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Beam Diverter Library documentation

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<b>Library</b>	
Title	BeamDiverter
Version	1
TwinCAT version	2.11.0
Name space	
Author	Sheila Dwyer and Jax Sanders
Description	<p>Controls a beam diverter D1100642. The beam diverter moves an optic into or out of a beam using a coil and magnets. There are two reed switches that sense the current position of the beam diverter. The coil current is driven by the beckhoff module EL7332. According to T1100252-v2 the beam diverter needs about half of an Amp of current. The EL7332 used in the "direct velocity" mode, with the Motor nominal resistance set to 10 Ohms, produces 1mA per 0.066 units of "velocity" when a 10 Ohm resistor and 330uH inductor are attached. The maximum current seems to be 1 Amp, or -1.2 Amps, reached for velocity settings above <math>\pm 20,000</math>.</p> <p>The readbacks under info setting for both coil current and voltage do not work, at least not in the direct velocity operating mode. To move the beam diverter this library sets the velocity to <math>\pm 7250</math> when the user asks to either open or close the beam diverter, applies this voltage for 5 seconds then uses the reed switches to check that the beam diverter has moved. The time could be shortened if desired.</p> <p>Each beam diverter can be locked (the DC motor disabled).</p>
Error Code	0x0001 Reed switches contradict each other 0x0002 Bean Diverter did not open 0x0003 Beam Diverter did not close 0x0004 DC motor controller error (beckhoff module EL7332)

<b>Hardware Input Type</b>	
TYPE BeamDiverterInStruct :	
STRUCT	
ClosedPositionSwitch:	BOOL; (* closed position reed switch *)
OpenPositionSwitch:	BOOL; (* open position reed switch *)
DCMReady:	BOOL;
DCMWarning:	BOOL;
DCMError:	BOOL;
END_STRUCT	
END_TYPE;	
Type name	BeamDiverterInStruct
Description	Structure of the hardware inputs that mapped into the EtherCAT memory

	space by the EtherCAT-to-Modbus gateway. There are two switches used as sensors for a readback of the diverter position , and readbacks from the DC motor controller.
Definition	STRUCT
Element	Name: ClosedPositionSwitch Type: BOOL Description: Indicates that beam diverter is closed
Element	Name: OpenPostionSwitch Type: BOOL Description: Indicates that beam diverter is open
Element	Name: DCMReady Type: BOOL Description: Readback from EL7332 indicating that the motor is ready
Element	Name: DCMWarning Type: BOOL Description: Readback from EL7332 indicating that the motor is ready
Element	Name: DCMError Type: BOOL Description: Readback from EL7332 indicating that the motor has an error

<b>Hardware Output Type</b>	
TYPE BeamDiverterOutStruct :	
STRUCT	
	DCMVelocity: INT:=0.0; (* output to coil *)
	DCMEnable: BOOL;
END_STRUCT	
END_TYPE;	
Type name	BeamDiverterOut
Description	Structure of the hardware output that is mapped into the EtherCAT memory space by the EtherCAT-to-Modbus gateway.
Definition	STRUCT
Element	Name: DCMVelocity Type: INT Description: Proportional to the current through the coil.
Element	Name: DCMEnable Type: BOOL Description: Enables the DCM

<b>User Interface Type</b>	
TYPE BeamDiverterStruct :	

<pre> STRUCT     Error:  ErrorStruct; (* error handling *)     Open:   BOOL;             (*~   (OPC           : 1 :   Make variable visible for OPC-Server)                 (OPC_PROP[005]  : 1 :   OPC_PROP_RIGHTS)                 (OPC_PROP[0101] :open beam diverter: Description)*)     Close:  BOOL;             (*~(OPC           : 1 :   Make variable visible for OPC-Server)                 (OPC_PROP[005]  : 1 :   OPC_PROP_RIGHTS)                 (OPC_PROP[0101] :close beam diverter: Description)                 *)     Locked: BOOL;             (*~(OPC           : 1 :   Make variable visible for OPC-Server)                 (OPC_PROP[005]  : 1 :   OPC_PROP_RIGHTS)                 (OPC_PROP[0101] :disable DC motor controler: Description)                 *)      Message: STRING;             (*~             (OPC           : 1 :   Make variable visible for OPC-Server)                 (OPC_PROP[005]  : 1 :   OPC_PROP_RIGHTS)                 (OPC_PROP[0101] : Message : Description)*)     FailedAttempts: INT;             (*~             (OPC           : 1 :   Make variable visible for OPC-Server)             (OPC_PROP[005]  : 1 :   OPC_PROP_RIGHTS)             (OPC_PROP[0101] : Number of failed attempts to move beam diverter : Description)             *)     ResetFailedAttempts: BOOL;             (*~             (OPC           : 1 :   Make variable visible for OPC-Server)             (OPC_PROP[005]  : 1 :   OPC_PROP_RIGHTS)             (OPC_PROP[0101] : Set number of failed attempts to zero : Description)             *) END_STRUCT END_TYPE; </pre>	
Type name	BeamDiverterStruct
Description	User interface variables for controlling a beam diverter
Definition	STRUCT
Output tags	Name: Error Type: ErrorStruct Description: Errors
Input tags	Name: Open Type: BOOL

	Description: Request to move to open position
Output tags	Name: Close Type: BOOL Description: Request to move beam diverter to closed
Output tags	Name: Locked Type: BOOL Description: Disable DC motor controller
Output tags	Name: Message Type: String Description: A message displays weather the beam diverter is ready to be moved, or waiting for a move to finish.
Output tags	Name: FailedAttempts Type: INT Description: Count of times the beam diverter has tried to move unsuccessfully
Output tags	Name: ResetFailedAttempts Type: BOOL Description: Set count back to zero

<b>Function Block</b> FUNCTION_BLOCK BeamDiverterFB VAR_INPUT Request:                    SaveRestoreEnum; BeamDiverterIn:            BeamDiverterInStruct; END_VAR VAR_OUTPUT BeamDiverterOut:          BeamDiverterOutStruct; END_VAR VAR_IN_OUT BeamDiverter:              BeamDiverterStruct; BeamDiverterInit:          BeamDiverterStruct; END_VAR VAR ErrorB:                    BOOL; ErrorCode:                  DWORD; ErrorMsg:                  STRING; ErrorHandler:              ErrorHandlerFB; TimerIndex:                INT :=0; END_VAR	
Name	BeamDiverterFB
Description	Controls a single beam diverter.
Parent type	
Interface implementation	
Input argument	Name:BeamDiverterIn Type:BeamDiverterInStruct Description: Hardware inputs (sensor readouts)
Output argument	Name: BeamDiverterOut Type:BeamDiverterOutStruct Description: Hardware outout (coil voltage)
In/out argument	Name:BeamDiverter Type: BeamDiverterStruct Description:User interface inputs and outputs

<p><b>Visual</b></p>	
Name	BeamDiverterVis
Description	Displays current position, as well as the readout of both sensors, error messages, a message indicating if the diverter is ready to move or waiting for a move to complete, and the number of times the beam diverter has failed to move when requested. Also has inputs to request that the beam diverter opens, closes, or flips position, and to reset the count of failed attempts to move.
Placeholder	Name:\$BeamDiverter\$ Type:BeamDiverterStruct Description:
Placeholder	Name:\$BeamDiverterIn\$ Type:BeamDiverterInStruct Description: