*LIGO Laboratory / LIGO Scientific Collaboration*

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TwinCAT Library for
DC Power

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LIGO Scientific Collaboration

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| **Library** |
| Title | DCPower |
| Version | 1 |
| TwinCAT version | 2.11 |
| Name space | – |
| Author | Alexa Staley |
| Description | Monitors the DC Power of monolithic photodiodes and quad photodiodesEach photodetector support DC offset adjustment, transimpedance and detector response values to compute current and power.Each photodetector also support optional low and high limits.Quad detectors compute sum, pitch and yaw depending on how the detector is mounted. |
| Error codes | DCPower:0x01 – DC offset out-of-range0x02 – Transimpedance out-of-range0x04 – Photodiode response out-of-range0x08 – Limits exceededDCQuadPower:0x01 – Error in Segment 10x02 – Error in Segment 20x04 – Error in Segment 30x08 – Error in Segment 40x10 – Sum below threshold |
| Library dependencies | Error, ReadADC, SaveRestore |

**Table of quad photodiode orientation**

**(Front view)**

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|  | **Orientation** |
| **Cross** | **Plus** |
| **Rotation** | **Normal** | **Flipped** | **Normal** | **Flipped** |
| **Up** | 1234 | 1432 | 1432 | 4123 |
| **Right** | 4123 | 2143 | 4321 | 1234 |
| **Down** | 3412 | 3214 | 3214 | 2341 |
| **Left** | 2341 | 4321 | 2143 | 3412 |

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| **Hardware Input Type**TYPE DCPowerInStruct :STRUCT DCPower: INT; PowerOk: BOOL; END\_STRUCTEND\_TYPE |
| Type name | DCPowerInStruct |
| Description | Structure of the hardware inputs that are wired up for the DC Power |
| Definition | STRUCT |
| Element | Name: DCPowerType: INTDescription: Monitors the DC power |

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| **User Interface Type**TYPE DCPowerLimitsEnum : (None, Low, High, HiLo);END\_TYPE |
| Type name | DCPowerLimitsEnum |
| Description | List of optional limit choices |
| Definition | ENUM |
| Enum Tag | Name: NoneDescription: No limit |
| Enum Tag | Name: LowDescription: Check low limit |
| Enum Tag | Name: HighDescription: Check high limit |
| Enum Tag | Name: HiLoDescription: Check low and high limit |

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| **User Interface Type**TYPE DCPowerStruct :STRUCT Error: ErrorStruct; DC: LREAL; Offset: LREAL; Transimpedance: LREAL; DCCurrent: LREAL; Response: LREAL; DCPower: LREAL; Limits: DCPowerLimitsEnum; Range: BOOL; Low: LREAL; High: LREAL;END\_STRUCTEND\_TYPE |
| Type name | DCPowerStruct |
| Description | Structure of the user interface tags that are used to control the DC power |
| Definition | STRUCT |
| Output Tag | Name: ErrorType: ErrorStructDescription: Error handling |
| Output Tag | Name: DCType: LREALDescription: Monitors the DC power in V |
| In/out Tag | Name: OffsetType: LREALDescription: DC offset in V |
| In/out Tag | Name: TransimpedanceType: LREALDescription: Photodetector transimpedance in Ohm |
| Output Tag | Name: DCCurrentType: LREALDescription: Photodetector current in mA |
| In/out Tag | Name: ResponseType: LREALDescription: Photodetector response in A/W |
| Output Tag | Name: DCPowerType: LREALDescription: Monitors the DC power in mW |
| Output Tag | Name: LimitsType: DCPowerLimitsEnumDescription: Specifies optional limits |
| Output Tag | Name: RangeType: BOOLDescription: True if limits exceeded |
| Output Tag | Name: LowType: LREALDescription: Low limit for power in mW |
| Output Tag | Name: HighType: LREALDescription: High limit for power in mW |

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| **Function Block**FUNCTION\_BLOCK DCPowerFBVAR\_INPUT Request: SaveRestoreEnum; DCPowerIn: DCPowerInStruct;END\_VARVAR\_IN\_OUT DCPowerInit: DCPowerStruct; DCPower: DCPowerStruct;END\_VAR |
| Name | DCPowerFB |
| Description | Controls the DC Power |
| Input argument | Name: RequestType: SaveRestoreEnumDescription: Save/restore command |
| Input argument | Name: DCPowerInType: DCPowerInStructDescription: Input hardware structure |
| In/out argument | Name: DCPowerInitType: DCPowerStructDescription: Interface structure for save/restore |
| In/out argument | Name: DCPowerType: DCPowerStructDescription: User Interface structure |

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| **Hardware Input Type**TYPE QuadDCPowerInStruct :STRUCT Seg: ARRAY [1..4] OF DCPowerInStruct;END\_STRUCTEND\_TYPE |
| Type name | QuadDCPowerInStruct |
| Description | Structure of the hardware inputs that are wired up for the DC Power |
| Definition | STRUCT |
| Element | Name: SegType: ARRAYDescription: Creates a four array of DCPowerInStruct |

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| **User Interface Type**TYPE QuadDCPowerOrientationEnum : (Cross, Plus);END\_TYPE |
| Type name | QuadDCPowerOrientationEnum |
| Description | Basic quad photodetector orientation  |
| Definition | ENUM |
| Enum Tag | Name: CrossDescription: Segment 1 on top, then clockwise |
| Enum Tag | Name: PlusDescription: Segment 1 top/right, then clockwise |

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| **User Interface Type**TYPE QuadDCPowerRotationEnum : (Up, Right, Down, Left);END\_TYPE |
| Type name | QuadDCPowerRotationEnum |
| Description | Photodetector rotation  |
| Definition | ENUM |
| Enum Tag | Name: UpDescription: Segment 1 on top or top/right |
| Enum Tag | Name: RightDescription: Segment 1 on the right or bottom/right |
| Enum Tag | Name: DownDescription: Segment 1 on bottom or bottom/left |
| Enum Tag | Name: LeftDescription: Segment 1 on the left or top/left |

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| **User Interface Type**TYPE QuadDCPowerStruct :STRUCT Error: ErrorStruct; Seg: ARRAY [1..4] OF DCPowerStruct; Sum: LREAL; Threshold: LREAL; Flip: BOOL; Orientation: QuadDCPowerOrientationEnum; Rotation: QuadDCPowerRotationEnum; Pitch: LREAL; Yaw: LREAL;END\_STRUCTEND\_TYPE |
| Type name | QuadDCPowerStruct |
| Description | Structure of the user interface tags that are used to control the DC power |
| Definition | STRUCT |
| Output Tag | Name: ErrorType: ErrorStructDescription: Error handling |
| Output Tag | Name: SegType: ARRAYDescription: Creates a four array for the four monitors of the DC power |
| Output Tag | Name: SumType: LREALDescription: Sum of the four DC power monitors in mW |
| In/Out Tag | Name: ThresholdType: LREALDescription: Threshold for sum in mW |
| In/out Tag | Name: FlipType: BOOLDescription: Counterclockwise numbering of segments |
| In/out Tag | Name: OrientationType: QuadDCPowerOrientationEnumDescription: Plus or cross configuration |
| In/out Tag | Name: RotationType: QuadDCPowerRotationEnumDescription: Rotation of photodetector in steps of 90 degree |
| Output Tag | Name: PitchType: LREALDescription: Pitch, calculated by (Top – Bottom) / Sum |
| Output Tag | Name: YawType: LREALDescription: Yaw, calculated by (Right – Left) / Sum |

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| **Function Block**FUNCTION\_BLOCK QuadDCPowerFBVAR\_INPUT Request: SaveRestoreEnum; QuadDCPowerIn: QuadDCPowerInStruct;END\_VARVAR\_IN\_OUT QuadDCPowerInit: QuadDCPowerStruct; QuadDCPower: QuadDCPowerStruct;END\_VAR |
| Name | DCPowerFB |
| Description | Controls the DC Power |
| Input argument | Name: RequestType: SaveRestoreEnumDescription: Save/restore command |
| Input argument | Name: QuadDCPowerInType: QuadDCPowerInStructDescription: Input hardware structure |
| In/out argument | Name: QuadDCPowerInitType: QuadDCPowerStructDescription: Interface structure for save/restore |
| In/out argument | Name: QuadDCPowerType: QuadDCPowerStructDescription: User Interface structure |

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| **Visual** |
| Name | DCPowerVis |
| Description | Displays the DC power |
| Placeholder | Name: DCPowerType: DCPowerStructDescription: DC power structure |

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| **Visual** |
| Name | QuadDCPowerVis |
| Description | Displays the DC power monitors, pitch, yaw, and error |
| Placeholder | Name: DCPowerType: QuadDCPowerStructDescription: DC power structure |