*LIGO Laboratory / LIGO Scientific Collaboration*

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

TwinCAT Library for ALS PDH Locking

Sheila Dwyer, Alexa Staley

Distribution of this document:

LIGO Scientific Collaboration

This is an internal working note  
of the LIGO Laboratory.

|  |  |
| --- | --- |
| **California Institute of Technology**  **LIGO Project – MS 18-34**  **1200 E. California Blvd.**  **Pasadena, CA 91125**  Phone (626) 395-2129  Fax (626) 304-9834  E-mail: info@ligo.caltech.edu | **Massachusetts Institute of Technology**  **LIGO Project – NW22-295**  **185 Albany St**  **Cambridge, MA 02139**  Phone (617) 253-4824  Fax (617) 253-7014  E-mail: info@ligo.mit.edu |
| **LIGO Hanford Observatory**  **P.O. Box 159**  **Richland WA 99352**  Phone 509-372-8106  Fax 509-372-8137 | **LIGO Livingston Observatory**  **P.O. Box 940**  **Livingston, LA 70754**  Phone 225-686-3100  Fax 225-686-7189 |

http://www.ligo.caltech.edu/

|  |  |
| --- | --- |
| **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 |

|  |  |
| --- | --- |
| **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: PDHDisengaged  Description: The autolocker is disengaged |
| Element | Name: PDHAcquire  Description: The autolocker is attempting to acquire lock |
| Element | Name: PDHLocked  Description: The arm cavity is locked to the 532nm beam |
| Element | Name: PDHFailed  Description: The autolocker failed to lock the cavity |

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

|  |  |
| --- | --- |
| **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\_STRUCT  END\_TYPE; | |
| Type name | ALSPDHLockingStruct |
| Description | Structure used in the user interface type for the autolocker |
| Definition | STRUCT |
| Input/Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| Output Tag | Name: State  Type: ALSPDHLockingEnum  Description: Autolocker state |
| Input Tag | Name: RelfPwrUnlockedNom  Type: LREAL  Description: Nominal power on REFL PD (cavity unlocked) |
| Input Tag | Name: ReflPwrLockedPercent  Type: LREAL  Description: Upper limit on REFL PD (cavity locked); default is 70% |
| Input Tag | Name: TransPDNormThresh  Type: LREAL  Description: Locking threshold set for Trans PD Norm |
| Output Tag | Name: Logic  Type: ALSPDHLockingLogicStruct  Description: Autolocker logic |
| Output Tag | Name: Status  Type: BOOL  Description: Status of 532nm locking |
| Output Tag | Name: LockLosses  Type: INT  Description: Lock loss count |
| Input Tag | Name: ResetLockLosses  Type: BOOL  Description: Reset lock loss count |
| Input Tag | Name: AcquireGain  Type: INT  Description: Gain to use when acquiring lock (in dB) |
| Input Tag | Name: LockGain  Type: INT  Description: Gain to use when locked (in dB) |

|  |  |
| --- | --- |
| **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\_VAR  VAR\_IN\_OUT  ALSPDHLockingInit: ALSPDHLockingStruct;  ALSPDHLocking: ALSPHDLockingStruct;  Servo: CommonModeStruct;  VCO: LowNoiseVCOStruct;  END\_VAR  END\_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: Request  Type: SaveRestoreEnum  Description: Request save/restore/safemood or noop |
| Input argument | Name: PLLLocking  Type: ALSLaserLockingStruct  Description: Checks if PLL is locked for locking conditions |
| Input argument | Name: GreenLaserPD  Type: DCPowerStruct  Description: Checks status of green laser PD |
| Input argument | Name: RFAmp  Type: RFAmplifierStruct  Description: Checks status of RF amplifier for locking conditions |
| Input argument | Name: ReflPDA  Type: DCPowerStruct;  Description: Checks reflected PD A DC power |
| Input argument | Name: ReflPDB  Type: DCPowerStruct  Description: Check reflected PD B DC power |
| Input argument | Name: PhaseShifter  Type: DelayLogicStruct  Description: Checks status of phase shifter for locking conditions |
| Input argument | Name: Demod  Type: DemodulatorLscStruct  Description: Checks status of demodulator for locking conditions |
| Input argument | Name: FromCornerPLC2  Type: CornerPLC2toEndStruct;  Description: Checks communication from corner station PLC2 to end station |
| Input argument | Name: RealTime  Type: RTCommunicationStruct;  Description: Checks the real time communication system |
| Input argument | Name: DummyRealTimeSend  Type: DWORD  Description: Dummy variable for real time |
| In/out argument | Name: ALSPDHLockingInit  Type: ALSPDHLockingStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: ALSPDHLocking  Type: ALSPDHLockingStruct  Description: User interface structure |
| In/out argument | Name: Servo  Type: CommdModeStruct  Description: User interface structure |
| In/out argument | Name: VCO  Type: LowNoiseVCOStruct  Description: User interface structure |