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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 number0x0002 – Illegal channel index numberIndividual 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 different0x0800 – Gain different0x1000 – GainStep different0x2000 – Filter different0x4000 – Set different0x8000 – 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\_STRUCTEND\_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: LiveListType: ARRAY[1..8] OF BYTEDescription: Information about the active connections, see HMS AB9000 manual |
| Element | Name: PCBType: ARRAY[1..4,1..13] OF WORDDescription: Readbacks form the binary IO chassis, see HMS AB9000 and ES2113 manual |
| Element | Name: InfoDataType: IscWhiteningInfoDataStructDescription: 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\_STRUCTEND\_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: PCBType: ARRAY[1..4,1..6] OF WORDDescription: Controls to the binary IO chassis, see HMS AB9000 and ES2113 manual |
| Element | Name: LiveListType: ARRAY[1..8] OF BYTEDescription: 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: InfoDataType: IscWhiteningInfoDataStructDescription: 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\_STRUCTEND\_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: ChassisType: ARRAY[1..6] OF IscWhiteningRawChassisStructDescription: Contains the binary IO data organized by chassis and channel. |

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| **Function Block**FUNCTION\_BLOCK IscWhiteningInterfaceFBVAR\_INPUT Request: SaveRestoreEnum; SequenceID: INT; In: IscWhiteningInStruct;END\_VARVAR\_OUTPUT Out: IscWhiteningOutStruct;END\_VARVAR\_IN\_OUT Val: IscWhiteningStruct; ValInit: IscWhiteningStruct;END\_VAR |
| Name | IscWhiteningInterfaceFB |
| Description | Controls a 384-channel binary IO chassis. |
| Input argument | Name: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| Input argument | Name: SequencIDType: INTDescription: Must be set to 1 for the first binary IO chassis, 2 for the second, etc. |
| Input argument | Name: InType: IscWhiteningInStructDescription: Input hardware structure |
| Output argument | Name: OutType: IscWhiteningOutStructDescription: Output hardware structure |
| In/out argument | Name: ValInitType: IscWhiteningStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: ValType: IscWhiteningStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: GainType: INTDescription: 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: GainStepType: INTDescription: 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: FilterType: ARRAY [1..3] OF BOOLDescription: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: SetType: ARRAY [1..3] OF BOOLDescription: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: ToggleType: ARRAY [1..3] OF BOOLDescription: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: ReadbackType: BYTEDescription: Bit encoded readback value from the whitening chassis |

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| **Function Block**FUNCTION\_BLOCK IscWhiteningChannelFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*) Index: INT; (\* 1 to 8 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| Input argument | Name: IndexType: INTDescription: Select the channel: Index from 1 to 8 |
| In/out argument | Name: ChannelInitType: IscWhiteningChannelStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: ChannelType: IscWhiteningChannelStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: IType: IscWhiteningChannelStructDescription:  |
| In/Out Tag | Name: QType: IscWhiteningChannelStructDescription: 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 IscWhiteningDemodIQFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*) Index: INT; (\* 1, 3, 5 or to 7 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| Input argument | Name: IndexType: INTDescription: Select the channel: Index is 1, 3, 5, or 7The selected index represents the quad-phase channel, whereas Index+1 represents the in-phase channel. |
| In/out argument | Name: DemodInitType: IscWhiteningDemodIQStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: DemodType: IscWhiteningDemodIQStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: GainType: INTDescription: 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: GainStepType: INTDescription: 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: FilterType: ARRAY [1..3] OF BOOLDescription: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: SetType: ARRAY [1..3] OF BOOLDescription: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: ToggleType: ARRAY [1..3] OF BOOLDescription: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: IReadbackType: BYTEDescription: Bit encoded readback value from the whitening chassis I-phase channel |
| Output Tag | Name: QReadbackType: BYTEDescription: Bit encoded readback value from the whitening chassis Q-phase channel |

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| **Function Block**FUNCTION\_BLOCK IscWhiteningSimpleDemodIQFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*) Index: INT; (\* 1, 3, 5 or to 7 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| Input argument | Name: IndexType: INTDescription: Select the channel: Index is 1, 3, 5, or 7The selected index represents the quad-phase channel, whereas Index+1 represents the in-phase channel. |
| In/out argument | Name: DemodInitType: IscWhiteningSimpleDemodIQStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: DemodType: IscWhiteningSimpleDemodIQStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: SegType: ARRAY [1..4] OF IscWhiteningDemodIQStructDescription: The four segments of a wavefront sensor  |

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| **Function Block**FUNCTION\_BLOCK IscWhiteningDemodWfsFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| In/out argument | Name: DemodWfsInitType: IscWhiteningDemodWfsStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: DemodWfsType: IscWhiteningDemodWfsStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: GainType: INTDescription: 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: GainStepType: INTDescription: 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: FilterType: ARRAY [1..3] OF BOOLDescription: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: SetType: ARRAY [1..3] OF BOOLDescription: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: ToggleType: ARRAY [1..3] OF BOOLDescription: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: IReadbackType: DWORDDescription: Bit encoded readback value from the four whitening chassis I-phase channels. Least significant byte is first channel. |
| Output Tag | Name: QReadbackType: DWORDDescription: 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 IscWhiteningSimpleDemodWfsFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| In/out argument | Name: DemodWfsInitType: IscWhiteningSimpleDemodWfsStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: DemodWfsType: IscWhiteningSimpleDemodWfsStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: SegType: ARRAY [1..4] OF IscWhiteningChannelStructDescription: The four segments of a QPD sensor  |

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| **Function Block**FUNCTION\_BLOCK IscWhiteningQpdFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*) Index: INT; (\* 1 or 5 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| Input argument | Name: IndexType: INTDescription: Select the channel: Index from 1 or 5The 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: QpdInitType: IscWhiteningQpdStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: QpdType: IscWhiteningQpdStructDescription: 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\_STRUCTEND\_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: ErrorType: ErrorStructDescription: Calls error handler |
| In/Out Tag | Name: GainType: INTDescription: 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: GainStepType: INTDescription: 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: FilterType: ARRAY [1..3] OF BOOLDescription: True if the whitening filter is on. Each array index represents a filter section. |
| Input Tag | Name: SetType: ARRAY [1..3] OF BOOLDescription: Set value for the whitening filters. Each array index represents a filter section. |
| Input Tag | Name: ToggleType: ARRAY [1..3] OF BOOLDescription: Set to True to toggle the state of a whitening filter. Each array index represents a filter section. |
| Output Tag | Name: ReadbackType: DWORDDescription: 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 IscWhiteningSimpleQpdFBVAR\_INPUT Request: SaveRestoreEnum; Chassis: INT; (\* 1 to 6 \*) Index: INT; (\* 1 or 5 \*)END\_VARVAR\_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: RequestType: SaveRestoreEnumDescription: Request for save/restore/safemode or noop. |
| In/Out argument | Name: IscWhiteningType: IscWhiteningStructDescription: Internal interface structure |
| Input argument | Name: ChassisType: INTDescription: Select the chassis: Values from 1 to 6 |
| Input argument | Name: IndexType: INTDescription: Select the channel: Index from 1 or 5The 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: QpdInitType: IscWhiteningSimpleQpdStructDescription: Save/restore variable in persistent memory |
| In/out argument | Name: QpdType: IscWhiteningSimpleQpdStructDescription: 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 WhiteningVAR 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\_VARVAR PERSISTENT IscWhiteningInit: IscWhiteningStruct;END\_VARSaveRestore(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: whiteningType: IscWhiteningStructDescription: Internal interface structure |

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

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| **Visual** |
| Name | IscWhiteningDemodIQVis |
| Description | Displays the tags of two channels of whitening |
| Placeholder | Name: demodType: IscWhiteningDemodIQStructDescription: ISC whitening IQ demodulator structure |

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

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| **Visual** |
| Name | IscWhiteningDemodWfsVis |
| Description | Displays the tags of eight channels of whitening |
| Placeholder | Name: wfsType: IscWhiteningDemodWfsStructDescription: ISC whitening WFS demodulator structure |

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

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| **Visual** |
| Name | IscWhiteningQpdVis |
| Description | Displays the tags of four channels of whitening |
| Placeholder | Name: qpdType: IscWhiteningQpdStructDescription: ISC whitening quad photodiode structure |

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