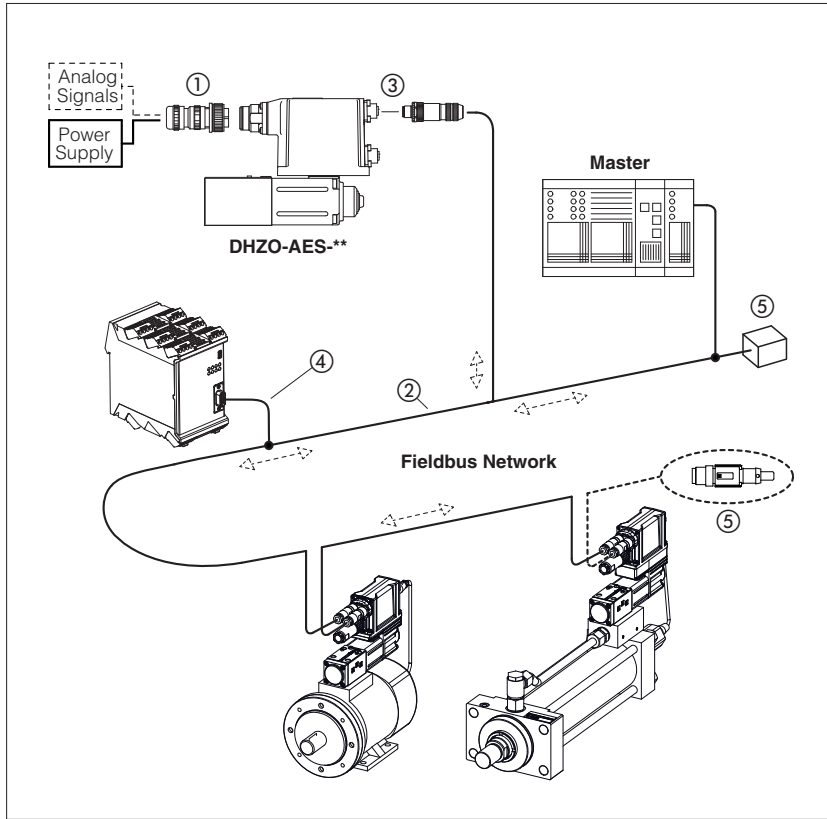


Fieldbus features

BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT),
EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET RT/IRT)

Typical CANopen or PROFIBUS DP fieldbus network



Fieldbus communication interfaces are available for digital proportional drivers and controllers, granting several plus:

- more information available for machine operation to enhance its performances
- improved accuracy and robustness of digital transmitted information
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance
- direct integration into machine's communication networks

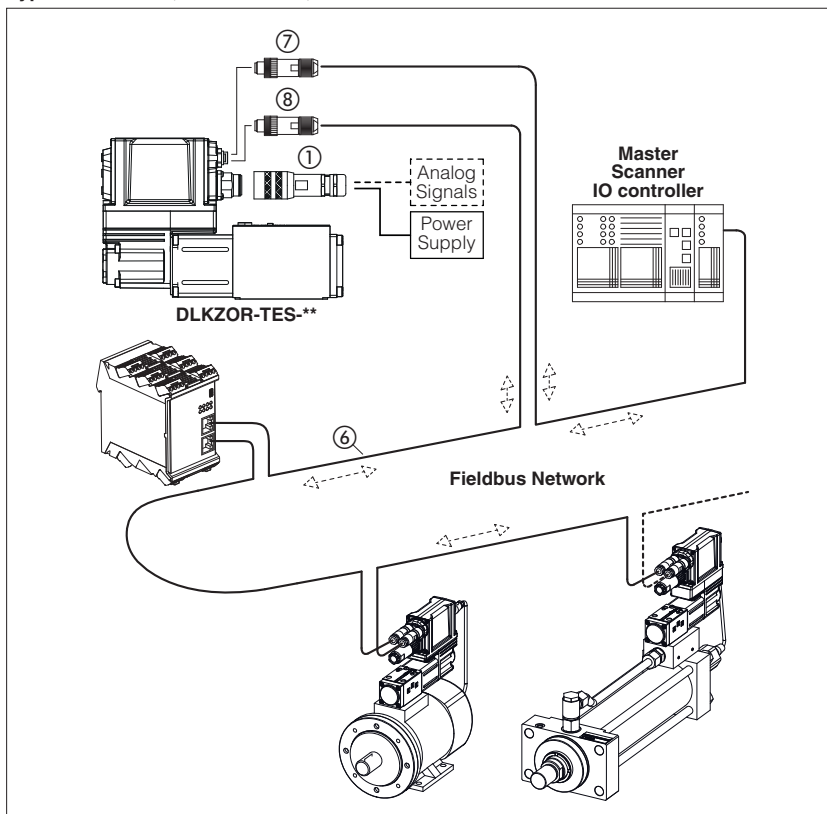
These executions allow to operate proportional valves and pumps through fieldbus or using the analog signals on main connector ①.

Fieldbus distributed-control

Fieldbus communication allows to share all the available information of the digital drivers and controllers (reference, monitor, etc).

This distributed-control design allows to implement powerful machines functionalities for tuning, diagnostic, maintenance, etc.

Typical EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT fieldbus network



CANopen and PROFIBUS DP networks consist of a common cable (2 twisted wire, ②) for digital communication: several devices (node ③) can be connected to this main cable by means of short cable branches ④.

The two endpoints of the main cable must be terminated with specific devices (terminator, ⑤) to dissipate the communication signal's energy thus preventing interferences and degradations of fieldbus transmission.

EtherCAT, POWERLINK, EtherNet/IP and PROFINET RT/IRT networks consist in a Ethernet common cable (4 twisted wire, ⑥) for digital communication. All slave, adapter and IO device have always the double connector for signal input ⑦ and signal output ⑧.

The main Ethernet cable starting from the master, scanner and IO controller has to be connected to the slave, adapter and IO device input connector.

The slave, adapter and IO device output connector has to be connected to the next slave, adapter and IO device input connector.

1 CANopen features for digital drivers and controllers in BC execution

Physical

Serial input format Industrial field-bus with optical insulation type CAN-Bus ISO11898
 Transmission rate Transmission rates from 10 Kbit/s to 1 Mbit/s
 Max node 32 per segment without repeater; 127 per segment with repeater

Communication Protocol

Data Link Layer DS301 V4.2.0 - based on CAN standard frame with 11-bit identifier
 Device Profile DS408 - Fluid Power Technology (EN50325-4)
 Device type Slave

Startup and configuration (as per DS301+DSP305)

Boot up process Minimum boot-up
 Node setting LSS (Layer Setting Services)
 SDO
 E-SW-FIELDBUS and Z-SW-FULL programming software
 Baudrate setting LSS (Layer Setting Services), SDO
 Baudrate 10 / 20 / 50 (default) / 125 / 250 / 500 / 1000Kbit/s

Fieldbus communication diagnostic (as per DS301)

Device Error Emergency
 Network Error Node Guarding
 Heartbeat

Real-time communication (as per DS301 + DS408)

RPDO 4 mappable PDOs to the drivers:
 AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES, PES
 4 mappable PDOs to the controllers:
 TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
 TPDO 4 mappable PDOs from the drivers:
 AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES, PES
 4 mappable PDOs from the controllers:
 TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
 R(T)PDO types Event Triggered, Remotely requested, Sync(cyclic) and Sync(acyclic)

Non real-time communication (as per DS301 + DS408)

SDO 1 SDO (1 Server + 1 Client)

Standard references

ISO 11898
 Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication
EN50325-4
 Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces
CiA DS301
 CANopen – Application Layer and Communication Profile for Industrial Systems
CiA DR303-1
 Cabling and connector pin assignment
CiA DSP305
 CANopen – Layer Setting Services and Protocol
CiA DS408
 CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.2

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adaptor (see tech table **GS500**) or CANopen master device

Configuration file

EDS (Electronic Data Sheet), enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BC and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
 Z-MAN-S-BC and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

2 PROFIBUS DP features for digital drivers and controllers in BP execution

Physical

| | |
|---------------------|--|
| Serial input format | Industrial field-bus with optical insulation type PROFIBUS-DP RS485 European fieldbus standard (lev.1 – EN50170-part 2) |
| Transmission rate | Transmission rates from 9,6 Kbit/s to 12 Mbit/s |
| Max node | 32 per segment without repeater; 126 node with repeater |

Communication Protocol

| | |
|-----------------|--|
| Data Link Layer | PROFIBUS DPV0 - IEC 61158 (type 3) |
| Device Profile | PROFIBUS-DP Profile for Fluid Power Technology |
| Device type | Slave |

Startup and configuration

| | |
|------------------|---|
| Boot up process | SAP 61 for sending parameter setting data SAP 62 for checking configuration data |
| Node setting | SAP 55 E-SW-FIELDBUS and Z-SW-FULL programming software |
| Baudrate setting | Automatic |
| Baudrate | 9,6 / 19,2 / 45,45 / 93,75 / 187,5 / 500 / 1500 / 3000 / 6000 / 12000 Kbit/s |

Fieldbus communication diagnostic

| | |
|--------------|--------|
| Device error | SAP 60 |
|--------------|--------|

Real-time communication

| | |
|-----|--|
| PZD | Process data area of PPO telegram by Data Exchange, default SAP: cyclic transmission of standard Profibus frame |
|-----|--|

Standard electronics - drivers

PPO type 3, 113, 213, 230 for:

AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES

PPO type 5, 115, 214, 240 for:

TES, BM-TEZ, LES, BM-LES, PES with alternated P/Q control

Note: PPO type 213, 230, 214, 240 are customizable by user

Standard electronics - controllers

PPO type 1, 111, 121, 123 for:

TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ

PPO type 1, 101, 103, 111, 121, 123, 223, 227 for:

TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ with alternated P/Q control

Note: PPO type 223, 227 are customizable by user

| | |
|-------------|---------------------------|
| Cyclic mode | standard, sync and freeze |
|-------------|---------------------------|

Non real-time communication

| | |
|-----|---|
| PKW | Parameter data area of PPO telegram by Data Exchange, default SAP: acyclic transmission of standard Profibus frame |
|-----|---|

Standard references

PROFIBUS profile

PROFIBUS Profile,
Fluid Power Technology,
Edition Oct. 2001

VDMA profile

Fluid Power Technology,
Proportional Valves and
Hydrostatic Transmissions, ver 1.1

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adaptor (see tech table **GS500**) or PROFIBUS DP master device

Configuration file

GSD (General Station Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS

Z-MAN-S-BP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

3 EtherCAT features for digital drivers and controllers in EH execution

Physical

| | |
|---------------------|---|
| Serial input format | Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2 |
| Transmission rate | 2 x 100 Mbit/s (Fast Ethernet, Full-Duplex) |
| Max node | 65535 slaves |
| Ethernet Standard | ISO/IEC 8802-3 frame format |
| EtherType | 0x88A4 according to IEEE 802.3 |
| Cable length | 0,2 - 100m (between two slave devices) |
| Cable type | CAT5 (4 wire twisted pair) according with T568B |
| Network topology | Line, tree and star |
| Termination | Device internally |

Communication Protocol

| | |
|--------------------|---|
| Data Link Layer | EtherCAT use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2 |
| Device Profile | CANopen over EtherCAT (CoE) DS408 - Fluid Power Technology EN 50325-4 |
| Device type | Slave |
| Supported protocol | CANopen SDO Mailbox-Interface "CoE" Network Management PDO PDO Watchdog Cycle time min 1 msec |

Startup and configuration (as per DS301+DSP305)

| | |
|--------------|---|
| Node setting | Automatic position addressing Device node addressing |
| Baudrate | 100 Mbit/s (Automatic) |

Fieldbus communication diagnostic (as per DS301)

| | |
|--------------|-----------|
| Device Error | Emergency |
|--------------|-----------|

Real-time communication (as per DS301 + DS408)

| | |
|---------------|---|
| RPDO | 4 PDOs messages to the driver and controller (up to 32 byte for each PDO) |
| TPDO | 4 PDOs messages from the driver and controller (up to 32 byte for each PDO) |
| R(T)PDO types | Remotely requested |

Non real-time communication (as per DS301 + DS408)

| | |
|-----|-----------------------------|
| SDO | 1 SDO (1 Server + 1 Client) |
|-----|-----------------------------|

Standard references

ISO 11898

Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

EN 50325-4

Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces

CiA DS301

CANopen – Application Layer and Communication Profile for Industrial Systems

CiA DSP305

CANopen – Layer Setting Services and Protocol

CiA DS408

CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1

IEC 61076-2-101

Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-2

Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-2

Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or EtherCAT master device

Configuration file

XML (Extensible Markup Language) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EH and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EH and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

4 POWERLINK features for digital drivers and controllers in EW execution

| | |
|--|--|
| Physical | |
| Serial input format | Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2 |
| Transmission rate | 2 x 100 Mbit/s (Fast Ethernet, Half-Duplex) |
| Max node | 239 slaves |
| Ethernet Standard | ISO/IEC 8802-3 frame format |
| EtherType | 0x88AB according to IEEE 802.3 |
| Integrated Hub | |
| Cable length | 0,2 - 100m (between two slave devices) |
| Cable type | CAT5 (4 wire twisted pair) according with T568B |
| Network topology | Line, tree, star, daisy chain, ring structure or any combination of these topologies |
| Ethernet Hub | Integrated with 2 ports: - one led for Link/Activity indicator (on each port) - one bicolor led Status/Error indicator |
| Communication Protocol | |
| Data Link Layer | POWERLINK use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2 |
| Comm. Profile | EPSP DS 301 v1.2 |
| Device Profile | CANopen over Ethernet based on DS408 - Fluid Power Technology |
| Device type | Slave - supported features: - Ethernet POWERLINK v2.0 - Ring Redundancy - Support PollResponse Chaining - Support Multiplexing - Cycle time min 200 µsec - SDO Multiple Parameter Read/Write |
| Startup and configuration (as per EPSP DS301 + EPSP DS 302-A/B/C/D/E) | |
| Node setting | E-SW-FIELDBUS and Z-SW-FULL programming software |
| Baudrate | 100 Mbit/s (Automatic) |
| Fieldbus communication diagnostic | |
| Custom parameters mappable on TPDO for emergency diagnosis | |
| Real-time communication (as per EPSP DS301 + DS408) | |
| RPDO | 1 PDO message to the driver (max number of of mapping parameters is Device specific) |
| TPDO | 1 PDO message from the driver (max number of of mapping parameters is Device specific) |

| |
|--|
| Standard references |
| <i>EPSP DS301</i> Ethernet POWERLINK Communication Profile Specification v 1.2 |
| <i>EPSP DS302-A/B/C/D/E</i> Ethernet POWERLINK Part A: High Availability v1.1 Part B: Multiple ASnd v1.0 Part C: PollResponse Chaining v1.0 Part D: Multiple PReq/Pres v1.0 Part E: Dynamic Node Allocation v1.0 |
| <i>EPSP DS311</i> Ethernet POWERLINK XML Device Description v 1.0 |
| <i>CiA DS408</i> CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1 |
| <i>IEC 61076-2-101</i> Connectors for electronic equipment - Product Requirements - Part 2-101: Circular connectors - Detail specification for M12 connectors with screw-locking |
| <i>IEC 61158-2</i> Industrial communication networks - Fieldbus specification - Part 2: Physical layer specification and service definition |
| <i>IEC 61784-2</i> Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3 |
| <i>IEC 61784-3</i> Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions |
| <i>IEC 61158-300/400/500/600</i> Industrial communication networks - Fieldbus specifications - Part 300: Data Link Layer service definition Part 400: Data Link Layer protocol specification Part 500: Application Layer service definition Part 600: Application Layer protocol specification |
| <i>ISO 15745-1</i> Industrial automation systems and integration - Open systems application integration framework - Part 1: Generic reference description |

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or POWERLINK master device

Configuration file

XDD (XML Device Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EW and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EW and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

Physical

| | |
|-------------------|--|
| Ethernet Standard | ISO/IEC 8802-3 frame format |
| EtherType | 0x08E1 according to IEEE 802.3 |
| Transmission rate | 10/100 Mbit Full/Half-Duplex |
| Integrated | 2-port switch |
| Cable length | max 100m |
| Cable type | CAT5 (4 wire twisted pair) according with T568B |
| Network topology | Device Level Ring (DLR), linear, star structure |
| Ethernet switch | integrated with two ports |
| Led indicator | 2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator |

Communication Protocol

ODVA CIP Object Model

ODVA CIP Object library for Generic Device Profile

- Identity Object (0x01)
- Message Router Object (0x02)
- Assembly Object (0x04)
- Connection Manager Object (0x06)
- Parameter Object (0x0F)
- DLR Object (0x47)
- QoS Object (0x48h)
- Port Object (0xF4)
- TCP/IP Object (0xF5)
- Ethernet Link Object (0xF6)

Valve parameters accessible via Vendor Specific Object 0xA2

IP address setting (range 0.0.0.0 - 255.255.255.255):

- TCP/IP Object (0xF5)
- DHCP
- Auxiliary USB communication + Atos Software

I/O Adapter and Explicit Message Server device type

Cyclic data transmission via Implicit Messages (transport class 1)

- Minimum RPI for Implicit Messages 1ms
- Total number of supported class 1 connections: 4
- Up to 5 parameters and 20 bytes for each connection
- Trigger types: Cyclic CoS

Acyclic data transmission via Connected and Unconnected Explicit Messages (transport class 3)

- Minimum RPI for Explicit Messages 100ms
- No. of simultaneous Class 3 connections: 6

Standard references

IEC 61918

Industrial communication networks
- Installation of communication networks in industrial premises

IEC 61076-2-101

Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-1

Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series

IEC 61158-2

Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-1

Industrial communication networks
- Profiles -
Part 1: Fieldbus profile

IEC 61784-2

Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-3

Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses -
General rules and profile definitions

IEC 61784-5-2

Industrial communication networks
- Profiles -
Part 5-2: Installation of fieldbuses -
Installation profiles for CPF 2

ISO 15745-4

Industrial automation systems and integration - Open systems application integration framework -
Part 4: Reference description for Ethernet-based control systems

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adaptor (see tech table **GS500**) or EtherNet/IP scanner device

Configuration file

EDS (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EI and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS

Z-MAN-S-EI and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

6 PROFINET RT/IRT features for digital drivers and controllers in EP execution

Physical

| | |
|-------------------|--|
| Ethernet Standard | ISO/IEC 8802-3 frame format |
| EtherType | 0x8892 according to IEEE 802.3 |
| Transmission rate | 100 Mbit Full-Duplex |
| Integrated | 2-port switch |
| Cable length | max 100m |
| Cable type | CAT5 (4 wire twisted pair) according with T568B |
| Network topology | line, star, tree and ring structure |
| Ethernet switch | integrated with two ports |
| Led indicator | 2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator |

Communication Protocol

| | |
|-----------------|---|
| Data Link Layer | PROFINET use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2 |
| Device type | IO device - supported features: - complies with PROFINET IO conformance Class A, B, C - Acyclic parameter Channel - Real Time (RT) and Isochronous Real Time (IRT) communication - Up to 8 input/output parameters for real time data exchange - PROFINET specific diagnostic support - Media Redundancy Protocol (MRP) - DCP Discovery and Configuration Protocol supported - Identification & Maintenance (I&M) - Cycle time min: 1 msec [RT] , 250 µsec [IRT] |

Startup and configuration

| | |
|-----------------|---|
| Address setting | IP Address and Station Name are assigned automatically by IO controller (e.g. Discovery and Configuration Protocol) |
| Baudrate | 100 Mbit/s (Automatic) |

Fieldbus communication diagnostic

Custom parameters mappable on real time communication for emergency diagnosis

Real-time communication

| | |
|----------------|--|
| Modular config | for drivers: AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES, PES up to 5 input parameters for real time data exchange up to 5 output parameters for real time data exchange for controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ up to 8 input parameters for real time data exchange up to 8 output parameters for real time data exchange |
|----------------|--|

Standard references

- IEC 61918**
Industrial communication networks
- Installation of communication networks in industrial premises
- IEC 61076-2-101**
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking
- IEC 61158-1**
Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series
- IEC 61158-2**
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition
- IEC 61158-5-10**
Industrial communication networks
- Fieldbus specification -
Part 5-10: Application layer service definition – Type 10 elements
- IEC 61784-1**
Industrial communication networks
- Profiles -
Part 1: Fieldbus profile
- IEC 61784-2**
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3
- IEC 61784-5-3**
Industrial communication networks
- Profiles -
Part 5-3: Installation of fieldbuses -
Installation profiles for CPF 3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFINET controller.

Configuration file

GSDML (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL