*LIGO Laboratory / LIGO Scientific Collaboration*

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Beam Diverter Library documentation

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LIGO Scientific Collaboration

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| **Library** |
| Title | BeamDiverter |
| Version | 1 |
| TwinCAT version | 2.11.0 |
| Name space |  |
| Author | Sheila Dwyer and Jax Sanders |
| Description | 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 ±20,000.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 ±7250 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. Each beam diverter can be locked (the DC motor disabled).  |
| Error Code | 0x0001 Reed switches contradict each other0x0002 Bean Diverter did not open0x0003 Beam Diverter did not close0x0004 DC motor controller error (beckhoff module EL7332) |

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| **Hardware Input Type**TYPE BeamDiverterInStruct :STRUCT ClosedPositionSwitch: BOOL; (\* closed position reed switch \*) OpenPositionSwitch: BOOL; (\* open position reed switch \*) DCMReady: BOOL; DCMWarning: BOOL; DCMError: BOOL;END\_STRUCTEND\_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: ClosedPositionSwitchType: BOOLDescription: Indicates that beam diverter is closed |
| Element | Name: OpenPostionSwitchType: BOOLDescription: Indicates that beam diverter is open |
| Element | Name: DCMReadyType: BOOLDescription: Readback from EL7332 indicating that the motor is ready |
| Element | Name: DCMWarningType: BOOLDescription: Readback from EL7332 indicating that the motor is ready |
| Element | Name: DCMErrorType: BOOLDescription: Readback from EL7332 indicating that the motor has an error |

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| **Hardware Output Type**TYPE BeamDiverterOutStruct :STRUCT DCMVelocity: INT:=0.0; (\* output to coil \*) DCMEnable: BOOL;END\_STRUCTEND\_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: DCMVelocityType: INTDescription: Proportional to the current through the coil.  |
| Element | Name: DCMEnableType: BOOLDescription: Enables the DCM |

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| **User Interface Type**TYPE BeamDiverterStruct :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 atttempts 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\_STRUCTEND\_TYPE; |
| Type name | BeamDiverterStruct |
| Description | User interface variables for controlling a beam diverter |
| Definition | STRUCT |
| Output tags | Name: ErrorType: ErrorStructDescription: Errors |
| Input tags | Name: OpenType: BOOLDescription: Request to move to open position |
| Output tags | Name: CloseType: BOOLDescription: Request to move beam diverter to closed |
| Output tags | Name: LockedType: BOOLDescription: Disable DC motor controller |
| Output tags | Name: MessageType: StringDescription: A message displays weather the beam diverter is ready to be moved, or waiting for a move to finish.  |
| Output tags | Name: FailedAttemptsType: INTDescription: Count of times the beam diverter has tried to move unsucsefully |
| Output tags | Name: ResetFailedAttemptsType: BOOLDescription: Set count back to zero |

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| **Function Block**FUNCTION\_BLOCK BeamDiverterFBVAR\_INPUT Request: SaveRestoreEnum; BeamDiverterIn: BeamDiverterInStruct;END\_VARVAR\_OUTPUT BeamDiverterOut: BeamDiverterOutStruct;END\_VARVAR\_IN\_OUT BeamDiverter: BeamDiverterStruct; BeamDiverterInit: BeamDiverterStruct;END\_VARVAR 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:BeamDiverterInType:BeamDiverterInStructDescription: Hardware inputs (sensor readouts) |
| Output argument | Name: BeamDiverterOutType:BeamDiverterOutStructDescription: Hardware outout (coil voltage) |
| In/out argument | Name:BeamDiverterType: BeamDiverterStructDescription:User interface inputs and outputs |

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| **Visual** |
| 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:BeamDiverterStructDescription: |
| Placeholder | Name:$BeamDiverterIn$Type:BeamDiverterInStructDescription: |