1 Resistive Output

CAN Controller with SAE J1939

USER MANUAL

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ACRONYMS

ACK	Positive Acknowledgement
CSR	CAN Status Report
DM	Diagnostic Message (from SAE J1939 standard)
DTC	Diagnostic Trouble Code
FMI	Failure Mode Identifier
OC	Occurrence Count
EA	Axiomatic Electronic Assistant (Service Tool for Axiomatic ECUs)
ECU	Electronic Control Unit (from SAE J1939 standard)
MAP	Memory Access Protocol
NAK	Negative Acknowledgement
PDU1	A format for messages that are to be sent to a destination address, either specific or global
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)
PropB	Message that uses a Proprietary B PGN
SPN	Suspect Parameter Number (from SAE J1939 standard)

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1. GENERAL INFORMATION

1.1. Introduction

The 1 Resistive Output CAN electronic control unit (ECU) is designed to deliver resistive output over J1939 CAN Network. The hardware supports 1 CAN input. The output will provide resistance range of 0 to 5000 Ohm. The output can be configured.

The ECU has been designed to allow the maximum amount of versatility to optimize the performance of the machine. Numerous configurable variables, called setpoints, have been provided which are accessible using Axiomatic Electronic Assistant (EA). Information about the setpoint defaults and ranges is outlined in Section 3. The EA communicates with the controller over J1939 CAN bus and uses Memory Access Protocol (MAP) to read/write each setpoint. Once the ECU has been setup as desired, the setpoints can be saved to a file, and flashed into other controllers using EA.

The ECU is an arbitrary address capable ECU, which can perform dynamic address allocation at the run time. It also provides all necessary network support required by the J1939 standard.

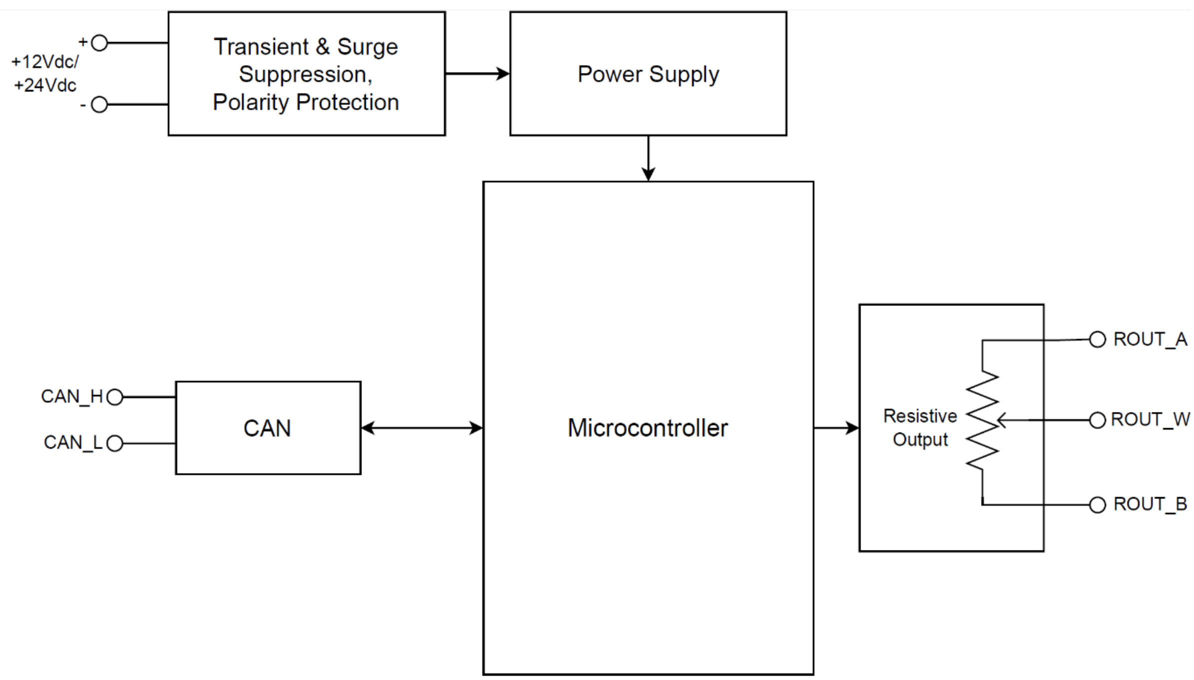


Figure 1: ECU Block Diagram

1.2. J1939 Network – Diagnostic Broadcast

Diagnostic messages are triggered by the internal function blocks and then broadcasted on the CAN bus network. However, in some applications this broadcast may not be required and so the user has the option to disable or enable this feature. Section 1.4 and 3.3 shows the configuration of this feature by using the Axiomatic Electronic Assistant tool.

1.3. Output

1.3.1. Digital Pot

A power on/off switch is provided on the digital potentiometer in the ECU. Simply turn disable to enable to turn on the potentiometer. The potentiometer will be activated.

1.3.2. Digital Pot Control Sources

The different function blocks in the ECU are commanded by a set of Control Sources. This section lists the different available control sources for these functions and their respective ranges.

Value	Meaning	Source Range
0	Control Not Used	[0]
1	CAN Receive	[1…10]
2	Constant Discrete Data	[1…5]
3	Constant Continuous Data	[1…5]
4	Lookup Table	[1…10]
5	Programmable Logic Block	[1…3]
6	Math Block	[1…5]
7	Conditional Logic Block	[1…5]
8	Set-Reset Latch	[1…5]
9	Voltage Power Supply Reading	[1]
10	Internal Temperature Reading	[1]

Table 1: Control Sources

While these sources are available for all functional blocks, it is not recommended to use Constant Data as a source in the Set-Reset Latch block.

1.3.3. Digital Pot Enable Sources

The **Enable Sources** parameter allows the user to select different control sources to enable of disable of the output. Table 2 shows the different options for enable sources.

Value	Meaning	Source Range
0	Control Not Used	[0]
1	CAN Receive	[1…10]
2	Constant Discrete Data	[1…5]
3	Constant Continuous Data	[1…5]
4	Lookup Table	[1…10]
5	Programmable Logic Block	[1…3]
6	Math Block	[1…5]
7	Conditional Logic Block	[1…5]
8	Set-Reset Latch	[1…5]
9	Voltage Power Supply Reading	[1]
10	Internal Temperature Reading	[1]

Table 2: Enable Sources

1.3.4. Digital Pot Enable Response

The **"Digital Pot Enable Source"** will determine whether or not the resistance output will be commanded by the **"Digital Pot Enable Source"**. There are six different **"Digital Pot Enable Response"** in which the enable signal can be used. These responses are listed in Table 3.

Value	Meaning
0	*Enable When ON*
1	*Enable When OFF*
2	*Disable When ON*
3	*Disable When OFF*
4	*Enable When ON Else Keep State*
5	*Enable When OFF Else Keep State*

Table 3: Enable Response

When the **"Digital Pot Enable Source"** is set to *'Enable When ON'* or *'Disable When OFF'*, the relay output will be commanded according to the combined signal of the **"Digital Pot Enable Source"** and **"Digital Pot Control Number"** only when the signal of the **"Digital Pot Enable Source"** and **"Digital Pot Enable Number"** is ON. Otherwise, the digital potentiometer output is commanded to the OFF state.

Similarly, when the **"Digital Pot Enable Response"** is set to *'Enable When OFF'* or *'Disable When ON'*, the digital potentiometer output will be commanded according to the **"Digital Pot Control Source"** and **"Digital Pot Control Number"** only when the signal of the **"Digital Pot Enable Source"** and **"Digital Pot Enable Number"** is OFF. Otherwise, the digital potentiometer output is commanded to the OFF state.

1.3.5. Digital Pot Terminal Select

The opposite ends of the potentiometer are connected to two of the terminals. Additionally, the third terminal is connected to a sliding contact known as a wiper. By selecting **Terminal A** or **Terminal B**, the user can pick from ROUT_A to ROUT_W or ROUT_B to ROUT_W as their output.

Value	Meaning
0	*Terminal B*
1	*Terminal A*

Table 4: Output Terminal Select

1.3.6. Output Range

The digital potentiometer can have different output ranges which can be configured. The **Output Range Min** and **Output Range Max** parameters are used to set the range for the output.

1.3.7. Ramp Setting / Ramp Up/Down Time

The ECU also provides ramp output function. When **Ramp Setting Enable**, the digital potentiometer will ramp to the input value in time **Ramp Up time** / **Ramp down time**. When **Ramp Setting Disable**, the digital potentiometer will set to input value instantly.

1.4. General Diagnostics

The General Diagnostics function block contains various parameters that affect the general diagnostic performance of the ECU.

The **Undervoltage Threshold**, **Overvoltage Threshold**, and **Shutdown Temperature** setpoints are used to set the limits for when their respective diagnostic messages are triggered.

Lastly, the **CAN1 Diagnostic Setting** parameter is used to control all diagnostics with one general setting for CAN Interface. This can be used to disable diagnostics entirely, only transmit messages without a blank SPN, or transmit diagnostic messages normally.

1.5. Diagnostic Function Blocks

The Diagnostic Input function blocks are used to setup the diagnostic messages for the controller.

The 4 types of diagnostics supported by the controller are shown in Table 4.

Function Block	Minimum Threshold	Maximum Threshold
Power Undervoltage Fault	VPS Undervoltage	N/A
Power Overvoltage Fault	N/A	VPS Overvoltage
Over Temperature Fault	N/A	Temperature Shutdown
Lost Communication Fault	N/A	Received Message Timeout (any)

Table 5: Diagnostic Blocks and Fault Detection Thresholds

If and only if the **Event Generates a DTC in DM1** parameter is set to true will the other setpoints in the function block be enabled. They are all related to the data that is sent to the J1939 network as part of the DM1 message, Active Diagnostic Trouble Codes.

A Diagnostic Trouble Code (DTC) is defined by the J1939 standard as a 4-byte value which is a combination of:

SPN	Suspect Parameter Number	(first 19 bits of the DTC, LSB first)
FMI	Failure Mode Identifier	(next 5 bits of the DTC)
CM	Conversion Method	(1 bit, always set to 0)
OC	Occurrence Count	(7 bits, number of times the fault has happened)

In addition to supporting the DM1 message, the Controller 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**

So long as even one Diagnostic function block has **Event Generates a DTC in DM1** set to true, the Controller will send the DM1 message every one second, regardless of whether there are any active faults, as recommended by the standard. While there are no active DTCs, the Controller will send the “No Active Faults” message. If a previously active DTC becomes inactive, a DM1 will be sent immediately to reflect this. As soon as the last active DTC goes inactive, it will send a DM1 indicating that there are no more active DTCs.

If there is more than on active DTC at any given time, the regular DM1 message will be sent using a multipacket Broadcast Announce Message (BAM). If the controller receives a request for a DM1 while this is true, it will send the multipacket message to the Requester Address using the Transport Protocol (TP).

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

The Diagnostic function block has a setpoint **Event Cleared Only by DM11**. By default, this is set to false, which means that as soon as the condition that caused an error flag to be set goes away, the DTC is automatically made Previously Active, and is no longer included in the DM1 message. However, when this setpoint is set to true, even if the flag is cleared, the DTC will not be made inactive, so it will continue to be sent on the DM1 message. Only when a DM11 has been requested will the DTC go inactive. This feature may be useful in a system where a critical fault needs to be clearly identified as having happened, even if the conditions that caused it went away.

In addition to all the active DTCs, another part of the DM1 message is the first byte, which reflects the Lamp Status. Each Diagnostic function block has the setpoint **Lamp Set by Event in DM1** which determines which lamp will be set in this byte while the DTC is active. The J1939 standard defines the lamps as '*Malfunction*', '*Red Stop*', '*Amber, Warning*' or *'Protect'*. By default, the *'Amber, Warning'* lamp is typically the one set by any active fault.

By default, every Diagnostic function block has associated with it a proprietary SPN. However, this setpoint **SPN for Event used in DTC** is fully configurable by the user should they wish it to reflect a standard SPN define in J1939-71 instead. If the SPN is change, the OC of the associate error log is automatically reset to zero.

Every Diagnostic function block also has associated with it a default FMI. The only setpoint for the user to change the FMI is **FMI for Event used in DTC**, even though some Diagnostic function blocks can have both high and low errors. In those cases, the FMI in the setpoint reflects that of the low-end condition, and the FMI used by the high fault will be determined per Table 5. If the FMI is changed, the OC of the associate error log is automatically reset to zero.

FMI for Event used in DTC – Low Fault	Corresponding FMI used in DTC – High Fault
FMI=1, Data Valid but Below Normal Operational 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 Range – 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 6: Low Fault FMI versus High Fault FMI

If the FMI used is anything other than one of those in Table 5, then both the low and the high faults will be assigned the same FMI. This condition should be avoided, as the log will still use different OC for the two types of faults, even though they will be reported the same in the DTC.

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 Sending DM1** timer for the Diagnostic function block. If the fault has remained present during the delay time, then the controller will set the DTC to active, and it 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.

1.6. Constant Data

The Constant Data block is used to provide fixed values as a control source to other function blocks. The setpoints are separated as "**Discrete Constant Data**" and "**Continuous Constant Data**". 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.

1.7. Math Function Block

There are four 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 Decimal Digits**" 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 $\mathrm{A\ operator\ B}$, where A and B are function inputs and operator is function selected with a setpoint "**Math Function X**". Setpoint options are presented in Table 6. 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.

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

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 7: 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.

1.8. 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 7. 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.

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

Table 8: 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 8, the associated Lookup Table is selected as output of the Logical block. Option '*0 – Default Table*' selects associated Lookup Table in all conditions.

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 9: 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.

1.9. 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 1.8.

Lookup tables have two differing modes defined by "**X-Axis Type**" setpoint, given in Table 9. 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.

0	*Data Response*
1	*Time Response*

Table 10: 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 10. 'Ramp To' gives a linearized slope between points, whereas 'Jump to' gives a point-to-point response, where any input value between X_{N-1} and X_N will result Lookup Table output being Y_N. "Point0 – Response" is always 'Jump To' and cannot be edited. Choosing 'Ignored' response causes associated point and all the following points to be ignored.

0	*Ignore*
1	*Ramp To*
2	*Jump To*

Table 11: 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 X_{10} 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.

1.10. 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 2 demonstrates the connections between all parameters.

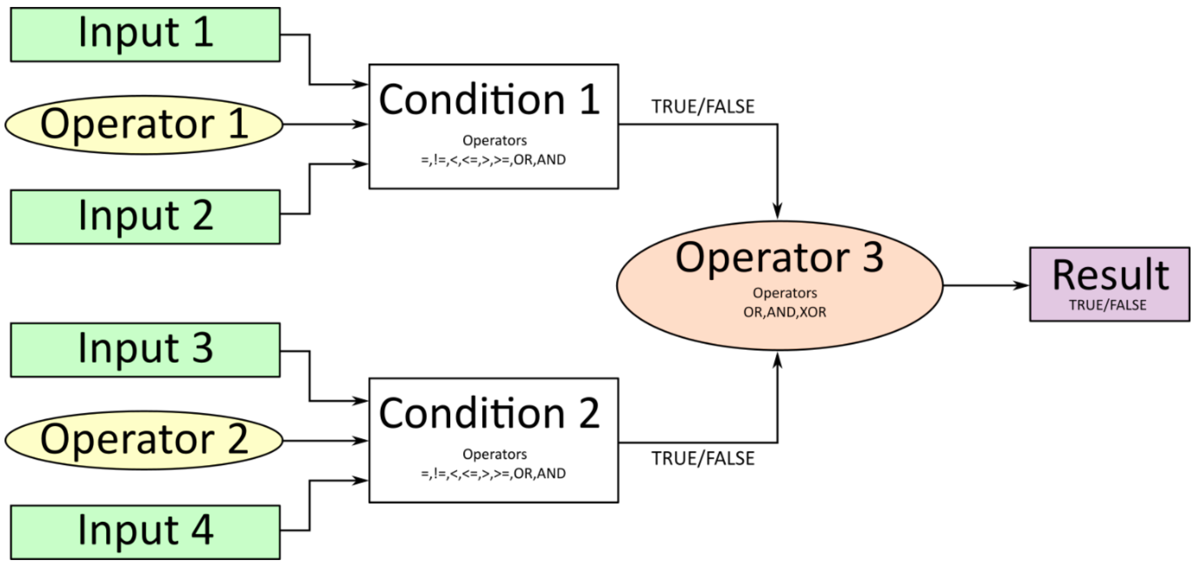


Figure 2: Conditional Block Diagram

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.

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 12: 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 12.

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 13: 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.

1.11. 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.

'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 14: 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 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'.

1.12. 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 AX030570 ECU has five CAN Transmit Messages, and each message has four completely user defined signals.

1.12.1. 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 "**CAN Interface**" setting determines which CAN interface the CAN Transmit signal is transmitted over. A CAN Transmit signal can only be transmitted over a single interface at a time.

The “**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**.

“**Transfer Rate**” setpoint defines the interval used to send the message to the J1939 network. If the “**Transfer 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’.

By default, all messages are sent on Proprietary B PGNs as broadcast messages. Thus “**Priority**” is always initialized to 6 (low priority) and the “**Destination**” 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.

1.12.2. CAN Transmit Signal Setpoints

Each CAN transmit message has four associated signals, which define data inside the Transmit message. “**Signal X Control Source**” setpoint together with “**Signal X Control Number**” setpoint define the signal source of the message. “**Signal X Control Source**” and “**Signal X Control Number**” options are listed in Table 1. Setting “**Signal X Control Source**” to ‘*Control Not Used’* disables the signal.

“**Signal X Size**” setpoint determines how many bits signal reserves from the message. “**Signal X Pos Byte**” determines in which of 8 bytes of the CAN message LSB of the signal is located. Similarly, “**Signal X Pos Bit**” 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**.

“**Signal X Resolution**” setpoint determines the scaling done on the signal data before it is sent to the bus. “**Signal X 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.

1.13. 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).

The “**CAN Interface**” setting determines which CAN interface the CAN Receive signal is received over. A CAN Receive signal can only be received over a single interface at a time.

The “**Signal Type**” is the most important setpoint associated with this function block and it should be selected first. Setting it to *‘Undefined’* will result in other setpoints being disabled. By default, ALL receive messages are set to *‘Continuous’*.

By default, all control messages are expected to be sent to the ECU on Proprietary B PGNs. However, should a PDU1 message be selected, the ECU can be setup to receive it from any other ECU by setting the “**Is From Selected Address**” to ‘True’ and the “**Selected Address**” to the Global Address (0xFF). If a specific address is selected instead, then any other ECU data on the PGN will be ignored.

The “**Size**”, “**Pos Byte**”, “**Pos Bit**”, “**Resolution**” and “**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 “**Data Minimum**” and “**Data Maximum**” 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.

Once a message has been enabled, a Lost Communication fault will be flagged if that message is not received off the bus within the “**Auto-Reset Time**” period. This could trigger a Lost Communication event as described in section 1.5. 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.

The CAN-ROUT I/O supports up to ten unique CAN Receive Messages. Defaults setpoint values are listed in section 3.12

2. 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

2.1. 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 Transmit, Default Digital I/O State Feedback	65280 ($00FF00)
• PropB Receive, Default Control Source Data Message	65408 ($00FF80)
• PropB Receive, Default Control Source Data Message	65409 ($00FF81)
• PropB Receive, Default Control Source Data Message	65410 ($00FF82)
• PropB Receive, Default Control Source Data Message	65411 ($00FF83)
• PropB Receive, Default Control Source Data Message	65412 ($00FF84)
• PropB Receive, Default Control Source Data Message	65413 ($00FF85)
• PropB Receive, Default Control Source Data Message	65414 ($00FF86)
• PropB Receive, Default Control Source Data Message	65415 ($00FF87)

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 CAN Receive or CAN Transmit messages.

From J1939-73 - Diagnostics

• DM1 – Active Diagnostic Trouble Codes	65226 ($00FECA)
• DM2 – Previously Active Diagnostic Trouble Codes	65227 ($00FECB)
• DM3 – Diagnostic Data Clear/Reset for Previously Active DTCs	65228 ($00FECC)
• DM11 - Diagnostic Data Clear/Reset for Active DTCs	65235 ($00FED3)
• DM14 – Memory Access Request	55552 ($00D900)
• DM15 – Memory Access Response	55296 ($00D800)
• 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.

2.2. J1939 Name, Address and Software ID

The controller has a J1939 name which is broadcasted at power up and/or when its ECU Address has been changed. The Software ID PGN gives useful information regarding the controller.

2.2.1. J1939 Name

The ECU 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	128, Axiomatic I/O Controller
Function Instance	3, AX030570, Single CAN to Resistance Output
ECU Instance	**0, First Instance**
Manufacture Code	162, Axiomatic Technologies Corporation
Identity Number	Variable, uniquely assigned during factory programming for each ECU

Table 15: J1939 Name Fields

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.

2.2.2. 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 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 controller will continue select the next highest address until it finds one that it can claim. See J1939/81 for more details about address claiming.

2.2.3. 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 the ECU, Byte 1 is set to 1, and the identification fields are as follows

(Version)*

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

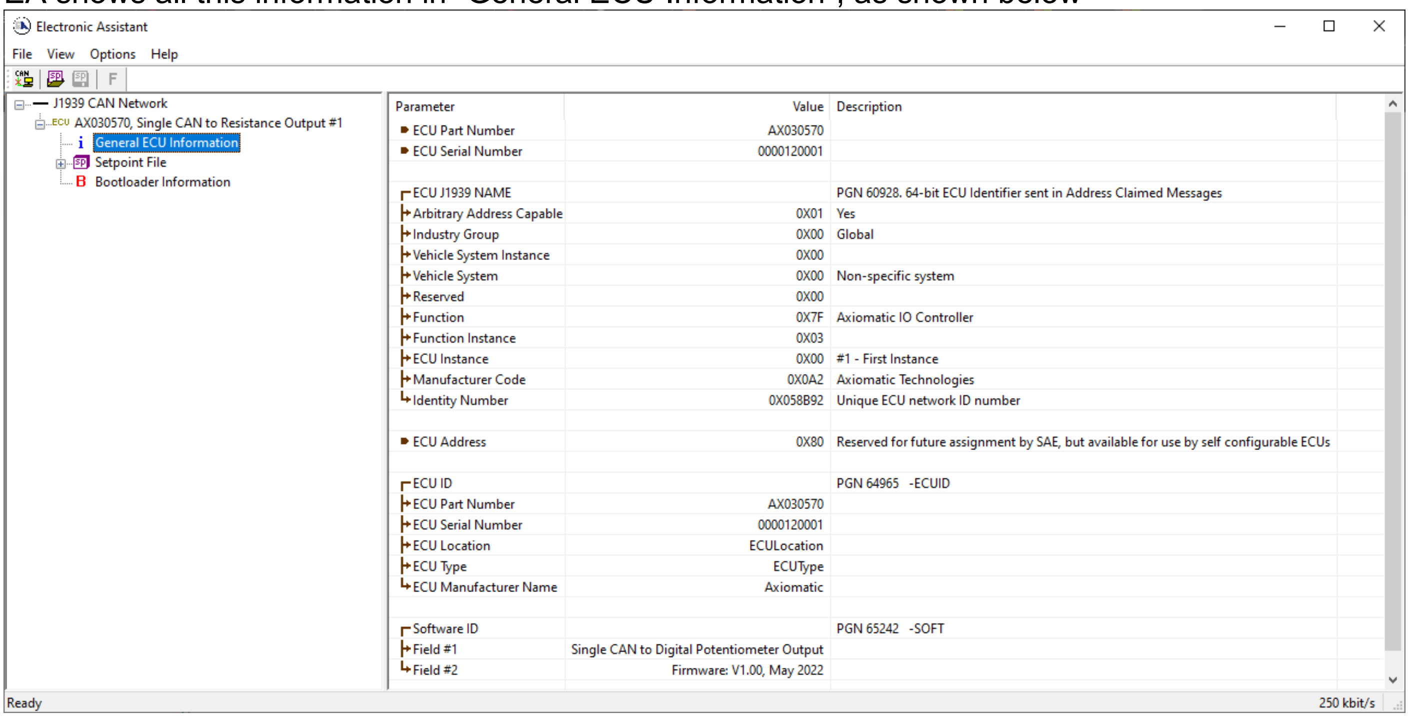


Figure 3: Screen Capture of General ECU Information

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

3. ECU SETPOINTS ACCESSED WITH AXIOMATIC ELECTRONIC ASSISTANT

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

3.1. J1939 Network Setpoints

The J1939 Network setpoints deal with the setpoints such as *ECU Instance Number* and *ECU Address*. Figure 4 and Table 15 below will explain these setpoints and their ranges.

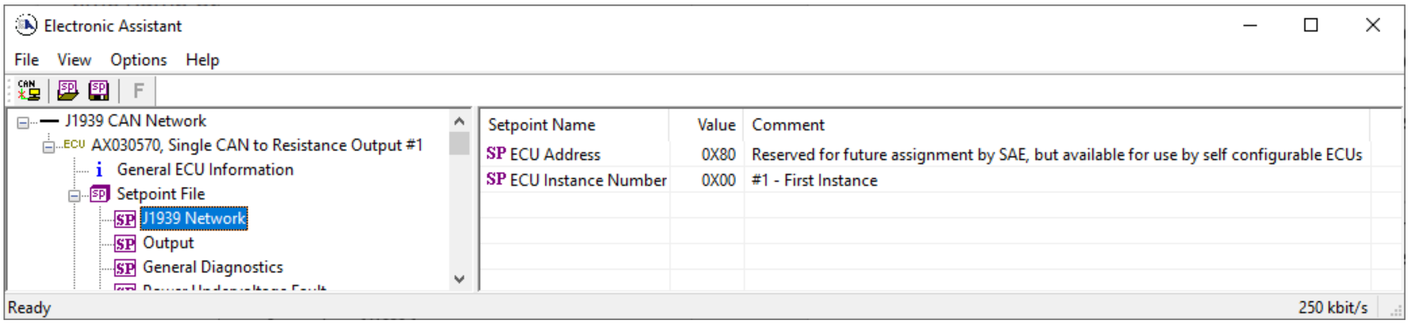


Figure 4: Screen Capture of J1939 Network Setpoints

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

Table 16: Default J1939 Network Setpoints

3.2. Output Setpoints

The Output setpoints are defined in Section 1.3. Refer to that section for detailed information on how these setpoints are used. The screen capture below in Figure 5 displays the available setpoints for Output.

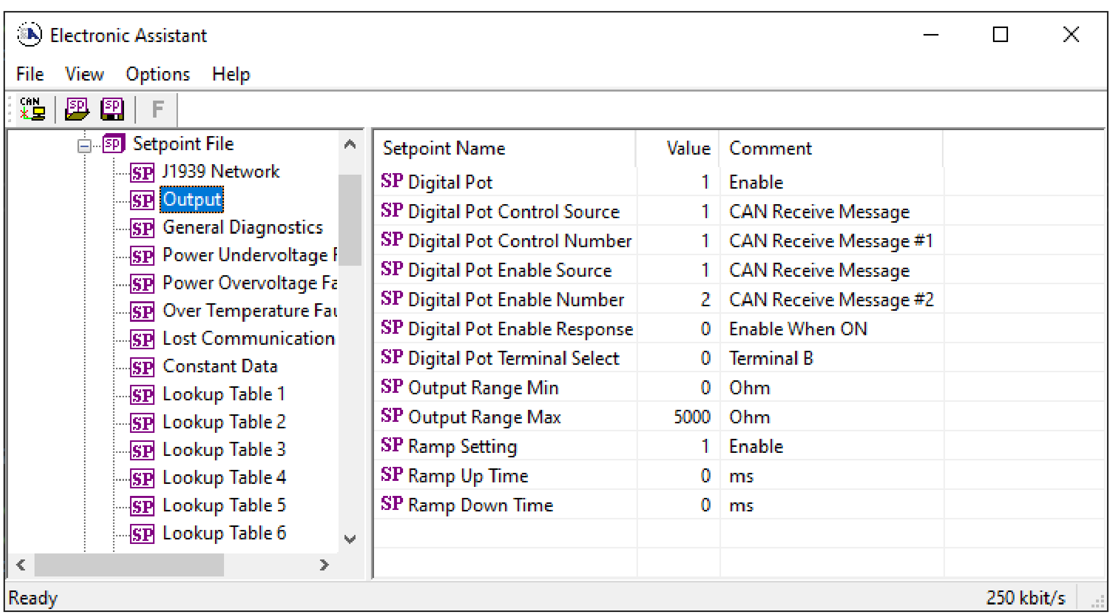


Figure 5: Screen Capture of Output Setpoints

Name	Range	Default	Notes
Digital Pot	Drop List	Disable	Refer to Section 1.3
Digital Pot Control Source	Drop List	Control Not Used	Refer to Section 1.3
Digital Pot Control Number	Depends on Control Source	0	Refer to Section 1.3
Digital Pot Enable Source	Drop List	Control Not Used	Refer to Section 1.3
Digital Pot Enable Number	Depends on Control Source	0	Refer to Section 1.3
Digital Pot Enable Response	Drop List	Enable When ON	Refer to Section 1.3
Digital Pot Terminal Select	Drop List	Terminal B	Refer to Section 1.3
Output Range Min	0 … Output Range Max	0 Ohm	Refer to Section 1.3
Output Range Max	Output Range Min … 5,000	5,000 Ohm	Refer to Section 1.3
Ramp Setting	Drop List	Disable	Refer to Section 1.3
Ramp Up Time	0 … 60,000	0ms	Refer to Section 1.3
Ramp Down Time	0…60,000	0ms	Refer to Section 1.3

Table 17: Default Output Setpoints

3.3. General Diagnostics

The General Diagnostics setpoints are defined in Section 1.4. Refer to that section for detailed information on how these setpoints are used. The screen capture below in Figure 6 displays the available setpoints. Table 17 highlights the allowable ranges for each setpoint.

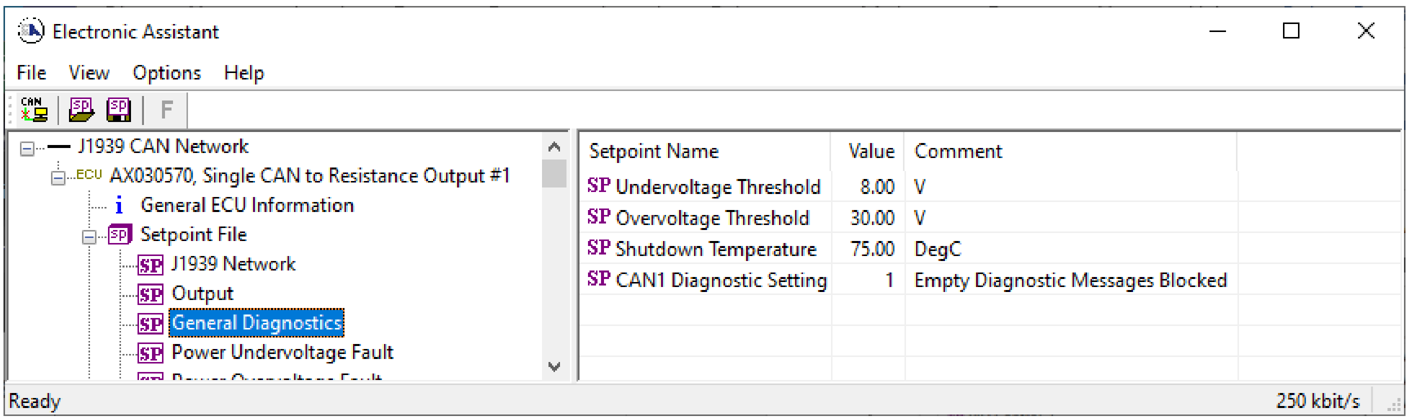


Figure 6: Screen Capture of Default General Diagnostics Setpoints

Name	Range	Default	Notes
Undervoltage Threshold	8.0…29.0	8.0	Units in [Volts]
Overvoltage Threshold	8.1…36.0	24.0	Units in [Volts]
Shutdown Temperature	40…125	75	Units in [Celsius]
Diagnostic Message Setting	Drop List	Empty Diagnostic Messages Blocked	

Table 18: Default General Diagnostics Setpoints

3.4. Diagnostic Setpoints

The Diagnostic Input function block is defined in Section 1.5. Please refer to that section for detailed information about how all these setpoints are used.

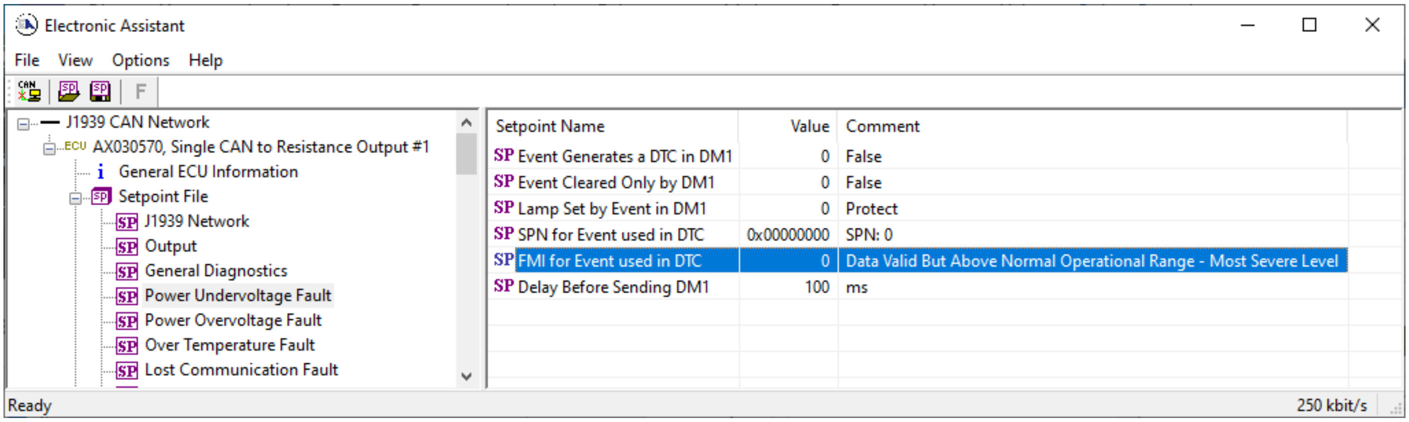


Figure 7: Screen Capture of Default Diagnostic Setpoints

Name	Range	Default	Notes
Event Generates a DTC in DM1	Drop List	True	Refer to Section 1.5
Event Only Cleared by DM11	Drop List	False	Refer to Section 1.5
Lamp Set by Event in DM1	Drop List	0	Refer to Section 1.5
SPN for Event used in DTC	0…524287	0	Refer to Section 1.5
FMI for Event used in DTC	Drop List	0	Refer to Section 1.5
Delay Before Sending DM1	0…60,000 ms	100 ms	Refer to Section 1.5

Table 19: Default Diagnostic Setpoints

3.5. Constant Data List Setpoints

The Constant Data List function block is provided to allow the user to select values as desired for various logic block functions. The four constants are fully user configurable to any value between +/- 1,000,000. The default values are displayed in the screen capture below.

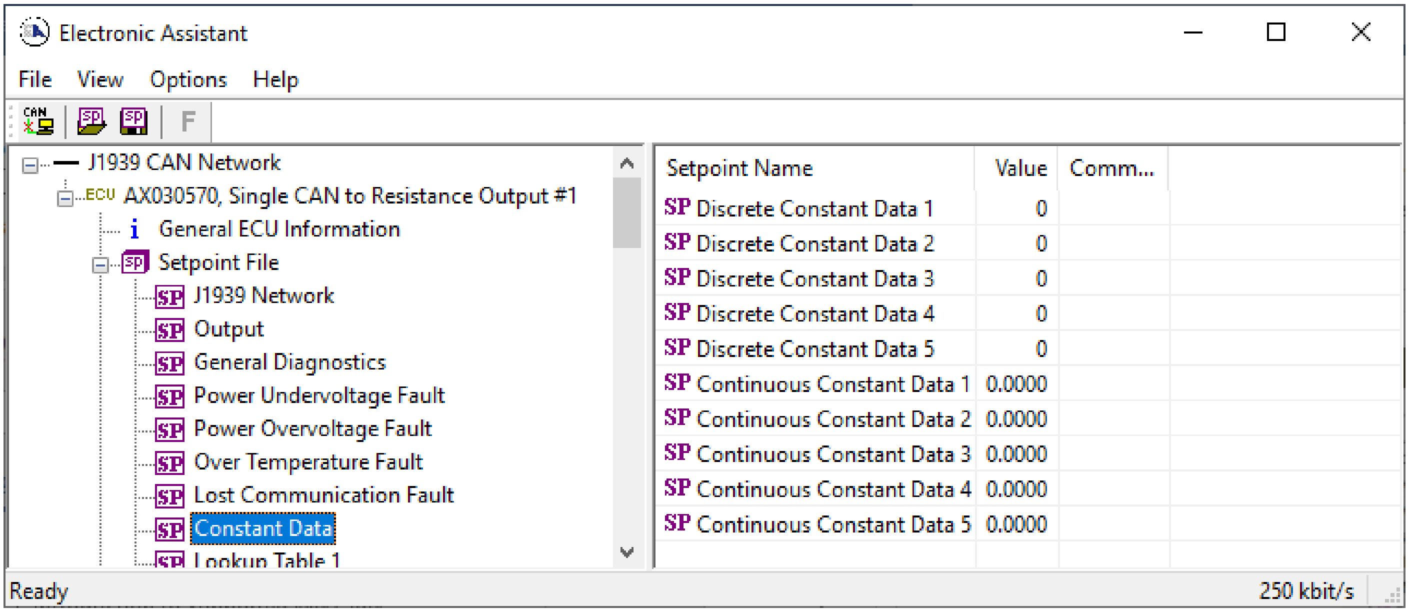
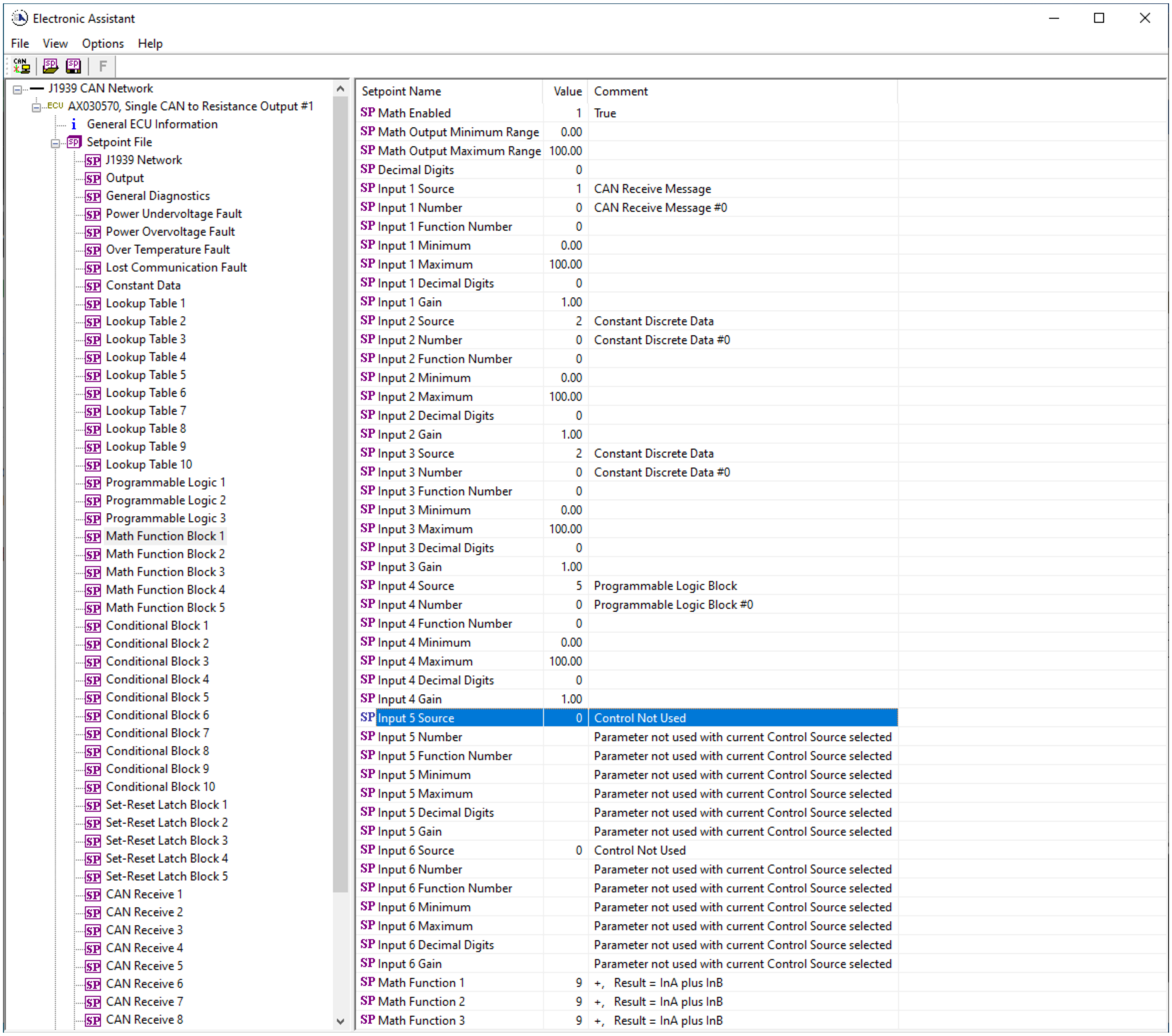


Figure 8: Screen Capture of Constant Data Setpoints

3.6. Math Functional Block Setpoints

The Math Functional Block setpoints are defined in Section 1.7. 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 Math Blocks. The table below the screen capture highlights the allowable ranges for each setpoint.

Note: Some setpoints were changed from their default values for informative purposes.



Setpoint Name	Value	Comment
SP Math Enabled	1	True
SP Math Output Minimum Range	0.00	
SP Math Output Maximum Range	100.00	
SP Decimal Digits	0	
SP Input 1 Source	1	CAN Receive Message
SP Input 1 Number	0	CAN Receive Message #0
SP Input 1 Function Number	0	
SP Input 1 Minimum	0.00	
SP Input 1 Maximum	100.00	
SP Input 1 Decimal Digits	0	
SP Input 1 Gain	1.00	
SP Input 2 Source	2	Constant Discrete Data
SP Input 2 Number	0	Constant Discrete Data #0
SP Input 2 Function Number	0	
SP Input 2 Minimum	0.00	
SP Input 2 Maximum	100.00	
SP Input 2 Decimal Digits	0	
SP Input 2 Gain	1.00	
SP Input 3 Source	2	Constant Discrete Data
SP Input 3 Number	0	Constant Discrete Data #0
SP Input 3 Function Number	0	
SP Input 3 Minimum	0.00	
SP Input 3 Maximum	100.00	
SP Input 3 Decimal Digits	0	
SP Input 3 Gain	1.00	
SP Input 4 Source	5	Programmable Logic Block
SP Input 4 Number	0	Programmable Logic Block #0
SP Input 4 Function Number	0	
SP Input 4 Minimum	0.00	
SP Input 4 Maximum	100.00	
SP Input 4 Decimal Digits	0	
SP Input 4 Gain	1.00	
SP Input 5 Source	0	Control Not Used
SP Input 5 Number		Parameter not used with current Control Source selected
SP Input 5 Function Number		Parameter not used with current Control Source selected
SP Input 5 Minimum		Parameter not used with current Control Source selected
SP Input 5 Maximum		Parameter not used with current Control Source selected
SP Input 5 Decimal Digits		Parameter not used with current Control Source selected
SP Input 5 Gain		Parameter not used with current Control Source selected
SP Input 6 Source	0	Control Not Used
SP Input 6 Number		Parameter not used with current Control Source selected
SP Input 6 Function Number		Parameter not used with current Control Source selected
SP Input 6 Minimum		Parameter not used with current Control Source selected
SP Input 6 Maximum		Parameter not used with current Control Source selected
SP Input 6 Decimal Digits		Parameter not used with current Control Source selected
SP Input 6 Gain		Parameter not used with current Control Source selected
SP Math Function 1	9	+, Result = InA plus InB
SP Math Function 2	9	+, Result = InA plus InB
SP Math Function 3	9	+, Result = InA plus InB

Figure 9: Screen Capture of Math Functional Block Setpoints

Setpoint ranges and default values for Math Blocks are listed in Table 20. Only "**Input 1**" setpoint are listed, because other "**Input X**" setpoints are similar.

Name	Range	Default	Notes
Math Enabled	Drop List	False	
Math Output Minimum Range	-32768…32767	0	
Math Output Maximum Range	-32768…32767	10000.0	
Decimal Digits	0…3	2	Resolution is 10^x, affects Output Min/Max Ranges
Input 1 Source	Drop List	Control not used	See **Table 1**
Input 1 Number	Depends on control source	1	See **Table 1**
Input 1 Function Number	1…3	1	
Input 1 Minimum	$-10^6…10^6$	0.00	
Input 1 Maximum	$-10^6…10^6$	10000.00	
Input 1 Decimal Digits	0..3	2	Resolution is 10^x, affects Input 1 Min/Max Ranges
Input 1 Gain	-100…100	100	
Math Function 1	Drop List	+, Result = InA plus InB	See **Table 7**
Math Function 2	Drop List	+, Result = InA plus InB	See **Table 7**
Math Function 3	Drop List	+, Result = InA plus InB	See **Table 7**

Table 20: Default Math Functional Block Setpoints

3.7. Programmable Logic Block Setpoints

The Programmable Logic Block setpoints are defined in Section 1.8. Refer to that section for detailed information on how these setpoints are used. The screen capture in Figure 10 displays the available setpoints for each of the Programmable Logic Blocks. The table below the screen capture highlights the allowable ranges for each setpoint.

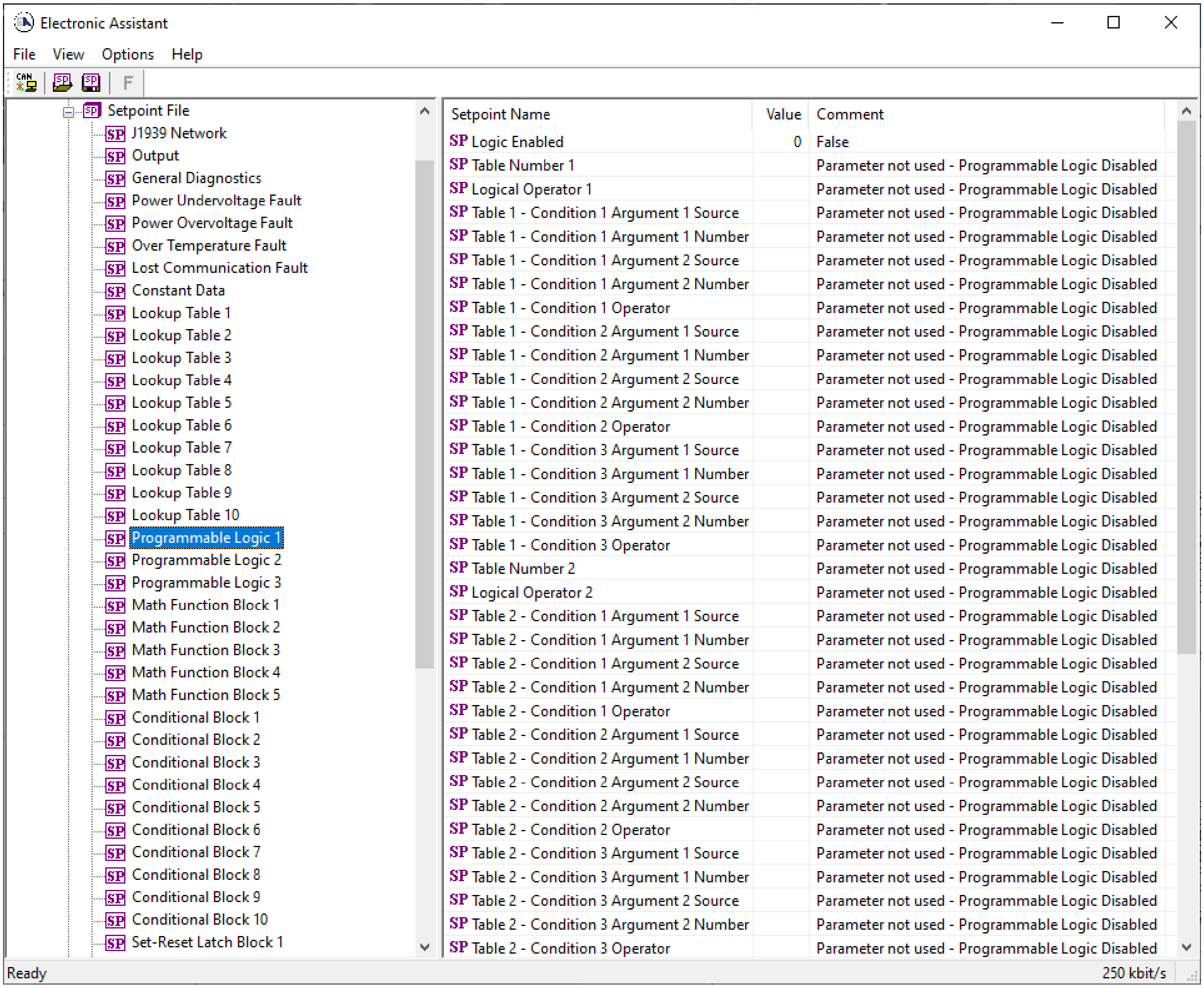


Figure 10: Screen Capture of Programmable Logic Block Setpoints

Setpoint ranges and default values for Programmable Logic Blocks are listed in Table 20. Only "**Table 1**" setpoint are listed, because other "**Table X**" setpoints are similar, except for the default value of the "**Table Number**" setpoint, which is X for "**Table X**".

Name	Range	Default	Notes
Logic Enabled	Drop List	False	
Table Number 1	1 to 12	Lookup Table 1	
Logical Operator 1	Drop List	Default Table	See Table 9
Table 1 - Condition 1 Argument 1 Source	Drop List	Control Not Used	Refer to Table 1
Table 1 - Condition 1 Argument 1 Number	Depends on control source	1	Refer to Table 1
Table 1 - Condition 1 Argument 2 Source	Drop List	Control Not Used	Refer to Table 1
Table 1 - Condition 1 Argument 2 Number	Depends on control source	1	Refer to Table 1
Table 1 - Condition 1 Operator	Drop List	=, Equal	See Table 9
Table 1 - Condition 2 Argument 1 Source	Drop List	Control Not Used	Refer to Table 1
Table 1 - Condition 2 Argument 1 Number	Depends on control source	1	Refer to Table 1
Table 1 - Condition 2 Argument 2 Source	Drop List	Control Not Used	Refer to Table 1
Table 1 - Condition 2 Argument 2 Number	Depends on control source	1	Refer to Table 1
Table 1 - Condition 2 Operator	Drop List	=, Equal	See Table 9
Table 1 - Condition 3 Argument 1 Source	Drop List	Control Not Used	Refer to Table 1
Table 1 - Condition 3 Argument 1 Number	Depends on control source	1	Refer to Table 1
Table 1 - Condition 3 Argument 2 Source	Drop List	Control Not Used	Refer to Table 1
Table 1 - Condition 3 Argument 2 Number	Depends on control source	1	Refer to Table 1
Table 1 - Condition 3 Operator	Drop List	=, Equal	See Table 9

Table 21: Default Programmable Logic Block Setpoints

3.8. Lookup Table Setpoints

The Lookup Table 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 11 displays the available setpoints for each of the Lookup Table Setpoints. The table below the screen capture highlights the allowable ranges for each setpoint.

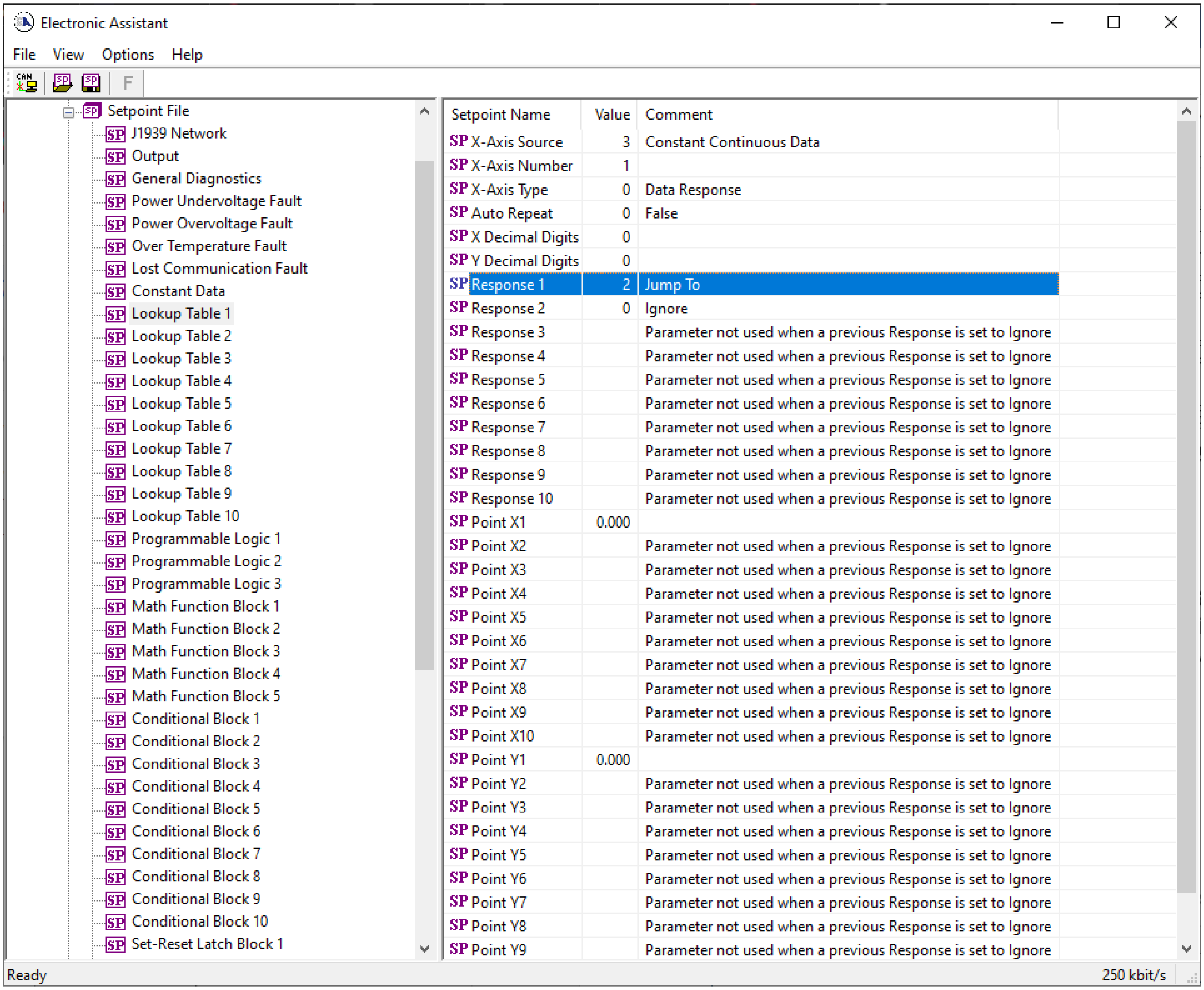


Figure 11: Screen Capture of Lookup Table Setpoints

Name	Range	Default	Notes
X-Axis Source	Drop List	Control Not Used	Refer to Table 1
X-Axis Number	Depends on control source	1	Refer to Table 1
X-Axis Type	Drop List	Data Response	See Table 10
Auto Repeat	Drop List	False	
X Decimal Digits	0…3	0	Resolution is 10^x, affects X points
Y Decimal Digits	0…3	0	Resolution is 10^x, affects Y points
Response 1	Drop List	Ramp To	See Table 11
Response 2	Drop List	Ramp To	See Table 11
Response 3	Drop List	Ramp To	See Table 11
Response 4	Drop List	Ramp To	See Table 11
Response 5	Drop List	Ramp To	See Table 11
Response 6	Drop List	Ramp To	See Table 11
Response 7	Drop List	Ramp To	See Table 11
Response 8	Drop List	Ramp To	See Table 11
Response 9	Drop List	Ramp To	See Table 11
Response 10	Drop List	Ramp To	See Table 11
Point X1	From X-Axis source minimum to Point 1 - X Value	X-Axis source minimum Depends on the Table number	See Section 1.9
Point X2	From Point 0 - X Value to Point 2 - X Value	Depends on the Table number	See Section 1.9
Point X3	From Point 1 - X Value to Point 3 - X Value	Depends on the Table number	See Section 1.9
Point X4	From Point 2 - X Value to Point 4 - X Value	Depends on the Table number	See Section 1.9
Point X5	From Point 3 - X Value to Point 5 - X Value source	Depends on the Table number	See Section 1.9
Point X6	From Point 4 - X Value to Point 6 - X Value	Depends on the Table number	See Section 1.9
Point X7	From Point 5 - X Value to Point 7 - X Value	Depends on the Table number	See Section 1.9
Point X8	From Point 6 - X Value to Point 8 - X Value	Depends on the Table number	See Section 1.9
Point X9	From Point 7 - X Value to Point 9 - X Value	Depends on the Table number	See Section 1.9
Point X10	From Point 8 - X Value to Point 10 - X Value	Depends on the Table number	See Section 1.9
Point Y1	-10^6 to 10^6	Depends on the Table number	
Point Y2	-10^6 to 10^6	Depends on the Table number	
Point Y3	-10^6 to 10^6	Depends on the Table number	
Point Y4	-10^6 to 10^6	Depends on the Table number	
Point Y5	-10^6 to 10^6	Depends on the Table number	
Point Y6	-10^6 to 10^6	Depends on the Table number	
Point Y7	-10^6 to 10^6	Depends on the Table number	
Point Y8	-10^6 to 10^6	Depends on the Table number	
Point Y9	-10^6 to 10^6	Depends on the Table number	
Point Y10	-10^6 to 10^6	Depends on the Table number	

Table 22: Default Lookup Table Setpoints

3.9. Conditional Block Setpoints

The Conditional 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 12 displays the available setpoints for each of the Conditional Blocks. The table below the screen capture highlights the allowable ranges for each setpoint.

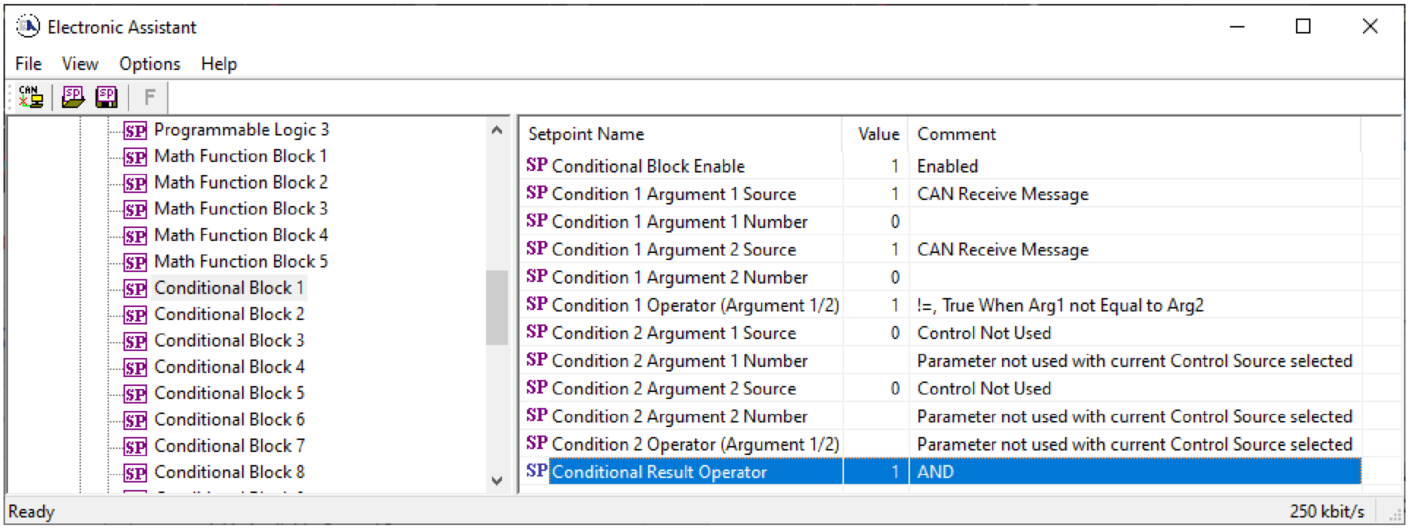


Figure 12: Screen Capture of Conditional Block Setpoints

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 13
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 13
Conditional Result Operator	Drop List	OR	Refer to Table 14

Table 23: Default Conditional Block Setpoints

3.10. Set-Reset Latch Block

The Set-Reset Latch Block setpoints are defined in Section Refer to that section for detailed information on how these setpoints are used. The screen capture in Figure 13 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.

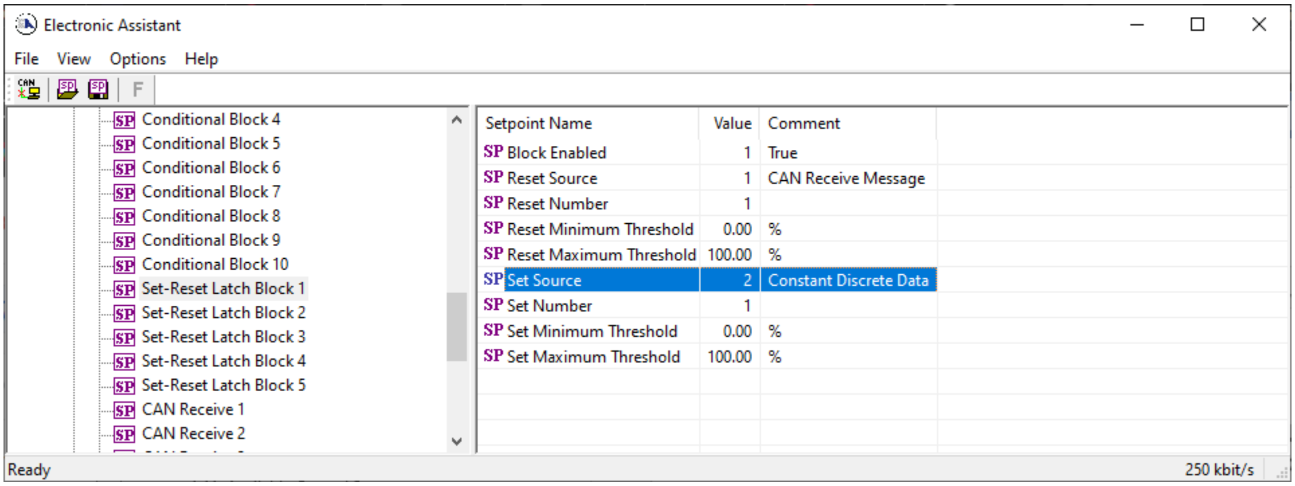


Figure 13: Screen Capture of Set-Reset Latch Block Setpoints

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 1.11
Reset Maximum Threshold	Depends on Source Selected	100%	Refer to Section 1.11
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 1.11
Set Maximum Threshold	Drop List	100%	Refer to Section 1.11

Table 24: Default Set-Reset Latch Block Setpoints

3.11. CAN Transmit Setpoints

The CAN Transmit setpoints are defined in Section 1.12. Refer to that section for detailed information on how these setpoints are used. The screen capture below in Figure 14 displays the available setpoints for the CAN Transmit setpoints. Table 24 below highlights the allowable ranges for the first CAN Transmit setpoint.

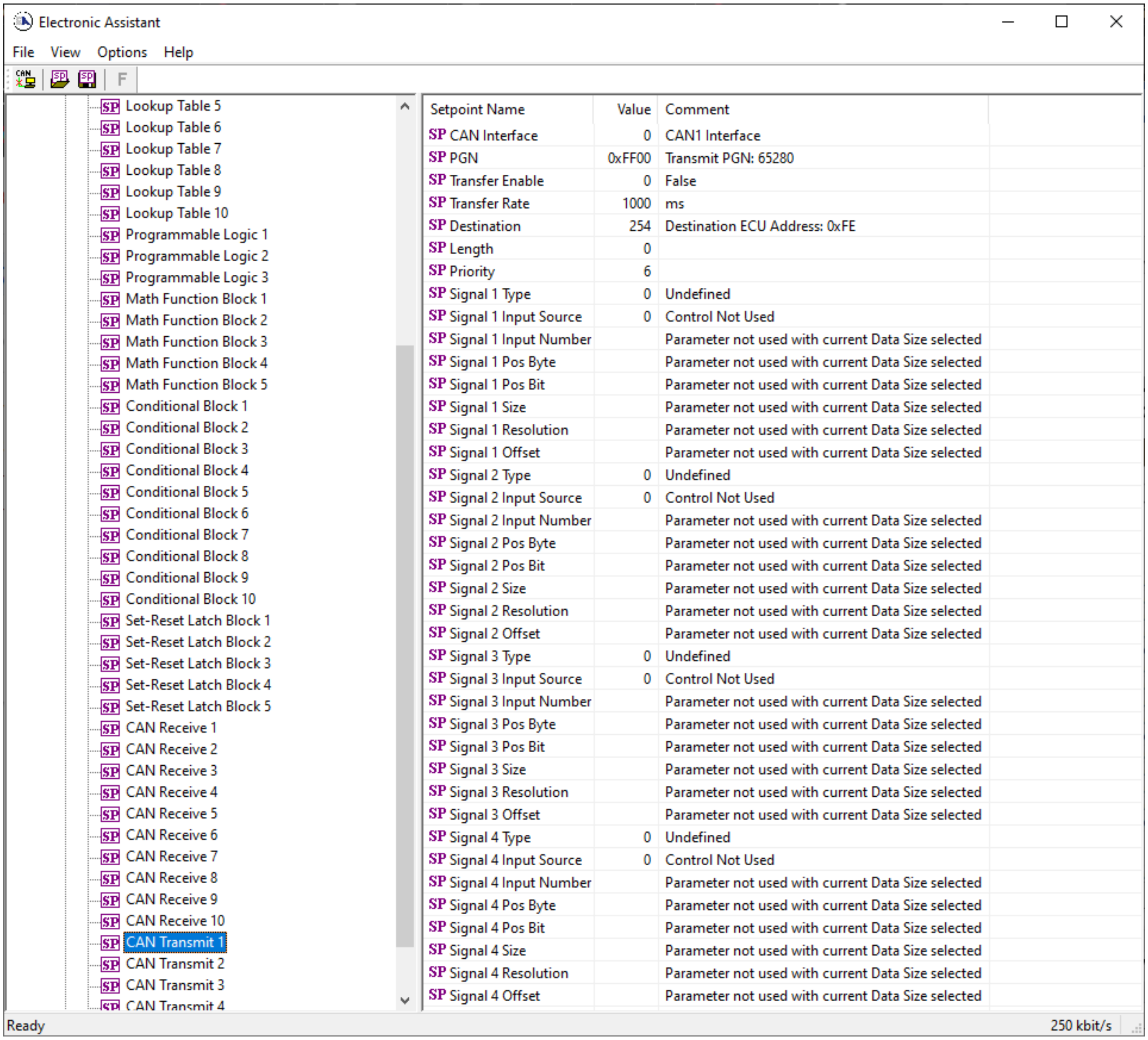


Figure 14: Screen Capture of CAN Transmit Setpoints

Name	Range	Default	Notes
PGN	0…65,535	65,280	Refer to Section 1.12
Repetition Rate	0…60,000	1000	Refer to Section 1.12
Message Priority	0...7	6	Refer to Section 1.12
Destination Address (PDU1)	0...255	254	Refer to Section 1.12
Data Source	Drop List	CAN Status Report	Refer to Table 1
Data Number	Depends on Source Selected	1	Refer to Table 1
Data Size	0…32	0 bits	Refer to Section 1.12
Pos Byte	Depends on Source Selected	0	Refer to Section 1.12
Pos Bit	Depends on Source Selected	65,280	Refer to Section 1.12
Resolution	-100,000...100,000	1	Refer to Section 1.12
Offset	-100,000...100,000	0	Refer to Section 1.12

Table 25: Default CAN Transmit Setpoints

3.12. CAN Receive Setpoints

The CAN Receive setpoints are defined in Section 1.13. Refer to that section for detailed information on how these setpoints are used. The screen capture below in Figure 15 displays the available setpoints for the CAN Receive setpoints. Table 25 below highlights the allowable ranges for each setpoint.

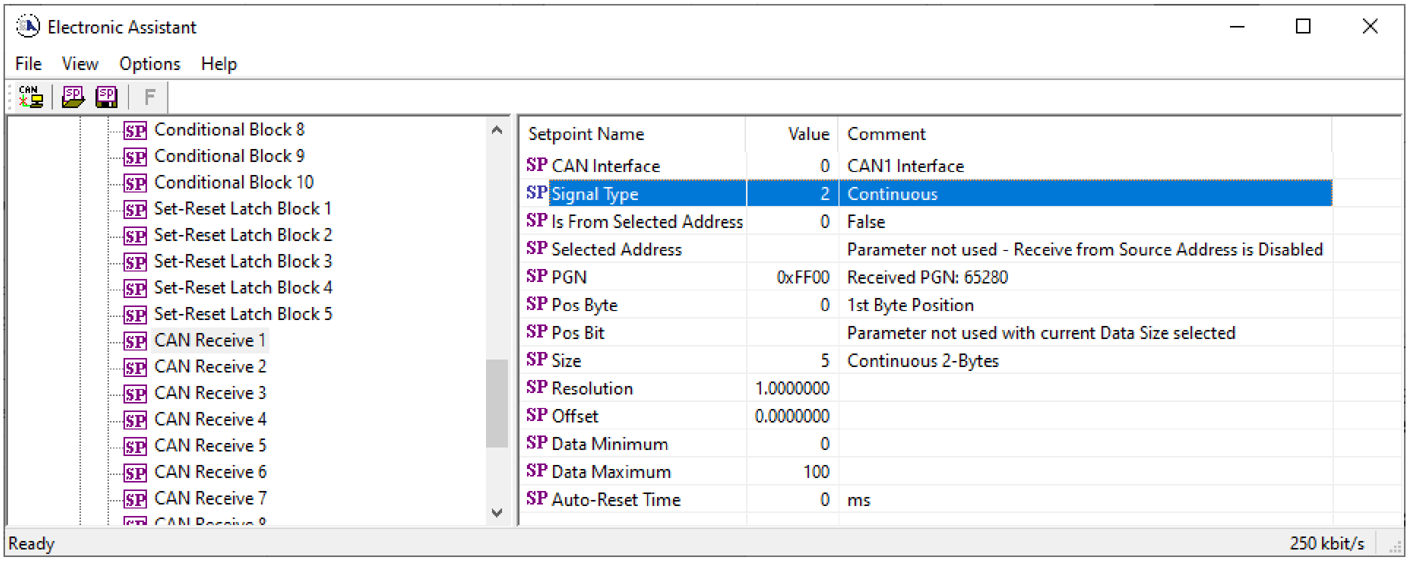


Figure 15: Screen Capture of CAN Receive Setpoints

Name	Range	Default	**Notes**
CAN Interface			Default changed to *True* for illustration purposes. Refer to Section 1.13
Signal Type	Drop List	0	Refer to 1.13
Is From Selected Address	Drop List	False	Refer to 1.13
Selected Address	Drop List	False	Refer to 1.13
PGN	0 to 65536	Different for each	Refer to 1.13
Pos Byte	0-7	0	Refer to 1.13
Pos Bit	0-7	0	Refer to 1.13
Size	Drop List	Continuous 2-Bytes	Refer to 1.13
Resolution	-100000.0 to 100000	1.0	Refer to 1.13
Offset	-10000 to 10000	0.0	Refer to 1.13
Data Minimum	-1000000 to Max	0.0	Refer to 1.13
Data Maximum	-100000 to 100000	100.0	Refer to 1.13
Auto-Reset Time	0 to 60 000 ms	0 ms	0ms disables the Lost Comm Fault

Table 26: Default CAN Receive Setpoints

4. REFLASHING OVER CAN WITH AXIOMATIC ELECTRONIC ASSISTANT BOOTLOADER

This chapter describes a procedure of re-programming an application firmware in CANJ1939 in the field.

4.1. Prerequisites

- A personal computer with a USB port running Windows operating system.
- A flash file for 6UIN-8VREF-CAN. It should have the following name: AF-21010-x.xx.bin, where x.xx – firmware version number, and sss are file comments information purposes.
- Axiomatic Electronic Assistant (EA) software, P/N AX070500.
- Axiomatic CAN Assistant – Scope software, P/N AX070501SCO.
- Axiomatic USB-CAN Converter. It should be connected to the USB port of the personal computer.
- Power supply to power the controllers.
- Wire harness to connect the controllers to the power supply and to the CAN port of the Axiomatic USB-CAN converter with proper termination resistance.

4.2. Re-flashing Procedure

1. Connect the ECU to the power supply and Axiomatic USB-CAN converter.
2. Open CAN port and start monitoring the CAN bus in CAN Assistant – Scope.
3. Power-up the controller.
4. Run the Axiomatic Electronic Assistant (EA) software and connect to the CAN port. The user should see the following screen:

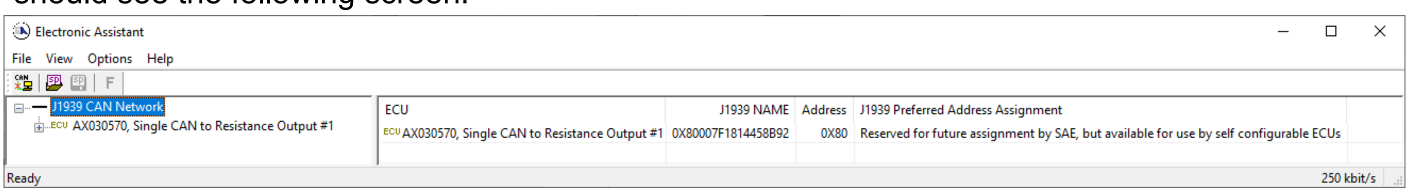


Figure 16

5. Click on *Bootloader Information* group in the left panel and then double click on *Force Bootloader to Load on Reset* and another window pops up. Select *OK* to switch to Bootloader Mode.

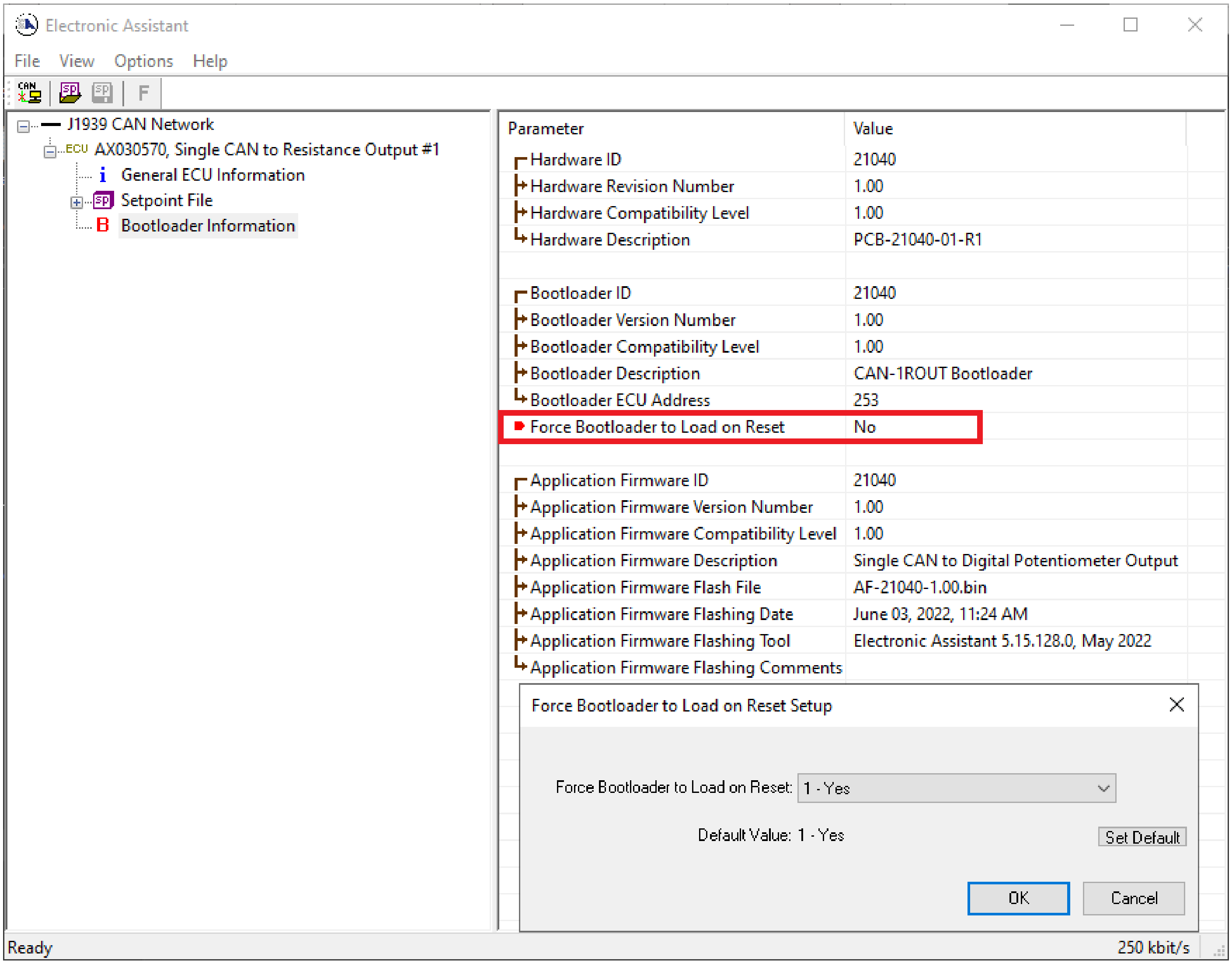


Figure 17

6. Cycle the power on to run the unit in Bootloader Mode. If you disconnect and reconnect the CAN connection in EA, you will only see the Bootloader ECU.

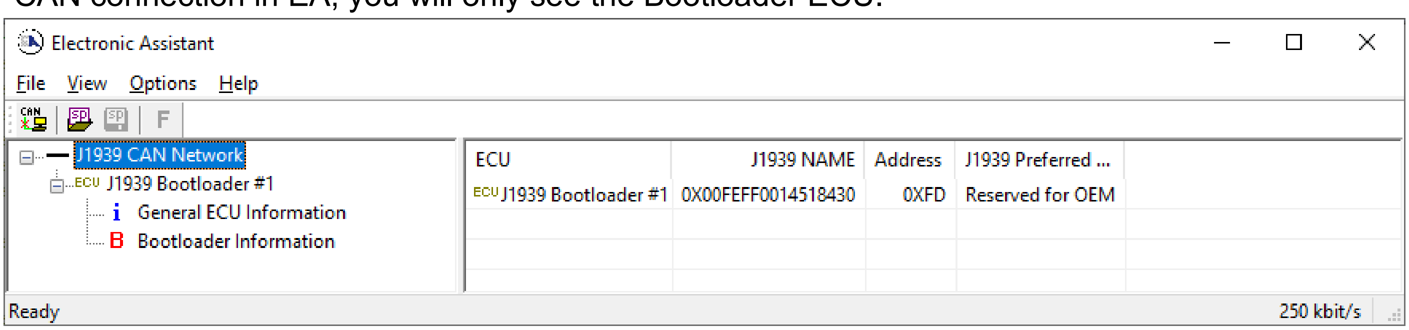


Figure 18

Click on the *Bootloader Information* group again and then on the ***F*** button in the EA toolbar. Select the flash file:

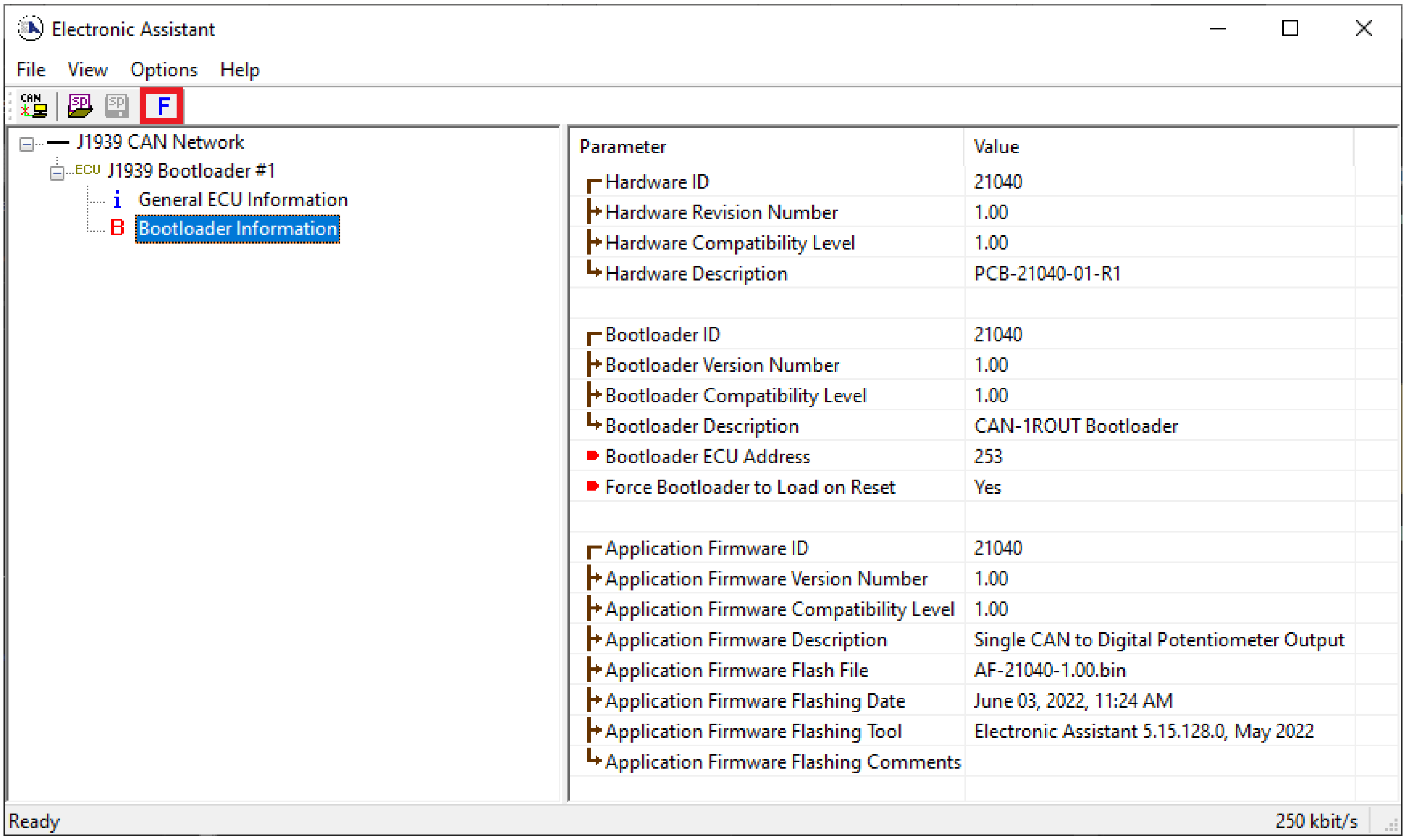


Figure 19

7. Open the flash file and start flashing operation by pressing the *Flash ECU* button. Make sure *Erase All ECU Flash Memory* is checked.

Optionally, the user can write their comments in the *Flashing Comments* field.

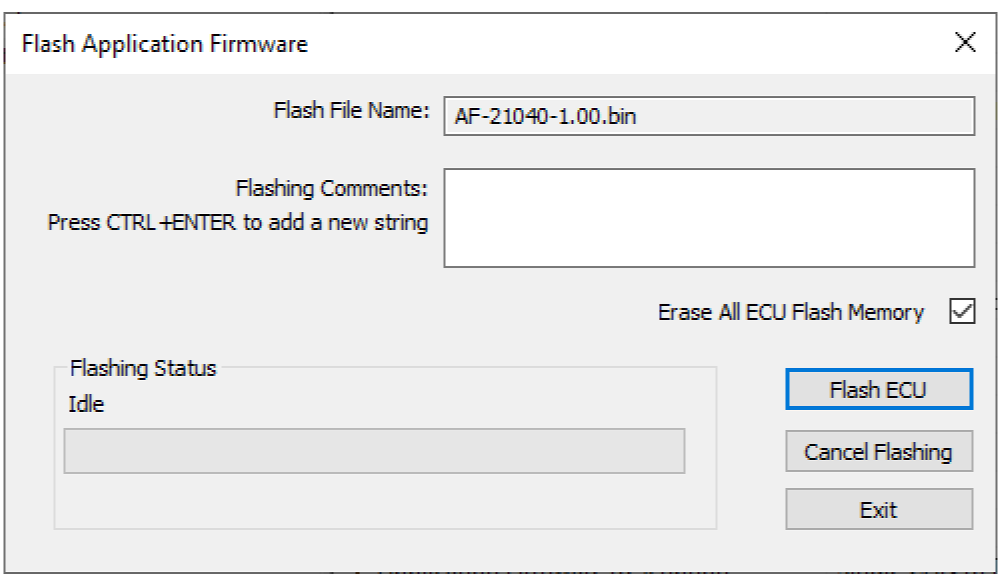


Figure 20

8. Confirm the warning message from EA.

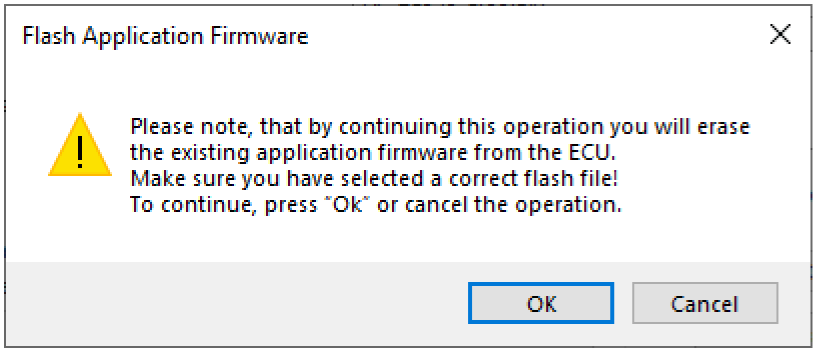


Figure 21

After confirming flashing, the user will see the flashing operation in dynamics on the EA screen.

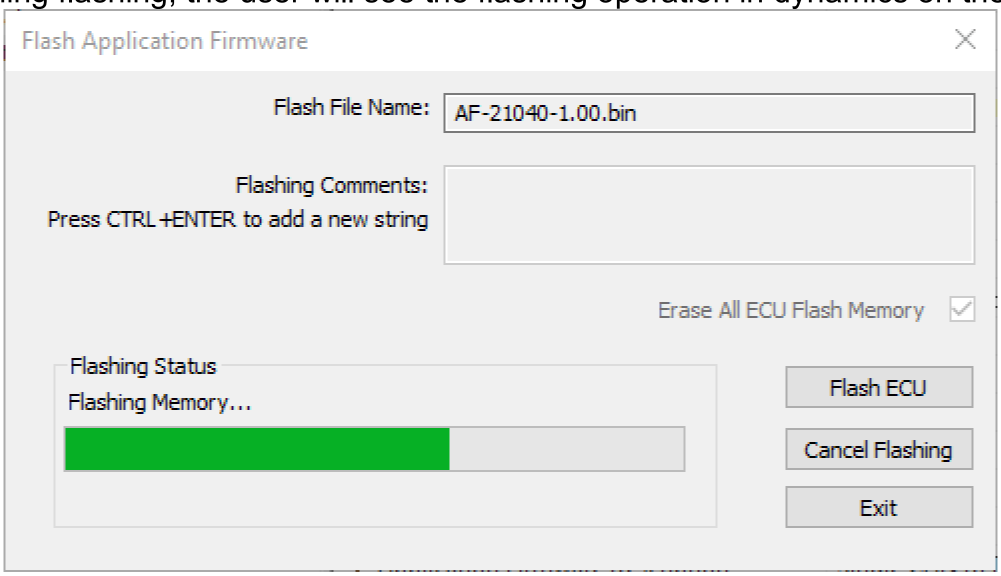


Figure 22

9. When flashing is done, reset the ECU and disconnect and reconnect the CAN connection.

The new firmware version should now be running on the unit, which can be reviewed by selecting Bootloader Information. The user can check the field *Application Firmware Flash File* to make sure that the uploaded firmware version is running on the unit.

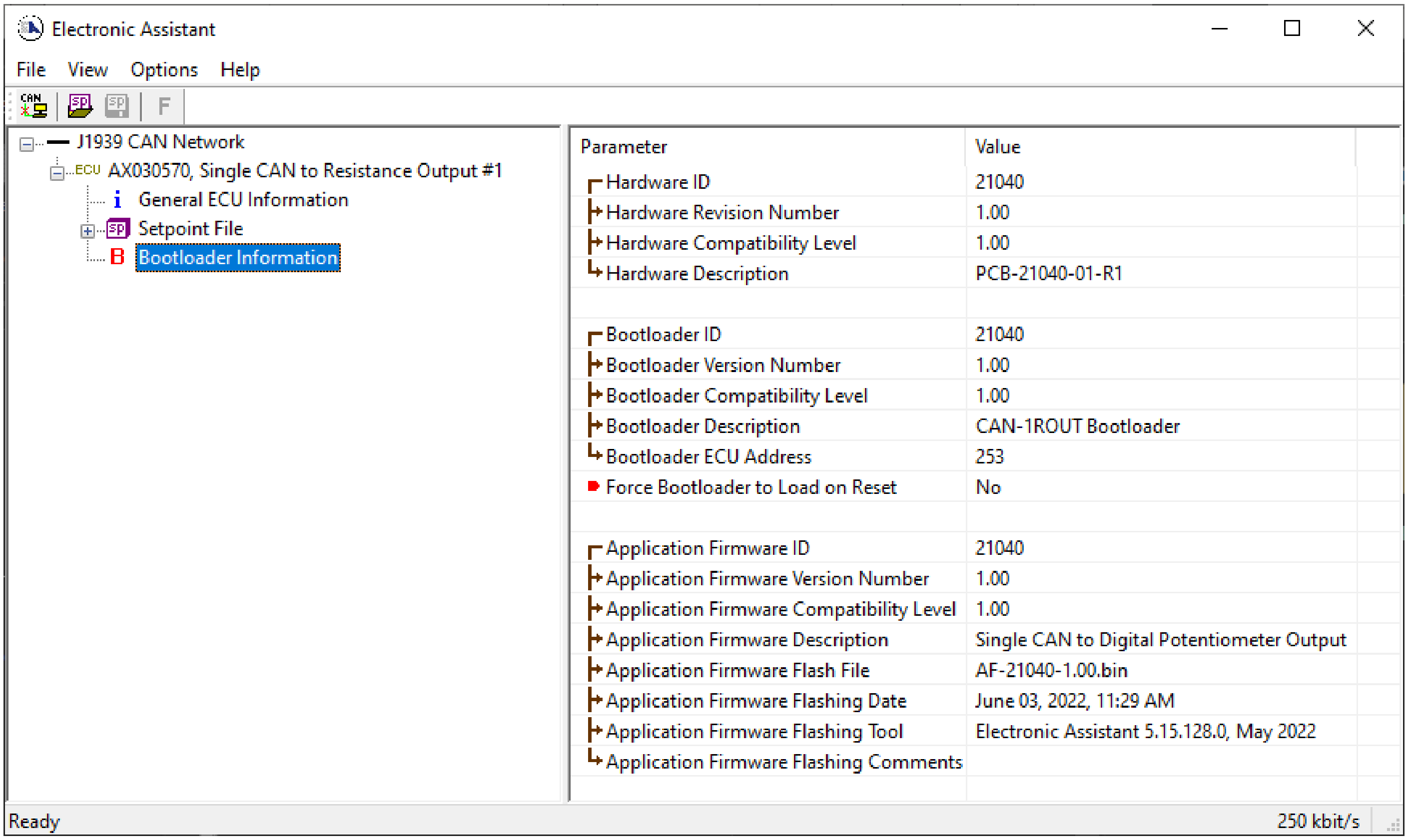


Figure 23

5. INSTALLATION INSTRUCTIONS

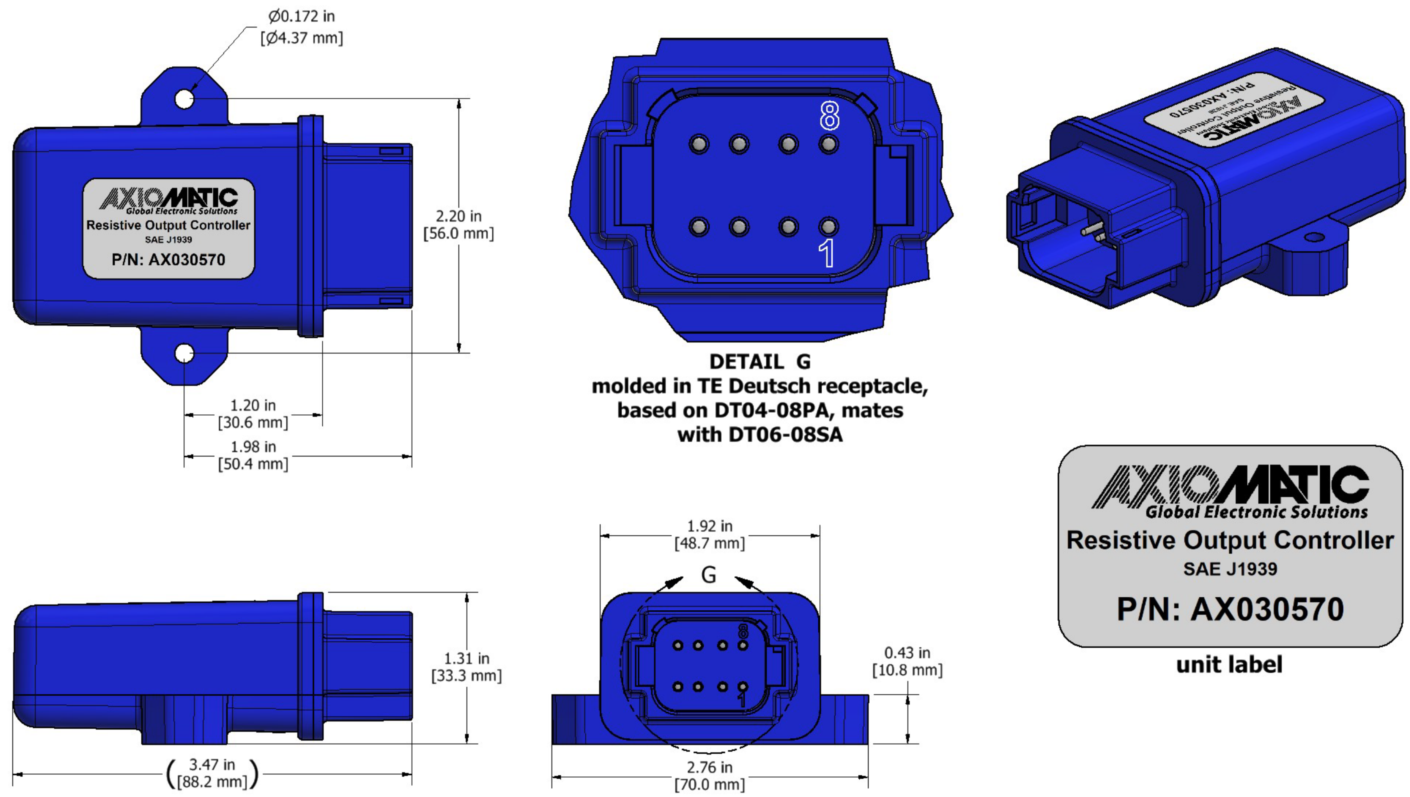


Figure 24

TE DEUTSCH 8-pin: DT04-08PA
18 AWG wire is recommended for use with contacts 0462-201-16141.

PIN	FUNCTION
1	Power Input +
2	Power Input -
3	CAN L
4	CAN H
5	Resistive Output A
6	Resistive Output W
7	Resistive Output B
8	Ground

6. 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 or 24 Vdc (nominal) 9 to 36 Vdc power supply range
Quiescent Current	30.8 mA @ 12 Vdc; 17.5 mA @ 24 Vdc (typical)
Protection	Surge protection provided Reverse polarity protection provided Overvoltage protection provided

Output

Signal Output	1 resistive output
Terminals	3 terminals (A, B, and W) as follows. A: Lead 1 of resistor B: Lead 2 of resistor W: Wiper
Resistance	5 kΩ nominal ±20%
Zero Offset	Max. 180 Ω
Output Resolution	8 bit
Ground	Provided

General Specifications

Microcontroller	STM32F413CGU6, 1 MB Flash, 320 KB RAM
CAN	1 CAN port (SAE J1939) 250 kbit/s, 500 kbit/s, 667 kbit/s, and 1Mbit/s with auto-baud-rate detection
Network Termination	It is necessary to terminate the network with external termination resistors. The resistors are 120 Ω, 0.25 W minimum, metal film or similar type. They should be placed between CAN H and CAN L terminals at both ends of the network.
User Interface	Axiomatic Electronic Assistant KIT - P/N: **AX070502** or **AX070506K**
Compliance	RoHS
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Storage Temperature	-55 to 125 °C (-67 to 257°F)
Enclosure and Dimensions	Molded Enclosure, integral connector Nylon 6/6, 30% glass, ultrasonically welded 3.47 in x 2.76 in x 1.31 in (88.2 mm x 70.0 mm x 33.3 mm) L x W x H including integral connector Refer to the dimensional drawing.
Weight	0.15 lb. (0.065 kg)
Protection	IP67
Mating Plug Kit	Available from Axiomatic under P/N: **AX070112**. It comprises the following TE Deutsch parts: 1x plug DT06-08SA, 1x wedgelock W8S, 8x contacts 0462-201-16141, and 3x sealing plugs 114017. 18 AWG wire is recommended for use with contacts 0462-201-16141.
Installation	Mounting holes are 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 0.43 in (10.8 mm) thick. It should be mounted with connectors facing left or right to reduce 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 in or 15 cm) and strain relief (12 in or 30 cm).

7. VERSION HISTORY

Version	Date	Author	Modifications
1.0.0	June 14, 2022	Weixin Kong	Initial draft
1.0.1	February 25, 2025	M Ejaz	Updated Technical Specifications Made legacy changes Updated address

OUR PRODUCTS

AC/DC Power Supplies

Actuator Controls/Interfaces

Automotive Ethernet Interfaces

Battery Chargers

CAN Controls, Routers, Repeaters

CAN/WiFi, CAN/Bluetooth, Routers

Current/Voltage/PWM Converters

DC/DC Power Converters

Engine Temperature Scanners

Ethernet/CAN Converters, Gateways, Switches

Fan Drive Controllers

Gateways, CAN/Modbus, RS-232

Gyroscopes, Inclinometers

Hydraulic Valve Controllers

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.

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