

AN709 – Valve Controller Truth Tables

Introduction

The purpose of this document is to describe how the Truth Table in the AX020510 and other Axiomatic Devices works for various applications

Truth Table

The Truth Table block implements a four-input truth table. Each of the four inputs are user selectable with source and number setpoint pair from available control sources **REF**. For each input there are “Switch On Point” and “Switch Off Point” setpoint to determine how the input signal is interpreted. When the selected input is equal or above the switch on value, it is interpreted as TRUE (1). When the input is equal or below the switch off value it is interpreted as FALSE (0). In between switching points interpretation does not change. If the switching points are set equal input is interpreted as TRUE (1) when its value is equal to the switching points. By Default, all inputs are disabled and 0 is used as the value of the input signals.

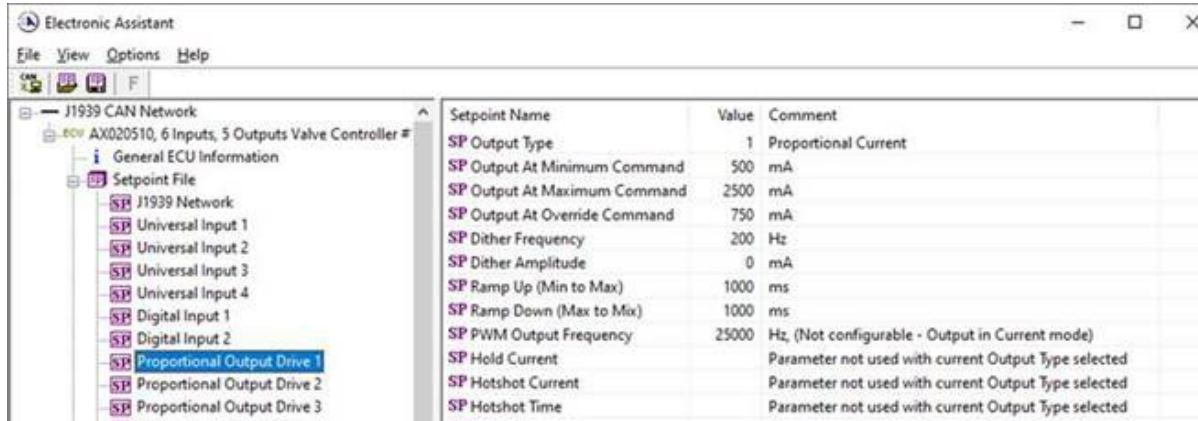
Input A	Input B	Input C	Input D	Output
0	0	0	0	Row1
0	0	0	1	Row2
0	0	1	0	Row3
0	0	1	1	Row4
0	1	0	0	Row5
0	1	0	1	Row6
0	1	1	0	Row7
0	1	1	1	Row8
1	0	0	0	Row9
1	0	0	1	Row10
1	0	1	0	Row11
1	0	1	1	Row12
1	1	0	0	Row13
1	1	0	1	Row14
1	1	1	0	Row15
1	1	1	1	Row16

For each condition row of the truth table there is output source and number setpoint pair. When condition of a row is evaluated as TRUE the selected output is set as output of the Truth Table. By default, all output sources are disabled, and the output of the Truth Table is 0.

*UMAX020510 Version 1.0.5 page 27-65 User manual

Example of using Truth Tables

This is an example of how to use the truth table to **enable** the proportional output drive 1. The example is simple, and it is easy to build more complex control schemes based on it.

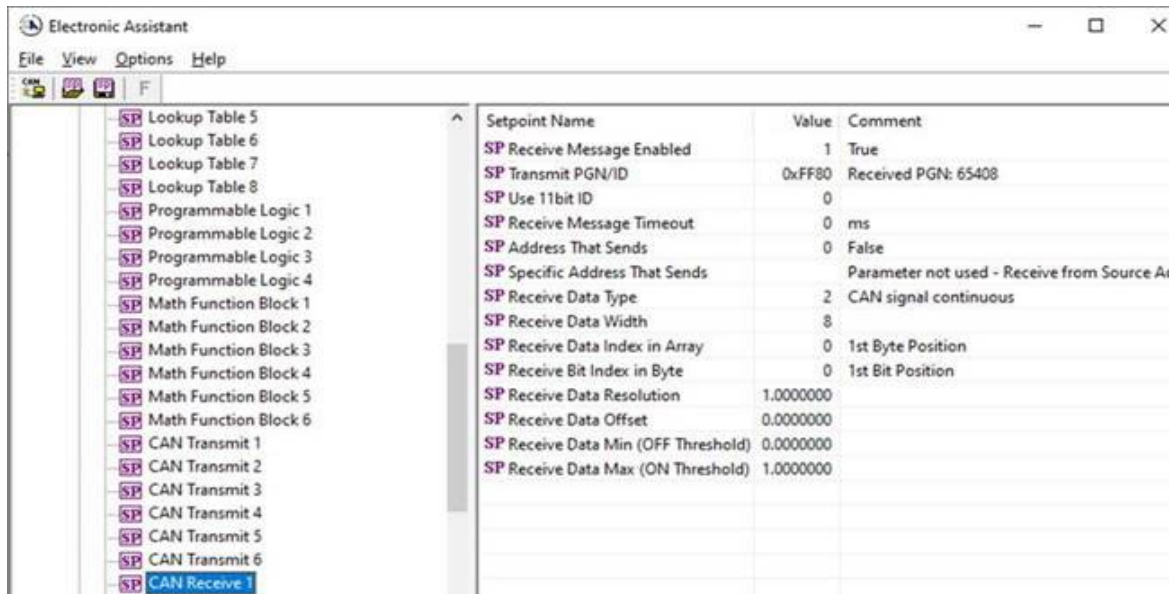


The screenshot shows the 'Electronic Assistant' window. On the left, a tree view shows the 'J1939 CAN Network' with 'AX020510, 6 Inputs, 5 Outputs Valve Controller #'. Under 'Setpoint File', 'Proportional Output Drive 1' is selected. The right pane shows a table of setpoint parameters:

Setpoint Name	Value	Comment
SP Output Type	1	Proportional Current
SP Output At Minimum Command	500	mA
SP Output At Maximum Command	2500	mA
SP Output At Override Command	750	mA
SP Dither Frequency	200	Hz
SP Dither Amplitude	0	mA
SP Ramp Up (Min to Max)	1000	ms
SP Ramp Down (Max to Min)	1000	ms
SP PWM Output Frequency	25000	Hz, (Not configurable - Output in Current mode)
SP Hold Current		Parameter not used with current Output Type selected
SP Hotshot Current		Parameter not used with current Output Type selected
SP Hotshot Time		Parameter not used with current Output Type selected

CAN Receive Message

CAN Receive 1 to 4 are set up as a discrete control. Using PGN 0xFF80 bytes 1 to 4 respectively.



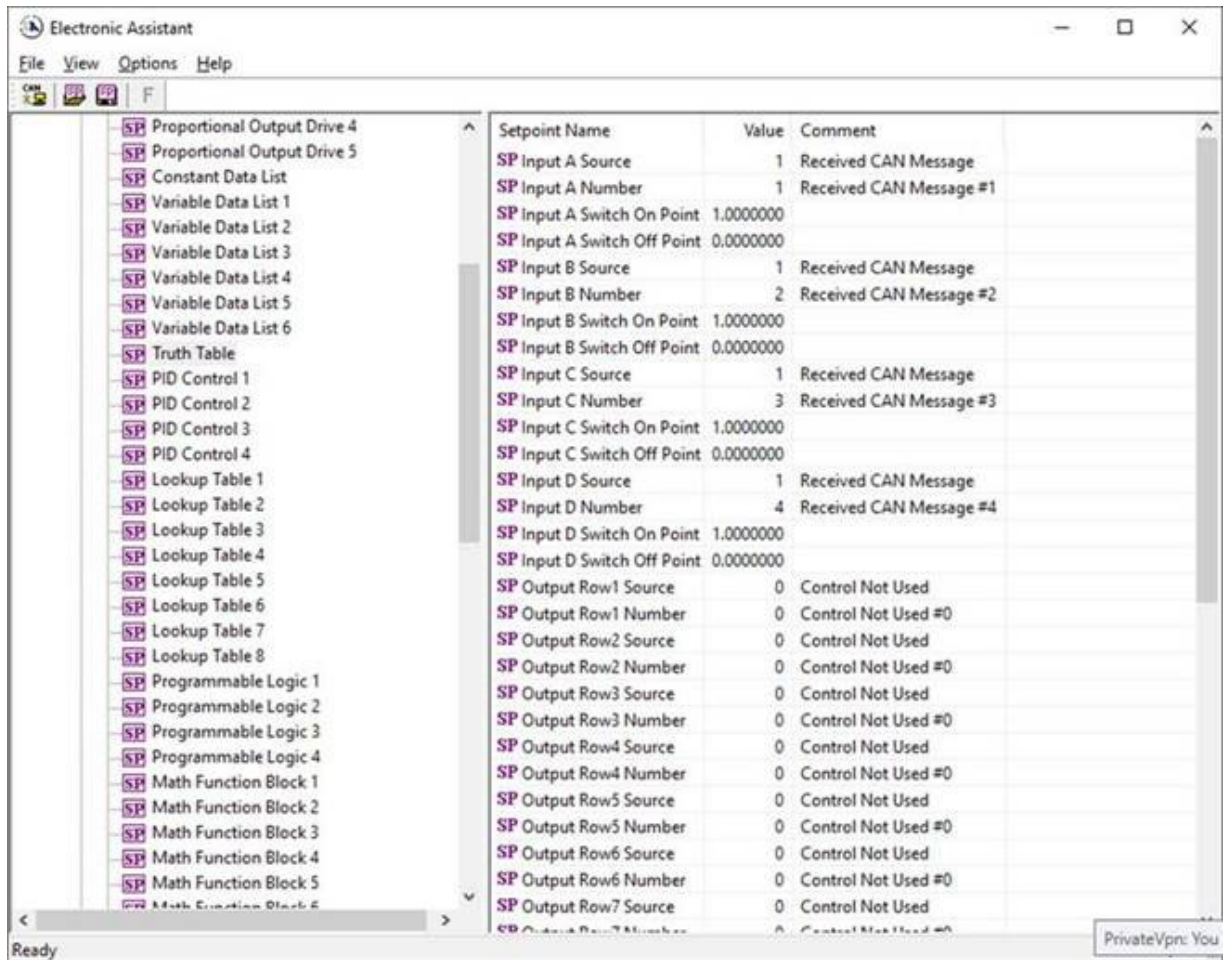
The screenshot shows the 'Electronic Assistant' window. On the left, a tree view shows the 'CAN' network with 'CAN Receive 1' selected. The right pane shows a table of setpoint parameters:

Setpoint Name	Value	Comment
SP Receive Message Enabled	1	True
SP Transmit PGN/ID	0xFF80	Received PGN: 65408
SP Use 11bit ID	0	
SP Receive Message Timeout	0	ms
SP Address That Sends	0	False
SP Specific Address That Sends		Parameter not used - Receive from Source A
SP Receive Data Type	2	CAN signal continuous
SP Receive Data Width	8	
SP Receive Data Index in Array	0	1st Byte Position
SP Receive Bit Index in Byte	0	1st Bit Position
SP Receive Data Resolution	1.0000000	
SP Receive Data Offset	0.0000000	
SP Receive Data Min (OFF Threshold)	0.0000000	
SP Receive Data Max (ON Threshold)	1.0000000	

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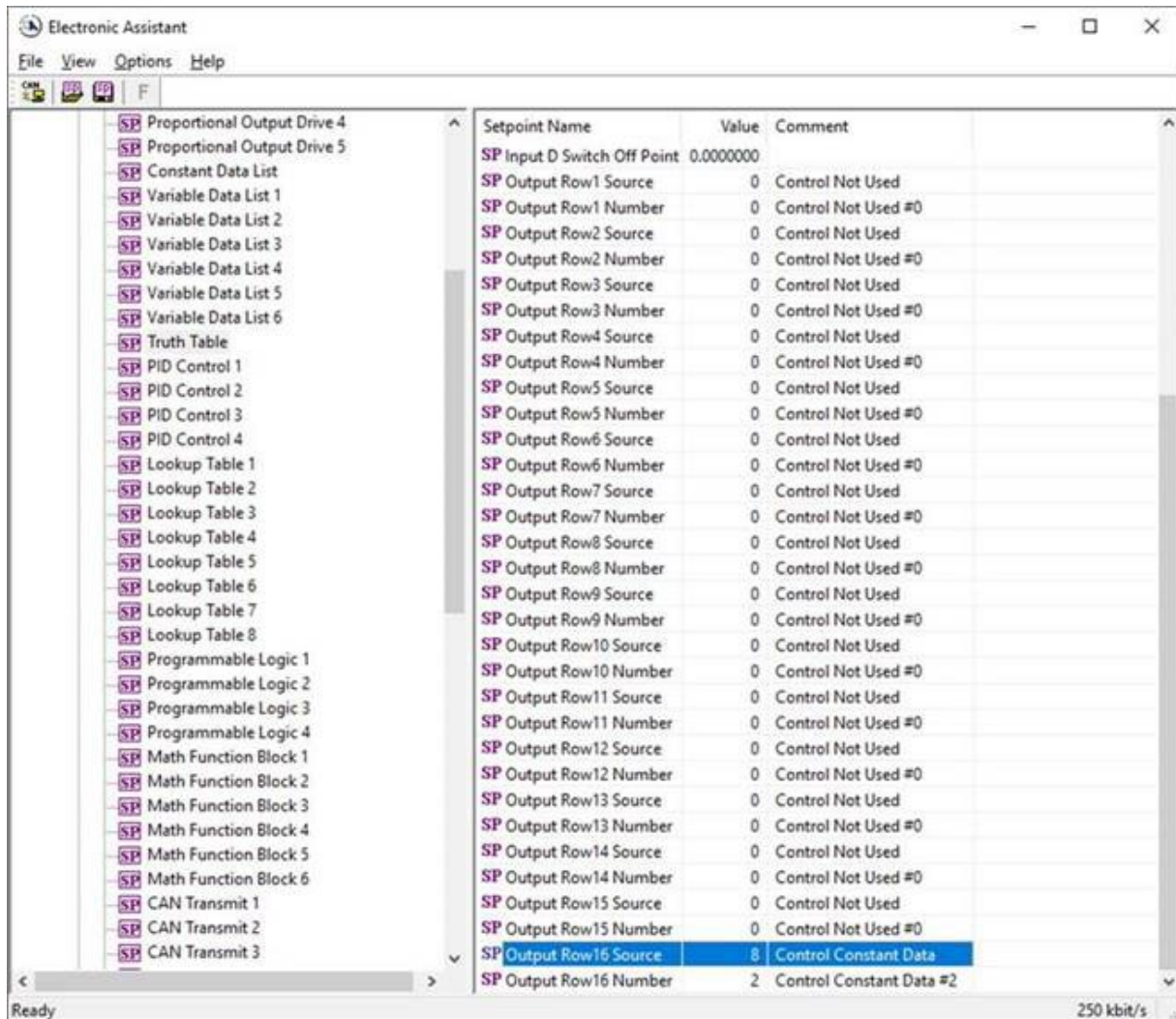
The Received CAN Message # 1 to 4 are used as the Input A to D source of the Truth Table. With the Switch On point = "1", Switch Off point = "0"



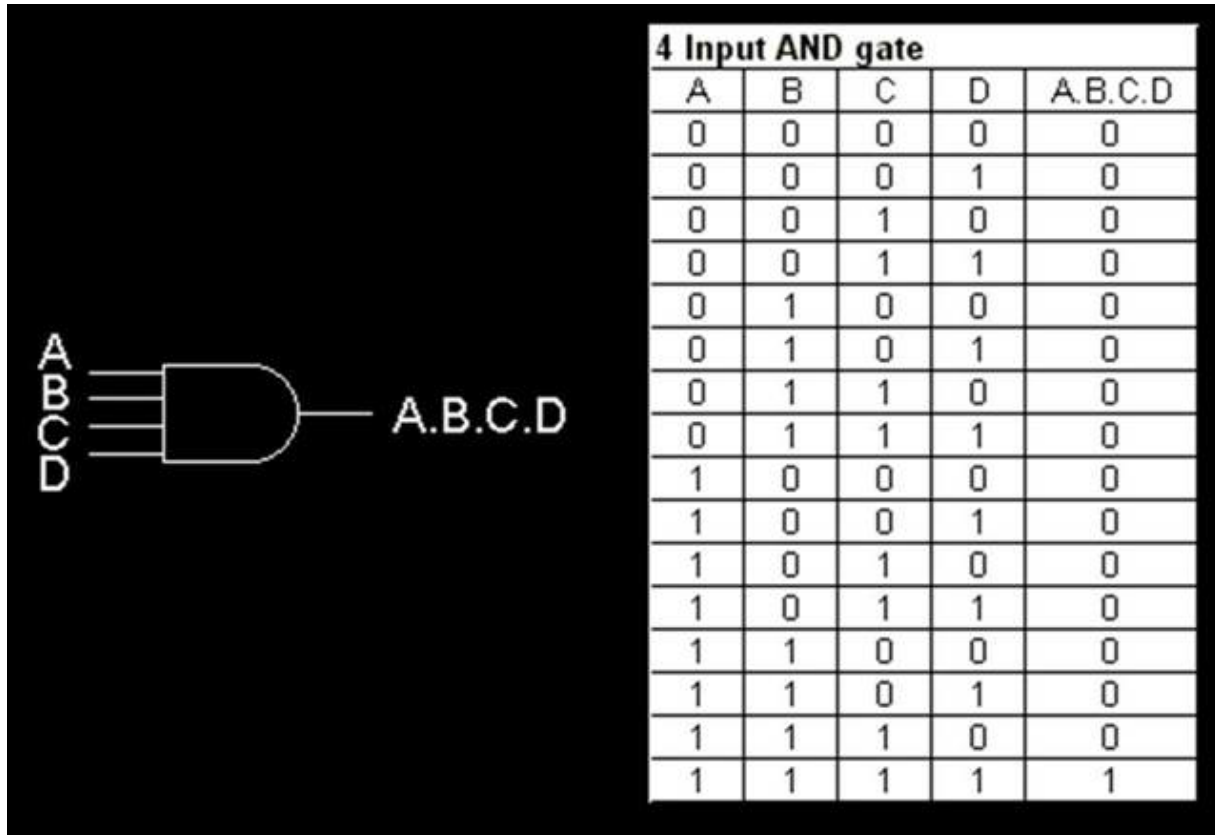
The screenshot shows the 'Electronic Assistant' software window. The left pane displays a tree view of various control elements, including Proportional Output Drives, Constant Data Lists, Variable Data Lists, Truth Tables, PID Controls, Lookup Tables, Programmable Logic, and Math Function Blocks. The right pane shows a table of setpoints (SP) with their names, values, and comments.

Setpoint Name	Value	Comment
SP Input A Source	1	Received CAN Message
SP Input A Number	1	Received CAN Message #1
SP Input A Switch On Point	1.0000000	
SP Input A Switch Off Point	0.0000000	
SP Input B Source	1	Received CAN Message
SP Input B Number	2	Received CAN Message #2
SP Input B Switch On Point	1.0000000	
SP Input B Switch Off Point	0.0000000	
SP Input C Source	1	Received CAN Message
SP Input C Number	3	Received CAN Message #3
SP Input C Switch On Point	1.0000000	
SP Input C Switch Off Point	0.0000000	
SP Input D Source	1	Received CAN Message
SP Input D Number	4	Received CAN Message #4
SP Input D Switch On Point	1.0000000	
SP Input D Switch Off Point	0.0000000	
SP Output Row1 Source	0	Control Not Used
SP Output Row1 Number	0	Control Not Used #0
SP Output Row2 Source	0	Control Not Used
SP Output Row2 Number	0	Control Not Used #0
SP Output Row3 Source	0	Control Not Used
SP Output Row3 Number	0	Control Not Used #0
SP Output Row4 Source	0	Control Not Used
SP Output Row4 Number	0	Control Not Used #0
SP Output Row5 Source	0	Control Not Used
SP Output Row5 Number	0	Control Not Used #0
SP Output Row6 Source	0	Control Not Used
SP Output Row6 Number	0	Control Not Used #0
SP Output Row7 Source	0	Control Not Used
SP Output Row7 Number	0	Control Not Used #0

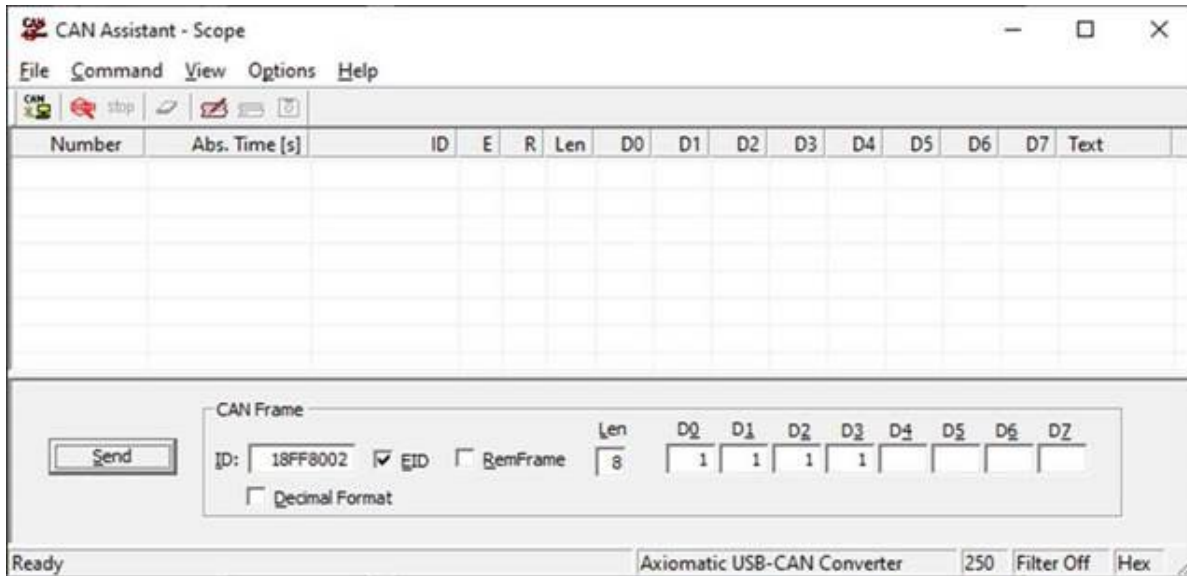
Output Row 16 Source is then enabled to use a Control constant Data source (#2) = "1" as an output



In this specific example, the condition in the Truth Table configured for Row 16: Inputs A-D: 1,1,1,1 = 1 is represented by a logic AND gate, as the picture below:



If the message below is sent using the CAN Assistant Scope the Proportional Output 1 will output 500mA. Set the Imin = 500mA so that there would be a noticeable change when the output was enabled. Note that any of the other 15 remaining combinations will disable the output.



Any valid combination of sources can be mapped as the truth table source. CAN Rx, Voltage, Current, Discrete etc. each with its own switch on/switch off thresholds.

The output value of the truth table can be a constant, analog, discrete value, or the output from another block (Lookup Table, Math, Logic block, etc.).

The Truth Table output can also be used as an input for other functional blocks (Lookup Table, Math, Logic block, etc.).

Notes

A few things when using the Look up Tables, the Time response works like this, the unit is powered, and the output will cycle through the changes in the Look up Table once then return to 0mA.

If the Look up Table is set to Data response the output will respond proportionally to the input and the values in the Look up Table.

Version	Date	Author	Comments
1.00	December 17, 2021	Lawrence Durham/ Sue Thomas	