



# UDC 3500 Application Note

## Logic Gates Set Up Group

### Introduction

This Set Up Group is provided only as part of the Math Options package.

This group deals with various Logic Gates that are available for use in the controller. Up to five different gates can be configured.

#### ATTENTION

Control Outputs take precedence over Alarms which in turn take precedence over Logic Gate Outputs. For example, if you select the Loop 2 Output Algorithm as Time Simplex, then the instrument will use Relay #3 to perform the Time Simplex output. Therefore, Relay #3 would not be available for Alarm 3 or Logic Gate functions.

Logic Gates are processed in numerical order. For example, if Logic Gate 2 and Logic Gate 4 are configured in a contradictory manner, then Logic Gate 2 will take precedence and Logic Gate 4 will be ignored.

### Function Prompts

**Table -1 LOGIC Group Function Prompts**

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition								
<b>LOG GATE</b>	DISABLE ENABLE	<p><b>LOGIC GATES</b>—This feature is available only with controllers that have the math option.</p> <p><b>DISABLE</b>—Disables Logic Gates Functions. <b>ENABLE</b>—Enables Logic Gates Function.</p> <p><b>ATTENTION</b> For each Logic Gate, make a selection for:</p> <table style="margin-left: 40px;"> <tr> <td>Gate Type</td> <td>GATEnTYP</td> </tr> <tr> <td>Input A Source</td> <td>GATEnINA</td> </tr> <tr> <td>Input B Source</td> <td>GATEnINB</td> </tr> <tr> <td>Output Use</td> <td>GATEnOUT</td> </tr> </table> <p style="text-align: center;">where n = 1, 2, 3, 4 or 5</p>	Gate Type	GATEnTYP	Input A Source	GATEnINA	Input B Source	GATEnINB	Output Use	GATEnOUT
Gate Type	GATEnTYP									
Input A Source	GATEnINA									
Input B Source	GATEnINB									
Output Use	GATEnOUT									
<b>GATE(n)TYP</b> (n = 1, 2, 3, 4, or 5)	NOT USED	<p><b>GATE TYPE</b>—In digital logic, there are only two states that can be present: “0” – OFF or “1” – ON</p> <p>Listed are definitions of the gates available and their truth table which indicate what happens to the Output with regard to the state of the Inputs.</p> <p><b>NOT USED</b>—No Selection</p>								



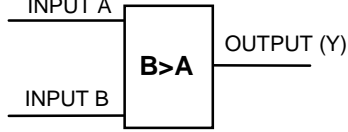


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Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition															
	X OR	<p><b>X OR (EXCLUSIVE OR)</b>—The operation of this gate is, as its name implies, <b>Exclusively “OR”</b>. If Input A <b>OR</b> Input B are <u>ON</u>, the Output will be <u>ON</u>. If Input A and Input B are <u>ON</u> or <u>OFF</u>, the Output will be <u>OFF</u>.</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>Y</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	Y	0	0	0	0	1	1	1	0	1	1	1	0
A	B	Y															
0	0	0															
0	1	1															
1	0	1															
1	1	0															
	XNOR	<p><b>X NOR EXCLUSIVE NOR</b>)—The <b>EXCLUSIVE NOR</b> is an inverted EXCLUSIVE OR. If Input A and Input B are <u>ON</u> or <u>OFF</u>, the Output will be <u>ON</u>.</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>Y</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	A	B	Y	0	0	1	0	1	0	1	0	0	1	1	1
A	B	Y															
0	0	1															
0	1	0															
1	0	0															
1	1	1															
	B LT A (B<A)	<p><b>B LT A (B&lt;A)</b>—B less than A is an Analog Comparator with two Analog Inputs and one Digital (On/Off) Output. A fixed Hysteresis Band of 0.1% of Input B span is applied to these comparators.</p> <p><b>Y = 1 if B&lt;A</b>  <b>Y = 0 if (B + .001 * Span of B) &gt;A</b></p> <p>Example: (B&lt;A)          B = 900 (Range 0 – 1000)  <math>900 - (1000 * .001) = 899</math>          If A &gt;900, then Output is ON(1)          If A &lt;899, then Output is OFF (0)</p>															



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Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
	B GT A (B>A)	<p><b>B GT A (B&gt;A)</b>—B greater than A is an Analog Comparator with two Analog Inputs and one Digital (On/Off) Output. A fixed Hysteresis Band of 0.1% of Input B span is applied to these comparators.</p>  <p style="text-align: center;"><b>Y = 1 if B&gt;A</b> <b>Y = 0 if (B + .001 * Span of B) &lt;A</b></p> <p>Example: (B&gt;A)            B = 900 (Range 0 – 1000)            900 +(1000 * .001) = 901            If A &lt;900, then Output is ON(1)            If A &gt;901, then Output is OFF (0)</p>
<p><b>GATE(n)INA</b> (n = 1, 2, 3, 4, or 5)</p>	<p>DIG IN1            DIG IN2            DIG IN3            DIG IN4            RELAY 1            RELAY 2            RELAY 3            RELAY 4            RELAY 5            GATE1OT            GATE2OT            GATE3OT            GATE4OT            GATE5OT            FIX ON            FIX OFF</p>	<p><b>GATE (n) INPUT A</b>—The selection here will indicate what Input A will be for any of the 5 Gates you want to configure.</p> <p>The following selections apply if the Gate Type is <b>OR, NOR, AND, NAND, X OR, or X NOR.</b></p> <p><b>DIGITAL INPUT 1</b>  <b>DIGITAL INPUT 2</b>  <b>DIGITAL INPUT 3</b>  <b>DIGITAL INPUT 4</b>  <b>RELAY 1</b>  <b>RELAY 2</b>  <b>RELAY 3</b>  <b>RELAY 4</b>  <b>RELAY 5</b>  <b>OUTPUT FROM GATE 1</b>  <b>OUTPUT FROM GATE 2</b>  <b>OUTPUT FROM GATE 3</b>  <b>OUTPUT FROM GATE 4</b>  <b>OUTPUT FROM GATE 5</b>  <b>ALWAYS A “1”</b>  <b>ALWAYS A “0”</b></p>



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Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
	MA MODE LR SPL1 ADAPT 1 MA MOD2 * LR SPL2 * ADAPT 2 *  INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 L1 PV L1 SP CONST K L2 PV * L2 SP *  * These prompts appear only when 2 Loops are configured.	<b>Manual or Auto mode – Loop 1</b> 0 = Manual    1 = Automatic <b>Local or Remote Setpoint – Loop 1</b> 0 = Local    1 = Remote <b>Disable or Enable Adaptive Tune – Loop 1</b> 0 = Disable    1 = Enable <b>Manual or Auto Mode – Loop 2</b> 0 = Manual    1 = Automatic <b>Local or Remote Setpoint – Loop 2</b> 0 = Local    1 = Remote <b>Disable or Enable Adaptive Tune – Loop 2</b> 0 = Disable    1 = Enable  The following selections apply if the Gate Type is <b>B LT A</b> (B less than A) or <b>B GT A</b> (B greater than A). <b>ANALOG INPUT 1</b> <b>ANALOG INPUT 2</b> <b>ANALOG INPUT 3</b> <b>ANALOG INPUT 4</b> <b>ANALOG INPUT 5</b> <b>LOOP 1 PROCESS VARIABLE</b> <b>LOOP 1 SETPOINT</b> <b>K CONSTANT</b> <b>LOOP 2 PROCESS VARIABLE</b> <b>LOOP 2 SETPOINT</b>
<b>GATE(n) K</b> (n = 1, 2, 3, 4, or 5)	–999.0 to +9999	<b>GATE (n) K CONSTANT</b> —This selection only appears if “CONST K” is selected a Input A for Gate n.
<b>GATE(n)INB</b> (n = 1, 2, 3, 4, or 5)		<b>GATE (n) INPUT B</b> —The selection here will indicate what Input B will be for any of the 5 Gates you want to configure.  The following selections apply if the Gate Type is <b>OR, NOR, AND, NAND, X OR, or X NOR.</b>



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	DIG IN1 DIG IN2 DIG IN3 DIG IN4 RELAY 1 RELAY 2 RELAY 3 RELAY 4 RELAY 5 GATE1OT GATE2OT GATE3OT GATE4OT GATE5OT FIX ON FIX OFF  MA MODE  LR SPL1  ADAPTIV  MA MOD2 *  LR SPL2 *  ADAPT 2 *      INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 L1 PV L1 SP TOTALZE L2 PV * L2 SP *  * These prompts appear only when 2 Loops are configured.	<b>DIGITAL INPUT 1</b> <b>DIGITAL INPUT 2</b> <b>DIGITAL INPUT 3</b> <b>DIGITAL INPUT 4</b> <b>RELAY 1</b> <b>RELAY 2</b> <b>RELAY 3</b> <b>RELAY 4</b> <b>RELAY 5</b> <b>OUTPUT FROM GATE 1</b> <b>OUTPUT FROM GATE 2</b> <b>OUTPUT FROM GATE 3</b> <b>OUTPUT FROM GATE 4</b> <b>OUTPUT FROM GATE 5</b> <b>ALWAYS A "1"</b> <b>ALWAYS A "0"</b>  <b>Manual or Auto mode – Loop 1</b> 0 = Manual    1 = Automatic <b>Local or Remote Setpoint – Loop 1</b> 0 = Local    1 = Remote <b>Disable or Enable Adaptive Tune – Loop 1</b> 0 = Disable    1 = Enable <b>Manual or Auto Mode – Loop 2</b> 0 = Manual    1 = Automatic <b>Local or Remote Setpoint – Loop 2</b> 0 = Local    1 = Remote <b>Disable or Enable Adaptive Tune – Loop 2</b> 0 = Disable    1 = Enable  The following selections apply if the Gate Type is <b>B LT A</b> (B less than A) or <b>B GT A</b> (B greater than A). <b>ANALOG INPUT 1</b> <b>ANALOG INPUT 2</b> <b>ANALOG INPUT 3</b> <b>ANALOG INPUT 4</b> <b>ANALOG INPUT 5</b> <b>LOOP 1 PROCESS VARIABLE</b> <b>LOOP 1 SETPOINT</b> <b>TOTALIZER (see Note 1)</b> <b>LOOP 2 PROCESS VARIABLE</b> <b>LOOP 2 SETPOINT</b>  Note 1: The Input B Totalizer Value will be the displayed value, not the actual Totalizer value.



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<p><b>GATE(n)OUT</b> (n = 1, 2, 3, 4, or 5)</p>	<p>RELAY 1 RELAY 2 RELAY 3 RELAY 4 RELAY 5 ANY GATE MA MODE</p> <p>LR SPL1</p> <p>ADAPT 1</p> <p>RESET T</p> <p>MA MOD2 *</p> <p>LR SPL2 *</p> <p>ADAPT 2 *</p> <p>* These prompts appear only when 2 Loops are configured.</p>	<p><b>GATE (n) OUTPUT</b>—The selection here indicates what the output will be for any of the 5 gates that you configure.</p> <p><b>RELAY 1</b> <b>RELAY 2</b> <b>RELAY 3</b> <b>RELAY 4</b> <b>RELAY 5</b></p> <p><b>Output to any Gate</b> <b>Manual or Auto mode – Loop 1</b> 0 = Manual    1 = Automatic</p> <p><b>Local or Remote Setpoint – Loop 1</b> 0 = Local    1 = Remote</p> <p><b>Disable or Enable Adaptive Tune – Loop 1</b> 0 = Disable    1 = Enable</p> <p><b>Disable or Enable Totalizer Reset</b> 0 = Disable    1 = Enable</p> <p><b>Manual or Auto Mode – Loop 2</b> 0 = Manual    1 = Automatic</p> <p><b>Local or Remote Setpoint – Loop 2</b> 0 = Local    1 = Remote</p> <p><b>Disable or Enable Adaptive Tune – Loop 2</b> 0 = Disable    1 = Enable</p>

**ATTENTION** Control and Alarm Outputs take priority over Logic Gate Outputs. For example, if Loop 1 is configured for Time Proportional and the output for Logic Gate2 is configured for RELAY 1, then Relay 1 will operate as directed by the output for Loop 1 and the Logic Gate output will be ignored. In a similar fashion, if Alarm 1 and a Logic Gate Output are both trying to access Relay 5, then only the Alarm function will operate Relay 5.

Logic Gate Outputs configured for Relays will light an annunciator when active. Outputs for Relay 1 through Relay 4 will light annunciators OUT 1 through 4. A Relay 5 Output will light annunciator ALM 1.