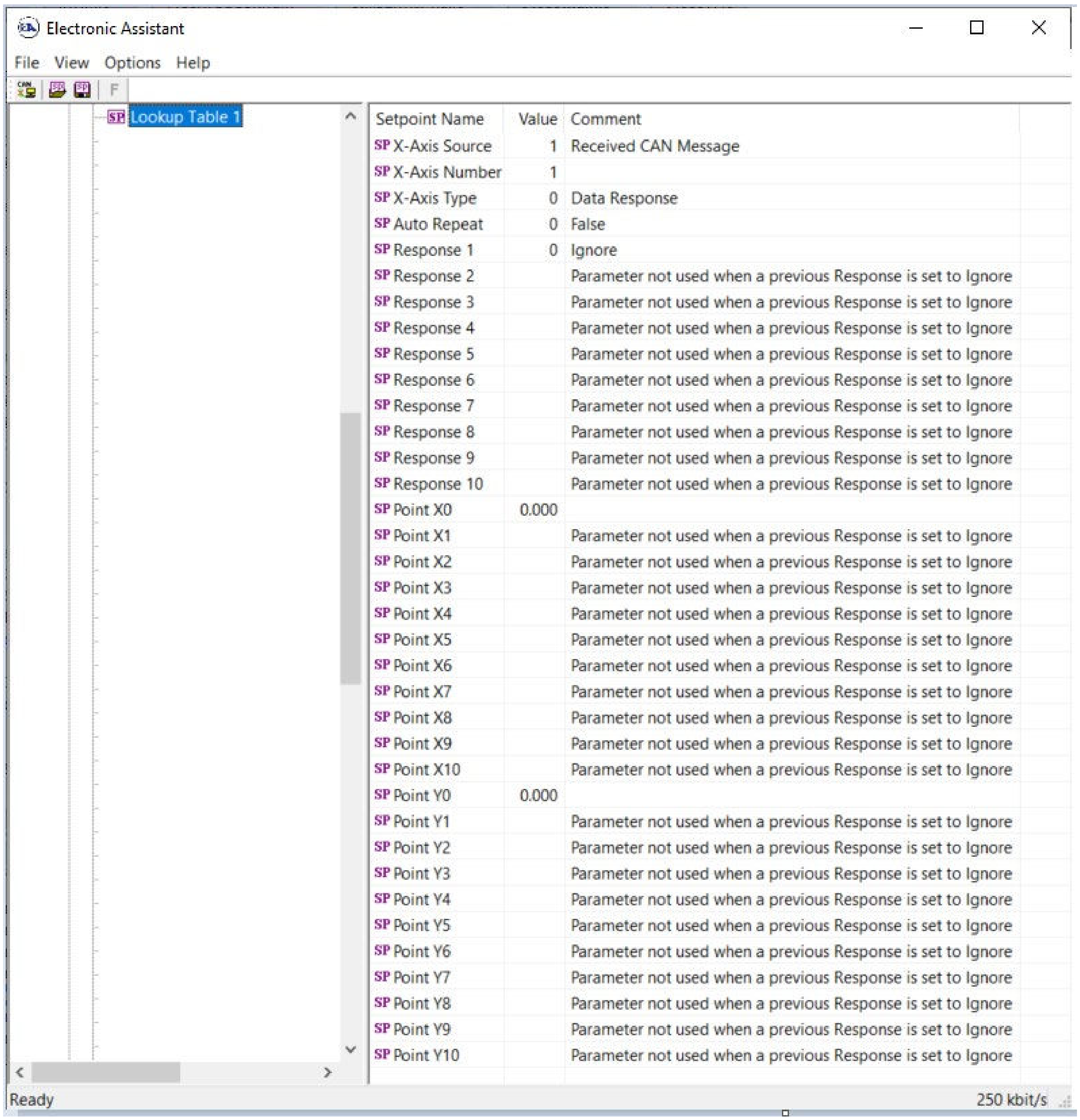


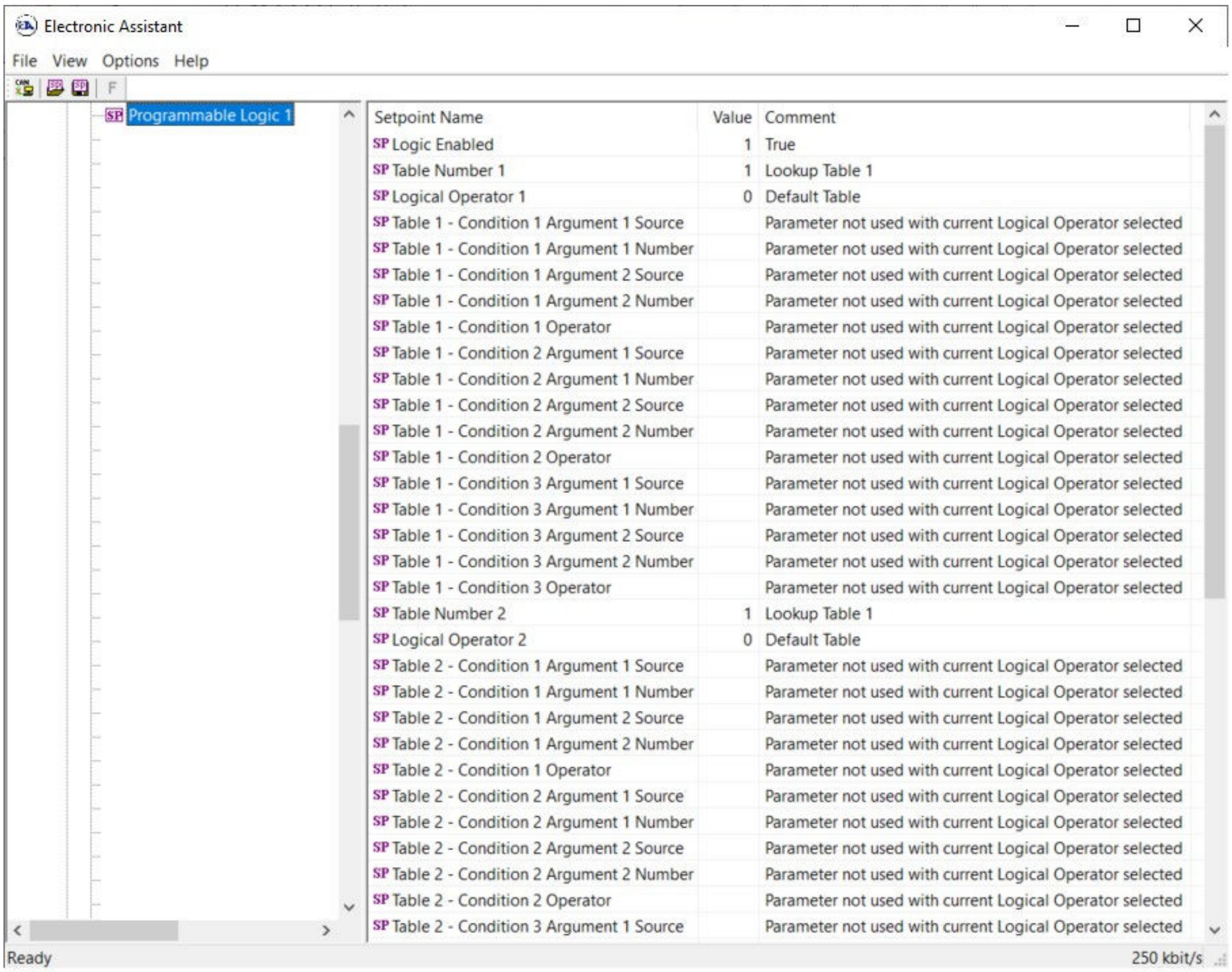
Figure 5 – Screen Capture of Lookup table Setpoints

Name	Range	Default	Notes
X-Axis Source	Drop List	Control Not Used	See Table 1
X-Axis Number	Depends on control source	1	See Table 1
X-Axis Type	Drop List	Data Response	See Table 11
Table Auto-Cycle	Drop List	0	
Point 1 - Response	Drop List	Ramp To	See Table 12
Point 2 - Response	Drop List	Ramp To	See Table 12
Point 3 - Response	Drop List	Ramp To	See Table 12
Point 4 - Response	Drop List	Ramp To	See Table 12
Point 5 - Response	Drop List	Ramp To	See Table 12
Point 6 - Response	Drop List	Ramp To	See Table 12
Point 7 - Response	Drop List	Ramp To	See Table 12
Point 8 - Response	Drop List	Ramp To	See Table 12
Point 9 - Response	Drop List	Ramp To	See Table 12
Point 10 - Response	Drop List	Ramp To	See Table 12
Point 1 - X Value	From X-Axis source minimum to Point 1 - X Value	X-Axis source minimum 0.000	See Section 1.5
Point 2 - X Value	From Point 0 - X Value to Point 2 - X Value	0.500	See Section 1.5
Point 3 - X Value	From Point 1 - X Value to Point 3 - X Value	1.000	See Section 1.5
Point 4 - X Value	From Point 2 - X Value to Point 4 - X Value	1.500	See Section 1.5
Point 5 - X Value	From Point 3 - X Value to Point 5 - X Value source	2.000	See Section 1.5
Point 6 - X Value	From Point 4 - X Value to Point 6 - X Value	2.500	See Section 1.5
Point 7 - X Value	From Point 5 - X Value to Point 7 - X Value	3.000	See Section 1.5
Point 8 - X Value	From Point 6 - X Value to Point 8 - X Value	3.500	See Section 1.5
Point 9 - X Value	From Point 7 - X Value to Point 9 - X Value	4.000	See Section 1.5
Point 10 - X Value	From Point 8 - X Value to Point 10 - X Value	4.500	See Section 1.5
Point 1 - Y Value	-10^6 to 10^6	0.000	
Point 2 - Y Value	-10^6 to 10^6	10.000	
Point 3 - Y Value	-10^6 to 10^6	20.000	
Point 4 - Y Value	-10^6 to 10^6	30.000	
Point 5 - Y Value	-10^6 to 10^6	40.000	
Point 6 - Y Value	-10^6 to 10^6	50.000	
Point 7 - Y Value	-10^6 to 10^6	60.000	
Point 8 - Y Value	-10^6 to 10^6	70.000	
Point 9 - Y Value	-10^6 to 10^6	80.000	
Point 10 - Y Value	-10^6 to 10^6	90.000	

Table 23 - Lookup Table Setpoints

4.6. Programmable Logic

The Programmable Logic function block is defined in Section 1.6. 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
Logic Enabled	1	True
Table Number 1	1	Lookup Table 1
Logical Operator 1	0	Default Table
Table 1 - Condition 1 Argument 1 Source		Parameter not used with current Logical Operator selected
Table 1 - Condition 1 Argument 1 Number		Parameter not used with current Logical Operator selected
Table 1 - Condition 1 Argument 2 Source		Parameter not used with current Logical Operator selected
Table 1 - Condition 1 Argument 2 Number		Parameter not used with current Logical Operator selected
Table 1 - Condition 1 Operator		Parameter not used with current Logical Operator selected
Table 1 - Condition 2 Argument 1 Source		Parameter not used with current Logical Operator selected
Table 1 - Condition 2 Argument 1 Number		Parameter not used with current Logical Operator selected
Table 1 - Condition 2 Argument 2 Source		Parameter not used with current Logical Operator selected
Table 1 - Condition 2 Argument 2 Number		Parameter not used with current Logical Operator selected
Table 1 - Condition 2 Operator		Parameter not used with current Logical Operator selected
Table 1 - Condition 3 Argument 1 Source		Parameter not used with current Logical Operator selected
Table 1 - Condition 3 Argument 1 Number		Parameter not used with current Logical Operator selected
Table 1 - Condition 3 Argument 2 Source		Parameter not used with current Logical Operator selected
Table 1 - Condition 3 Argument 2 Number		Parameter not used with current Logical Operator selected
Table 1 - Condition 3 Operator		Parameter not used with current Logical Operator selected
Table Number 2	1	Lookup Table 1
Logical Operator 2	0	Default Table
Table 2 - Condition 1 Argument 1 Source		Parameter not used with current Logical Operator selected
Table 2 - Condition 1 Argument 1 Number		Parameter not used with current Logical Operator selected
Table 2 - Condition 1 Argument 2 Source		Parameter not used with current Logical Operator selected
Table 2 - Condition 1 Argument 2 Number		Parameter not used with current Logical Operator selected
Table 2 - Condition 1 Operator		Parameter not used with current Logical Operator selected
Table 2 - Condition 2 Argument 1 Source		Parameter not used with current Logical Operator selected
Table 2 - Condition 2 Argument 1 Number		Parameter not used with current Logical Operator selected
Table 2 - Condition 2 Argument 2 Source		Parameter not used with current Logical Operator selected
Table 2 - Condition 2 Argument 2 Number		Parameter not used with current Logical Operator selected
Table 2 - Condition 2 Operator		Parameter not used with current Logical Operator selected
Table 2 - Condition 3 Argument 1 Source		Parameter not used with current Logical Operator selected

Figure 6 – Screen Capture of Programmable Logic Setpoints

Setpoint ranges and default values for Programmable Logic Blocs are listed in Table 24. 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**".

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 14
Table1 - Condition1, Argument 1 Source	Drop List	Control Not Used	See Table 1
Table1 - Condition1, Argument 1 Number	Depends on control source	1	See Table 1
Table1 - Condition1, Operator	Drop List	=, Equal	See Table 13
Table1 - Condition1, Argument 2 Source	Drop List	Control Not Used	See Table 1
Table1 - Condition1, Argument 2 Number	Depends on control source	1	See Table 1
Table1 - Condition2, Argument 1 Source	Drop List	Control Not Used	See Table 1
Table1 - Condition2, Argument 1 Number	Depends on control source	1	See Table 1
Table1 - Condition2, Operator	Drop List	=, Equal	See Table 13
Table1 - Condition2, Argument 2 Source	Drop List	Control Not Used	See Table 1
Table1 - Condition2, Argument 2 Number	Depends on control source	1	See Table 1
Table1 - Condition3, Argument 1 Source	Drop List	Control Not Used	See Table 1
Table1 - Condition3, Argument 1 Number	Depends on control source	1	See Table 1
Table1 - Condition3, Operator	Drop List	=, Equal	See Table 13
Table1 - Condition3, Argument 2 Source	Drop List	Control Not Used	See Table 1
Table1 - Condition3, Argument 2 Number	Depends on control source	1	See Table 1

Table 24 - Programmable Logic Setpoints

4.7. Math Function Block

The Math Function Block is defined in Section 1.8 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**".

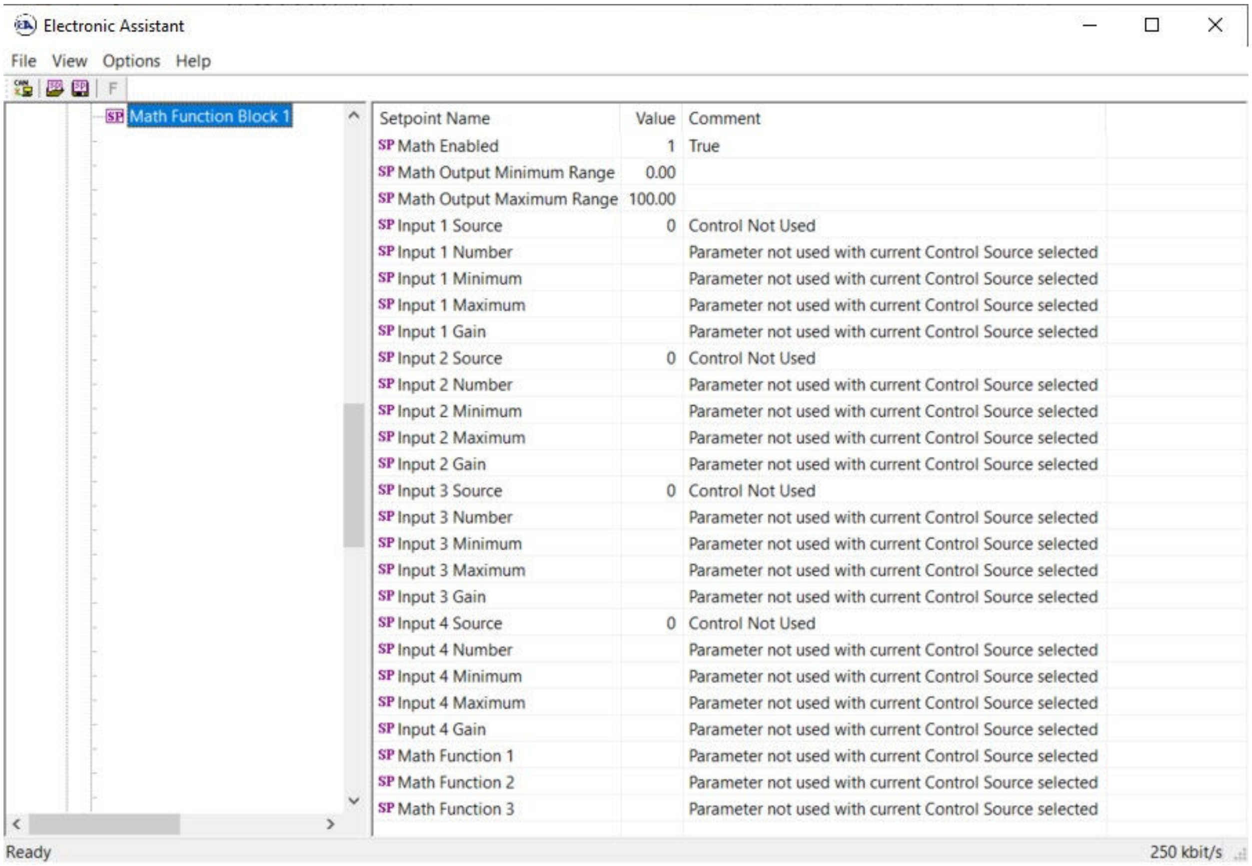


Figure 7 – Screen Capture of Math Function Block Setpoints

Name	Range	Default	Notes
Math Function Enabled	Drop List	False	
Function 1 Input A Source	Drop List	Control not used	See Table 1
Function 1 Input A Number	Depends on control source	1	See Table 1
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	-1.00 to 1.00	1.00	
Function 1 Input B Source	Drop List	Control not used	See Table 1
Function 1 Input B Number	Depends on control source	1	See Table 1
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	-1.00 to 1.00	1.00	
Math Function 1 Operation	Drop List	=, True when InA Equals InB	See Table 15
Function 2 Input B Source	Drop List	Control not used	See Table 1
Function 2 Input B Number	Depends on control source	1	See Table 1
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 15

Function 3 Input B Source	Drop List	Control not used	See Table 1
Function 3 Input B Number	Depends on control source	1	See Table 1
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 15
Function 4 Input B Source	Drop List	Control not used	See Table 1
Function 4 Input B Number	Depends on control source	1	See Table 1
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 15
Math Output Minimum Range	-10^6 to 10^6	0.0	
Math Output Maximum Range	-10^6 to 10^6	100.0	

Table 25 - Math Function Setpoints

4.8. Conditional Logic Block Setpoints

The Conditional Block setpoints are defined in Section 1.9. Refer to that section for detailed information on how these setpoints are used. The screen capture in Figure 8 displays the available setpoints for each of the Conditional Blocks. The table below the screen capture highlights the allowable ranges for each setpoint.

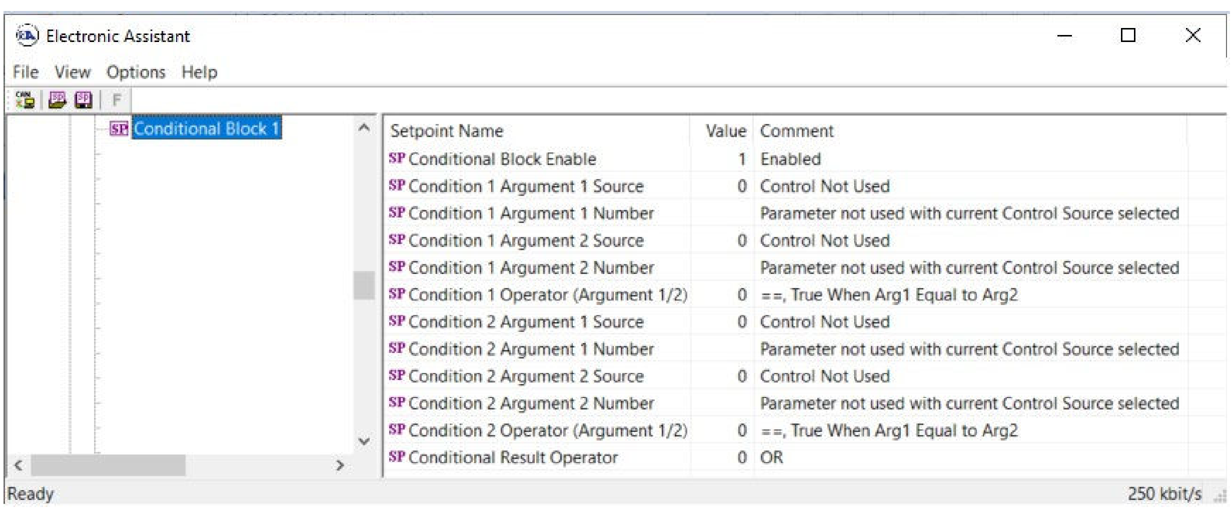


Figure 8: Screen Capture of Conditional Block Setpoints

Name	**Range**	**Default**	**Notes**
Conditional Function Enabled	Drop List	Disabled	
Condition 1 Argument 1 Source	Drop List	Digital Input	Refer to Table 1
Condition 1 Argument 1 Number	Depends on Source Selected	0	Refer to Table 1
Condition 1 Argument 2 Source	Drop List	Digital Input	Refer to Table 1

Condition 1 Argument 2 Number	Depends on Source Selected	0	Refer to Table 1
Condition 1 Operator (Argument 1/2)	Drop List	0	Refer to Table 16
Condition 2 Argument 1 Source	Drop List	Digital Input	Refer to Table 1
Condition 2 Argument 1 Number	Depends on Source Selected	0	Refer to Table 1
Condition 2 Argument 2 Source	Drop List	Digital Input	Refer to Table 1
Condition 2 Argument 2 Number	Depends on Source Selected	0	Refer to Table 1
Condition 2 Operator (Argument 1/2)	Drop List	0	Refer to Table 16
Conditional Result Operator	Drop List	OR	Refer to Table 17

Table 26 - Default Conditional Block Setpoints

4.9. Set-Reset Latch Block

The Set-Reset Latch Block setpoints are defined in Section 1.10. Refer to that section for detailed information on how these setpoints are used. The screen capture in Figure 9 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.

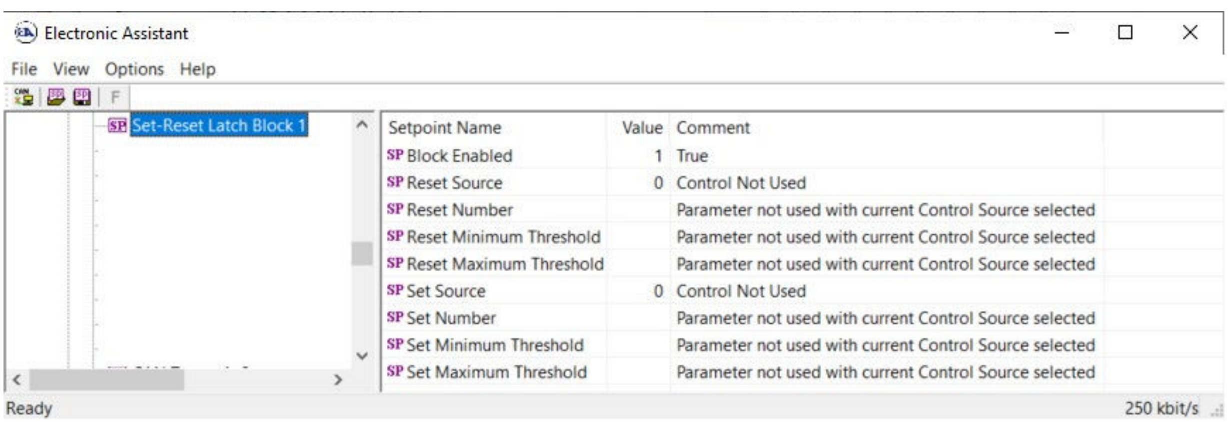


Figure 9: Screen Capture of Set-Reset Latch Block Setpoints

Name	**Range**	**Default**	**Notes**
Block Enabled	Drop List	False	
Reset Source	Drop List	Control Not Used	Refer to Table 1
Reset Number	Depends on Source Selected	1	Refer to Table 1
Reset Minimum Threshold	Drop List	0%	Refer to Section 1.10
Reset Maximum Threshold	Depends on Source Selected	100%	Refer to Section 1.10
Set Source	Drop List	Control Not Used	Refer to Table 1
Set Number	Drop List	1	Refer to Table 1
Set Minimum Threshold	Depends on Source Selected	0%	Refer to Section 1.10
Set Maximum Threshold	Drop List	100%	Refer to Section 1.10

Table 27 - Default Set-Reset Latch Block Setpoints

4.10. CAN Transmit Setpoints

CAN Transmit Message Function Block be presented in section 1.14. Please refer there for detailed information how these setpoints are used. “**Transmit Repetition Rate**” is 0ms by default, thus no message will be sent.

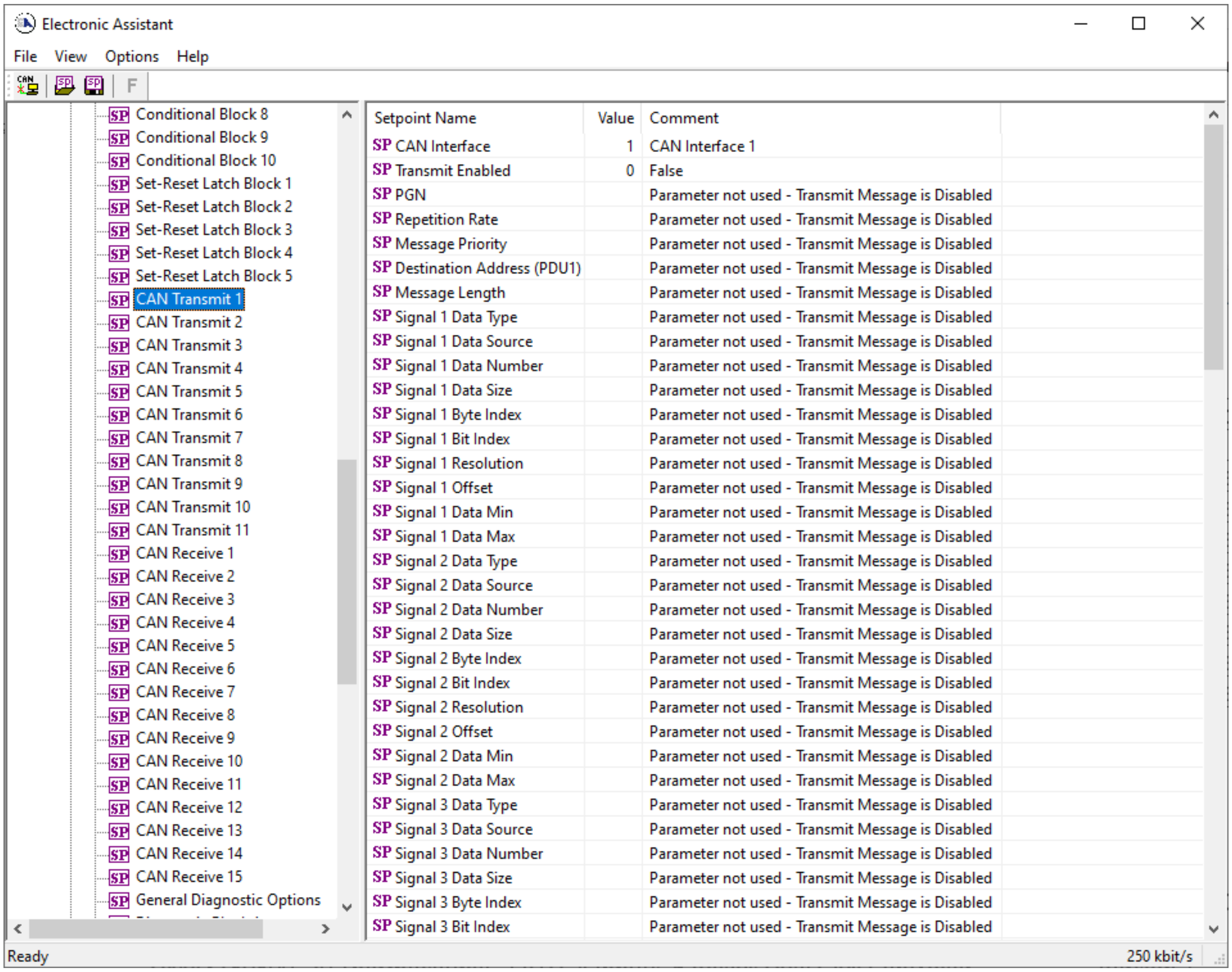


Figure 10 – Screen Capture of CAN Transmit Message Setpoints

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 1.14.1
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 1
Signal X Control Number	Drop List	Different for each	See Table 1
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	

Table 28 - CAN Transmit Message Setpoints

4.11. CAN Receive Setpoints

The CAN Receive Block is defined in section 1.13. 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.

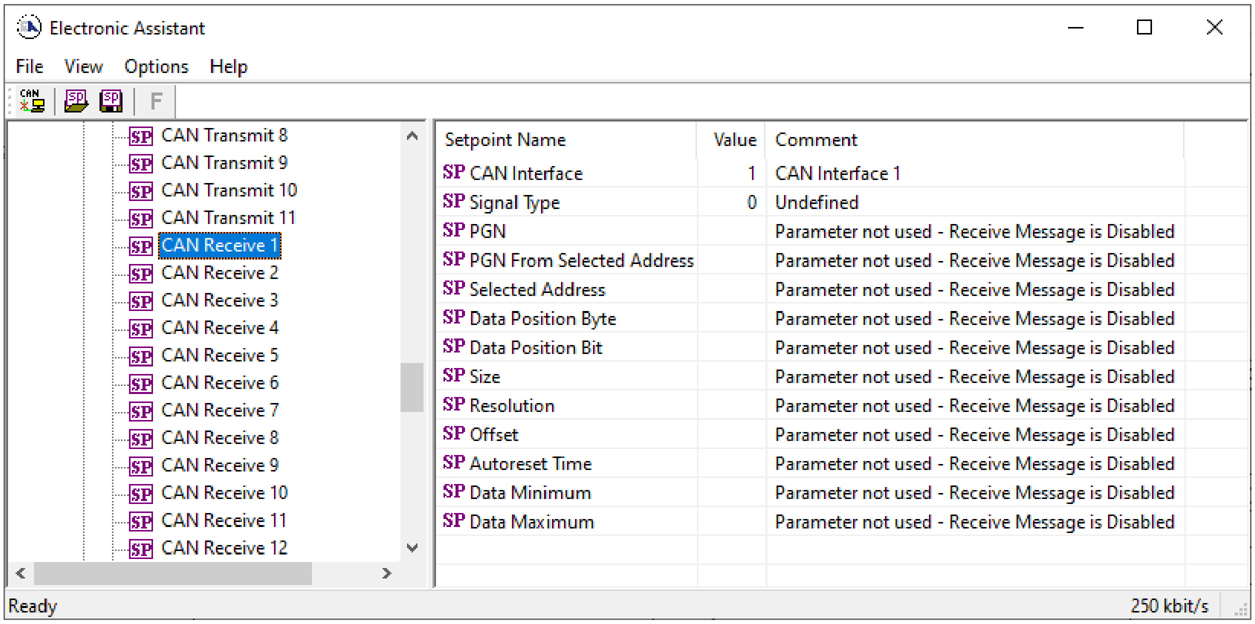


Figure 11 – Screen Capture of CAN Receive Message Setpoints

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	

Table 29 - CAN Receive Setpoints

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 1.11 for more info.

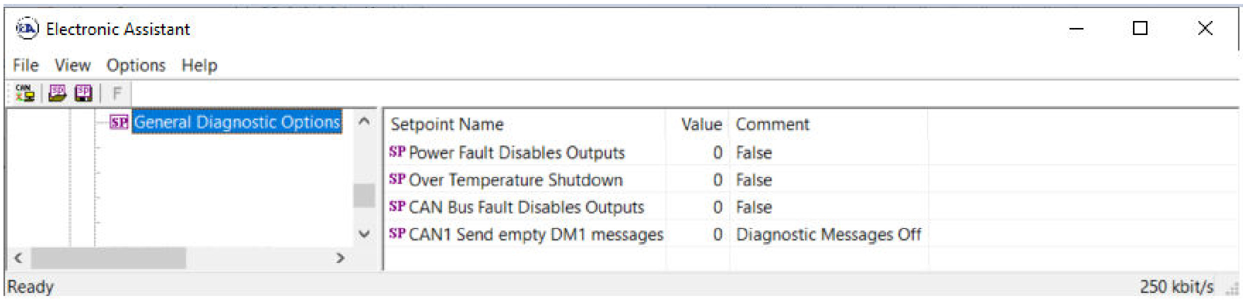


Figure 12 – Screen Capture of General Diagnostics Options Setpoints

Name	**Range**	**Default**	**Notes**
Power Fault Disables Outputs	Drop List	0	
Over Temperature Shutdown	Drop List	0	

Table 30 - General Diagnostics Options Setpoints

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 1.11. Please refer there for detailed information on how these setpoints are used.

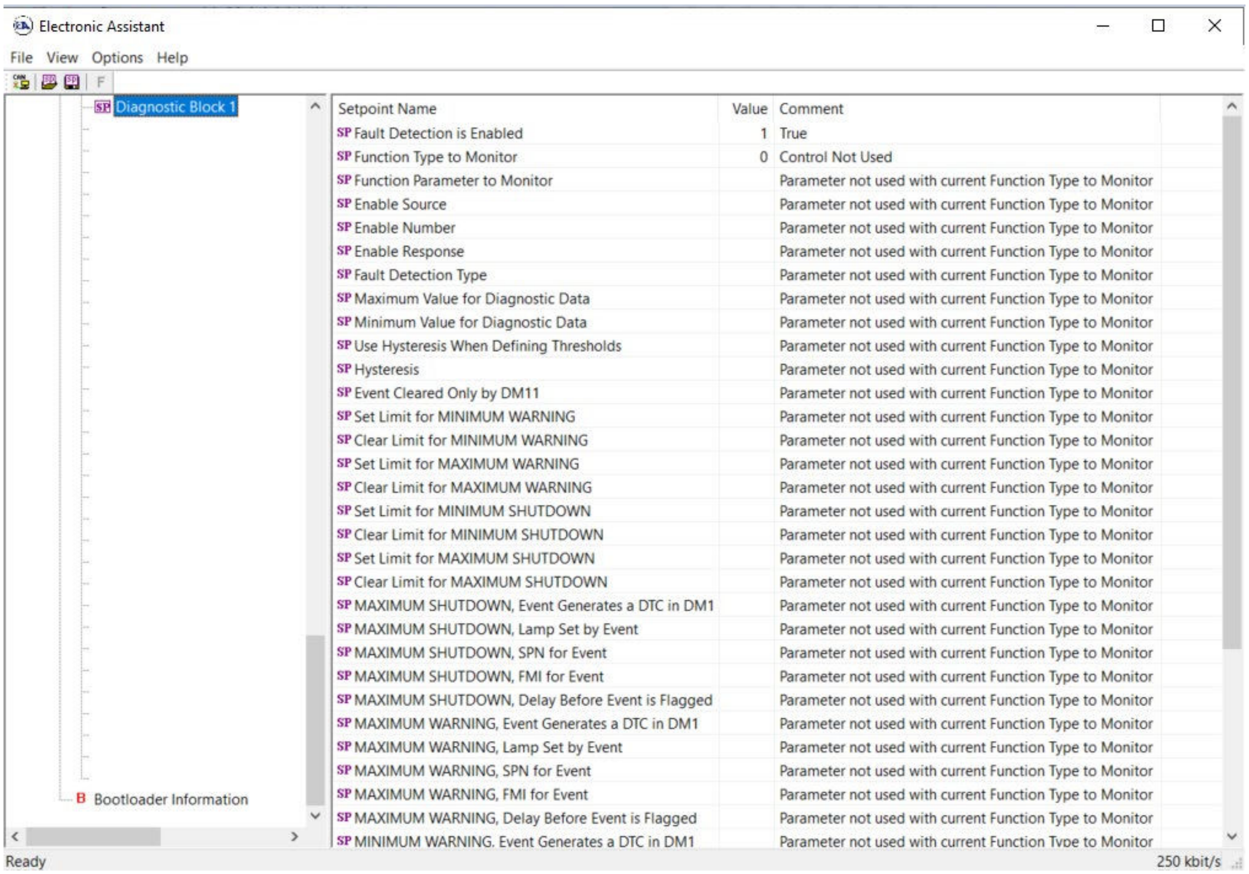


Figure 13 – Screen Capture of Diagnostic Block Setpoints

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 1.11
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	0.0	

	for Diagnostic Data		
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 19
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 20
MAXIMUM	0…60000 ms	1000	

SHUTDOWN, Delay Before Event is Flagged			
MAXIMUM WARNING, Event Generates a DTC in DM1	Drop List	True	
MAXIMUM WARNING, Lamp Set by Event	Drop List	0 – Protect	See Table 19
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 20
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 19
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 20
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 19
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 20
MINIMUM SHUTDOWN, Delay Before Event is Flagged	0…60000 ms	1000	

Table 31 - Diagnostic Block Setpoints

4.14. DTC React Function Block

The DTC React function block is described in Section 1.12. The Figure below shows the DTC React function block setpoints. The Table below shows the default values. Please note: *The setpoint "DTC React is Enabled" was changed to 1, True.*

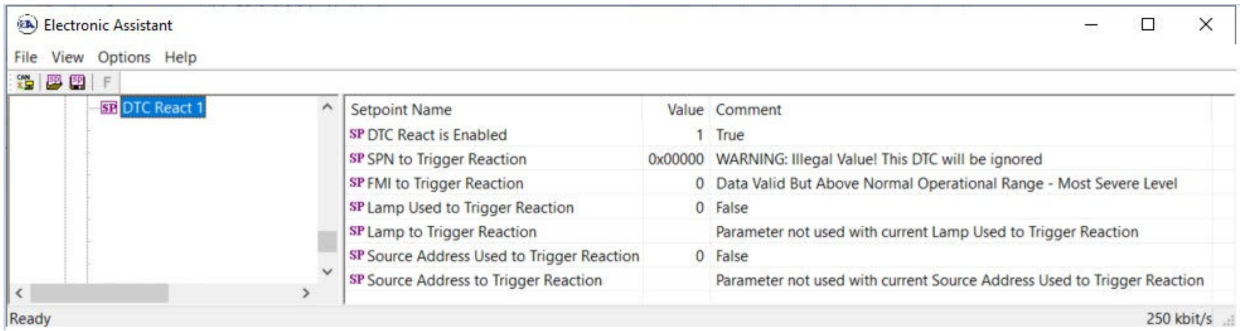


Figure 14 DTC React Setpoints

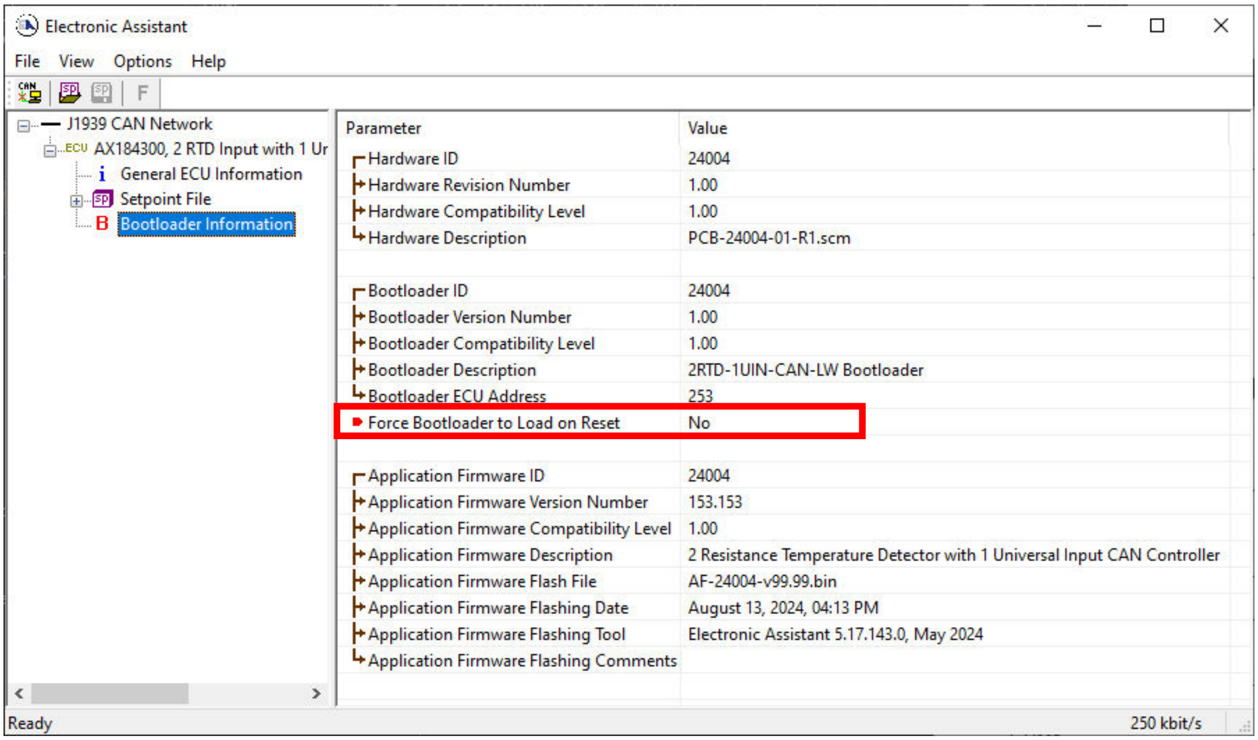
Name	Range	Default	Notes
DTC React is Enabled	Drop List	0, False	
SPN to Trigger Reaction	0x00 to 0x3FFFF	0	
FMI to Trigger Reaction	Drop List	0	
Lamp Used to Trigger Reaction	Drop list	0, False	
Lamp to Trigger Reaction	Drop List	0, Protect	
Source Address Used to Trigger Reaction	Drop list	0, False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

Table 32 - DTC React Setpoints

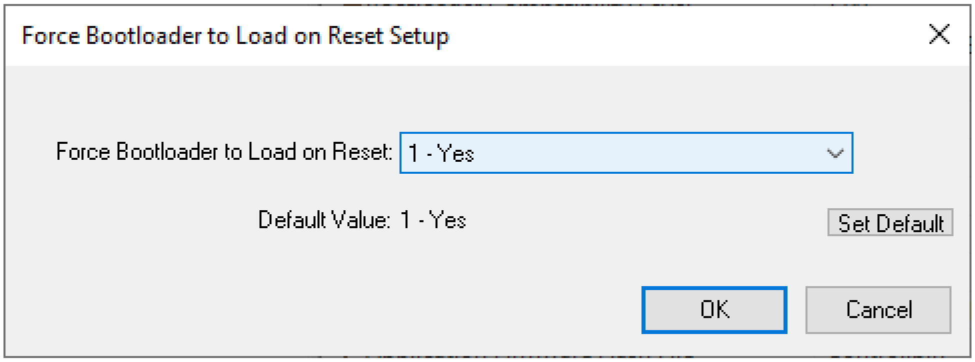
5. REFLASHING OVER CAN WITH THE AXIOMATIC EA BOOTLOADER

The AX184300 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.

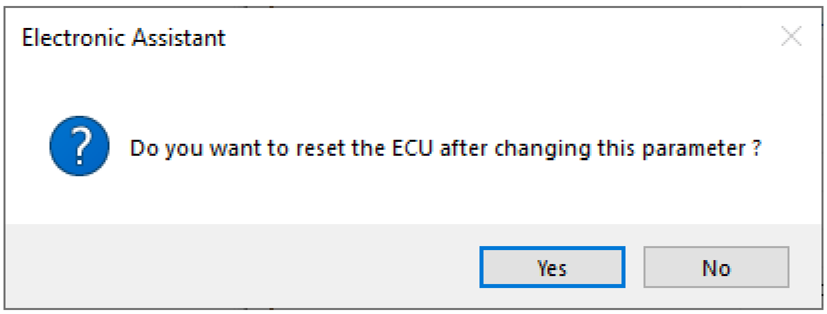
1. When the Axiomatic EA first connects to the ECU, the **Bootloader Information** section will display the following information.



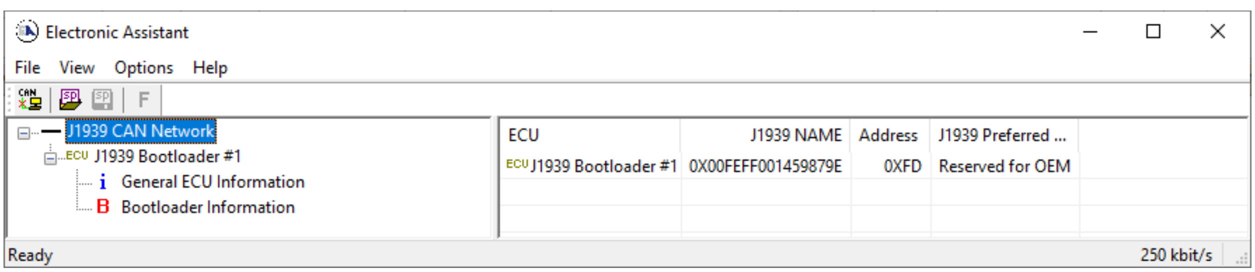
2. To use the bootloader to upgrade the firmware running on the ECU, change the variable **“Force Bootloader to Load on Reset”** to *Yes.*

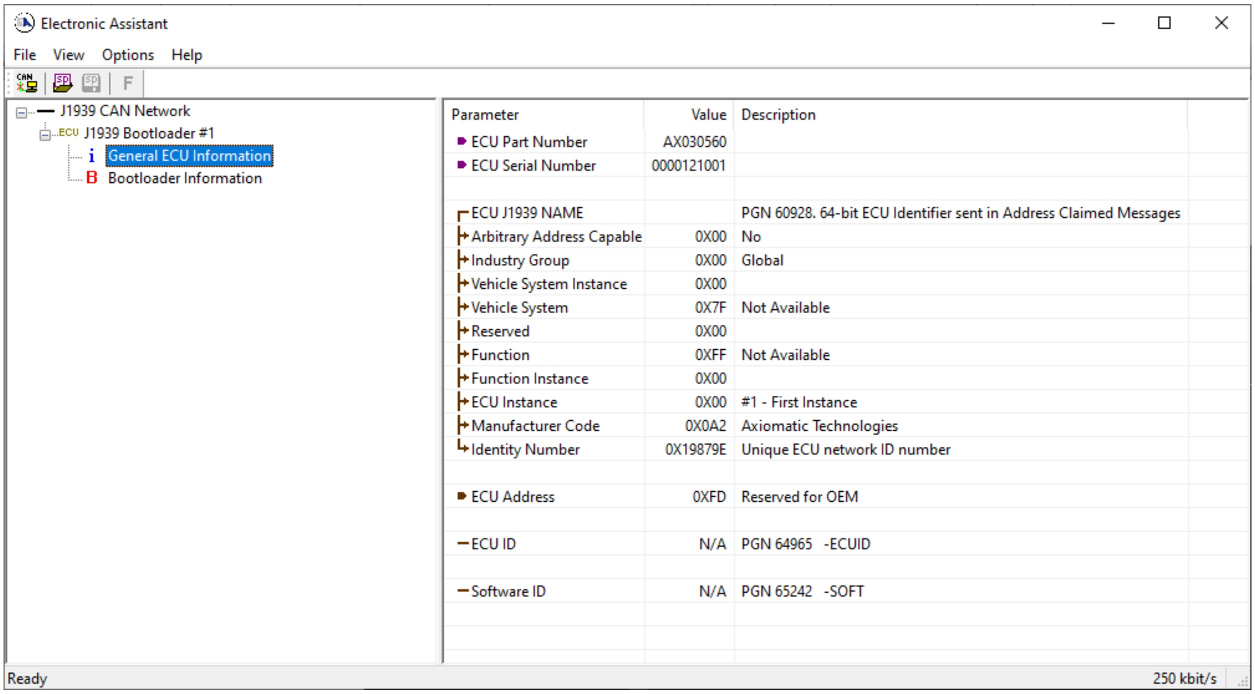


3. When the prompt box asks if you want to reset the ECU, select *Yes*.



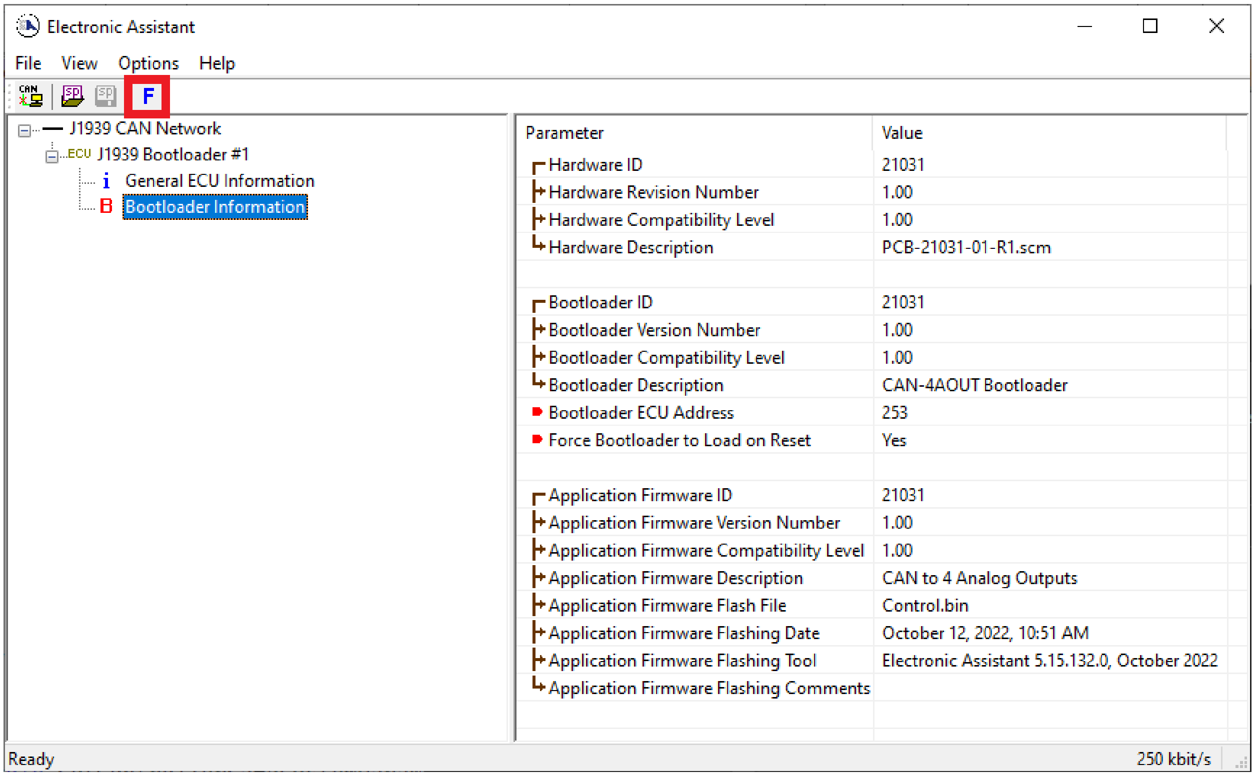
4. Upon reset, the ECU will no longer show up on the J1939 network as an AX184300 but rather as **J1939 Bootloader #1**.





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.

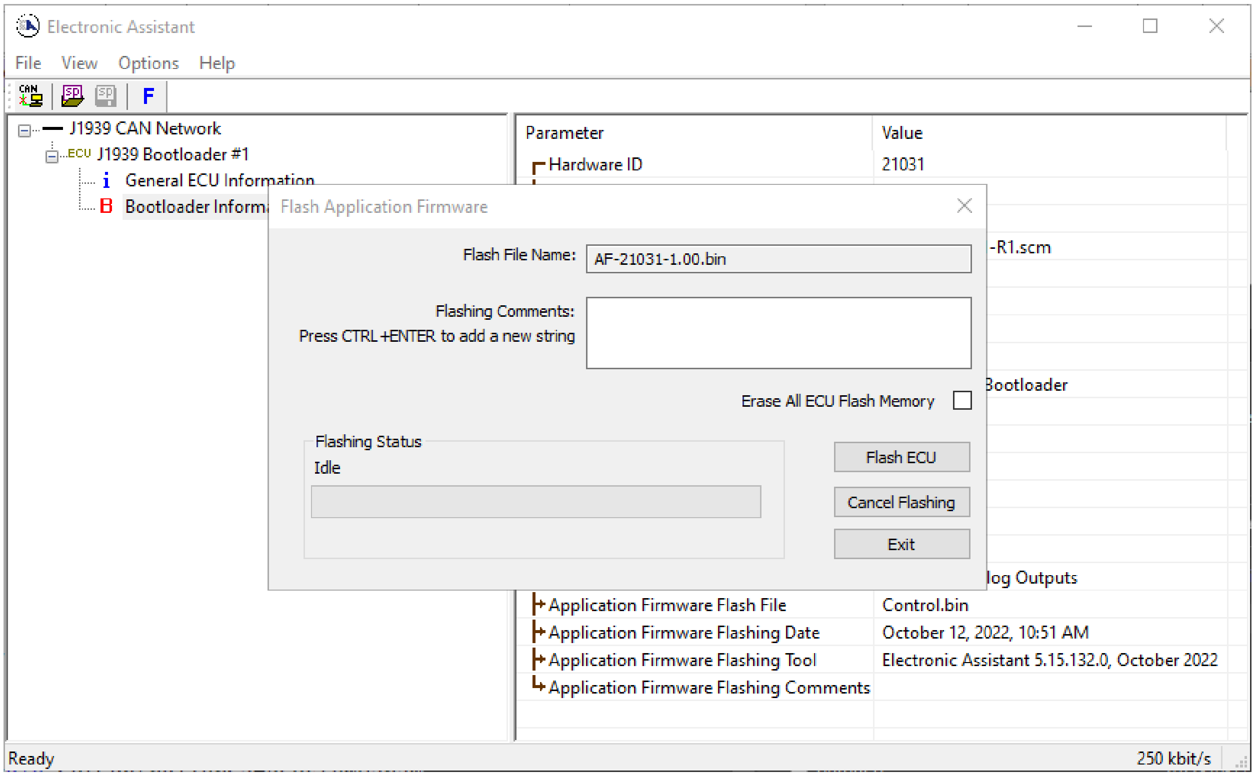
5. When the **Bootloader Information** section is selected, the same information is shown as when it was running the AX184300 firmware, but in this case the Flashing feature has been enabled.



6. Select the Flashing button and navigate to where you had saved the **AF-20017_x.yy.bin** file sent from Axiomatic. (Note: only binary (.bin) files can be flashed using the Axiomatic EA tool)

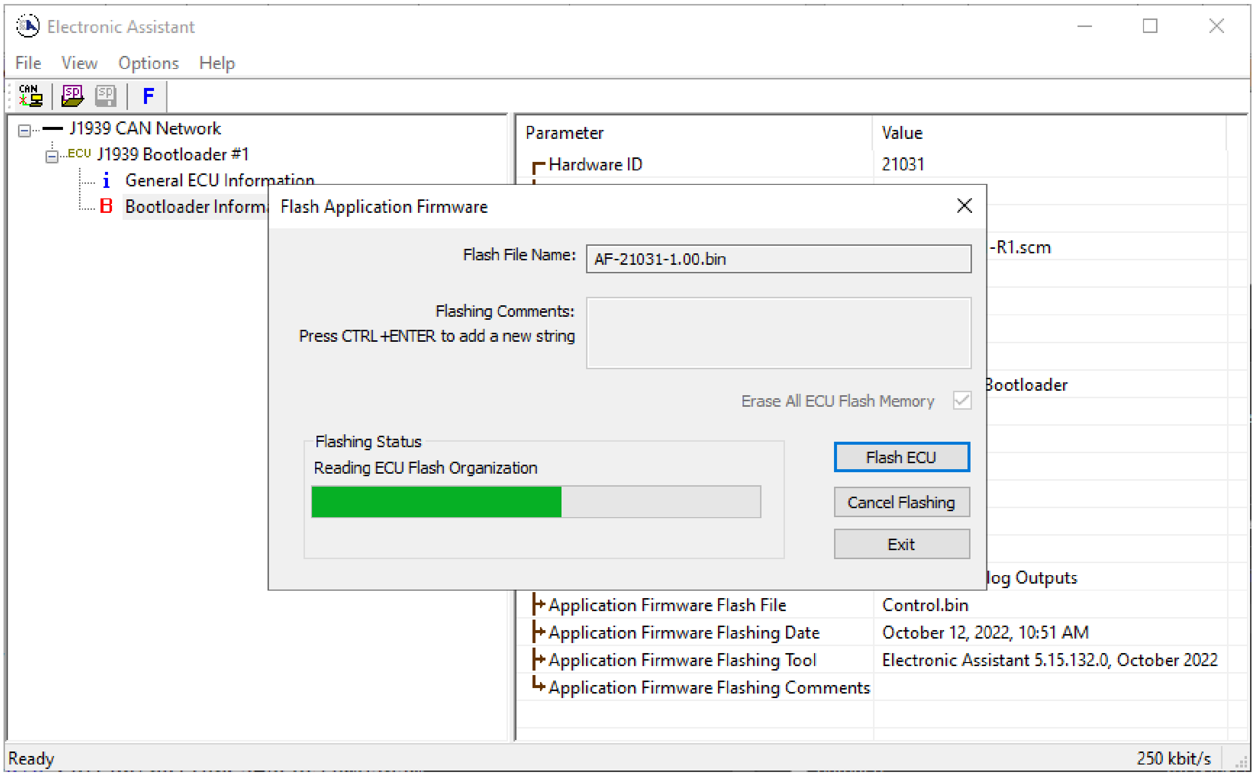
7. Once the Flash Application Firmware window opens, you can enter comments such as “Firmware upgraded by [Name]” if you so desire. This is not required, and you can leave the field blank if you do not want to use it.

   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.

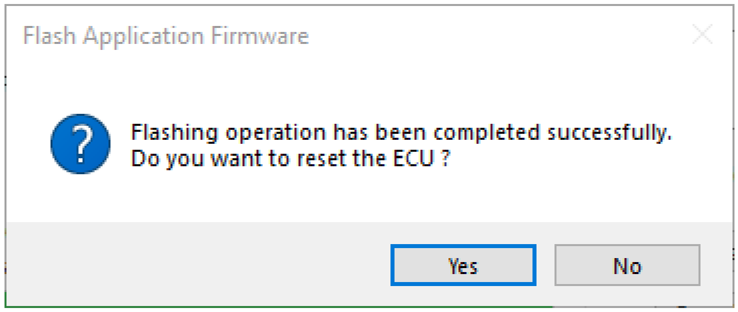


WARNING: Do not check the “Erase All ECU Flash Memory” box unless instructed to do so by your Axiomatic contact. Selecting this will erase ALL data stored in non-volatile flash, including the calibration done by Axiomatic during factory testing. It will also erase any configuration of the setpoints that 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.

8. 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.



9. Once the firmware has finished uploading, a message will popup indicating the successful operation. If you select to reset the ECU, the new version of the AX184300 application will start running, and the ECU will be identified as such by the Axiomatic EA. Otherwise, the next time the ECU is power-cycled, the AX184300 application will run rather than the bootloader function.



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.

6. VERSION HISTORY

Version	Date	Author	Modifications
1.0.0	Aug. 27, 2024	Weixin Kong	Initial Draft
1.0.1	Sep. 26, 2024	M Ejaz	Updated technical specifications, pin out, dimensional drawing, and description in section 1.1. Marketing review
1.0.2	Apr. 11, 2025	M Ejaz	Added auto-baud-rate detection to technical specifications

APPENDIX A - Technical Specifications

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 Limitations & Return Materials Process as described on https://www.axiomatic.com/service/.

Power Supply

Power Supply Input	12, 24, or 48 VDC nominal (6 to 62 VDC)
Quiescent Current	36.8 mA @ 12 V; 19.8 mA @ 24 V; 11.5 mA @ 48 V typical
Protection	Surge and transient protection Reverse polarity protection (up to 400 VDC) Under-voltage protection (Hardware shutdown at 5.5 V) Over-voltage protection (Hardware shutdown at 63 V)

Inputs

<table>
<tr><td>RTD Inputs</td><td>2 channels of 3-wire Pt100 sensor input

<u>Scan Rate</u>:
10 samples per second per channel
<u>RTD Resistance Range</u>:
20 Ω to 400 Ω
<u>RTD Lead Resistance Range</u>:
0 Ω to 10 Ω
<u>Accuracy</u>:
±0.02 Ω</td></tr>
<tr><td>Universal Input</td><td>1 input selectable as follows
<table>
<tr><td>Voltage</td><td><u>Ranges</u>:
0-5V or 0-10V
<u>Resolution</u>:
1 mV
<u>Accuracy</u>:
±0.2 % error
<u>Input Impedance</u>:
204 kΩ for 0-5V
136 kΩ for 0-10V</td></tr>
<tr><td>Current</td><td><u>Ranges</u>:
0-20mA or 4-20mA
<u>Resolution</u>:
1 µA
<u>Accuracy</u>:
±0.2 % error
<u>Input Impedance</u>:
124 Ω</td></tr>
<tr><td>Frequency</td><td><u>Range</u>:
1 Hz to 10 kHz
<u>Resolution</u>:
0.01 %
<u>Accuracy</u>:
±0.1 % error</td></tr>
<tr><td>PWM</td><td><u>Range</u>:
1 Hz to 10 kHz
<u>Duty Cycle</u>:
0 to 100 %</td></tr>
<tr><td>Digital</td><td>Active High or Active Low with 10 kΩ pull-up or pull-down
Amplitude up to 36 V</td></tr>
</table>

12-bit Analog to Digital (voltage and current inputs)
Protected against shorts to Ground or +Vsupply</td></tr>
</table>

General Specifications

Microcontroller	STM32H725RGV3
Isolation	400 VDC from power supply (Input and CAN port are not isolated from each other.)
Communications	1 CAN SAE J1939-compliant port Supported baud-rates: 250 kbit/s, 500 kbit/s, 667 kbit/s, or 1 Mbit/s with auto-baud-rate detection
Control Logic	Standard embedded control logic is provided. Refer to the User Manual.
User Interface	User configuration and diagnostics are provided with the Axiomatic Electronic Assistant P/N: **AX070502** or **AX070506K**
Compliance	RoHS
Operating Conditions	-40°C to 85°C (-40 to 185°F)
Storage Temperature	-50°C to 125°C (-58 to 257°F)
Weight	0.07 kg (0.15 lbs.)
Protection	IP67
Enclosure and Dimensions	Molded Enclosure, integral connector Nylon 6/6, 30% glass Ultrasonically welded Flammability Rating: UL 94V-0 3.54 x 2.75 x 1.31 inches (90.09 x 70.00 x 33.35 mm) L x W x H including integral connector Refer to the dimensional drawing.
Electrical Connections	Integral 12-pin receptacle (equivalent to TE Deutsch P/N: **DTM04-12PA**)
Mating Connectors	Mating Plug KIT P/N: **PL-DTM06-12SA** (includes 1 DTM06-12SA plug, 1 WM-12S wedgelock, 12 0462-201-20141 solid contacts, and 6 0413-204-2005 sealing plugs)
Mounting	Mounting holes are sized for #10 or M5 bolts. The bolt length will be determined by the end-user's mounting plate thickness. The mounting flange of the controller is 0.47 inches (12 mm) thick. It should be mounted with connectors facing left or right to reduce the likelihood of moisture entry. All field wiring should be suitable for the operating temperature range. 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).

OUR PRODUCTS

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Inclinometers, Triaxial

I/O Controls

LVDT Signal Converters

Machine Controls

Modbus, RS-422, RS-485 Controls

Motor Controls, Inverters

Power Supplies, DC/DC, AC/DC

PWM Signal Converters/Isolators

Resolver Signal Conditioners

Service Tools

Signal Conditioners, Converters

Strain Gauge CAN Controls

Surge Suppressors

OUR COMPANY

Axiomatic provides electronic machine control components to the off-highway, commercial vehicle, electric vehicle, power generator set, material handling, renewable energy and industrial OEM markets. ***We innovate with engineered and off-the-shelf machine controls that add value for our customers.***

QUALITY DESIGN AND MANUFACTURING

We have an ISO9001:2015 registered design/manufacturing facility in Canada.

WARRANTY, APPLICATION APPROVALS/LIMITATIONS

Axiomatic Technologies Corporation reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. 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 at https://www.axiomatic.com/service/.

COMPLIANCE

Product compliance details can be found in the product literature and/or on axiomatic.com. Any inquiries should be sent to sales@axiomatic.com.

SAFE USE

All products should be serviced by Axiomatic. Do not open the product and perform the service yourself.

This product can expose you to chemicals which are known in the State of California, USA to cause cancer and reproductive harm. For more information go to www.P65Warnings.ca.gov.

SERVICE

All products to be returned to Axiomatic require a Return Materials Authorization Number (RMA#) from rma@axiomatic.com. Please provide the following information when requesting an RMA number:

- Serial number, part number
- Runtime hours, description of problem
- Wiring set up diagram, application and other comments as needed

DISPOSAL

Axiomatic products are electronic waste. Please follow your local environmental waste and recycling laws, regulations and policies for safe disposal or recycling of electronic waste.

CONTACTS

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