*LIGO Laboratory / LIGO Scientific Collaboration*

LIGO- E1700239-v1 Advanced LIGO 7/10/2017

TwinCAT Library for
4th Generation TTFSS

Daniel Sigg

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

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

|  |
| --- |
| **Library** |
| Title | TtFssV4 |
| Version | 1 |
| TwinCAT version | 2.11 |
| Name space | – |
| Author | Daniel Sigg |
| Description | Controls the 4th generation TTFFS, .The RF detector measures the power off a -20 dB directional coupler. It is a logarithmic device and has the following equation:LO: $P=-75 dBm+16.667 dBm/V×U$RF: $P=-72 dBm+16.667 dBm/V×U$ |
| Error code | TtFssV4:1 – DemodulatorDemod:1 – Power supply voltages out-of-range2 – LO power level out-of-range3 – RF power level overload4 – Sign is wrong |
| Library dependencies | ReadADC, WriteADC, Error, SaveRestore, Demodulator |

|  |
| --- |
| **Hardware Input Type**TYPE TtFssV4InStruct :STRUCT LoMon: INT; RfMon: INT; MixerMon: INT EomRmsMon: INT; FastMon: INT;  ComExcSw: BOOL; FastExcSw: BOOL; PfdSignSw: BOOL; PowerOk: BOOL;END\_STRUCTEND\_TYPE |
| Type name | TtFssV4InStruct |
| Description | Structure of the hardware inputs that are wired to the TTFFS V4 |
| Definition | STRUCT |
| Element | Name: RFMonType: INTDescription: Monitors the RF power at the RF input |
| Element | Name: LOMonType: INTDescription: Monitors the RF power at the LO input |
| Element | Name: MixerMonType: INTDescription: Mixer output monitor |
| Element | Name: EomRmsMonType: INTDescription: Eom RMS monitor |
| Element | Name: FastMonType: INTDescription: Fast output monitor |
| Element | Name: ComExcSwType: BOOLDescription: Common excitation switch |
| Element | Name: FastExcSwType: BOOLDescription: Fast excitation switch |
| Element | Name: PfdSignSwType: BOOLDescription: Sign of phase-frequency discriminator |
| Element | Name: PowerOkType: BOOLDescription: Voltage monitor readback |

|  |
| --- |
| **Hardware Output Type**TYPE TtFssV4OutStruct :STRUCT ComGain: INT; ComOfs: INT; FastGain: INT; FastOfs: INT; SlowOfs: INT; AoEn: BOOL; Boost1: BOOL; ComExcEn: BOOL; FastExcEn: BOOL; RampEn: BOOL; EomEn: BOOL; PfdSign: BOOL; FastSign: BOOL; Boost2: BOOL; Boost3: BOOL; Spare1: BOOL; Spare2: BOOL;END\_STRUCTEND\_TYPE |
| Type name | TtFssV4OutStruct |
| Description | Structure of the hardware output that are wired to the TTFSS V4 |
| Definition | STRUCT |
| Element | Name: ComGainType: INTDescription: Common path gain |
| Element | Name: ComOfsType: INTDescription: Common path offset adjust |
| Element | Name: FastGainType: INTDescription: Fast path gain |
| Element | Name: FastOfsType: INTDescription: Fast path offset adjust |
| Element | Name: SlowOfsType: INTDescription: Slow path output |
| Element | Name: AoEnType: BOOLDescription: AO enable |
| Element | Name: Boost1Type: BOOLDescription: Boost1 enable |
| Element | Name: ComExcEnType: BOOLDescription: Common excitation enable |
| Element | Name: FastExcEnType: BOOLDescription: Fast excitation enable |
| Element | Name: RampEnType: BOOLDescription: Ramp input enable |
| Element | Name: EomEnType: BOOLDescription: EOM path enable |
| Element | Name: PfdSignType: BOOLDescription: Sign of PFD |
| Element | Name: FastSgnType: BOOLDescription: Sign of fast path |
| Element | Name: Boost2Type: BOOLDescription: Boost2 enable |
| Element | Name: Boost3Type: BOOLDescription: Boost3 enable |
| Element | Name: Spare1Type: BOOLDescription: Spare1 enable |
| Element | Name: Spare2Type: BOOLDescription: Spare2 enable |

|  |
| --- |
| **User Interface Type**TYPE TtFssV4Struct :STRUCT Error: ErrorStruct; Demod: DemodulatorLscStruct;  MixerMon: LREAL;  FastMon: LREAL;  EomRmsMon: LREAL; ComExcSw: BOOL;  FastExcSw: BOOL; PowerOk: BOOL;  ComGain: LREAL;  ComOfs: LREAL;  FastGain: LREAL;  FastOfs: LREAL;  SlowOfs: LREAL; AoEn: BOOL;  Pol: BOOL;  Boost1En: BOOL;  Boost2En: BOOL;  Boost3En: BOOL;  ComExcEn: BOOL;  FastExcEn: BOOL;  FastPol: BOOL;  RampEn: BOOL;  EomEn: BOOL;  Spare1: BOOL;  Spare2: BOOL; END\_STRUCTEND\_TYPE |
| Type name | TtFssV4Struct |
| Description | Structure of the user interface tags that are used to control the TTFSS V4 |
| Definition | STRUCT |
| Output Tag | Name: ErrorType: ErrorStructDescription: For error handling |
| In/Outt Tag | Name: DemodType: DemodulatorLscStructDescription: Represents the demodulator section |
| Output Tag | Name: MixerMonType: LREALDescription: Monitors the mixer output in V |
| Output Tag | Name: FastMonType: LREALDescription: Monitors the fast output in V |
| Output Tag | Name: EomRmsMonType: LREALDescription: Monitors the EOM output in Vrms |
| Output Tag | Name: ComExcSwType: BOOLDescription: Common excitation switch |
| Output Tag | Name: FastExcSwType: BOOLDescription: Fast excitation switch |
| Output Tag | Name: PowerOkType: BOOLDescription: Voltage monitor readback |
| Input Tag | Name: ComGainType: LREALDescription: Common gain in dB (-10 to +30) |
| Input Tag | Name: ComOfsType: LREALDescription: Common path offset adjust |
| Input Tag | Name: FastGainType: LREALDescription: Fast gain in dB (-10 to +30) |
| Input Tag | Name: FastOfsType: LREALDescription: Fast path offset adjust |
| Input Tag | Name: SlowOfsType: LREALDescription: Slow path offset |
| Input Tag | Name: AoEnType: BOOLDescription: Additive offset enable |
| Input Tag | Name: PolType: BOOLDescription: Common sign |
| Input Tag | Name: Boost1EnType: BOOLDescription: Boost 1 enable |
| Input Tag | Name: Boost2EnType: BOOLDescription: Boost 2 enable |
| Input Tag | Name: Boost3En Type: BOOLDescription: Boost 3 enable |
| Input Tag | Name: ComExcEnType: BOOLDescription: Common excitation enable |
| Input Tag | Name: FastExcEnType: BOOLDescription: Fast excitation enable |
| Input Tag | Name: FastPolType: BOOLDescription: Fast sign |
| Input Tag | Name: RampEnType: BOOLDescription: Ramp input enable |
| Input Tag | Name: EomEnType: BOOLDescription: EOM path option enable |
| Input Tag | Name: Spare1Type: BOOLDescription: Spare1 enable |
| Input Tag | Name: Spare2Type: BOOLDescription: Spare2 enable |

|  |
| --- |
| **Function Block**FUNCTION\_BLOCK TtFssV4FBVAR\_INPUT DemodulatorType: DemodulatorTypeEnum := PhaseFrequency; Request: SaveRestoreEnum; TtFssIn: TtFssV4InStruct; END\_VARVAR\_OUTPUT TtFssOut: TtFssV4OutStruct;END\_VARVAR\_IN\_OUT TtFssInit: TtFssV4Struct; TtFss: TtFssV4Struct;END\_VAR |
| Name | TtFssV4FB |
| Description | Controls the 4th generation TTFSS.  |
| Input argument | Name: DemodulatorTypeType: DemodulatorTypeEnumDescription: Describes the demodulator (PhaseFrequency or SingleFast) |
| Input argument | Name: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop |
| Input argument | Name: TtFssInType: TtFssV4InStructDescription: Input hardware structure |
| Output argument | Name: TtFssOutType: TtFssV4OutStructDescription: Output hardware structure |
| In/out argument | Name: TtFssInitType: TtFssV4StructDescription: Save/restor variable in persistent memory |
| In/out argument | Name: TtFssType: TtFssV4StructDescription: User Interface structure |