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TwinCAT Library for PLCInfo

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| **Library** | |
| Title | PLCInfo |
| Version | 1 |
| TwinCAT version | V2.11.0 |
| Name space |  |
| Author | Daniel Sigg |
| Description | Information about PLC status/location  Includes system information |
| Error Code | MasterInfoStruct\_Errors:  0x0001 – Link error detected  0x0002 – IO reset required  0x0004 – Missing frame in redundancy mode  0x0008 – Watchdog triggered  0x0010 – Ethernet driver not found  0x0020 – I/O reset active  0x0040 – At least one device not in OP state  0x0080 – Distributed clock not in sync  0x0100 – Slave count mismatch  0x0200 – Frame working counter wrong  0x0400 – Illegal AMS address  0x0800 – Master not in OP state  0x1000 – Frame statistics error |
| Library Dependencies | Error, SaveRestore, TcSystem, TcEtherCAT |

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| **User Interface Type**  TYPE IfoIdEnum : (IfoH1, IfoL1, IfoH2, IfoT1, IfoI1)  END\_TYPE; | |
| Type Name | IfoIdEnum |
| Description | Identification of IFO |
| Definition | ENUM |
| Element | Name: IfoH1  Description: H1 |
| Element | Name: IfoL1  Description: L1 |
| Element | Name: IfoH2  Description: H2 |
| Element | Name: IfoT1  Description: T1 |
| Element | Name: IfoI1  Description: I1 |

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| **User Interface Type**  TYPE LocationIdEnum : (Corner, EndX, EndY, MidX, MidY)  END\_TYPE; | |
| Type Name | LocationIdEnum |
| Description | Location of PLC |
| Definition | ENUM |
| Element | Name: Corner  Description: Located in Corner station |
| Element | Name: EndX  Description: Located in EX station |
| Element | Name: EndY  Description: Located in EY station |
| Element | Name: MidX  Description: Located in MX station |
| Element | Name: MidY  Description: Located in MY station |

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| **User Interface Type**  TYPE PlcTaksInfoStruct :  STRUCT  Active: BOOL;  Name: STRING(16);  Priority: DINT;  CycleCount: UDINT;  CycleTime: LREAL;  LastExecTime: LREAL;  CycleTimeExceeded: BOOL;  CycleTimeError: UDINT;  END\_STRUCT  END\_TYPE; | |
| Type Name | PlcTaksInfoStruct |
| Description | Structure used in the user interface to describe the information for all available tasks in the PLC. |
| Definition | STRUCT |
| Output Tag | Name: Active  Type: BOOL  Description: True if task is configured and active |
| Output Tag | Name: Name  Type: STRING(16)  Description: Name of task |
| Output Tag | Name: Priority  Type: DINT  Description: Priority of task |
| Output Tag | Name: CycleCount  Type: UDINT  Description: Cycle count of task |
| Output Tag | Name: CycleTime  Type: LREAL  Description: Predefined cycle time in µs |
| Output Tag | Name: LastExecTime  Type: LREAL  Description: Cycle time of last executed cycle in µs. |
| Output Tag | Name: CycleTimeExceeded  Type: BOOL  Description: True if cycle time exceeded allocated time. |
| Output Tag | Name: CycleTimeError  Type: UDINT  Description: Error counter (updated at rate of task running PLCInfo) |

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| **User Interface Type**  TYPE PlcInfoStruct :  STRUCT  IfoId: IfoIdEnum;  LocationId: LocationIdEnum;  Status: ErrorStruct;  SvnRevision: DINT;  StartTime: TIMESTRUCT;  CurrentTime: TIMESTRUCT;  Hostname: T\_MaxString;  CpuUsage: UDINT:  SysLatencyActual: UDINT;  SysLatencyMax: UDINT:  RuntimeNumber: DINT;  ProjectName: STRING(32);  NumberOfTasks: DINT;  OnlineChangeCount: DINT;  RetainLoaded: BOOL;  PersistantLoaded: BOOL;  Task: ARRAY [1..4] OF PlcTaksInfoStruct;  END\_STRUCT;  END\_TYPE; | |
| Type Name | PlcInfoStruct |
| Description | Structure used in the user interface |
| Definition | STRUCT |
| Output Tag | Name: IfoId  Type: IfoIdEnum  Description: Interferometer identification |
| Output Tag | Name: LocationId  Type: LocationIdEnum  Description: Building Location |
| Output Tag | Name: Status  Type: ErrorStruct  Description: Calls error handler |
| Output Tag | Name: SvnRevision  Type: DINT  Description: Subversion Revision |
| Output Tag | Name: StartTime  Type: TIMESTRUCT  Description: PLC start time |
| Output Tag | Name: CurrentTime  Type: TIMESTRUCT  Description: PLC current time |
| Output Tag | Name: ElapsedTime  Type: DINT  Description: Elapsed time since last restart in sec |
| Output Tag | Name: Hostname  Type: T\_MaxString  Description: PLC host name |
| Output Tag | Name: CpuUsage  Type: UDINT  Description: CPU usage |
| Output Tag | Name: SysLatencyActual  Type: UDINT  Description: Actual system latency |
| Output Tag | Name: SysLatencyMax  Type: UDINT  Description: Max system latency |
| Output Tag | Name: RuntimeNumber  Type: DINT  Description: PLC runtime number |
| Output Tag | Name: ProjectName  Type: STRING(32)  Description: Name of PLC project |
| Output Tag | Name: NumberOfTasks  Type: DINT  Description: Number of active tasks in current PLC |
| Output Tag | Name: OnlineChangeCount  Type: DINT  Description: The number of online changes made since the last complete download |
| Output Tag | Name: RetainLoaded  Type: BOOL  Description: Valid retain data loaded |
| Output Tag | Name: PersistentLoaded  Type: BOOL  Description: Valid persistent data loaded |
| Output Tag | Name: Task  Type: ARRAY [1..4] OF PlcTaksInfoStruct  Description: Information on active tasks |

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| **Function Block**  FUNCTION\_BLOCK PlcInfoFB:  VAR\_INPUT  Request: SaveRestoreEnum;  Ifo: IfoIdEnum;  Loc: LocationIdEnum;  Svn: DINT;  Status: ErrorStruct;  END\_VAR;  VAR\_OUTPUT  CurrentTime: TIMESTRUCT;  CurrentTimeValid: BOOL;  END\_VAR;  VAR\_IN\_OUT  Plc: PlcInfoStruct;  END\_VAR:  END\_TYPE; | |
| Type Name | PlcInfoFb |
| Description | Function block used to monitor the PLC status/location |
| Definition | Function Block |
| Input Argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safe mode or noop |
| Input Argument | Name: Ifo  Type: IfoIdEnum  Description: IFO identification |
| Input Argument | Name: Loc  Type: LocationIdEnum  Description: Location ID |
| Input Argument | Name: Svn  Type: DINT  Description: Subversion status |
| Input Argument | Name: Status  Type: ErrorStruct  Description: Calls error handler |
| Output Argument | Name: CurrentTime  Type: TIMESTRUCT  Description: Current time |
| Output Argument | Name: CurrentTimeValid  Type: BOOL  Description: Current time valid |
| In/out Argument | Name: Plc  Type: PlcInfoStruct  Description: User interface structure |

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| **User Interface Type**  TYPE ECatCommStateEnum : (  ECatCommStateUNDEFINED := 0,  ECatCommStateINIT := 1,  ECatCommStatePREOP := 2,  ECatCommStateBOOT := 3,  ECatCommStateSAFEOP := 4,  ECatCommStateOP := 8);  END\_TYPE | |
| Type Name | ECatCommStateEnum |
| Description | EtherCAT state machine |
| Definition | ENUM |
| Element | Name: ECatCommStateUNDEFINED  Description: Undefined |
| Element | Name: ECatCommStateINIT  Description: INIT |
| Element | Name: ECatCommStatePREOP  Description: PREOP |
| Element | Name: ECatCommStateBOOT  Description: BOOT |
| Element | Name: ECatCommStateSAFEOP  Description: SAFEOP |
| Element | Name: ECatCommStateOP  Description: OP |

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| **User Interface Type**  TYPE MasterInfoFastInStruct :  STRUCT  FrmWcState: ARRAY[0..7] OF WORD;  END\_STRUCT  END\_TYPE | |
| Type Name | MasterInfoFastInStruct |
| Description | Structure used to interface the PLC at fast rate. |
| Definition | STRUCT |
| Input Tag | Name: FrmWcState  Type: ARRAY[0..7] OF WORD  Description: Set of frame working counter states |

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| **User Interface Type**  TYPE MasterInfoInStruct :  STRUCT  SlaveCount: UINT;  DeviceStatus: UINT;  ChangeCount: UINT;  DeviceId: UINT;  NetId: T\_AmsNetIdArr;  ConfigSlaveCount: UINT;  END\_STRUCT  END\_TYPE | |
| Type Name | MasterInfoInStruct |
| Description | Structure used to interface the PLC at standard rate. |
| Definition | STRUCT |
| Input Tag | Name: SlaveCount  Type: UINT  Description: Number of slave terminals connected to the master |
| Input Tag | Name: DeviceStatus  Type: UINT  Description: Status of the master device (network interface) |
| Input Tag | Name: ChangeCount  Type: UINT  Description: Number of changes to the device image |
| Input Tag | Name: DeviceId  Type: UINT  Description: Device ID |
| Input Tag | Name: NetId  Type: T\_AmsNetIdArr  Description: AMS address of master |
| Input Tag | Name: ConfigSlaveCount  Type: UINT  Description: Number of configured slave terminals |

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| **User Interface Type**  TYPE MasterInfoFastStruct :  STRUCT  State: ARRAY[0..7] OF WORD;  Error: ARRAY[0..7] OF BOOL;  Flag: BOOL;  END\_STRUCT  END\_TYPE | |
| Type Name | MasterInfoFastStruct |
| Description | Structure used to interface the PLC at fast rate. |
| Definition | STRUCT |
| Output Tag | Name: State  Type: ARRAY[0..7] OF WORD  Description: Array of working counter states |
| Output Tag | Name: Error  Type: ARRAY[0..7] OF BOOL  Description: Array of working counter errors |
| Output Tag | Name: Flag  Type: BOOL  Description: Working counter error flag |

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| **User Interface Type**  TYPE MasterInfoStruct :  STRUCT  Error: ErrorStruct;  FrameWorkingCnt: MasterInfoFastStruct;  DeviceId: UINT;  NetId: T\_AmsNetIdArr;  NetIdStr: T\_AmsNetId;  AddressError: BOOL;  ChangeCount: UINT;  DeviceStatus: WORD;  DeviceError: BOOL;  LinkError: BOOL;  ResetRequired: BOOL;  MissingFrame: BOOL;  Watchdog: BOOL;  DriverNotFound: BOOL;  ResetActive: BOOL;  NotAllInOp: BOOL;  DcNotInSync: BOOL;  SlaveCountActual: UINT;  SlaveCountConfig: UINT;  SlaveCountError: BOOL;  DeviceState: ECatCommStateEnum;  LostFrames: UDINT;  FrameRate: LREAL;  LostQueuedFrames: UDINT;  QueuedFrameRate: LREAL;  StatisticsError: BOOL;  END\_STRUCT  END\_TYPE | |
| Type Name | MasterInfoStruct |
| Description | Structure used in the user interface for a master (network interface) |
| Definition | STRUCT |
| Output Tag | Name: Error  Type: ErrorStruct  Description: Error handling |
| Output Tag | Name: FrameWorkingCnt  Type: MasterInfoFastStruct  Description: Frame working counters |
| Output Tag | Name: FrameWorkingCounterError  Type: ARRAY[0..7] OF BOOL  Description: Array of working counter errors |
| Output Tag | Name: FrameWorkingCounterFlag  Type: BOOL  Description: Working counter error flag |
| Output Tag | Name: DeviceId  Type: UINT  Description: Device ID (optional) |
| Output Tag | Name: NetId  Type: T\_AmsNetIdArr  Description: AMS network address of master |
| Output Tag | Name: NetIdStr  Type: T\_AmsNetId  Description: AMS network address of master in string form |
| Output Tag | Name: AddressError  Type: BOOL  Description: Address error (all zeroes) |
| Output Tag | Name: ChangeCount  Type: UINT  Description: Number to changes to the device image |
| Output Tag | Name: DeviceStatus  Type: WORD  Description: Device status (bit encoded) |
| Output Tag | Name: DeviceError  Type: BOOL  Description: Device error derived from the status |
| Output Tag | Name: LinkError  Type: BOOL  Description: A link error is detected |
| Output Tag | Name: ResetRequired  Type: BOOL  Description: A IO reset is required |
| Output Tag | Name: MissingFrame  Type: BOOL  Description: A missing frame in redundant mode |
| Output Tag | Name: Watchdog  Type: BOOL  Description: Watchdog has triggered |
| Output Tag | Name: DriverNotFound  Type: BOOL  Description: the network driver (miniport) was not found |
| Output Tag | Name: ResetActive  Type: BOOL  Description: A reset is active |
| Output Tag | Name: NotAllInOp  Type: BOOL  Description: Not all terminals are in OP mode |
| Output Tag | Name: DcNotInSync  Type: BOOL  Description: The distributed clock is out-of-synchronization |
| Output Tag | Name: SlaveCountActual  Type: UINT  Description: Number of actual slaves connected to the master |
| Output Tag | Name: SlaveCountConfig  Type: UINT  Description: Number of configured slaves in the master |
| Output Tag | Name: SlaveCountError  Type: BOOL  Description: A slave count error has been detected |
| Output Tag | Name: DeviceState  Type: ECatCommStateEnum  Description: The operational state of the master |
| Output Tag | Name: LostFrames  Type: UDINT  Description: The number of lost frames |
| Output Tag | Name: FrameRate  Type: LREAL  Description: The frame rate in Hz |
| Output Tag | Name: LostQueuedFrames  Type: UDINT  Description: The number of lost queued frames |
| Output Tag | Name: QueuedFrameRate  Type: LREAL  Description: The queued frame rate in Hz |
| Output Tag | Name: StatisticsError  Type: BOOL  Description: An error occurred in reading the frame statistics |

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| **Function Block**  FUNCTION\_BLOCK MasterInfoFastFB  VAR\_INPUT  Request: SaveRestoreEnum;  MasterIn: MasterInfoFastInStruct;  END\_VAR  VAR\_IN\_OUT  Master: MasterInfoFastStruct;  END\_VAR | |
| Type Name | MasterInfoFastFB |
| Description | Function block used to process the fast master information |
| Definition | Function Block |
| Input Argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safe mode or noop |
| Input Argument | Name: MasterIn  Type: MasterInfoFastInStruct  Description: master info input structure |
| In/out Argument | Name: Master  Type: MasterInfoFastStruct  Description: User interface structure |

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| **Function Block**  FUNCTION\_BLOCK MasterInfoFB  VAR\_INPUT  Request: SaveRestoreEnum;  MasterIn: MasterInfoInStruct;  END\_VAR  VAR\_IN\_OUT  Master: MasterInfoStruct;  END\_VAR | |
| Type Name | MasterInfoFB |
| Description | Function block used to process the master information |
| Definition | Function Block |
| Input Argument | Name: Request  Type: SaveRestoreEnum  Description: Request for save/restore/safe mode or noop |
| Input Argument | Name: MasterIn  Type: MasterInfoInStruct  Description: master info input structure |
| In/out Argument | Name: Master  Type: MasterInfoStruct  Description: User interface structure |

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| **Program Example:**  (\* Global variables \*)  VAR\_GLOBAL  Device0: MasterInfoStruct;  Device0In AT %IB\*: MasterInfoInStruct;  Device0FB: MasterInfoFB;  Device0FastIn AT %IB\*: MasterInfoFastInStruct;  Device0FastFB: MasterInfoFastFB;  SaveRestore: SaveRestoreFB;  GotoSafe: BOOL;  Request: SaveRestoreEnum;  END\_VAR  (\* Call from fast task with 1 ms update rate \*)  PROGRAM DeviceFast  Device0FastFB (  Request := Request,  MasterIn := Device0FastIn,  Master := Device0. FrameWorkingCnt);  END\_PROGRAM  (\* Call from standard task with 10 ms update rate \*)  PROGRAM Device  SaveRestore( SaveInterval := T#1m,  GotoSafe := GotoSafe,  Request => Request );  Device0FB (  Request := Request,  MasterIn := Device0In,  Master := Device0);  END\_PROGRAM |