*LIGO Laboratory / LIGO Scientific Collaboration*

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TwinCAT Library for AOM Driver

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| **Library** | |
| Title | AomDriver |
| Version | 1 |
| TwinCAT version | 2.11 |
| Name space | – |
| Author | Daniel Sigg |
| Description | Controls the AM-modulated AOM driver, [E1900038](https://dcc.ligo.org/LIGO-E1900038).  The frequency difference mixer is using the same RF mixer circuit but without a divider and a VCO. It implements none of the extra frequency controls of the VCO neither.  The fixed ratio frequency source locks an OCXO to an RF signal using an internal PLL, in order to generate a clean higher order harmonics.  The RF power monitor has the calibration  The corresponding temperature readout has the calibration  The factor 1.10 is due to the voltage divider at the temperature readout.  The RF power levels can be alarmed when outside ±1dBm of nominal. |
| Error codes | Version 1:  0x01 – Power supply voltages out-of-range  0x02 – Output RF power level out-of-range  0x04 – Excitation switch  Version 2:  0x01 – Power supply voltages out-of-range  0x02 – Output RF power level out-of-range  0x04 – Excitation switch |
| Library dependencies: | Error, SaveRestore, ReadADC. WriteDAC |

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| **Hardware Input Type (Version 1)**  TYPE AomDriverInStruct :  STRUCT  OutputMon: INT;  OutputTemp: INT;  ModulationMon: INT;  Spare: INT;  ExcitationSwitch: BOOL;  PowerOk: BOOL;  END\_STRUCT  END\_TYPE | |
| Type name | AomDriverInStruct |
| Description | Structure of the hardware inputs that are wired up for the AOM driver |
| Definition | STRUCT |
| Element | Name: OutputMon  Type: INT  Description: Monitors the RF power after the output amplifier |
| Element | Name: OutputTemp  Type: INT  Description: Monitors the temperature of the output RF detector |
| Element | Name: ModulationMon  Type: INT  Description: Monitor for the modulation signal |
| Element | Name: Spare  Type: INT  Description: not used |
| Element | Name: ExcitationSwitch  Type: BOOL  Description: Monitors the excitation input enable |
| Element | Name: PowerOk  Type: BOOL  Description: Voltage monitor readback |

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| **Hardware Output Type (Version 1)**  TYPE AomDriverOutStruct :  STRUCT  ModulationBias: INT;  ExcitationEn: BOOL;  DewhiteSwitchAB: BOOL;  DewhiteSwitchA: BOOL;  END\_STRUCT  END\_TYPE | |
| Type name | AomDriverOutStruct |
| Description | Structure of the hardware outputs that are wired up for the AOM Driver |
| Definition | STRUCT |
| Element | Name: ModulationBias  Type: INT  Description: Set point for the modulation bias |
| Element | Name: ExcitationEn  Type: BOOL  Description: Enables the excitation input |
| Element | Name: DewhiteSwitchAB  Type: BOOL  Description: Enables the dewhitening switches A and B |
| Element | Name: DewhiteSwitchA  Type: BOOL  Description: Enables the dewhitening switch A |

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| **Hardware Input Type (Version 2)**  TYPE AomServoInStruct :  STRUCT  OutputMon: INT;  OutputTemp: INT;  ErrorMon: INT;  ControlMon: INT;  Limiter: BOOL;  ExcitationSwitch: BOOL;  RfSwitch: BOOL;  PowerOk: BOOL;  END\_STRUCT  END\_TYPE | |
| Type name | AomServoInStruct |
| Description | Structure of the hardware inputs that are wired up for the AOM servo |
| Definition | STRUCT |
| Element | Name: OutputMon  Type: INT  Description: Monitors the RF power after the output amplifier |
| Element | Name: OutputTemp  Type: INT  Description: Monitors the temperature of the output RF detector |
| Element | Name: ErrorMon  Type: INT  Description: Monitors the input error point |
| Element | Name: ControlMon  Type: INT  Description: Monitors the output control point |
| Element | Name: Limiter  Type: BOOL  Description: Indicates that limits are reached |
| Element | Name: ExcitationSwitch  Type: BOOL  Description: Monitors the excitation input enable |
| Element | Name: RfSwitch  Type: BOOL  Description: Monitors the state of the RF on/off switch |
| Element | Name: PowerOk  Type: BOOL  Description: Voltage monitor readback |

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| **Hardware Output Type (Version 2)**  TYPE AomServoOutStruct :  STRUCT  SetPoint: INT;  DrivePoint: INT;  LowerLimit: INT;  UpperLimit: INT;  Gain: INT;  Polarity: BOOL;  ExcitationEn: BOOL;  Bypass: BOOL;  Boost2: BOOL;  Generic: BOOL;  Boost1: BOOL;  Option: BOOL;  OutputSwitch: BOOL;  DewhiteSwitchA: BOOL;  DewhiteSwitchB: BOOL;  END\_STRUCT  END\_TYPE | |
| Type name | AomServoOutStruct |
| Description | Structure of the hardware outputs that are wired up for the AOM servo |
| Definition | STRUCT |
| Element | Name: SetPoint  Type: INT  Description: Set point (offset) for the error signal of the servo |
| Element | Name: DrivePoint  Type: INT  Description: Drive point (offset) for the control signal of the servo |
| Element | Name: LowerLimit  Type: INT  Description: Lower limit of the output drive |
| Element | Name: UpperLimit  Type: INT  Description: Upper limit of the output drive |
| Element | Name: Gain  Type: INT  Description: Servo gain |
| Element | Name: Polarity  Type: BOOL  Description: Polarity of the input signal |
| Element | Name: ExcitationEn  Type: BOOL  Description: Enables the excitation input |
| Element | Name: Bypass  Type: BOOL  Description: Bypass the servo filters |
| Element | Name: Boost2  Type: BOOL  Description: Enable the second boost |
| Element | Name: Generic  Type: BOOL  Description: Enable the generic filter |
| Element | Name: Boost1  Type: BOOL  Description: Enable the first boost filter |
| Element | Name: Option  Type: BOOL  Description: Enable the option board |
| Element | Name: OutputSwitch  Type: BOOL  Description: Switches between servo and ramp inputs |
| Element | Name: DewhiteSwitchA  Type: BOOL  Description: Enable the dewhitening switch A |
| Element | Name: DewhiteSwitchB  Type: BOOL  Description: Enable the dewhitening switch B |

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| **User Interface Type**  TYPE AomDriverDewehiteEnum :  AomDriverDewhiteNone, AomDriverDewhiteOne, AomDriverDewhiteTwo);  END\_TYPE | |
| Type name | AomDriverPowerEnum |
| Description | Enumerated type to describe the dewhitening switch state of the AOM driver |
| Definition | ENUM |
| Enum Tag | Name: AomDriverDewhiteNone  Short: NONE  Description: None of the dewhitening filters is on |
| Enum Tag | Name: AomDriverDewhiteOne  Short: A  Description: First dewhitening filter is on |
| Enum Tag | Name: AomDriverDewhiteTwo  Short A+B  Description: Both dewhitening filters are on |

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| **User Interface Type (Version 1)**  TYPE AomDriverStruct :  STRUCT  Error: ErrorStruct;  OutputMon: LREAL;  OuptutNom: LREAL;  OutputTemp: LREAL;  ModulationBias: LREAL;  ModulationMon: LREAL;  ExcitationSwitch: BOOL;  ExcitationEn: BOOL;  PowerOk: BOOL;  DewhiteSwitch: AomDriverDewhiteEnum;  END\_STRUCT  END\_TYPE | |
| Type name | AomDriverStruct |
| Description | Structure of the user interface tags that are used to control the AM driver |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: For error handler |
| Output Tag | Name: OutputMon  Type: LREAL  Description: Monitors the RF power after the output amplifier dBm |
| Input Tag | Name: OutputNom  Type: LREAL  Description: Nominal value for the RF power at the output amplifier in dBm |
| Output Tag | Name: OutputTemp  Type: LREAL  Description: Monitors the temperature of the output RF detector in C |
| Input Tag | Name: ModulationBias  Type: LREAL  Description: Set point for the modulation bias in V |
| Output Tag | Name: ModulationMon  Type: LREAL  Description: Monitor for the modulation signal in V |
| Input Tag | Name: ExcitationEn  Type: BOOL  Description: Enables the excitation input |
| Output Tag | Name: ExcitationSwitch  Type: BOOL  Description: Monitors the excitation input enable |
| Output Tag | Name: PowerOk  Type: BOOL  Description: Voltage monitor readback |
| Input Tag | Name: DewhiteSwitch  Type: AomDriverDewhiteEnum  Description: State of dewhitening filter stages |

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| **User Interface Type (Version 2)**  TYPE AomServoStruct :  STRUCT  Error: ErrorStruct;  ErrorMon: INT;  ControlMon: INT;  OutputMon: LREAL;  OuptutNom: LREAL;  OutputTemp: LREAL;  SetPoint: LREAL;  DrivePoint: LREAL;  LowerLimit: LREAL;  UpperLimit: LREAL;  LimitReached: BOOL;  LimitCount: DINT;  LimitReset: BOOL;  RfSwitch: BOOL;  Polarity: BOOL;  ExcitationSwitch: BOOL;  ExcitationEn: BOOL;  Gain: INT;  Bypass: BOOL;  Boost1: BOOL;  Boost2: BOOL;  Generic: BOOL;  Option: BOOL;  OutputRamp: BOOL;  PowerOk: BOOL;  DewhiteSwitch: AomDriverDewhiteEnum;  END\_STRUCT  END\_TYPE | |
| Type name | AomServoStruct |
| Description | Structure of the user interface tags that are used to control the AOM servo |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: For error handler |
| Output Tag | Name: ErrorMon  Type: LREAL  Description: Monitors the input voltage in V |
| Output Tag | Name: ControlMon  Type: LREAL  Description: Monitors the output voltage in V |
| Output Tag | Name: OutputMon  Type: LREAL  Description: Monitors the RF power after the output amplifier dBm |
| Input Tag | Name: OutputNom  Type: LREAL  Description: Nominal value for the RF power at the output amplifier in dBm |
| Output Tag | Name: OutputTemp  Type: LREAL  Description: Monitors the temperature of the output RF detector in C |
| Input Tag | Name: SetPoint  Type: LREAL  Description: Set point for the input bias in V |
| Input Tag | Name: DrivePoint  Type: LREAL  Description: Drive point for the output bias in V |
| Input Tag | Name: LowerLimit  Type: LREAL  Description: Lower limit of the output drive in V |
| Input Tag | Name: UpperLimit  Type: LREAL  Description: Upper limit of the output drive in V |
| Output Tag | Name: LimitReached  Type: BOOL  Description: Indicates that the output limits have been reached |
| Output Tag | Name: LimitCount  Type: DINT  Description: Count of how many times limits have been reached |
| Input Tag | Name: LimitReset  Type: BOOL  Description: Reset the limit count |
| Output Tag | Name: RfSwitch  Type: BOOL  Description: Indicates that the RF amplifier is powered up |
| Input Tag | Name: Polarity  Type: BOOL  Description: Polarity of the input signal |
| Output Tag | Name: ExcitationSwitch  Type: BOOL  Description: Indicates that the excitation is enabled |
| Input Tag | Name: ExcitationEn  Type: BOOL  Description: Enables the excitation input |
| Input Tag | Name: Gain  Type: INT  Description: Servo gain in dB (-32 to +31) |
| Input Tag | Name: Bypass  Type: BOOL  Description: Bypass the servo filters |
| Input Tag | Name: Boost1  Type: BOOL  Description: Enable the first boost filter |
| Input Tag | Name: Boost2  Type: BOOL  Description: Enable the second boost |
| Input Tag | Name: Generic  Type: BOOL  Description: Enable the generic filter |
| Input Tag | Name: Option  Type: BOOL  Description: Enable the option board |
| Input Tag | Name: OutputRamp  Type: BOOL  Description: Switches between servo and ramp inputs |
| Output Tag | Name: PowerOk  Type: BOOL  Description: Voltage monitor readback |
| Input Tag | Name: DewhiteSwitch  Type: AomDriverDewhiteEnum  Description: State of dewhitening filter stages |

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| **Function Block (Version 1)**  FUNCTION\_BLOCK AomDriverFB  VAR\_INPUT  Request: SaveRestoreEnum;  AomDriverIn: AomDriverInStruct;  END\_VAR  VAR\_OUTPUT  AomDriverOut: AomDriverOutStruct;  END\_VAR  VAR\_IN\_OUT  AomDriverInit: AomDriverStruct;  AomDriver: AomDriverStruct;  END\_VAR | |
| Name | AomDriverFB |
| Description | Controls the AOM driver. One function block for each AOM driver chassis needs to be instantiated. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Save restore command |
| Input argument | Name: AomDriverIn  Type: AomDriverInStruct  Description: Input hardware structure |
| Output argument | Name: AomDriverOut  Type: AomDriverOutStruct  Description: Output hardware structure |
| In/out argument | Name: AomDriverInit  Type: AomDriverStruct  Description: Save/restore variables in persistent memory |
| In/out argument | Name: AomDriver  Type: AomDriverStruct  Description: User Interface structure |

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| **Function Block (Version 2)**  FUNCTION\_BLOCK AomServoFB  VAR\_INPUT  Request: SaveRestoreEnum;  AomServoIn: AomServoInStruct;  END\_VAR  VAR\_OUTPUT  AomServoOut: AomServoOutStruct;  END\_VAR  VAR\_IN\_OUT  AomServoInit: AomServoStruct;  AomServo: AomServoStruct;  END\_VAR | |
| Name | AomServoFB |
| Description | Controls the AOM servo. One function block for each AOM servo chassis needs to be instantiated. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Save restore command |
| Input argument | Name: AomServoIn  Type: AomServoInStruct  Description: Input hardware structure |
| Output argument | Name: AomServoOut  Type: AomServoOutStruct  Description: Output hardware structure |
| In/out argument | Name: AomServoInit  Type: AomServoStruct  Description: Save/restore variables in persistent memory |
| In/out argument | Name: AomServo  Type: AomServoStruct  Description: User Interface structure |