acontis technologies GmbH

EC-Master
EtherCAT® Master Stack

Version 2.9

Release Notes

1 EC-Master – Features

The EtherCAT specification contains a broad range of different protocols. The EC-Master EtherCAT Master Stack supports the following EtherCAT features:

- Configuration: EtherCAT Network Information Format (ENI XML)
- Cyclic process data update
    - Synchronous and asynchronous modes
    - Master triggered and user triggered data update
    - Memory provider interface for user application synchronization
- Error detection and diagnosis, e.g.
    - Bus scan with bus topology/configuration check
    - Lost cable connection or missing EtherCAT slave response
    - Wrong EtherCAT slave reaction (not all slaves responded)
    - Slave operation monitoring
    - Ethernet link layer debug messages for run-time error diagnostics
- ADS over EtherCAT (AoE)
- CANopen over EtherCAT (CoE)
- Ethernet over EtherCAT (EoE)
- File access over EtherCAT (FoE)
- Vendor specific profile over EtherCAT (VoE)
- Servo Profile over EtherCAT (SoE)
- Distributed Clocks (DC)
- EtherCAT Bus Scan
    - Slave detection without existing bus configuration
    - Slave EEPROM information service
    - Topology detection
    - Slave Alias Addressing support
- Slave EEPROM Read/Write Support
- Slave to slave communication via master ("CopyInfos" in ENI file)
- Feature Pack EoE Endpoint
- Feature Pack Cable Redundancy
- Feature Pack Hot Connect
- Feature Pack Master Object Dictionary
- Feature Pack External Synchronization

2 Migration from Version 2.8

- QNX uses –Y_gpp linker flag for demos and link layers
- ecatGetCfgSlaveInfo(): wIdentifyAdo returns 0x134 instead of 0x130 for explicit identification (conforming to ESI tag <IdentificationReg134>).
- Application calling EC_T_DC_SYNCSO_CB_PARM should consider that the start delay (default: 50ms or set by EC_IOCTL_DC_SETSYNCSTARTOFFSET) will be applied.

3 New Features of V2.9

- Reduce memory peak during emConfigureMaster
- XML-Parser optional
- emRescueScan()

3.1 List of enhancements/bug fixes in V2.9.1.09

Core
- eUsrJob_SendCycFramesByTaskId returns EC_E_INVALIDINDEX if TaskId not found
- Fix wait for DC / DCM in case of EC_IOCTL_SET_ADJUST_CYCFRAMES_AFTER_SLAVES_STATE_CHANGE is used
- Fix DCM mode was changed evene if ecatDcmConfigure returned error
- Set slaves first to master state if previous call to ecatSetMasterState returns error
- Allow EC_NOWAIT in emTferSingleRawCmd(). Fix emSetSlaveState returns EC_E_INVALIDPARM
- Fix client re-registration in EcMasterDemoRasServer
- Don't open the red master port automatically if topology change is in manual mode
- Protect against NULL pointer access to pdwNumOutData during emNotifyApp()
- Fix FoE mailbox statistics (PPC)

Platforms
- Add interrupt mode for Xenomai (needs also atemsys V1.2.16)

3.2 List of enhancements/bug fixes in V2.9.1.08

Core
- Protect for unnecessary mailbox repeating during cable redundancy handling in DC state machine
- Fix file name length reading to not exceed given buffer for FoE up- and download
- Fix Mailbox Statistics FoE counting direction (read/write) fixed, cumulated counting fixed.
- Fix EC_IOCTL_SET_BUS_CYCLE_TIME modifies init master parameter dwBusCycleTimeUsec
- Link layers return EC_E_NOTSUPPORTED instead of EC_E_INVALIDCMD if IOCTL is not supported

3.3 List of enhancements/bug fixes in V2.9.1.07

Core
- Skip some DC related master InitCmds during state transition of single slave
- Fix AoE Mailbox APIs return vendor specific AoE device error
- Fix DC window sync monitoring after RefClock reconnect
- Fix crash if DC RefClock removed by ecatConfigExcludeSlave()
- Fix External Synchronization Status PDO handling in DCM mode DCX

- Add EC_IOCTL_SET_ADJUST_CYCFRAMES_AFTER_SLAVES_STATE_CHANGE
- Fix erroneous RAS disconnection at the end of large FoE transfer
- Fix DC start time calculation in DCM mode MasterRefClock
- Fix WKC calculation for split sync units
- Fix unexpected VoE notification to RAS clients
- EC_E_MAX_BUS_SLAVES_EXCEEDED correctly returned instead EC_E_LINE_CROSSED if more slaves are connected than MasterInitParms.dwMaxBusSlaves
- Fix DCX with external memory provider write request callback
- Fix missing client ID information during FoE progress notification causing "Out of mailbox notification memory!" errors
- Add ecatPerfMeasSetIrqCtlEnabled
- Fix Syntax variant 1: EcMasterDemoMotion [DemoConfigFileName]
- Fix Mailbox Statistics Object (0x2006) (SubIndex 65 size wrong, complete access size check wrong)
- Deny instead of truncate too long FoE file name
- Performance Measurement include minimum time
- Fix always trigger DC state machine if topology change detected
- Master Object Dict. History Object. Big Endian Support for notifications.
- Fix DCM mode LinkLayerRefClock and add bLogEnabled, nCtlSetVal parameters

Platforms
- Intel I219 support
- DCM MasterShift support for Xenomai
- Fix SockRaw default link layer parameter to fix starting with ENI (DisableForceBroadcast only for EAP)
- Fix erroneous filtering of own traffic in WinPcap linklayer for Windows 8 and above
- Remove CRC in RecvFrame from CPSW and ETSEC

3.4 List of enhancements/bug fixes in V2.9.1.06

Core
- Fix access violation in ecatSetMasterState() during ecatConfigureMaster() sometimes
- Fix access violation during ecatconfigureMaster(GenPreOp) sometimes
- Fix bus mismatch errors if a slave needs more than one cycle to return its identification value (Ado 0x134)

3.5 List of enhancements/bug fixes in V2.9.1.05

Core
- Fix frame leak during Configure Master
- Fix DC and redundancy even if link layers don't enhanced line crossed detection
- Fix connection drop if read data from socket take more time than watchdog
- Add Master OD Object 0x2006 Mailbox Statistics Object
- Add ecatGetMasterInfo, EC_IOCTL_CLEAR_MASTER_INFO_COUNTERS
- Start DC window monitoring only after DCM or DCX is in sync
- Add ecatConfigExtend

Platforms
- Fix logging priority for Xenomai3 in Examples
- Add PhyInterface and UseDmaBuffers parameters to DW3504

3.6 List of enhancements/bug fixes in V2.9.1.04

Core
- SupersetEni supports HC group modification
- Fix crash during remote configuration on a master running with GenPreop
- Fix If DCX enabled, master state change from PREOP to SAFEOP only when DCM Mastershift and DCX in sync
- Add ecatRescueScan
- Fix multiple client registration support (EC-Engineer doesn't get all notifications)
- Fix Mastershift.bCtlOff = EC_TRUE in EC_T_DCM_CONFIG_DCX disabled erroneously DCX controller too
- Fix SPOC for GetCfgSlaveInfo, GetBusSlaveInfo, ReadSlaveIdentification, SetSlaveDisabled, SetSlaveDisconnected

3.7 List of enhancements/bug fixes in V2.9.1.03

Core

- Adjust DC slave register 0x0934 in DCM mode BusShift to minimize synchronization jitter
- Fix CopyInfo copy 0 on WKC error

3.8 List of enhancements/bug fixes in V2.9.1.02

Core

- Add ecatSetSlaveDisabled
- Add ecatSetSlaveDisconnected
- Add EC_IOCTL_SET_AUTO_ADJUST_CYCCMD_WKC_ENABLED
- Add EC_IOCTL_SET_AUTO_ACK_AL_STATUS_ERROR_ENABLED
- Add EC_IOCLT_DC_FIRST_DC_SLV_AS_REF_CLOCK
- Add emGetMemoryUsage
- Add sending InitCmds of transition II and PP
- Add CoE Index, SubIndex info at EC_NOTIFY_MBOXRCV for ecatCoESdoUploadReq and ecatCoESdoDownloadReq
- Add DCX time stamp difference alignment to DcStartTimeGrid to compensate DCX initial error
- Add dwDcStartTimeGrid to struct EC_T_DC_CONFIGURE for DC start time alignment on startup
- Add RTLockHeap() to LinkOsMapMemory() for RTOS-32 to protect for race condition
- All APIs return EC_E_INVALIDSTATE if master instance was not initialized
- Add RtosCommStart to EC-Win demo programs
- Add ETSEC VxWorks DIAB support
- Fix topology detection if slave with matching fixed address (duplicate) is connected
- Fix propagation delay calculation in DCM modes and LinkLayerRefClock
- Fix no external synchronization error handling in DCX with EL6695
- Fix erroneous bus time calculation in 64 bit timestamp emulation
- Fix CoeSdoUploadReq in CoeSdoDownloadReq EcMasterDotNet
- Don't read mailbox when slave is in INIT
- Send master InitCmds to new slaves with FPRD instead of BRD
- Execute DC initialization for bridge slaves even if there is no DC configuration for them in the ENI file
- Configure all DC slave controller registers 0x0934 and 0x0930 in the same way
- Update pbyElementFlags at ecatSoeWriteReq, ecatSoeReadReq
- Reduce time to get InSync in DCM mode MasterRefClock
- Add FoeDownloadReq to EcMasterDotNet

Platforms

- Add support for Xenomai3 x86Cobalt and x86Mercury
- RTX64: add RAS Server and change library extension from .lib to .rtdll
- Linux: Update atemsys from 1.2.13 to 1.2.15
  - Add support for Linux Kernel 2.6.18
  - Add udev auto-loading support via DTB

3.9 List of enhancements/bug fixes in V2.9.1.01

Core

- Master Object Dictionary use ecatGetText() to create strings for notifications
- Fix slave error notifications during emReadSlaveIdentification (Ado 0x134)
- Don't queue command directly in EC_IOCTL_FORCE_SLVSTAT_COLLECTION only set a request flag to fix lock issue between jobtask and API
- No OsLock() in JobTask required anymore to queue notifications if RAS client is connected

Platforms

- VxWorks7: support new VxBus
- EcWin: remove unused code for EXCLUDE_ECWIN_SHM
- EcWin: DCM Mastershift for RTOS-32

3.10 List of enhancements/bug fixes in V2.9.0.09

Core

- Add DCX mode - External synchronization

Platforms

- Add PCI_DEVICE_I219V
- Fslfec: Read mac from eFuse for iMX6 if exists

3.11 List of enhancements/bug fixes in V2.9.0.08

Core

- Fix long delay (20s) in SetMasterState if slaves are absent
- Don't process PotentialRefClock tag as ReferenceClock tag
- Add EC_IOCTL_SET_GENENI_ASSIGN_EEPROM_BACK_TO_ECAT

Platforms

- Add JSL-Ware implementation
- Force process priority class to *time critical* only in case of threads created with highest priority (e.g. **not** for remote diagnosis with EC-Engineer, EC-STA).
- Fix stack overflow in example programs for RTOS-32

3.12 List of enhancements/bug fixes in V2.9.0.07

Core

- Fix error parsing "read hot connect prev address" identify command (Ado 0x10)
- Fix RAS client taking several minutes to detect inactive RAS Server <= V2.7 on RAS logon.
- Fix config slave still have old link to invalid bus slave during remote configuration EC-Engineer

- Fix erroneous line crossed notification due to acyclic AL status BRD during port receive time latching.
- Fix crash if ecatSetSlavePortState is called for absent slave Return immediately from ecatSetSlavePortState if called for absent slave
- Reset SettleTime timer on reference clock disconnection
- Change verbosity level for "Input Value updated" message in EcMasterDemo

Platforms

- SYSBIOS use IDK 1.1.0.8

3.13 List of enhancements/bug fixes in V2.9.0.06

Core

- Fix error in EC_COPYBITS

3.14 List of enhancements/bug fixes in V2.9.0.05

Core

- Fix error 0x98110021 during EC-Engineer remote configuration

Platforms

- GEM: add license check

3.15 List of enhancements/bug fixes in V2.9.0.04

Core

- Fix missing topology change delay in some case of redundancy line fixed
- Avoid OsMalloc in Job_MasterTimer because of ecatConfigureMaster(GenPreopEni)
- Fix EEPROM Write: Repeat also last word in case of EEPROM was busy
- Fix SoE Fragmented Write and Read

Platforms

- Xenomai: use rt_timer_read instead of rt_timer_tsc
- Add instance identification by PCI location for INtime

3.16 List of enhancements/bug fixes in V2.9.0.03

Core

- Fix compiler errors with EXCLUDE_LINE_CROSSED_DETECTION
- Reorder InitCmd for Omron slaves to protect against error 83 during falling transitions to PREOP
- Fix wrong frame size in snarf link layer sending corrupted frames
- Fix long delay if emDeinitMaster is called without jobtask running
- Fix missed slave connection if connection up during bus scan

- Only enable log to link layer if bLogToLinkLayer is enabled even in level EC_LOG_LEVEL_VERBOSE
- Add EC_IOCTL_SET_IGNORE_INPUTS_ON_WKC_ERROR
- Improve unexpected cyclic frame detection in case of too short cycle
- Add sanity checks in EcMemPool
- Generate DC out of sync notification if DC timeout too short and go further in the master state machine
- Detected more line crossed topologies
- Fix very long default timeout for acyclic commands
- Fix Slave state machine stuck in PREOP if DC unit disabled and slave is DC configured
- Fix emGetSlaveInpVarInfoEx() missing index and sub index

Platforms

- Remove forwarding bit check in MAC address in Winpcap for Windows 8 or later
- Support 64Bit based PCI address in Linux
- Fix support for Intel Pro/1000 I218 and add Device ID 0x15A3
- Change CPSW command line parameters
- Fix corrupted frames in ETSEC for PPC
- Renesas SuperH for ARM Linux
- CPSW link layer add am437x support for Linux

3.17 List of enhancements/bug fixes in V2.9.0.02

Core

- Fix Master stuck in PREOP on second call to emSetMasterState if first one failed during DC initialization
- Fix unexpected line crossed notification in case of junction redundancy line break
- Add EC_IOCTL_SB_SET_JUNCTION_REDUNDANCY_ENABLED
- Fix missed slave connection if connection up during bus scan
- Add bAcycDistributionDisabled to EC_T_DC_CONFIGURE
- Add bIsRefClock to EC_T_BUS_SLAVE_INFO
- Fix persistent bus mismatch status even if no slaves are connected and full hot-connect configuration
- Don't generate erroneous line crossed notification on closed junction redundancy segment
- Detect EL9010 disconnection
- Fix static error introduced by disconnecting and reconnecting RefClock
- CoE InitCmds now also using optimized algorithm to reduce network load
- Add identification value check support
- Add Intel 82576NS
- Fix immediately expiring dwDcmInSync timeout
- Add emDcmGetAdjust API function
- Reorder InitCmd for Omron slaves to protect against WKC error during falling transitions to PREOP
- Reduce static error introduced by disconnecting and reconnecting RefClock

- Don't notify if emCoeSdoUploadReq / emCoeSdoDownloadReq returns with error. Even not if slave is not present.

Platforms

- CPSW link layer add am387x support for Linux
- SHEth link layer implementation
- Renesas RzG NoOs implementation

3.18 List of enhancements/bug fixes in V2.9.0.01

Core

- Reduce memory peak during emConfigureMaster, XML-Parser optional
- Add Memory Pool
- emDcmGetStatus returns DCM_E_MAX_CTL_ERROR_EXCEED if dwDcmInSync timeout elapsed
- Fix erroneous line crossed notification on main reconnection at crossed first slave if enhanced line crossed detection is not enabled
- Increase MAX_NUMOF_MASTER_INSTANCES to 12
- Reorder InitCmd for Omron slaves to protect against slave error during falling transitions to PREOP
- Add dwDcmInSync to EC_T_MASTERDEFAULTTIMEOUTS_DESC passed to EC_IOCTL_SET_MASTER_DEFAULT_TIMEOUTS
- Fix support for previous PhysAddr 0 in PreviousPort tag needed for CX system
- Fix FoE transfer errors for password "1"
- Detected more line crossed topologies

Platforms

- Fix C++11 compiler errors for ATECAT_PLATFORMSTR Linux, QNX, Xenomai, WinCE, RTEMS
- Fix "Instance not found" for RTL8139 and CCAT Link Layer on Linux and QNX
- Fix system lock-up in Logging for RTX64
- Linux uses Aux clocks instead of sleep and support DCM MasterShift

Examples

Fix occasional missing slave tree refresh on init Master in EC-STA

4 Migration from Version 2.7

4.1 API change for emClntQueueRawCmd

- Fixed Master ID and Client ID at emClntQueueRawCmd.
- Removed obsolete OsSetSharedLibraryLocation.

5 New Features of V2.8

Core

- Topology information returned even if line crossed detected
- Detailed line crossed information returned even if redundancy is used

5.1 List of enhancements/bug fixes in V2.8.1.04

Core

- Detected more line crossed topologies
- Fix sometimes erroneous HC slave identification behind bus mismatch
- Fix persistent line crossed information after reconnection if "not connected Port A" was detected before
- OsSystemTimeGet() returning 1 day too much
- Fix CoE Emergency for small header lengths
- EC_NOTIFY_JUNCTION_RED_CHANGE works again (broken in V2.8)

5.2 List of enhancements/bug fixes in V2.8.1.03

Core

- Fix notification only forwarded to instance 0 by RAS client
- Fix endless bus scan if topology change delay is too big compared to the SB timeout
- Fix 30s delay in emConfigureMaster() if job task suspended and EC_IOCTL_INITIATE_UPDATE_ALL_SLAVE_STATE was called before
- Fix missing bus scan after permanent frame loss because of 2 slaves with port A not connected if EC_IOCTL_INITIATE_UPDATE_ALL_SLAVE_STATE was called before
- emGetBusSlaveInfo() returns EL9010_SLAVE_ID in adwPortSlaveIds if EL9010 connection was detected

5.3 List of enhancements/bug fixes in V2.8.1.02

Core

- Generate EC_NOTIFY_LINE_CROSSED if connected port detected without slave assignment (EC_IOCTL_SB_SET_NOTIFY_UNEXPECTED_CONNECTED_PORT)
- emBlocknode is not supported if line crossed detected by concerned slave
- Fix emWriteSlaveRegister and emReadSlaveRegister over RAS only accessing to first instance
- Improve detection of red link disconnection during enhanced line crossed detection
- Wait one cycle after opening ports with slave behind to reduce the amount of bus scan iteration

- Fix missing topology change delay on slave connection during enhanced line crossed detection
- Fix endless bus scan if topology change delay is huge and enhance line crossed detection is enabled
- Fix emDcmConfigure doesn't apply settings for MasterShift

5.4 List of enhancements/bug fixes in V2.8.1.01

Core

- Fix missed topology changed detection in some cases
- Fix crash in ENI parsing if HC group has more members than configured slaves
- Fix erroneous slave disappear notification in case of topology change at beginning of bus scan (ecbtsms_getbusslaves)
- Add support for ecatConfigureMaster(eCnfType_None, ...) to de-configure.

Examples

- Fix EcMasterDemoMulti (use em...-API instead of ecat...-API)

5.5 V2.8.0.06

Core

- Fix topology change while scan during redundancy port close and open states of enhanced line crossed detection (hangs on slave reset at main adapter)
- Reset topology information of each bus slave at bus scan start
- Detect and retrigger bus scan on slaves count changes on main and red link
- Fix erroneous topology change detection generating timeout during bus scan
- Fix occasional wrong propagation delays behind branching slaves. Port receive times were not read if DC unit disabled!
- emForceProcessDataBits(): Multiple forcing of same variable doesn´t create an new entry in force list. Old entry will be updated with new value
- Don't wait for timeout if topology change occurs during red port reopen on enhanced line crossed detection
- Fix endless bus scan on link disconnection if enhanced line crossed detection is used
- Fix topology error on line break
- Add ecatGetMasterParms, ecatSetMasterParms
- Protection against lock up due to unsupported topologies
- Add support init Master without link layer
- Detect new connection at slave at redundancy line during enhanced line crossed detection
- Disable PDI watchdog for slaves with device emulation to protect against DL status interrupt storm

Platforms

- Add Intel I219-LM

- Change emllPcap to not modify LinkParms in EcLinkOpen
- Fix handle leak on Linux for Link layers

5.6 List of enhancements/bug fixes in V2.8.0.05

Core

- Fix skipped standard InitCmd before MbxInitCmd if slave reappears (-> Fix Timeout: 'eoe init')
- Fix topology change delay sometimes not applied on link reconnection
- Logging in demo application always with timestamp
- Apply topology change delay on InitMaster if redundancy is configured
- Fix discarded EC_NOTIFY_SLAVE_UNEXPECTED_STATE
- Integrate MasterShift in master stack
- Missing red line information in emGetBusSlaveInfo if line break and enhanced line crossed detection enabled

Platforms

- ETSEC: add possibility to not use DMA buffers

5.7 List of enhancements/bug fixes in V2.8.0.04

Core

- Fix emGetBusSlaveInfo returns EC_E_NOTFOUND in some case of line crossed slave
- Detect more line crossed topologies
- Fix OEM support for PPC

Platforms

- Removed obsolete and defect OsSetSharedLibraryLocation from Linux, Xenomai, and RTAI

5.8 List of enhancements/bug fixes in V2.8.0.03

Core

- Detect more line crossed topologies
- Fix occasional EoE dead-locks after corrupt fragments from EtherCAT causing resource leak
- Fix erroneous line crossed notification in case of enhanced line crossed detection enabled
- Fix bad bus index management on slave disappear

Platforms

- CPSW: add possibility to not use DMA buffers

5.9 List of enhancements/bug fixes in V2.8.0.02

Core

- Add EC_LINKIOCTL_GET_SPEED
- Fix bad bus index management on slave disappear
- DC In-Sync settle time has to restarted after deviation is outside the limit
- Fix erroneous line crossed notification in case of line break and enhanced line crossed detection enabled
- Return correct topology information in case of line crossed
- Cancel pending EoE frame is slave disappear
- Add OEM support

5.10 List of enhancements/bug fixes in V2.8.0.01

Core

- Return correct topology information in case of line crossed
- Line crossed detection returns detailed information like without redundancy
- Fix crash in ecatGetSlaveOutpVarInfo if slave address does not exist

6 Supported CPU architectures

The following 32 bit CPU architectures are supported in little endian mode:

- x86
- ARM9
- XScale
- PowerPC

7 Supported compilers

The EtherCAT master stack was built and tested with the following compilers:

- Microsoft Visual C++ 6.0
- Microsoft embedded Visual C++ 4.0 (x86, ARM, XScale)
- GNU compilers for VxWorks 5.4 up to VxWorks 6.7 (x86)
- DIAB compiler for VxWorks 6.3 up to VxWorks 6.7 (x86)
- GNU compiler for QNX 6.3.2, QNX 6.4
- GNU compilers for VxWorks 5.5 (ARM9)
- GNU compiler used for rcX version 1.0 and 2.0 (ARM9)

8 Notes and known Limitations

- EL9010: The EL9011 device has to be used instead if distributed clock and redundancy are used simultaneously.