

LIGO Laboratory / LIGO Scientific Collaboration

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**TwinCAT Library for
Delay Line**

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LIGO Scientific Collaboration

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Library	
Title	DelayLinePhaseShifter
Version	1
TwinCAT version	2.11
Name space	–
Author	Alexa Staley, Daniel Sigg
Description	<p>The delay line shifter delays an input signal by a selectable amount. This amount can be controlled by a step or phase slider. The delay can be between 0ns and 30.762ns for a single delay line.</p> <p>If necessary, multiple delay lines can be chained in series to double, triple or quadruple this delay.</p>
Error Codes	0x01 – Invalid frequency
Library dependencies	Error

Hardware Output Type TYPE DelayLogicOutStruct : STRUCT DelayStep: INT; LacthEn: BOOL; END_STRUCT END_TYPE	
Type name	DelayLogicOutStruct
Description	Structure of the hardware output that are wired up for the delay line
Definition	STRUCT
Element	Name: DelayStep Type: INT Description: The delay line step slider
Element	Name: LacthEn Type: BOOL Description: Enables latch

User Interface Type TYPE DelayLogicStruct : (* single delay line *) TYPE DelayLogicDoubleStruct : (* double delay line *) TYPE DelayLogicTripleStruct : (* triple delay line *) TYPE DelayLogicQuadStruct : (* quadruple delay line *) STRUCT FreqMHz: LREAL; PhaseDeg: LREAL; DelayNs: LREAL; DelayStep: INT; Error: ErrorStruct; END_STRUCT END_TYPE	
Type name	DelayLogicStruct (single delay line) DelayLogicDoubleStruct (two delay lines) DelayLogicTripleStruct (three delay lines) DelayLogicQuadStruct (four delay lines)
Description	Structure of the user interface tags that are used to control the delay line
Definition	STRUCT
Output Tag	Name: Error Type: ErrorStruct Description: For error handling
Input Tag	Name: FreqMHz Type: LREAL Description: Input frequency in MHz
In/out Tag	Name: PhaseDeg Type: LREAL Description: Input phase in degrees, between 0 and 360°.
In/out Tag	Name: DelayNs Type: LREAL Description: Delay of input signal in nanoseconds, between 0 ns and 30.7622 ns (511 steps, single delay line), 61.5244 ns (1022 steps, double delay line), 92.2866 ns (1533 steps, triple delay line) or 123.0488 ns (2044 steps, quadruple delay line).
In/out Tag	Name: DelayStep Type: INT Description: Delay steps between 0 and 511 (single delay line), 1022 (double delay line), 1533 (triple delay line) or 2044 (quadruple delay line). One step corresponds to 0.0602ns

Function Block FUNCTION_BLOCK DelayLogicFB VAR_INPUT Request: SaveRestoreEnum; END_VAR VAR_OUTPUT DelayLogicOut: DelayLogicOutStruct; END_VAR VAR_IN_OUT DelayLogicInit: DelayLogicStruct; DelayLogic: DelayLogicStruct; END_VAR	
Name	DelayLogicFB
Description	Controls a single delay line
Input argument	Name: Request Type: SaveRestoreEnum Description: Request save/restore/safemode or noop
Output argument	Name: DelayLogicOut Type: DelayLogicOutStruct Description: Output hardware structure
In/out argument	Name: DelayLogicInit Type: DelayLogicStruct Description: Save/restore variable in persistent memory
In/out argument	Name: DelayLogic Type: DelayLogicStruct Description: User Interface structure

Function Block FUNCTION_BLOCK DelayLogicDoubleFB VAR_INPUT Request: SaveRestoreEnum; END_VAR VAR_OUTPUT DelayLogic1Out: DelayLogicOutStruct; DelayLogic2Out: DelayLogicOutStruct; END_VAR VAR_IN_OUT DelayLogicInit: DelayLogicDoubleStruct; DelayLogic: DelayLogicDoubleStruct; END_VAR	
Name	DelayLogicDoubleFB
Description	Controls two delay lines
Input argument	Name: Request Type: SaveRestoreEnum Description: Request save/restore/safemode or noop
Output argument	Name: DelayLogic1Out Type: DelayLogicOutStruct Description: Output hardware structure for 1 st delay line
Output argument	Name: DelayLogic2Out Type: DelayLogicOutStruct Description: Output hardware structure for 2 nd delay line
In/out argument	Name: DelayLogicInit Type: DelayLogicDoubleStruct Description: Save/restore variable in persistent memory
In/out argument	Name: DelayLogic Type: DelayLogicDoubleStruct Description: User Interface structure

Function Block FUNCTION_BLOCK DelayLogicTripleFB VAR_INPUT Request: SaveRestoreEnum; END_VAR VAR_OUTPUT DelayLogic1Out: DelayLogicOutStruct; DelayLogic2Out: DelayLogicOutStruct; DelayLogic3Out: DelayLogicOutStruct; END_VAR VAR_IN_OUT DelayLogicInit: DelayLogicTripleStruct; DelayLogic: DelayLogicTripleStruct; END_VAR	
Name	DelayLogicTripleFB
Description	Controls three delay lines
Input argument	Name: Request Type: SaveRestoreEnum Description: Request save/restore/safemode or noop
Output argument	Name: DelayLogic1Out Type: DelayLogicOutStruct Description: Output hardware structure for 1 st delay line
Output argument	Name: DelayLogic2Out Type: DelayLogicOutStruct Description: Output hardware structure for 2 nd delay line
Output argument	Name: DelayLogic3Out Type: DelayLogicOutStruct Description: Output hardware structure for 3 rd delay line
In/out argument	Name: DelayLogicInit Type: DelayLogicTripleStruct Description: Save/restore variable in persistent memory
In/out argument	Name: DelayLogic Type: DelayLogicTripleStruct Description: User Interface structure

Function Block FUNCTION_BLOCK DelayLogicQuadFB VAR_INPUT Request: SaveRestoreEnum; END_VAR VAR_OUTPUT DelayLogic1Out: DelayLogicOutStruct; DelayLogic2Out: DelayLogicOutStruct; DelayLogic3Out: DelayLogicOutStruct; END_VAR VAR_IN_OUT DelayLogicInit: DelayLogicQuadStruct; DelayLogic: DelayLogicQuadStruct; END_VAR	
Name	DelayLogicQuadFB
Description	Controls four delay lines
Input argument	Name: Request Type: SaveRestoreEnum Description: Request save/restore/safemode or noop
Output argument	Name: DelayLogic1Out Type: DelayLogicOutStruct Description: Output hardware structure for 1 st delay line
Output argument	Name: DelayLogic2Out Type: DelayLogicOutStruct Description: Output hardware structure for 2 nd delay line
Output argument	Name: DelayLogic3Out Type: DelayLogicOutStruct Description: Output hardware structure for 3 rd delay line
Output argument	Name: DelayLogic4Out Type: DelayLogicOutStruct Description: Output hardware structure for 4 th delay line
In/out argument	Name: DelayLogicInit Type: DelayLogicQuadStruct Description: Save/restore variable in persistent memory
In/out argument	Name: DelayLogic Type: DelayLogicQuadStruct Description: User Interface structure

Visual	
Phase	◀ [Slider] ▶ %3.2f deg
Delay	%3.3f ns Freq. %3.6f MHz
Steps	◀ [Slider] ▶ %i
Error	%i %s
Name	DelayLogicVis
Description	Displays phase, steps, and delay
Placeholder	Name: DelayLogic Type: DelayLogicStruct Description: Delay Line structure