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For EtherCAT, acyclic communication is also called mailbox communication and only possible starting from the *“Pre-Operational”* state. There are different protocols that can be tunneled via EtherCAT. For information on which protocols are supported by a slave, refer to the documentation (or device description) of the slave device.

Overview on mailbox protocols

Fig. 7: Overview on mailbox protocols

CoE: CAN application protocol over EtherCAT

CoE objects are also called *“Process Data Objects”* (PDO) or *“Service Data Objects”* (SDO). An object is addressed with *“Index”* and *“Subindex”*, e.g. 0x1018:01. If an object has more than one subindex, the number of subindices is written to the subindex 0.

The object directory of a slave as well as the object descriptions and element descriptions of the subindices can be retrieved using the optional CoE service *“SDO Information”*.

Also refer to ↘ *“CoE SDO abort codes”*.

SoE: Servo drive profile over EtherCAT

SoE is an adapted Sercos II profile for Servo drives, i.e. some Sercos II parameters do not have any or not the same meaning for SoE. One parameter is addressed with a 16-bit identification number (IDN: Parameter type S/P, parameter set, data block number).

In contrast to Sercos, multi-axis devices represent only one slave device for SoE. The subordinate drives differ by a drive number (DriveNo: 0 / 1 / ... / 7), optionally also referred to as channel (channel: A / B / ... / H).

Also refer to ↘ *“SoE error codes”*.

The following IDNs are **not** relevant for SoE:

S-0-0003 Minimum AT transmit starting time (T1min)

S-0-0004	Transmit/receive transition time (TATMT)
S-0-0005	Minimum actual value detection (T4min)
S-0-0009	Initial address in the master-data telegram
S-0-0010	Length of the master-data telegram
S-0-0088	Receive-to-receive recovery time TMTSY
S-0-0090	Command value proceeding time TMTSG
S-0-0127	C0100 Communication phase 3 transition check It is performed during the EtherCAT state transition from PreOP => SafeOP. If there is an error, the cause can be evaluated using S-0-0021.
S-0-0128	C5200 Communication phase 4 transition check It is performed during the EtherCAT state transition from SafeOP => OP. If there is an error, the cause can be evaluated using S-0-0022.

The following IDNs have an **adjusted** meaning at SoE:

S-0-0006	Transmission time of the drive telegram (T1) T1 specifies the time shift from the EtherCAT Sync signal to the point in time when the application should provide new AT data to the ESC memory.
S-0-0014	Interface status This parameter is intended to display the DL status, AL status and the AL status code of the EtherCAT.
S-0-0028	MST error counter Counter for missing datagrams of cyclic data and RX error counter and lost link counter of the EtherCAT.

S-0- T2 Transmit starting time MDT
0089 T2 specifies the time shift from the EtherCAT Sync signal to the point in time when new data is available to the master in the ESC memory.

FoE: File access over EtherCAT

FoE is a protocol, analog to TFTP, to transfer files. Normally, a firmware update is used for FoE. Thus, FoE is only possible in the EtherCAT state "Bootstrap" (device-specific).

Also refer to ↘ "FoE error codes".

EoE: Ethernet over EtherCAT

EoE can be used to tunnel the standard Ethernet configuration (e.g. TCP/IP) via EtherCAT. A *"virtual Ethernet switch"* is required in the EtherCAT master.

An IP-capable device (e.g. laptop) cannot be connected to any location in the EtherCAT EtherCAT network. A *"switch port"* is required (e.g. special terminal with *"switch port"* ↔ is not an EtherCAT port).

Optionally, an IP port can also be configured for an EtherCAT slave device if the device supports EoE to allow for addressing of an integrated web server via a configured IP port.

In both cases, the EtherCAT slave requires a *"virtual MAC address"* in the EtherCAT network specified in the EtherCAT configuration. The EoE settings are then written from the master to the slave devices upon bus startup (transition Init => PreOP). EoE is only possible starting from the PreOP state like all mailbox protocols.



To use IP routing between the Engineering port and the EtherCAT master, enable IP forwarding at the Engineering port.

Fig. 8: EoE configuration example

VoE: Vendor specific protocol over EtherCAT

VoE is used to transmit vendor-specific protocols.

AoE: ADS over EtherCAT

AoE is a device- and field bus-independent interface by Beckhoff (ADS: Automation Device Specification).

Slaves without mailbox communication

EtherCAT slave device do not have to support a mailbox protocol. Simple digital input/output terminals do not support any mailbox protocol for example. For these slave devices, only the registers supported by EtherCAT slave can be read and written. This has to be supported by every EtherCAT slave controller (ESC).