



UDC 3500 Application Note

Math Set Up Group

Introduction

These selections are provided only as part of the Math Options package.

Function Prompts

Table 1 MATH Group Function Prompts

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
<p>8SEG CH1</p>	<p>DISABLE INPUT1 INPUT2 INPUT3 INPUT4 INPUT5 L1 OUT L2 OUT</p>	<p>8 SEGMENT CHARACTERIZER #1—An eight segment characterizer can be applied to any analog input, Output 1 or Output 2.</p> <p>DISABLE—Disables characterizer.</p> <p>INPUT 1—Characterizer is applied to Input 1.</p> <p>INPUT 2—Characterizer is applied to Input 2.</p> <p>INPUT 3—Characterizer is applied to Input 3.</p> <p>INPUT 4—Characterizer is applied to Input 4.</p> <p>INPUT 5—Characterizer is applied to Input 5.</p> <p>LOOP 1 OUTPUT—Characterizer is applied to Loop 1 Output. – Should not be used for Three Position Step Control or Position Proportional Control applications</p> <p>LOOP 2 OUTPUT—Characterizer is applied to Loop 2 Output.</p> <p>There are eight (Xn) Input values and eight (Yn) Output values to be selected. The following rules apply:</p> <ul style="list-style-type: none"> • When any analog input is used, the Input Ratio and Bias for that input are applied to the Xn Values. • When one of the Loop outputs are selected, the Xn Input values are the Output from the control algorithm, and the Yn Output is the final control element action. This application is useful for non-linear control elements or Process Variable. <p>A simple example is shown in Figure 1.</p>



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Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
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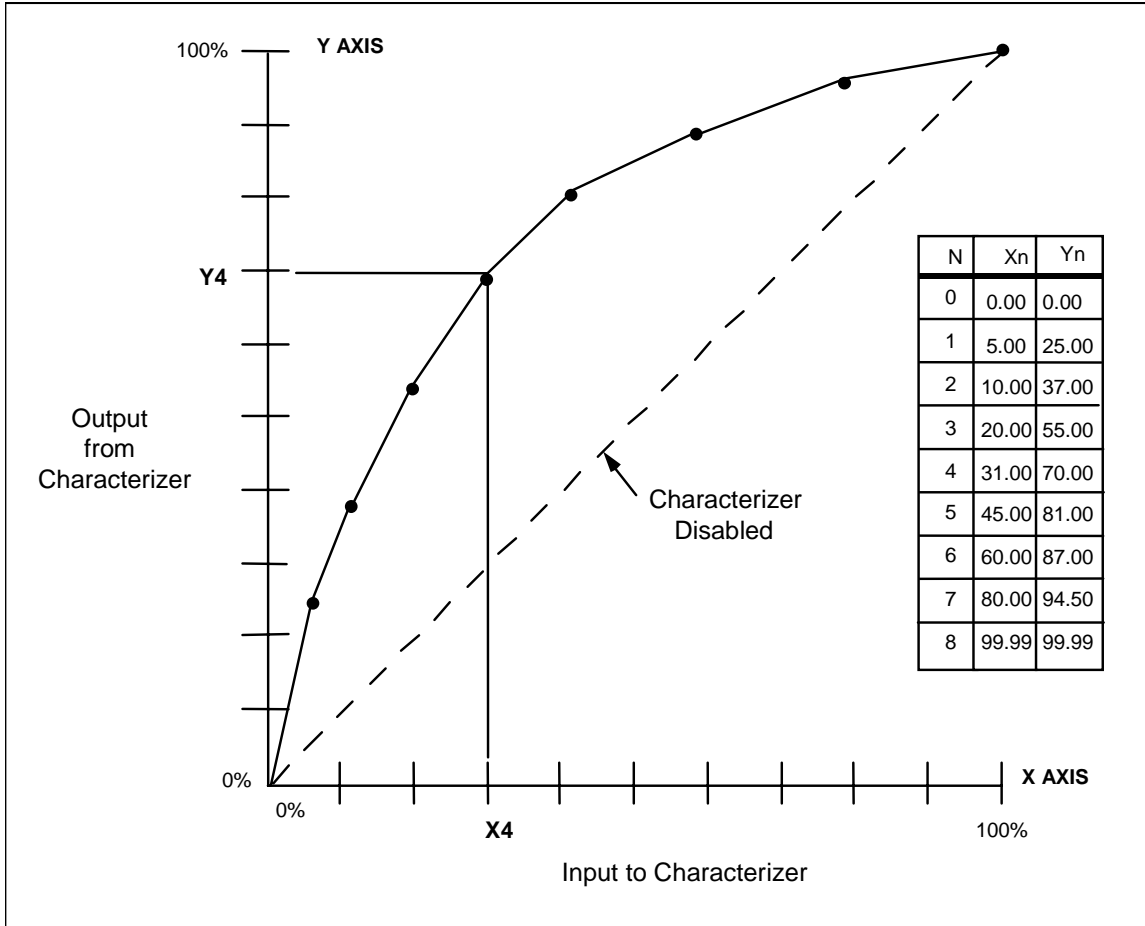


Figure 1 Example of Eight Segment Characterizer

ATTENTION The X values below should be entered as increasing values (from 0% to 100%) from N = 0 to 8.

X0 VALUE	0.00 to 99.99 %	X0 INPUT VALUE (X AXIS)
X1 VALUE	0.00 to 99.99 %	X1 INPUT VALUE (X AXIS)
X2 VALUE	0.00 to 99.99 %	X2 INPUT VALUE (X AXIS)
X3 VALUE	0.00 to 99.99 %	X3 INPUT VALUE (X AXIS)
X4 VALUE	0.00 to 99.99 %	X4 INPUT VALUE (X AXIS)
X5 VALUE	0.00 to 99.99 %	X5 INPUT VALUE (X AXIS)
X6 VALUE	0.00 to 99.99 %	X6 INPUT VALUE (X AXIS)
X7 VALUE	0.00 to 99.99 %	X7 INPUT VALUE (X AXIS)
X8 VALUE	0.00 to 99.99 %	X8 INPUT VALUE (X AXIS)



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Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
Y0 VALUE	0.00 to 99.99 %	Y0 INPUT VALUE (Y AXIS)
Y1 VALUE	0.00 to 99.99 %	Y1 INPUT VALUE (Y AXIS)
Y2 VALUE	0.00 to 99.99 %	Y2 INPUT VALUE (Y AXIS)
Y3 VALUE	0.00 to 99.99 %	Y3 INPUT VALUE (Y AXIS)
Y4 VALUE	0.00 to 99.99 %	Y4 INPUT VALUE (Y AXIS)
Y5 VALUE	0.00 to 99.99 %	Y5 INPUT VALUE (Y AXIS)
Y6 VALUE	0.00 to 99.99 %	Y6 INPUT VALUE (Y AXIS)
Y7 VALUE	0.00 to 99.99 %	Y7 INPUT VALUE (Y AXIS)
Y8 VALUE	0.00 to 99.99 %	Y8 INPUT VALUE (Y AXIS)
8SEG CH2	DISABLE INPUT1 INPUT2 INPUT3 INPUT4 INPUT5 L1 OUT L2 OUT LINK	<p>8 SEGMENT CHARACTERIZER #2—An eight segment characterizer can be applied to any analog input, Output 1 or Output 2. When Characterizer # 1 is set to LINK, then a single sixteen segment characterizer is formed.</p> <p>DISABLE—Disables characterizer.</p> <p>INPUT 1—Characterizer is applied to Input 1.</p> <p>INPUT 2—Characterizer is applied to Input 2.</p> <p>INPUT 3—Characterizer is applied to Input 3.</p> <p>INPUT 4—Characterizer is applied to Input 4.</p> <p>INPUT 5—Characterizer is applied to Input 5.</p> <p>LOOP 1 OUTPUT—Characterizer is applied to Loop 1 Output. – Should not be used for Three Position Step Control or Positional Proportional Control applications.</p> <p>LOOP 2 OUTPUT—Characterizer is applied to Loop 2 Output.</p> <p>There are eight (Xn) Input values and eight (Yn) Output values to be selected. The following rules apply:</p> <ul style="list-style-type: none"> • When any analog input is used, the Input Ratio and Bias for that input are applied to the Xn Values. • When one of the Loop outputs are selected, the Xn Input values are the Output from the control algorithm, and the Yn Output is the final control element action. This application is useful for non-linear control elements or Process Variable. <p>LINK—Concatenate the two 8 segment characterizers into a single 16 segment characterizer. Application of the characterizer is then selected by the Characterizer #1 configuration.</p>




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Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
ATTENTION <i>The X values below should be entered as increasing values (from 0% to 100%) from N=9 to 17.</i>		
X9 VALUE	0.00 to 99.99 %	X9 INPUT VALUE (X AXIS)
X10VALUE	0.00 to 99.99 %	X10 INPUT VALUE (X AXIS)
X11VALUE	0.00 to 99.99 %	X11 INPUT VALUE (X AXIS)
X12VALUE	0.00 to 99.99 %	X12 INPUT VALUE (X AXIS)
X13VALUE	0.00 to 99.99 %	X13 INPUT VALUE (X AXIS)
X14VALUE	0.00 to 99.99 %	X14 INPUT VALUE (X AXIS)
X15VALUE	0.00 to 99.99 %	X15 INPUT VALUE (X AXIS)
X16VALUE	0.00 to 99.99 %	X16 INPUT VALUE (X AXIS)
X17VALUE	0.00 to 99.99 %	X17 INPUT VALUE (X AXIS)
Y9 VALUE	0.00 to 99.99 %	Y9 INPUT VALUE (Y AXIS)
Y10VALUE	0.00 to 99.99 %	Y10 INPUT VALUE (Y AXIS)
Y11VALUE	0.00 to 99.99 %	Y11 INPUT VALUE (Y AXIS)
Y12VALUE	0.00 to 99.99 %	Y12 INPUT VALUE (Y AXIS)
Y13VALUE	0.00 to 99.99 %	Y13 INPUT VALUE (Y AXIS)
Y14VALUE	0.00 to 99.99 %	Y14 INPUT VALUE (Y AXIS)
Y15VALUE	0.00 to 99.99 %	Y15 INPUT VALUE (Y AXIS)
Y16VALUE	0.00 to 99.99 %	Y16 INPUT VALUE (Y AXIS)
Y17VALUE	0.00 to 99.99 %	Y17 INPUT VALUE (Y AXIS)
TOTALIZE	DISABLE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN AL1 IN AL2	<p>TOTALIZER FUNCTION calculates and displays the total flow volume as measured by any analog input or applied to either Input Algorithm 1 or Input Algorithm 2 to totalize the compensated flow rate being calculated by the algorithm. Displayed value is eight digits with a configurable scale factor.</p> <p>DISABLE—Disables the totalizer function.</p> <p>INPUT 1—Input 1 is Totalized.</p> <p>INPUT 2—Input 2 is Totalized.</p> <p>INPUT 3—Input 3 is Totalized.</p> <p>INPUT 3—Input 4 is Totalized.</p> <p>INPUT 5—Input 5 is Totalized.</p> <p>IN ALG1—Input Algorithm 1 is Totalized.</p> <p>IN ALG2—Input Algorithm 2 is Totalized.</p> <p>ATTENTION The totalizer should always be reset to initialize the counters whenever it is enabled.</p>
ΣXXXXXXX	Σ*En	<p>TOTALIZER VALUE—READ ONLY</p> <p>Current Scale Factor (Upper Display)</p> <p>Actual Current Totalized Value (Lower Display)</p>



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TOT SCAL	E0 = 1 x 10⁰ = 1 E1 = 1 x 10¹ = 10 E2 = 1 x 10² = 100 E3 = 1 x 10³ = 1,000 E4 = 1 x 10⁴ = 10,000 E5 = 1 x 10⁵ = 100,000 E6 = 1 x 10⁶ = 1,000,000	TOTALIZER SCALE FACTOR —Selects the desired Scale Factor (i.e., Multiplier). The desired factor is applied to the calculated value to extend the maximum flow range that can be displayed.
TOT SCR	UNLOCK LOCK	TOTALIZER RESET SECURITY LOCK —Allows the totalizer to be reset. UNLOCK —Allows the totalizer value to be reset. LOCK —Prevents the totalizer value from being reset.
Σ RESET?	NO YES	TOTALIZER RESET —This prompt appears only if the totalizer is unlocked. NO —No Reset YES —Resets the Totalizer value on next  key press.
TOT RATE	SECOND MINUTE HOUR DAY MIL/DAY	TOTALIZER INTEGRATION RATE —Determines the rate at which the Totalizer is updated. SECOND —Engineering units per second MINUTE —Engineering units per minute HOUR —Engineering units per hour DAY —Engineering units per day MIL/DAY —Millions of units per day ATTENTION The source of the Totalizer is averaged over the sample and update rates. For example, as the loop cycle speed is six per second, then with the Totalizer Rate set at once per minute, the source is averaged six times per second and the Totalizer value is updated with this average value ÷ 60 once per second.
POLYNOM	DISABLE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5	POLYNOMIAL EQUATION —A fifth order Polynomial Equation can be used on any one of the five Analog Inputs. The equation is in the form: $Y = C_0 + C_1 X + C_2 * 10^{-1} X^2 + C_3 * 10^{-3} X^3 + C_4 * 10^{-5} X^4 + C_5 * 10^{-7} X^5$



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		<p>Where:</p> <p>X is the value of the input in % of span C₀ is a value between -99.99 to +99.99 C₁ – C₅ are values between -9.999 to +9.999</p> <p>Ratio and Bias can be applied on the “Y” output term as follows: Calculated “Y” Value = Y * Input X Ratio + Input X Bias</p> <p>After the Polynomial is enabled, refer to the prompts listed below and enter the coefficients.</p>
C0 VALUE	-99.99 to 99.99	POLYNOMIAL COEFFICIENT C0
C1 VALUE	-9.999 to 9.999	POLYNOMIAL COEFFICIENT C1
C2 X 10⁻¹	-9.999 to 9.999	POLYNOMIAL COEFFICIENT C2
C3 X 10⁻³	-9.999 to 9.999	POLYNOMIAL COEFFICIENT C3
C4 X 10⁻⁵	-9.999 to 9.999	POLYNOMIAL COEFFICIENT C4
C5 X 10⁻⁷	-9.999 to 9.999	POLYNOMIAL COEFFICIENT C5