

LIGO Laboratory / LIGO Scientific Collaboration

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Advanced LIGO

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**TwinCAT Library for
DC Power**

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LIGO Scientific Collaboration

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of the LIGO Laboratory.

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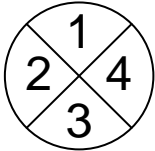
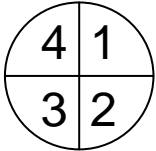
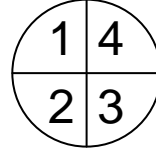
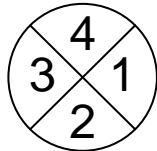

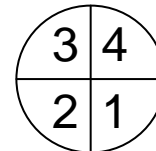
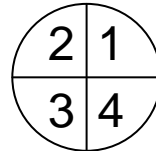
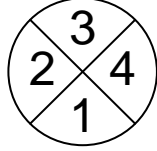
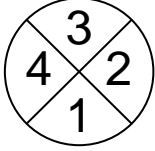
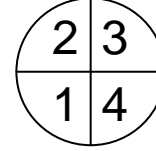
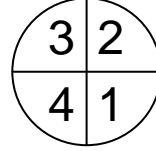
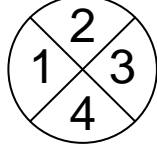
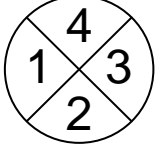
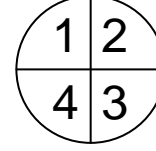
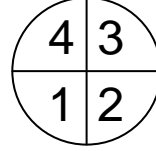
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| Library | |
|----------------------|---|
| Title | DCPower |
| Version | 1 |
| TwinCAT version | 2.11 |
| Name space | – |
| Author | Alexa Staley |
| Description | <p>Monitors the DC Power of monolithic photodiodes and quad photodiodes Each photodetector 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.</p> |
| Error codes | <p>DCPower: 0x01 – DC offset out-of-range 0x02 – Transimpedance out-of-range 0x04 – Photodiode response out-of-range 0x08 – Limits exceeded</p> <p>DCQuadPower: 0x01 – Error in Segment 1 0x02 – Error in Segment 2 0x04 – Error in Segment 3 0x08 – Error in Segment 4 0x10 – Sum below threshold</p> |
| Library dependencies | Error, ReadADC, SaveRestore |

**Table of quad photodiode orientation
(Front view)**

| | Orientation | | | |
|----------|---|---|--|---|
| | Cross | | Plus | |
| Rotation | Normal | Flipped | Normal | Flipped |
| Up |  |  |  |  |
| Right |  |  |  |  |
| Down |  |  |  |  |
| Left |  |  |  |  |

| | |
|---|---|
| Hardware Input Type TYPE DCPowerInStruct : STRUCT DCPower: INT; PowerOk: BOOL; END_STRUCT END_TYPE | |
| Type name | DCPowerInStruct |
| Description | Structure of the hardware inputs that are wired up for the DC Power |
| Definition | STRUCT |
| Element | Name: DCPower Type: INT Description: Monitors the DC power |

| | |
|---|---|
| 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: None Description: No limit |
| Enum Tag | Name: Low Description: Check low limit |
| Enum Tag | Name: High Description: Check high limit |
| Enum Tag | Name: HiLo Description: Check low and high limit |

| | |
|--|---|
| 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_STRUCT END_TYPE | |
| Type name | DCPowerStruct |
| Description | Structure of the user interface tags that are used to control the DC power |
| Definition | STRUCT |
| Output Tag | Name: Error Type: ErrorStruct Description: Error handling |
| Output Tag | Name: DC Type: LREAL Description: Monitors the DC power in V |
| In/out Tag | Name: Offset Type: LREAL Description: DC offset in V |
| In/out Tag | Name: Transimpedance Type: LREAL Description: Photodetector transimpedance in Ohm |
| Output Tag | Name: DCCurrent Type: LREAL Description: Photodetector current in mA |
| In/out Tag | Name: Response Type: LREAL Description: Photodetector response in A/W |
| Output Tag | Name: DCPower Type: LREAL Description: Monitors the DC power in mW |

| | |
|------------|---|
| Output Tag | Name: Limits Type: DCPowerLimitsEnum Description: Specifies optional limits |
| Output Tag | Name: Range Type: BOOL Description: True if limits exceeded |
| Output Tag | Name: Low Type: LREAL Description: Low limit for power in mW |
| Output Tag | Name: High Type: LREAL Description: High limit for power in mW |

| | |
|--|---|
| Function Block FUNCTION_BLOCK DCPowerFB VAR_INPUT Request: SaveRestoreEnum; DCPowerIn: DCPowerInStruct; END_VAR VAR_IN_OUT DCPowerInit: DCPowerStruct; DCPower: DCPowerStruct; END_VAR | |
| Name | DCPowerFB |
| Description | Controls the DC Power |
| Input argument | Name: Request Type: SaveRestoreEnum Description: Save/restore command |
| Input argument | Name: DCPowerIn Type: DCPowerInStruct Description: Input hardware structure |
| In/out argument | Name: DCPowerInit Type: DCPowerStruct Description: Interface structure for save/restore |
| In/out argument | Name: DCPower Type: DCPowerStruct Description: User Interface structure |

| | |
|---|--|
| Hardware Input Type TYPE QuadDCPowerInStruct : STRUCT Seg: ARRAY [1..4] OF DCPowerInStruct; END_STRUCT END_TYPE | |
| Type name | QuadDCPowerInStruct |
| Description | Structure of the hardware inputs that are wired up for the DC Power |
| Definition | STRUCT |
| Element | Name: Seg Type: ARRAY Description: Creates a four array of DCPowerInStruct |





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

| | |
|---|--|
| User Interface Type TYPE QuadDCPowerRotationEnum : (Up, Right, Down, Left); END_TYPE | |
| Type name | QuadDCPowerRotationEnum |
| Description | Photodetector rotation |
| Definition | ENUM |
| Enum Tag | Name: Up Description: Segment 1 on top or top/right |
| Enum Tag | Name: Right Description: Segment 1 on the right or bottom/right |
| Enum Tag | Name: Down Description: Segment 1 on bottom or bottom/left |
| Enum Tag | Name: Left Description: Segment 1 on the left or top/left |

| 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_STRUCT END_TYPE | |
|--|---|
| Type name | QuadDCPowerStruct |
| Description | Structure of the user interface tags that are used to control the DC power |
| Definition | STRUCT |
| Output Tag | Name: Error Type: ErrorStruct Description: Error handling |
| Output Tag | Name: Seg Type: ARRAY Description: Creates a four array for the four monitors of the DC power |
| Output Tag | Name: Sum Type: LREAL Description: Sum of the four DC power monitors in mW |
| In/Out Tag | Name: Threshold Type: LREAL Description: Threshold for sum in mW |
| In/out Tag | Name: Flip Type: BOOL Description: Counterclockwise numbering of segments |
| In/out Tag | Name: Orientation Type: QuadDCPowerOrientationEnum Description: Plus or cross configuration |
| In/out Tag | Name: Rotation Type: QuadDCPowerRotationEnum Description: Rotation of photodetector in steps of 90 degree |

| | |
|------------|--|
| Output Tag | Name: Pitch Type: LREAL Description: Pitch, calculated by (Top – Bottom) / Sum |
| Output Tag | Name: Yaw Type: LREAL Description: Yaw, calculated by (Right – Left) / Sum |

| | |
|---|---|
| Function Block FUNCTION_BLOCK QuadDCPowerFB VAR_INPUT Request: SaveRestoreEnum; QuadDCPowerIn: QuadDCPowerInStruct; END_VAR VAR_IN_OUT QuadDCPowerInit: QuadDCPowerStruct; QuadDCPower: QuadDCPowerStruct; END_VAR | |
| Name | DCPowerFB |
| Description | Controls the DC Power |
| Input argument | Name: Request Type: SaveRestoreEnum Description: Save/restore command |
| Input argument | Name: QuadDCPowerIn Type: QuadDCPowerInStruct Description: Input hardware structure |
| In/out argument | Name: QuadDCPowerInit Type: QuadDCPowerStruct Description: Interface structure for save/restore |
| In/out argument | Name: QuadDCPower Type: QuadDCPowerStruct Description: User Interface structure |

| Visual | | | |
|---|---|----------------|-----------|
| DC Mon | %3.4f V | DC Offset | %3.4f V |
| DC Current | %3.4f mA | Transimpedance | %3.0f Ohm |
| DC Power | %3.4f mW | Response | %3.3f A/W |
| Limits | %s | | |
| Low | %3.3f mW | High | %3.3f mW |
| Error | %i | %s | |
|  | \$ErrorMessage\$ | | |
|  | \$ErrorMessage\$ | | |
|  | \$ErrorMessage\$ | | |
|  | \$ErrorMessage\$ | | |
| Name | DCPowerVis | | |
| Description | Displays the DC power | | |
| Placeholder | Name: DCPower Type: DCPowerStruct Description: DC power structure | | |

| Visual | | | |
|--------------|---|------------------|----------------|
| DC Power 1 | %3.3 mW | Segment 1 | |
| DC Power 2 | %3.3f mW | Segment 2 | |
| DC Power 3 | %3.3f mW | Segment 3 | |
| DC Power 4 | %3.3f mW | Segment 4 | |
| Sum | %3.3f mW | Threshold | %3.3f mW |
| Pitch | %3.4f | Flip | Orientation %s |
| Yaw | %3.4f | | Rotation %s |
| Error | %i | %s | |
| | | \$ErrorMessage\$ | |
| | | \$ErrorMessage\$ | |
| | | \$ErrorMessage\$ | |
| | | \$ErrorMessage\$ | |
| | | \$ErrorMessage\$ | |
| Name | QuadDCPowerVis | | |
| Description | Displays the DC power monitors, pitch, yaw, and error | | |
| Placeholder | Name: DCPower Type: QuadDCPowerStruct Description: DC power structure | | |