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LIGO-E1300706-v1 *advanced LIGO*  9/04/2013

 TwinCAT Library for ALS PDH Locking

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| **Library** |
| Title | ALSPDHLocking |
| Version | 1 |
| TwinCAT version | V2.11.0 |
| Name space |  |
| Author | Sheila Dwyer, Alexa Staley |
| Description | Autolocker for ALS PDH at end station. To begin, the autolocker checks whether the locking conditions have been meet. These conditions are specified in the library; for example, the PLL must be locked. The user is allowed to override these locking conditions by forcing the autolocker to run. When the autolocker runs, the settings on the common mode board for the REFL servo are manipulated until lock is reached (or the acquisition fails). Lock is determined from either the REFL PD or the Trans PD input. The user specifies which to use and the threshold of each. |
| Error Code | 16#2000—Acquisition Failed |
| Library dependencies | ALSCommunication, ALSLaser, ALSLaserLocking, ALSStateMachine, WriteADC, DCPower, DelayLinePhaseShifter, CommonModeServo, Demodulator, Error, FiberDistribution, IscWhitening, LowNoiseVCO, Photodetectors, ReadADC, RFAmplifier, RTCommunication, SaveRestore |

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| **ALS PDH Locking Type**TYPE ALSPDHLockingEnum : (PDHDisengaged, PDHAcquire, PDHLocked, PDHFailed);END\_TYPE; |
| Type name | ALSPDHLockingEnum |
| Description | Specifies the state of the autolocker and arm cavity |
| Definition | ENUM |
| Element | Name: PDHDisengagedDescription: The autolocker is disengaged |
| Element | Name: PDHAcquireDescription: The autolocker is attempting to acquire lock |
| Element | Name: PDHLockedDescription: The arm cavity is locked to the 532nm beam |
| Element | Name: PDHFailedDescription: The autolocker failed to lock the cavity |

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| **User Interface Type**TYPE ALSPDHLockingLogicStruct :STRUCT Conditions: BOOL; LockingCriteria: BOOL; Enable: BOOL; Force: BOOL; On: BOOL; SlowOn: BOOL;END\_STRUCTEND\_TYPE; |
| Type name | ALSPDHLockingLogicStruct |
| Description | Structure used in the user interface type to control the autolocker  |
| Definition | STRUCT |
| Input Tag | Name: ConditionsType: BOOLDescription: Pre-conditions for locking  |
| Input Tag | Name: LockingCriteriaType: BOOLDescription: Locking conditions used to determine arm lock  |
| Input Tag | Name: EnableType: BOOLDescription: Enable autolocker |
| Input Tag | Name: ForceType: BOOLDescription: Force autolocker to engage even if conditions are not met  |
| Output Tag | Name: OnType: BOOLDescription: Autolocker is on  |
| Input Tag | Name: SlowOnType: BOOLDescription: Slow Servo is on  |

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| **User Interface Type**TYPE ALSPDHLockingStruct :STRUCT Error: ErrorStruct; State: ALSPDHLockingEnum; ReflPwrUnlockedNom: LREAL;  ReflPwrLockedPercent: LREAL := 70; TransPDNormThresh: LREAL; Logic: AKSODHLockingLogicStruct; Status: BOOL; LockLosses: INT; ResetLockLosses: BOOL; AcquireGain: INT; LockedGain: INT;END\_STRUCTEND\_TYPE; |
| Type name | ALSPDHLockingStruct |
| Description | Structure used in the user interface type for the autolocker |
| Definition | STRUCT |
| Input/Output Tag | Name: ErrorType: ErrorStructDescription: Calls error handler |
| Output Tag | Name: StateType: ALSPDHLockingEnumDescription: Autolocker state |
| Input Tag | Name: RelfPwrUnlockedNomType: LREALDescription: Nominal power on REFL PD (cavity unlocked) |
| Input Tag | Name: ReflPwrLockedPercentType: LREALDescription: Upper limit on REFL PD (cavity locked); default is 70% |
| Input Tag | Name: TransPDNormThreshType: LREALDescription: Locking threshold set for Trans PD Norm  |
| Output Tag | Name: LogicType: ALSPDHLockingLogicStructDescription: Autolocker logic |
| Output Tag | Name: StatusType: BOOLDescription: Status of 532nm locking |
| Output Tag | Name: LockLossesType: INTDescription: Lock loss count |
| Input Tag | Name: ResetLockLossesType: BOOLDescription: Reset lock loss count  |
| Input Tag | Name: AcquireGainType: INTDescription: Gain to use when acquiring lock (in dB)  |
| Input Tag | Name: LockGainType: INTDescription: Gain to use when locked (in dB) |

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| **Function Block**TYPE ALSPDHLockingFB :VAR\_INPUT Request: SaveRestoreEnum; PLLLocking: ALSLaserLockingStruct; GreenLaserPD: DCPowerStruct; RFAmp: RFAmplifierStruct; RelfPDA: DCPowerStruct; ReflPDB: DCPowerStruct; PhasShifter: DelayLogicStruct; Demod: DemodulatorLscStruct; FromCornerPLC2: CornerPLC2toEndStruct; RealTime: RTCommunicationStruct; DummyREalTimeSend: DWORD;END\_VARVAR\_IN\_OUT ALSPDHLockingInit: ALSPDHLockingStruct; ALSPDHLocking: ALSPHDLockingStruct; Servo: CommonModeStruct; VCO: LowNoiseVCOStruct;END\_VAREND\_TYPE; |
| Type name | ALSPDHLockingStruct |
| Description | This function block attempts to lock the arm cavity to the green beam depending on the user interface commands and locking conditions. This function block also indicates whether lock has been acquired.  |
| Definition |  |
| Input argument | Name: RequestType: SaveRestoreEnumDescription: Request save/restore/safemood or noop |
| Input argument | Name: PLLLockingType: ALSLaserLockingStructDescription: Checks if PLL is locked for locking conditions |
| Input argument | Name: GreenLaserPDType: DCPowerStructDescription: Checks status of green laser PD |
| Input argument | Name: RFAmpType: RFAmplifierStructDescription: Checks status of RF amplifier for locking conditions |
| Input argument | Name: ReflPDAType: DCPowerStruct;Description: Checks reflected PD A DC power  |
| Input argument | Name: ReflPDBType: DCPowerStructDescription: Check reflected PD B DC power |
| Input argument | Name: PhaseShifterType: DelayLogicStructDescription: Checks status of phase shifter for locking conditions |
| Input argument | Name: DemodType: DemodulatorLscStructDescription: Checks status of demodulator for locking conditions |
| Input argument | Name: FromCornerPLC2Type: CornerPLC2toEndStruct;Description: Checks communication from corner station PLC2 to end station |
| Input argument | Name: RealTimeType: RTCommunicationStruct;Description: Checks the real time communication system |
| Input argument | Name: DummyRealTimeSendType: DWORDDescription: Dummy variable for real time |
| In/out argument | Name: ALSPDHLockingInitType: ALSPDHLockingStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: ALSPDHLockingType: ALSPDHLockingStructDescription: User interface structure |
| In/out argument | Name: ServoType: CommdModeStructDescription: User interface structure |
| In/out argument | Name: VCOType: LowNoiseVCOStructDescription: User interface structure |