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LIGO- E1200424-v5 Advanced LIGO 1/21/2013

TwinCAT Library for ISC Whitening Chassis

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| **Library** | |
| Title | IscWhitening |
| Version | 5 |
| TwinCAT version | 2.11 |
| Name space | IscWhitening |
| Author | Daniel Sigg |
| Description | Controls an ISC whitening chassis, [D1002559](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=21724), through the 384-channel binary IO chassis, [D1100251](https://dcc.ligo.org/cgi-bin/DocDB/ShowDocument?docid=33399). The binary IO chassis is controlled through a Modbus interface using four Acromag ES2113 that are connected to an EtherCAT-to-Modbus gateway, HMS AB9000. The setup instructions can be found in [T1100607](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=76566) and [C1107420](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=76567).  The ISC whitening chassis contain 8 channels of whitening, [D1001530](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=12594). Each whitening channel employs a gain slider and 3 separately switchable filter stages. The ISC whitening chassis are used to interface the I and Q readouts of an LSC demodulator to the DAQ system, they are used to interface the I and Q readouts of a ASC wavefront sensor, and they are used to interface the 4 segments of a QPD (quad photodiode). Four LSC demodulators can be controlled from a single ISC whitening chassis, or one wavefront sensor, or two QPDs. Up to 6 ISC whitening chassis are controlled from a 384-channel binary IO chassis.  This library is organized in two parts:  - An interface to the binary IO chassis that controls individual IO lines and organizes them by ISC whitening chassis, and - Individual interfaces for the LSC PDs, ASC WFSs and QPDs which interface with the above binary IO chassis data structures. |
| Error codes | 0x0001 – Illegal chassis number  0x0002 – Illegal channel index number  Individual channel error indications:  0x0004 – Invalid data (first channel)  0x0008 – Invalid data (second channel)  …  0x0200 – Invalid data (eighth channel)  For unified interfaces over multiple channels:  0x0400 – Readback different  0x0800 – Gain different  0x1000 – GainStep different  0x2000 – Filter different  0x4000 – Set different  0x8000 – Toggle different |
| Library dependencies | Error, SaveRestore, TcSystem, TcEtherCAT |

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| **Hardware Input Type**  TYPE IscWhiteningInStruct :  STRUCT  LiveList: ARRAY[1..8] OF BYTE;  PCB: ARRAY[1..4,1..13] OF WORD;  InfoData: IscWhiteningInfoDataStruct;  END\_STRUCT  END\_TYPE | |
| Type name | IscWhiteningInStruct |
| Description | Structure of the hardware inputs that mapped into the EtherCAT memory space by the EtherCAT-to-Modbus gateway. For mapping see next page. |
| Definition | STRUCT |
| Element | Name: LiveList  Type: ARRAY[1..8] OF BYTE  Description: Information about the active connections, see HMS AB9000 manual |
| Element | Name: PCB  Type: ARRAY[1..4,1..13] OF WORD  Description: Readbacks form the binary IO chassis, see HMS AB9000 and ES2113 manual |
| Element | Name: InfoData  Type: IscWhiteningInfoDataStruct  Description: State and AMS address information of the gateway. |

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| **Hardware Output Type**  TYPE IscWhiteningOutStruct :  STRUCT  PCB: ARRAY[1..4,1..6] OF WORD;  LiveList: ARRAY[1..8] OF BYTE;  InfoData: IscWhiteningInfoDataStruct;  END\_STRUCT  END\_TYPE | |
| Type name | IscWhiteningOutStruct |
| Description | Structure of the hardware outputs that mapped into the EtherCAT memory space by the EtherCAT-to-Modbus gateway. The outputs LiveList and InfoData are used in configurations where multiple 384-channel binary IO chassis are read through the same EtherCAT-to-Modbus gateway. In this case only the first IO chassis connects to the LiveList and InfoData of the gateway, whereas the following chassis daisy chain with the corresponding outputs of the previous chassis. For mapping see next page. |
| Definition | STRUCT |
| Element | Name: PCB  Type: ARRAY[1..4,1..6] OF WORD  Description: Controls to the binary IO chassis, see HMS AB9000 and ES2113 manual |
| Element | Name: LiveList  Type: ARRAY[1..8] OF BYTE  Description: Information about the active connections, see HMS AB9000 manual. This output list strips the first 12 bits and shifts the result by 12 bits to the left, effectively removing the live bits of the chassis associated with this structure. This can be used in a daisy chain configuration as an input live list for the next chassis in the chain. |
| Element | Name: InfoData  Type: IscWhiteningInfoDataStruct  Description: State and AMS address information of the gateway. |

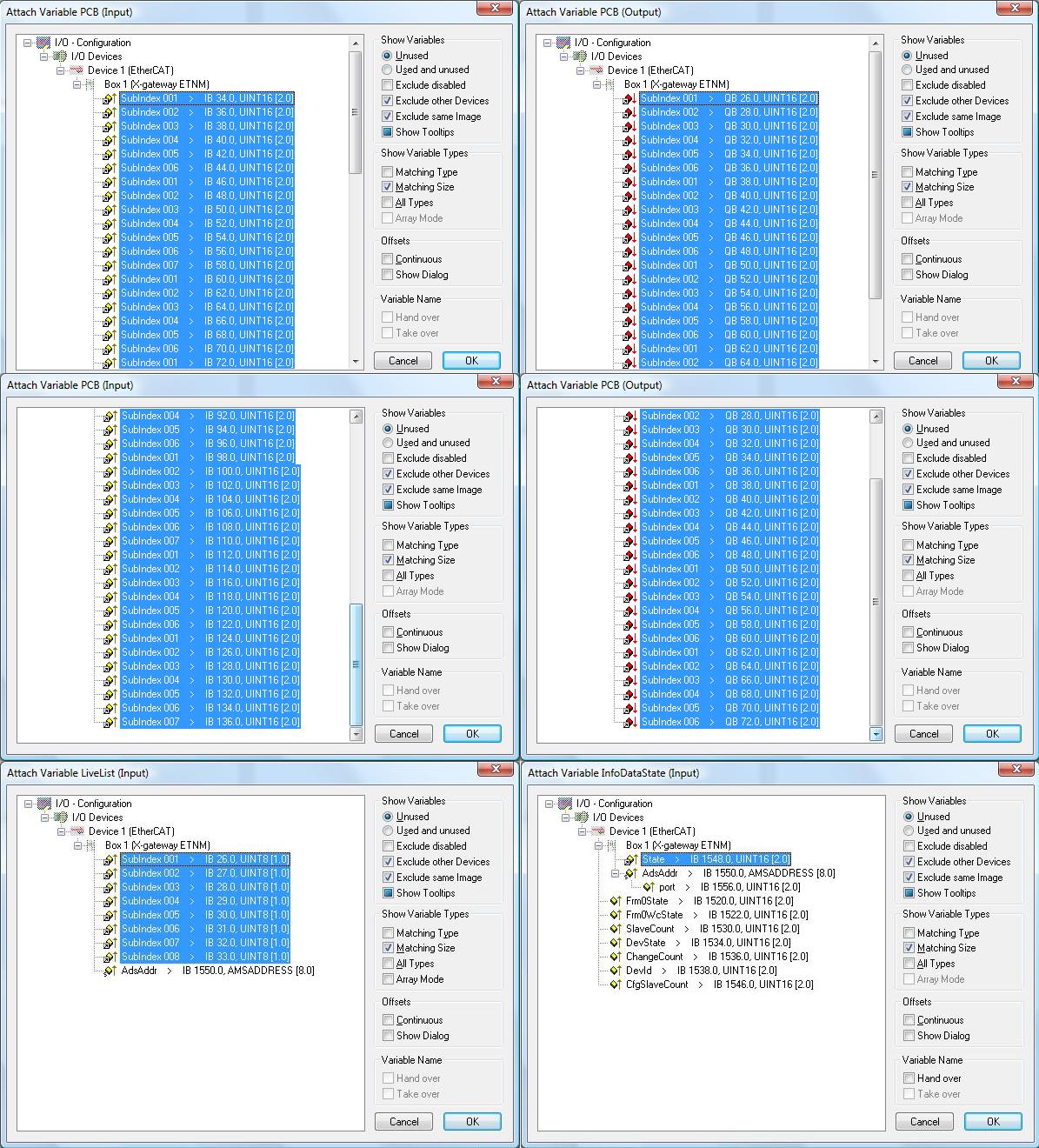


Fig 1. Mapping of IO structures into the EtherCAT memory space.

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| **Internal Interface Type**  TYPE IscWhiteningStruct :  STRUCT  Chassis: ARRAY[1..6] OF IscWhiteningRawChassisStruct;  END\_STRUCT  END\_TYPE | |
| Type name | IscWhiteningStruct |
| Description | Internal interface structure between the binary IO chassis function blocks and the ISC whitening chassis function blocks |
| Definition | STRUCT |
| Input/Output Tag | Name: Chassis  Type: ARRAY[1..6] OF IscWhiteningRawChassisStruct  Description: Contains the binary IO data organized by chassis and channel. |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningInterfaceFB  VAR\_INPUT  Request: SaveRestoreEnum;  SequenceID: INT;  In: IscWhiteningInStruct;  END\_VAR  VAR\_OUTPUT  Out: IscWhiteningOutStruct;  END\_VAR  VAR\_IN\_OUT  Val: IscWhiteningStruct;  ValInit: IscWhiteningStruct;  END\_VAR | |
| Name | IscWhiteningInterfaceFB |
| Description | Controls a 384-channel binary IO chassis. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| Input argument | Name: SequencID  Type: INT  Description: Must be set to 1 for the first binary IO chassis, 2 for the second, etc. |
| Input argument | Name: In  Type: IscWhiteningInStruct  Description: Input hardware structure |
| Output argument | Name: Out  Type: IscWhiteningOutStruct  Description: Output hardware structure |
| In/out argument | Name: ValInit  Type: IscWhiteningStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: Val  Type: IscWhiteningStruct  Description: Internal interface structure |

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| **User Interface Type**  TYPE IscWhiteningChannelStruct :  STRUCT  Error: ErrorStruct;  Gain: INT;  GainStep: INT;  Filter: ARRAY [1..3] OF BOOL;  Set: ARRAY [1..3] OF BOOL;  Toggle: ARRAY [1..3] OF BOOL;  Readback: BYTE;  END\_STRUCT  END\_TYPE | |
|  | IscWhiteningChannelStruct |
| Description | Structure of the user interface tags that are used to control a single channel of the ISC whitening chassis |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: Gain  Type: INT  Description: Whitening gain in dB from 0 dB to 45 dB in 3 dB steps.  This value is tight to GainStep. Any change in one of the two variables will updated the other. |
| In/Out Tag | Name: GainStep  Type: INT  Description: Whitening gain in steps from 0 to 15.  This value is tight to Gain. Any change in one of the two variables will updated the other. |
| Output Tag | Name: Filter  Type: ARRAY [1..3] OF BOOL  Description: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: Set  Type: ARRAY [1..3] OF BOOL  Description: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: Toggle  Type: ARRAY [1..3] OF BOOL  Description: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: Readback  Type: BYTE  Description: Bit encoded readback value from the whitening chassis |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningChannelFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  Index: INT; (\* 1 to 8 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  ChannelInit: IscWhiteningChannelStruct;  Channel: IscWhiteningChannelStruct;  END\_VAR | |
| Name | IscWhiteningChannelFB |
| Description | Controls a single channel in the whitening chassis (1 byte)  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| Input argument | Name: Index  Type: INT  Description: Select the channel: Index from 1 to 8 |
| In/out argument | Name: ChannelInit  Type: IscWhiteningChannelStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: Channel  Type: IscWhiteningChannelStruct  Description: User Interface structure for a single channel of ISC whitening |

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| **User Interface Type**  TYPE IscWhiteningDemodIQStruct :  STRUCT  Error: ErrorStruct;  I: IscWhiteningChannelStruct;  Q: IscWhiteningChannelStruct;  END\_STRUCT  END\_TYPE | |
| Type name | IscWhiteningDemodIQStruct |
| Description | Structure of the user interface tags that are used to control two channels of the ISC whitening chassis which are used for an LSC demodulator |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: I  Type: IscWhiteningChannelStruct  Description: |
| In/Out Tag | Name: Q  Type: IscWhiteningChannelStruct  Description: Whitening gain in steps from 0 to 15.  This value is tight to Gain. Any change in one of the two variables will update the other. |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningDemodIQFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  Index: INT; (\* 1, 3, 5 or to 7 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  DemodInit: IscWhiteningDemodIQStruct;  Demod: IscWhiteningDemodIQStruct;  END\_VAR | |
| Name | IscWhiteningDemodIQFB |
| Description | Controls two channels in the whitening chassis (2 bytes)  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| Input argument | Name: Index  Type: INT  Description: Select the channel: Index is 1, 3, 5, or 7  The selected index represents the quad-phase channel, whereas Index+1 represents the in-phase channel. |
| In/out argument | Name: DemodInit  Type: IscWhiteningDemodIQStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: Demod  Type: IscWhiteningDemodIQStruct  Description: User Interface structure for two channels of ISC whitening describing the I and Q channels of a LSC demodulator. |

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| **User Interface Type**  TYPE IscWhiteningSimpleDemodIQStruct:  STRUCT  Error: ErrorStruct;  Gain: INT;  GainStep: INT;  Filter: ARRAY [1..3] OF BOOL;  Set: ARRAY [1..3] OF BOOL;  Toggle: ARRAY [1..3] OF BOOL;  IReadback: BYTE;  QReadback: BYTE;  END\_STRUCT  END\_TYPE | |
|  | IscWhiteningSimpleDemodIQStruct |
| Description | Simplified structure of the user interface tags that are used to control two channels of the ISC whitening chassis which are used for an LSC demodulator. All channels are switched simultaneously. |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: Gain  Type: INT  Description: Whitening gain in dB from 0 dB to 45 dB in 3 dB steps.  This value is tight to GainStep. Any change in one of the two variables will updated the other. |
| In/Out Tag | Name: GainStep  Type: INT  Description: Whitening gain in steps from 0 to 15.  This value is tight to Gain. Any change in one of the two variables will updated the other. |
| Output Tag | Name: Filter  Type: ARRAY [1..3] OF BOOL  Description: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: Set  Type: ARRAY [1..3] OF BOOL  Description: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: Toggle  Type: ARRAY [1..3] OF BOOL  Description: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: IReadback  Type: BYTE  Description: Bit encoded readback value from the whitening chassis I-phase channel |
| Output Tag | Name: QReadback  Type: BYTE  Description: Bit encoded readback value from the whitening chassis Q-phase channel |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningSimpleDemodIQFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  Index: INT; (\* 1, 3, 5 or to 7 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  DemodInit: IscWhiteningSimpleDemodIQStruct;  Demod: IscWhiteningSimpleDemodIQStruct;  END\_VAR | |
| Name | IscWhiteningSimpleDemodIQFB |
| Description | Controls two channels in the whitening chassis (2 bytes). All channels are switched simultaneously.  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| Input argument | Name: Index  Type: INT  Description: Select the channel: Index is 1, 3, 5, or 7  The selected index represents the quad-phase channel, whereas Index+1 represents the in-phase channel. |
| In/out argument | Name: DemodInit  Type: IscWhiteningSimpleDemodIQStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: Demod  Type: IscWhiteningSimpleDemodIQStruct  Description: User Interface structure for two channels of ISC whitening describing the I and Q channels of a LSC demodulator. |

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| **User Interface Type**  TYPE IscWhiteningDemodWfsStruct :  STRUCT  Error: ErrorStruct;  Seg: ARRAY [1..4] OF IscWhiteningDemodIQStruct;  END\_STRUCT  END\_TYPE | |
| Type name | IscWhiteningDemodWfsStruct |
| Description | Structure of the user interface tags that are used to control eight channels of the ISC whitening chassis which are used for an ASC wavefront sensor demodulator. |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: Seg  Type: ARRAY [1..4] OF IscWhiteningDemodIQStruct  Description: The four segments of a wavefront sensor |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningDemodWfsFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  DemodWfsInit: IscWhiteningDemodWfsStruct;  DemodWfs: IscWhiteningDemodWfsStruct;  END\_VAR | |
| Name | IscWhiteningDemodWfsFB |
| Description | Controls eight channels in a whitening chassis (8 bytes)  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| In/out argument | Name: DemodWfsInit  Type: IscWhiteningDemodWfsStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: DemodWfs  Type: IscWhiteningDemodWfsStruct  Description: User Interface structure for eight channels of ISC whitening describing the I and Q channels of a four segment ASC wavefront sensor demodulator. |

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| **User Interface Type**  TYPE IscWhiteningSimpleDemodWfsStruct:  STRUCT  Error: ErrorStruct;  Gain: INT;  GainStep: INT;  Filter: ARRAY [1..3] OF BOOL;  Set: ARRAY [1..3] OF BOOL;  Toggle: ARRAY [1..3] OF BOOL;  IReadback: DWORD;  QReadback: DWORD;  END\_STRUCT  END\_TYPE | |
|  | IscWhiteningSimpleDemodWfsStruct |
| Description | Simplified of the user interface tags that are used to control eight channels of the ISC whitening chassis which are used for an ASC wavefront sensor demodulator. All channels are switched simultaneously. |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: Gain  Type: INT  Description: Whitening gain in dB from 0 dB to 45 dB in 3 dB steps.  This value is tight to GainStep. Any change in one of the two variables will updated the other. |
| In/Out Tag | Name: GainStep  Type: INT  Description: Whitening gain in steps from 0 to 15.  This value is tight to Gain. Any change in one of the two variables will updated the other. |
| Output Tag | Name: Filter  Type: ARRAY [1..3] OF BOOL  Description: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: Set  Type: ARRAY [1..3] OF BOOL  Description: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: Toggle  Type: ARRAY [1..3] OF BOOL  Description: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: IReadback  Type: DWORD  Description: Bit encoded readback value from the four whitening chassis I-phase channels. Least significant byte is first channel. |
| Output Tag | Name: QReadback  Type: DWORD  Description: Bit encoded readback value from the four whitening chassis Q-phase channel. Least significant byte is first channel. |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningSimpleDemodWfsFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  DemodWfsInit: IscWhiteningSimpleDemodWfsStruct;  DemodWfs: IscWhiteningSimpleDemodWfsStruct;  END\_VAR | |
| Name | IscWhiteningSimpleDemodWfsFB |
| Description | Controls eight channels in a whitening chassis (8 bytes). All channels are switched simultaneously.  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| In/out argument | Name: DemodWfsInit  Type: IscWhiteningSimpleDemodWfsStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: DemodWfs  Type: IscWhiteningSimpleDemodWfsStruct  Description: User Interface structure for eight channels of ISC whitening describing the I and Q channels of a four segment ASC wavefront sensor demodulator. |

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| **User Interface Type**  TYPE IscWhiteningQpdStruct :  STRUCT  Error: ErrorStruct  Seg: ARRAY [1..4] OF IscWhiteningChannelStruct;  END\_STRUCT  END\_TYPE | |
| Type name | IscWhiteningQpdStruct |
| Description | Structure of the user interface tags that are used to control four channels of the ISC whitening chassis which are used for an ASC quadrant photo detector. |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: Seg  Type: ARRAY [1..4] OF IscWhiteningChannelStruct  Description: The four segments of a QPD sensor |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningQpdFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  Index: INT; (\* 1 or 5 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  QpdInit: IscWhiteningQpdStruct;  Qpd: IscWhiteningQpdStruct;  END\_VAR | |
| Name | IscWhiteningQpdFB |
| Description | Controls four channels in a whitening chassis (4 byte)  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| Input argument | Name: Index  Type: INT  Description: Select the channel: Index from 1 or 5  The selected index represents the first channel of a QPD, whereas Index+1, Index+2 and Index+3 represent the second, third and forth channel, respectively. |
| In/out argument | Name: QpdInit  Type: IscWhiteningQpdStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: Qpd  Type: IscWhiteningQpdStruct  Description: User Interface structure for four channels of ISC whitening describing the channels of a four segment ASC quad photodiode. |

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| **User Interface Type**  TYPE IscWhiteningSimpleQpdStruct:  STRUCT  Error: ErrorStruct;  Gain: INT;  GainStep: INT;  Filter: ARRAY [1..3] OF BOOL;  Set: ARRAY [1..3] OF BOOL;  Toggle: ARRAY [1..3] OF BOOL;  Readback: DWORD;  END\_STRUCT  END\_TYPE | |
|  | IscWhiteningSimpleQpdStruct |
| Description | Simplified structure of the user interface tags that are used to control four channels of the ISC whitening chassis which are used for an ASC quadrant photo detector. All channels are switched simultaneously. |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Calls error handler |
| In/Out Tag | Name: Gain  Type: INT  Description: Whitening gain in dB from 0 dB to 45 dB in 3 dB steps.  This value is tight to GainStep. Any change in one of the two variables will updated the other. |
| In/Out Tag | Name: GainStep  Type: INT  Description: Whitening gain in steps from 0 to 15.  This value is tight to Gain. Any change in one of the two variables will updated the other. |
| Output Tag | Name: Filter  Type: ARRAY [1..3] OF BOOL  Description: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: Set  Type: ARRAY [1..3] OF BOOL  Description: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: Toggle  Type: ARRAY [1..3] OF BOOL  Description: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: Readback  Type: DWORD  Description: Bit encoded readback value from the four whitening chassis QPD channels. Least significant byte is first channel. |

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| **Function Block**  FUNCTION\_BLOCK IscWhiteningSimpleQpdFB  VAR\_INPUT  Request: SaveRestoreEnum;  Chassis: INT; (\* 1 to 6 \*)  Index: INT; (\* 1 or 5 \*)  END\_VAR  VAR\_IN\_OUT  IscWhitening: IscWhiteningStruct;  QpdInit: IscWhiteningSimpleQpdStruct;  Qpd: IscWhiteningSimpleQpdStruct;  END\_VAR | |
| Name | IscWhiteningSimpleQpdFB |
| Description | Controls four channels in a whitening chassis (4 byte). All channels are switched simultaneously.  Call this function block before IscWhiteningInterfaceFB. |
| Input argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhitening  Type: IscWhiteningStruct  Description: Internal interface structure |
| Input argument | Name: Chassis  Type: INT  Description: Select the chassis: Values from 1 to 6 |
| Input argument | Name: Index  Type: INT  Description: Select the channel: Index from 1 or 5  The selected index represents the first channel of a QPD, whereas Index+1, Index+2 and Index+3 represent the second, third and forth channel, respectively. |
| In/out argument | Name: QpdInit  Type: IscWhiteningSimpleQpdStruct  Description: Save/restore variable in persistent memory |
| In/out argument | Name: Qpd  Type: IscWhiteningSimpleQpdStruct  Description: User Interface structure for four channels of ISC whitening describing the channels of a four segment ASC quad photodiode. |

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| **Program Example:**  PROGRAM Whitening  VAR  IscWhiteningIn AT %IB0: IscWhiteningInStruct;  IscWhiteningOut AT %QB0: IscWhiteningOutStruct;  IscWhitening: IscWhiteningStruct;  IscWhiteningChassis: IscWhiteningInterfaceFB;  LenSensor: ARRAY [1..4] OF IscWhiteningDemodIQStruct;  Power: IscWhiteningChannelStruct;  Wfs: ARRAY [1..2] OF IscWhiteningDemodWfsStruct;  Qpd: ARRAY [1..2] OF IscWhiteningQpdStruct;  DemodLen: ARRAY [1..4] OF IscWhiteningDemodIQFB;  MonitorPower: IscWhiteningChannelFB;  DemodWfs: ARRAY [1..2] OF IscWhiteningDemodWfsFB;  MonitorQpd: ARRAY [1..2] OF IscWhiteningQpdFB;  SaveRestore: SaveRestoreFB;  GotoSafe: BOOL;  Request: SaveRestoreEnum;  I: INT;  END\_VAR  VAR PERSISTENT  IscWhiteningInit: IscWhiteningStruct;  END\_VAR  SaveRestore(SaveInterval := T#1m, GotoSafe := GotoSafe, Request => Request);  (\* Process individual sensors \*)  FOR I := 1 TO 4 DO  DemodLen[I] (IscWhitening := IscWhitening, Chassis := 1, Index := I, Demod := LenSensor[I]);  END\_FOR;  MonitorPower (IscWhitening := IscWhitening, Chassis := 1, Index := 5, Channel := Power);  FOR I := 1 TO 2 DO  DemodWfs[I] (IscWhitening := IscWhitening, Chassis := I+1, DemodWfs := Wfs[I]);  END\_FOR;  FOR I := 1 TO 2 DO  MonitorQpd[I] (IscWhitening := IscWhitening, Chassis := 4, Index := I+4, Qpd := Qpd[I]);  END\_FOR;  (\* Process whitening chassis after individual sensors \*)  IscWhiteningChassis (Request := Request, SequenceID := 1, In := IscWhiteningIn,   Out => IscWhiteningOut, Val := IscWhitening, ValInit := IscWhiteningInit); |

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| **Visual**  **IscWhiteningVis.jpg** | |
| Name | IscWhiteningVis |
| Description | Displays the tags of an 384-channel binary IO chassis organized in six ISC whitening chassis which in turn show a list of 8 channels each. Each channel has 8 bits (1 byte) and shows the readback value. It lets you choose a new set value or apply a toggle value. The channel background turns red if the value is invalid. |
| Placeholder | Name: whitening  Type: IscWhiteningStruct  Description: Internal interface structure |

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| **Visual** | |
| Name | IscWhiteningChannelVis |
| Description | Displays the tags of single channel of whitening |
| Placeholder | Name: channel  Type: IscWhiteningChannelStruct  Description: ISC whitening channel structure |

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| **Visual** | |
| Name | IscWhiteningDemodIQVis |
| Description | Displays the tags of two channels of whitening |
| Placeholder | Name: demod  Type: IscWhiteningDemodIQStruct  Description: ISC whitening IQ demodulator structure |

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| **Visual** | |
| Name | IscWhiteningSimpleDemodIQVis |
| Description | Displays the tags of two channels of whitening |
| Placeholder | Name: demod  Type: IscWhiteningSimpleDemodIQStruct  Description: Unified ISC whitening IQ demodulator structure |

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| **Visual** | |
| Name | IscWhiteningDemodWfsVis |
| Description | Displays the tags of eight channels of whitening |
| Placeholder | Name: wfs  Type: IscWhiteningDemodWfsStruct  Description: ISC whitening WFS demodulator structure |

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| **Visual** | |
| Name | IscWhiteningSimpleDemodWfsVis |
| Description | Displays the tags of eight channels of whitening |
| Placeholder | Name: wfs  Type: IscWhiteningSimpleDemodWfsStruct  Description: Unified ISC whitening WFS demodulator structure |

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| **Visual** | |
| Name | IscWhiteningQpdVis |
| Description | Displays the tags of four channels of whitening |
| Placeholder | Name: qpd  Type: IscWhiteningQpdStruct  Description: ISC whitening quad photodiode structure |

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| **Visual** | |
| Name | IscWhiteningSimpleQpdVis |
| Description | Displays the tags of four channels of whitening |
| Placeholder | Name: qpd  Type: IscWhiteningSimpleQpdStruct  Description: Unified ISC whitening quad photodiode structure |