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5846EN-1

X45e ELECTRICAL SYSTEM

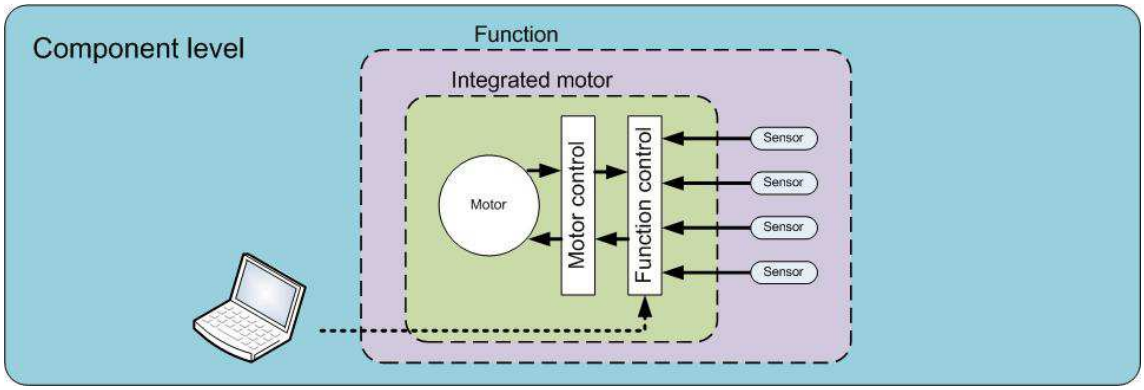
USER DOCUMENTATION

Table of content

Overview

The electrical and control part of the platform X45e are structured in an object oriented way. All motors in the platform have an integrated distributed control system and the local sensors are connected directly to the motor unit. It is a big advantage both regarding software developing, electrical design as well as electrical installation.

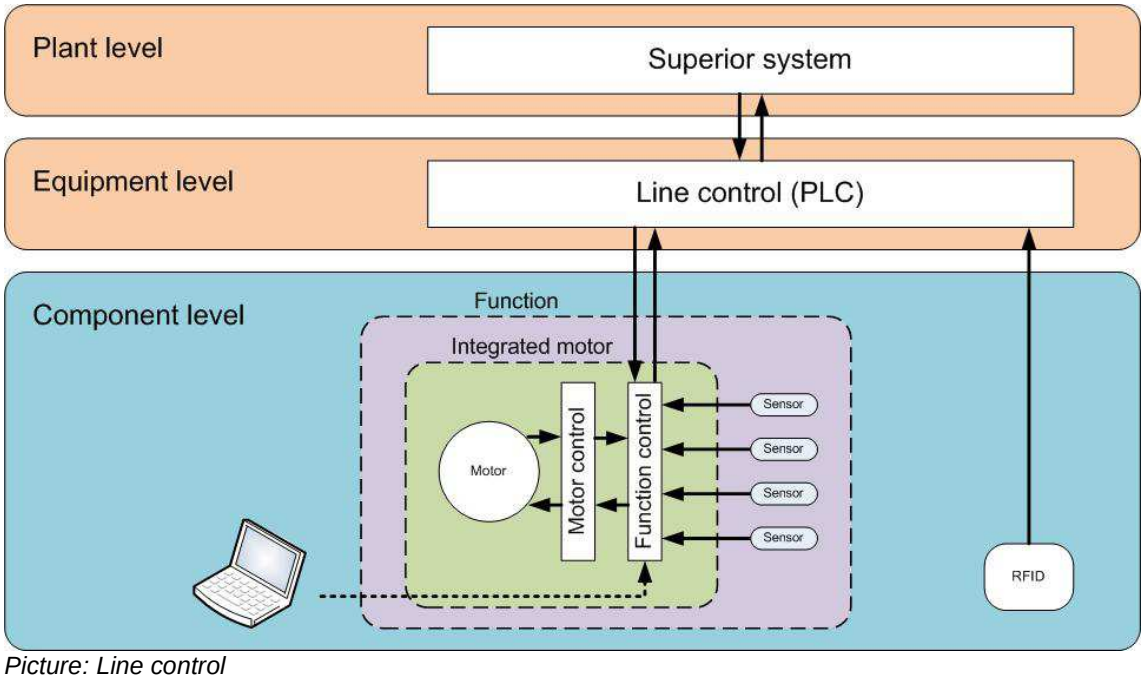
The control hierarchy in the platform can be implemented in two ways. The easiest solution is a stand-alone control of the motors with no control system in the level above. All input needed for the motors to execute their task are gathered via the digital inputs.



Picture: Autonomous control

The other way to implement the control is to connect the motors via a network. The motors are executing their task in the distributed control but commands based on information on system level can be sent from the line controller through a network master/scanner module.

If RFID are to be used, there can be a separate network for this purpose.



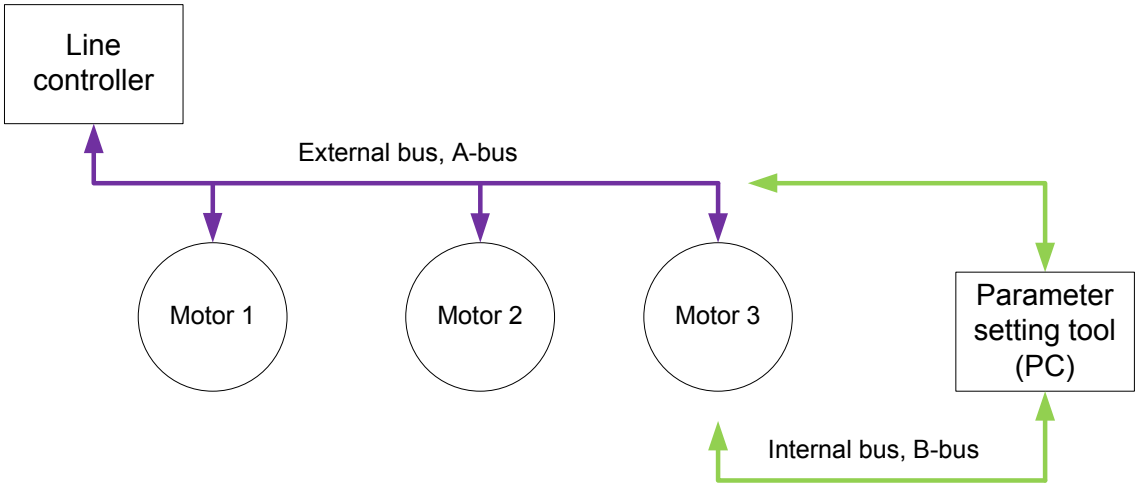
Picture: Line control

Hardware

Integrated motor

The motors in the X45e platform are integrated with controllers and sensor connectors.

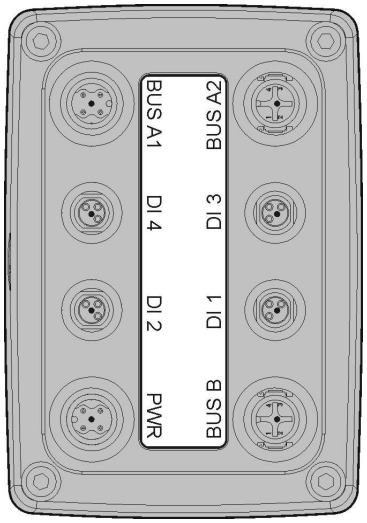
Communication buses



External bus, A-Bus
All motors can communicate up to a line controller via a field bus. This communication bus is called the A-Bus or the external bus. Via the Parameter setting tool software is it possible to connect to this network for reading and writing parameters to all motors.

Internal bus, B-Bus
The motor units have also an internal network called the B-Bus. This is used for communication inside the motor unit but can also be reached from the Parameter setting tool software via a separate contact, see below. If this is used only the connected motor can be reached. Some parameters has to be changed via this network (address and A-Bus network protocol)

Motor interface



BUS A1 – External bus, in
Connect this if external network is used

BUS A2 – External bus, out
Connect this if external network is used

DI 4 – Digital input 4:
Sensor, connect if used in specific function

DI 3 – Digital input 3:
Sensor, connect if used in specific function

DI 2 – Digital input 2:
Sensor, connect if used in specific function

DI 1 – Digital input 1:
Sensor, connect if used in specific function

PWR - Power in:
Connect power cable

BUS B – Internal bus:
Used for parameter setting

Electrical cabinet

The electrical cabinet for this system have to be designed according to some rules. The main function with the cabinet is to supply power to the motors. Additional features can be line control and safety functions. Only the X45e specific features are described in this document.

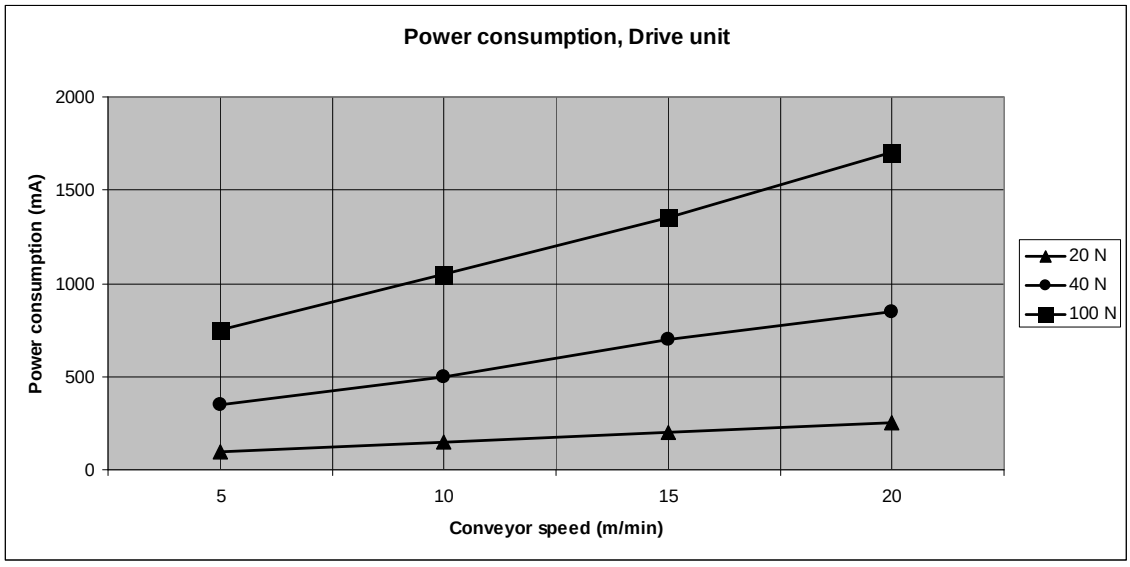
Power supply

A main 24 VDC power supply is needed in every X45e system. The consumers of power can be divided in the following categories:

- Drive power supply
- Electronics power supply
- External bus power supply

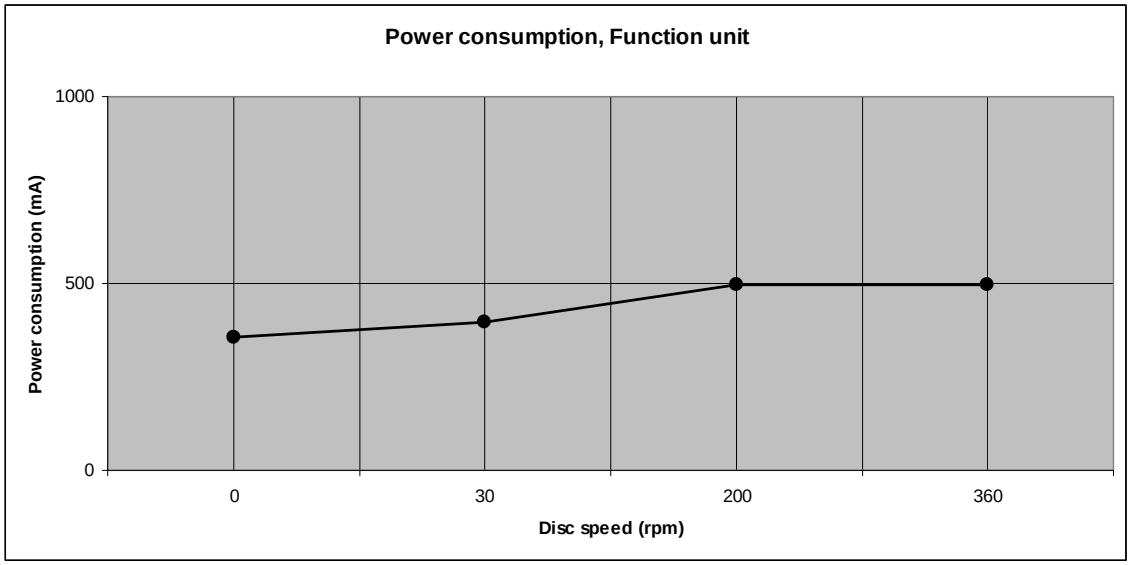
Drive power supply:
The power consumption for a drive unit (conveyor motor) depends mainly on two parameters, conveyor speed (x axis) and chain pull (the different curves).
(use FlexLink Calculation Tool to calculate actual force)

Maximum continuous current for a drive unit: 1,7 A (20 m/min and 100 N)



Picture: Power consumption, Drive unit

The power consumption for a function unit depends only on rotation speed of the rotation disc. This relation is not linear due to the fact that there has to be a stand still torque.
Maximum continuous current for a function motor: 0.5 A



Picture: Power consumption, Function unit

Electronics power supply:
Each motor unit has continuous power consumption of approximately 85 mA for feeding all electronic components (except the external bus transceiver, see below)

External bus power supply:
If the motors are connected into a network; all motors has to be supplied with power to CAN transceivers. These consume approximately 10 mA per motor unit.

Line control

Another main function for the electrical cabinet is the line control (this is not needed in the stand alone case).

Except the actual controller, there has to be a device for communicating over the external bus. The easiest way to achieve this is to use a real master/scanner device.

If a Siemens S7-300 controller is used the following product can be used as a CANopen master:

- Systeme Helmholz: CAN 300 PRO

If an Allen Bradley controller (CompactLogix) is used the following product can be used as a DeviceNet scanner:

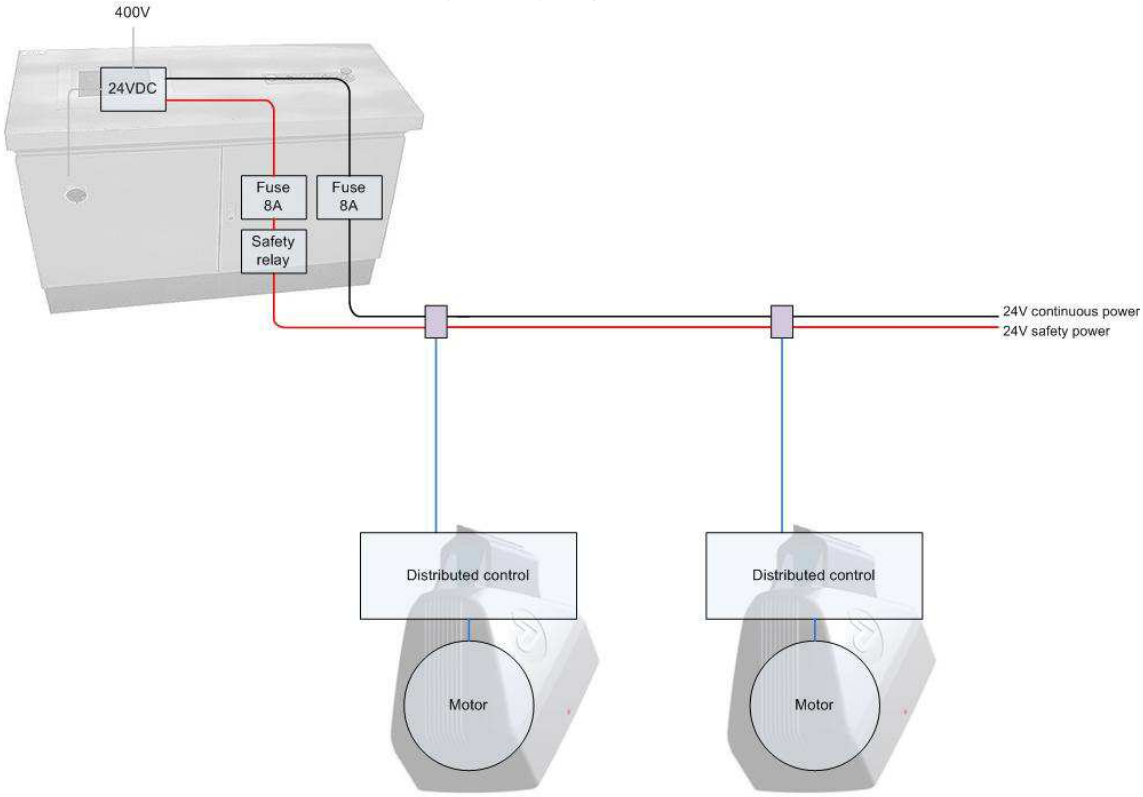
1769-SDN Scanner Module

An alternative solution is to use a gateway that acts like a master/scanner on the external network

(e.g. Profibus DP slave to CANopen master).

Safety function

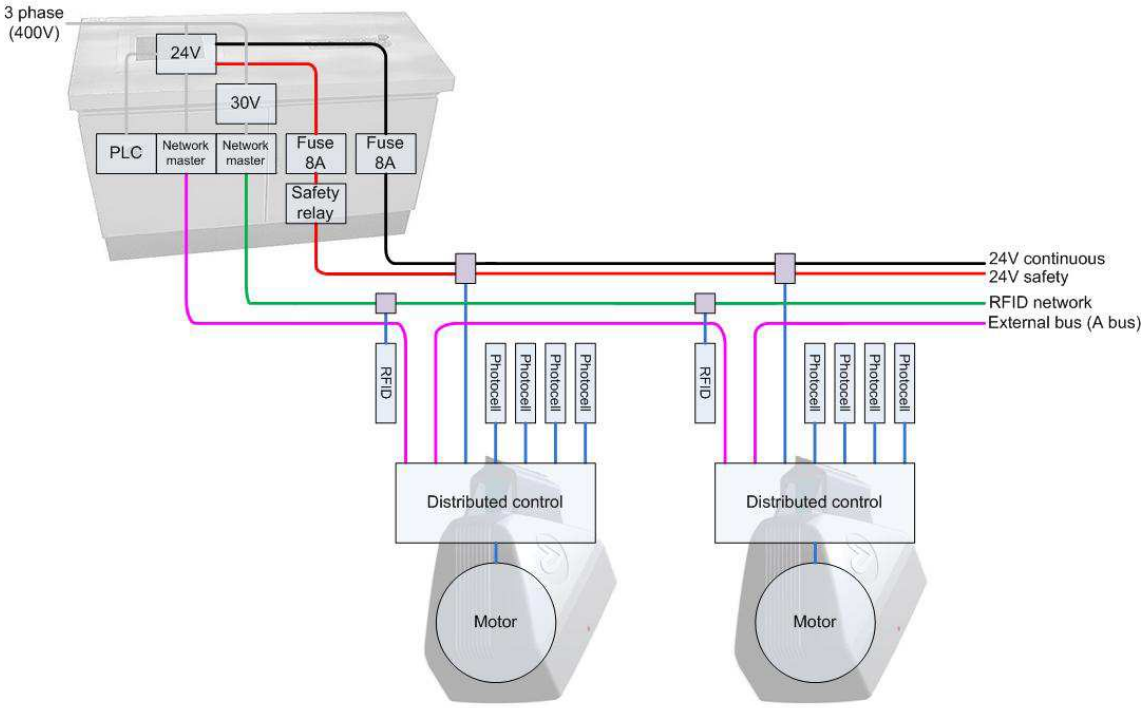
The motors are prepared for the ability to cut the drive power but keep the logic power to the units. If the system will be designed with this feature some safety components has to be added in the main cabinet.
The power line with safe power has to be cut by a safety relay or a corresponding unit. This power supplies all the motors with drive power.
The continuous power line supplies all electrical components inside the motors. This makes the motors able to communicate even during a safety stop.



During a loss of only safety power (drive power to the motors) the motors get an internal alarm, Low UDC. This can be read out via the monitoring function in the Parameter Setting Tool. The motor units are internally keeping their state even though they have no drive power. When the safety power is back the Low UDC alarms are automatically reset and the unit continues with its task.

Electrical installation

One big advantage with the X45e platform is the process of installation and cabling.



Picture: Overview of electrical installation

Power to the motor units

The motor units are supplied with power through a M12 A-coded contact (male contact on the motor).

Pin	Signal name	Direction	Function
1.	+24_POWER	In	+24 VDC Supply for motor drives, (Safety)
2.	GND	Out	Ground
3.	GND	Out	Ground
4.	+24_LOGIC	In	+24 VDC (continuous)
5	NC	--	Not connected

Picture: Pin configuration power supply contact

As can be seen in the table above both LOGIC (continuous power to the electronics) and POWER (drive power interrupted by emergency stop) has to be distributed. This can be achieved by two separate flat cables (AS-Interface, auxiliary power type) and a connection cable that gathers those two flat cables into one drop cable with the appropriate M12 contact. The components below can be used for this purpose.

- Phoenix contacts: VS-ASI-J-Y-B-M12FS or VS-ASI-J-Y-B-PUR-1,0-M12Fs SCO
- Bihl Wiedemann: BW1974

The AS-I flat cables are rated maximum 8A. Many vendors can also supply a number of useful additional components in this AS-I concept (T-connectors, splitters,…).

External network (A-Bus)

The motor nodes have two standard M12 A-coded contacts for external bus connections (one in-connector and one out-connector). This network can be either CANopen or DeviceNet. Both of these are based on the lower level CAN and use the same connector types. The installation method is described separately for each protocol on the next pages. Use cables designed for CANopen or DeviceNet (same specification due to the fact that both protocols are built on the CAN field bus).

Pin	Signal name	Function
1.	CAN_SHLD	Shield
2.	+24V_CAN	+24VDC supported from outside
3.	GND_CAN	Ground CAN
4.	CAN_H	Dominant High
5.	CAN_L	Dominant Low

Picture: Pin configuration CANopen/DeviceNet contacts

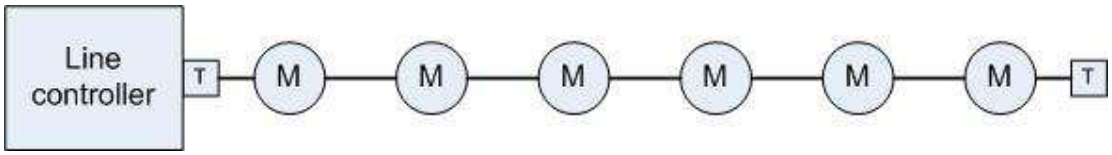
Example of cable components: (MURR Elektronik)

DeviceNet, CANopen, Male straight to female straight, M12 - M12, 5-pole, shielded
Art. No. 7000-40531-8031000 (1,0m)

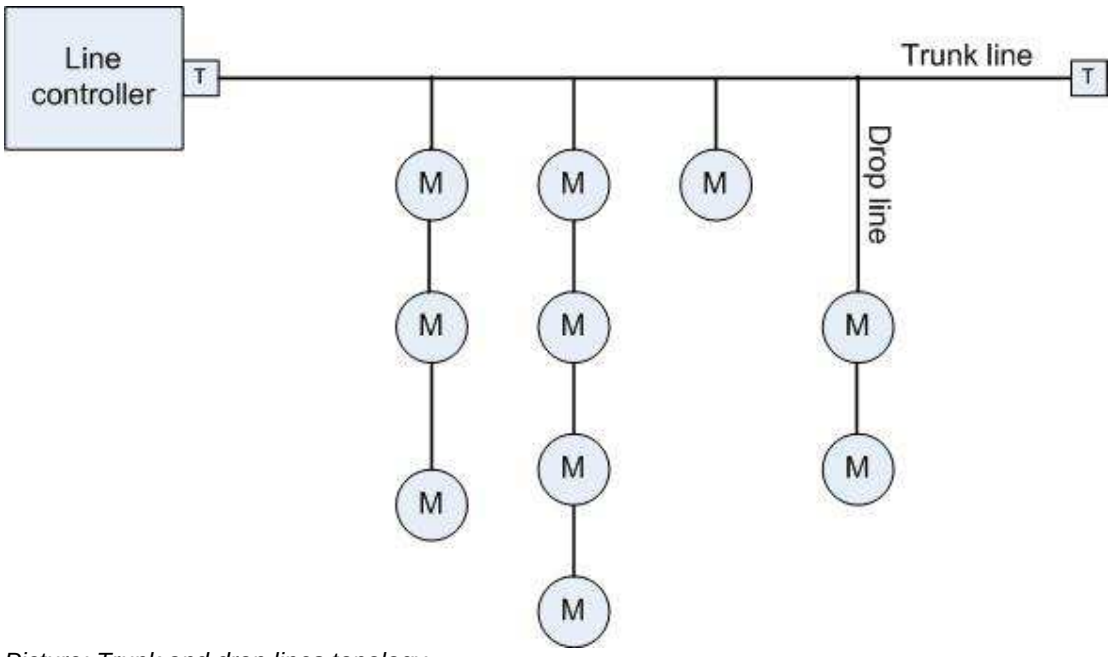
Terminator M12, A-coded, 5-pole
Art. No. 7000-13461-0000000

Network layout

The layout of a CANopen or DeviceNet network is line type (bus). The motors are linked by daisy chain or trunk and drop lines. Each end has to contain a bus terminator (120 Ohm). Maximum number of nodes is 128 for CANopen and 64 for DeviceNet.



Picture: Daisy chain topology



Picture: Trunk and drop lines topology

Sensors

All sensors that are needed for each function are already connected before delivery. Each motor unit has four M8 connectors for digital sensors. If some of them are not connected there is a possibility to connect them with other sensors and read these signals over the external bus. The sensors exist in two variants only differed by the sensing distance and one variant with reflector.

Sensors, SICK

GTB2S-P5331 – 30 mm
WTB2S-2P3160 – 60 mm
GL2S- F5311 – reflector

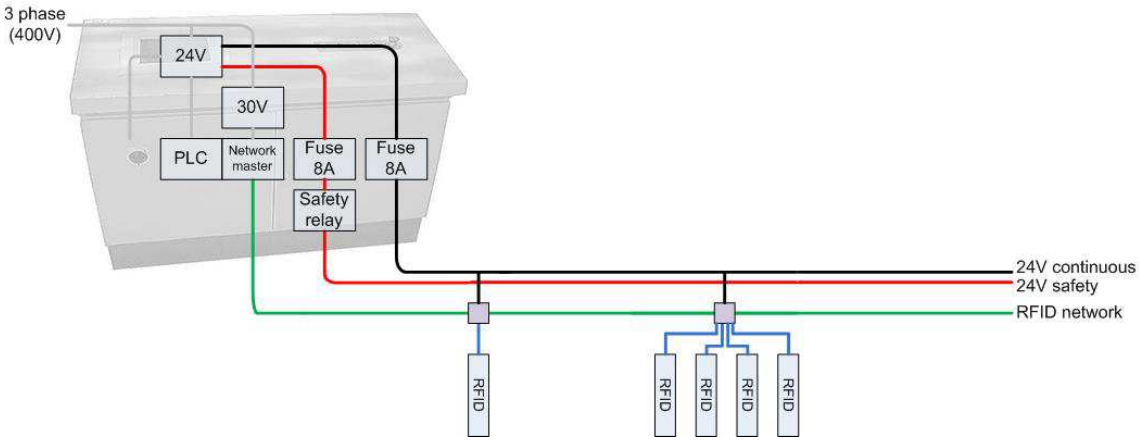
RFID

The RFID readers/writer used in the X45e platform are IDENT from Pepperl&Fuchs. These units communicate with a line controller via a field bus unit. This field bus unit can be ordered with many different standard protocols e.g. Profibus, Profinet, DeviceNet and Ethernet IP. The field bus exists in different variants which can connect to 1, 2 or 4 reader/writer units.

Recommended RFID components: (Pepperl + Fuchs)

IQH1-F61-V1: Read/write head
IC-KP-B12-V45: Field bus node (4 channels, Ethernet IP/Profinet IO)
IC-KP2-2HB17-2V1D: Field bus node (2 channels, Ethernet IP/Profinet IO)
IQC33-30: RFID Tag, 16 kBit
IQC21-30P: RFID Tag, 1024 Bit
V1-G-5M-PUR-ABG-V1-W: Cable Read/write head – Field bus node

See FlexLink Product catalogue!



Software

Motor software

Each motor has two microprocessors for achieving the desired functionality of the motor. The first one is the drive controller. This controller sends the actual control signals to the motors and receives feedback. The second microprocessor runs the application program which completes the function. This controller receives signals from the sensors and communicates both down to the drive controller and up the line controller, if used. This controller has a set of parameter that can be changed in order to achieve a certain function.

How to set these parameters from a laptop can be read in the user documentation for the Parameter setting tool (51113270 in the Technical library at flexlink.com).

Motor parameters

Address
The address of the node (Only possible to change on the B-Bus)
CANopen: 1-127
DeviceNet: 1-63

Motor type
1 = Conveyor motor (PM)
2 = Function motor (Stepper motor)
This parameter is read only and is preset from the production.

Enable drive
Enable the drive in Function or a Conveyor motor
0 = Disable
1 = Enable
Only valid if *A-bus enable drive and reset* is set to 0.

Function mode
Only applicable to a Function motor
1 = Diverter
2 = Merger – Combined Diverter/Merger
3 = Transfer – Stop – Locating unit
4 = Position mode
5 = Speed mode

A-Bus signal rate
Send Tx PDOs when a counter ≥ PDOTimer
This timer specifies how often data is to be sent to a line controller.
This parameter must be different from zero in order to make the diagnosis function work from the Parameter setting tool software.

This parameter is only valid for CANopen. When DeviceNet is used this value is set in the DeviceNet scanner module.

SpeedSP2
The speed of a Conveyor motor or a Function motor

Conveyor motor
Second speed for special usage like reverse direction
If the motor is a Right version positive speed values runs the conveyor in forward direction.
If the motor is a Left version negative speed values runs the conveyor in forward direction.

Speed value interval:
Right version: 80 – 400 rpm
Left version: - 80 – - 400 rpm

Function motor
Speed used during turn
Interval: 0 - 360 rpm

SpeedSP1
The speed of a Conveyor motor or a Function motor

Conveyor motor
Standard speed
If the motor is a Right version positive speed values runs the conveyor in forward direction.
If the motor is a Left version negative speed values runs the conveyor in forward direction.

Speed value interval:
Right version: 80 – 400 rpm
Left version: - 80 – - 400 rpm

Function motor
Speed used pre turn and post turn
Interval: 0 - 360 rpm

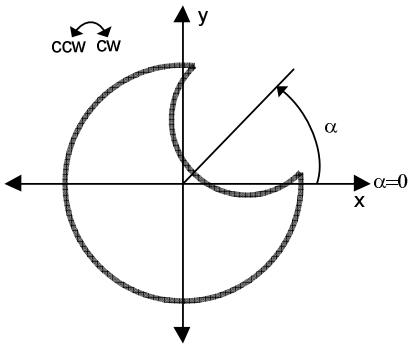
Torque
The torque of Conveyor motor
Interval: 0 – 100 %

Automatic reset errors
1 = FEG reset errors automatically when they appear
0 = Leave errors to be cleared by Line controller

Reset errors
Reset all errors by sending 1. If the value re-appears in PDO2Tx[Errors] the error is still valid

Acceleration ramp
The speed increasing ramp of a Function or a Conveyor motor
Increasing interval: 1 – 300

Deceleration ramp
The speed decreasing ramp of Function or a Conveyor motor
Decreasing interval: 1 – 300



Receive angle 1
The angle position 0 – 360° for receiving pucks from conveyor 1, counted clockwise relative the home position.

Receive angle 2
The angle position 0 – 360° for receiving pucks from conveyor 2, counted clockwise relative the home position.

Receive angle 3
The angle position 0 – 360° for receiving pucks from conveyor 3, counted clockwise relative the home position.

Release angle 1
The angle position 0 – 360° for releasing pucks to conveyor 1, counted clockwise relative the home position.

Release angle 2
The angle position 0 – 360° for releasing pucks to conveyor 2, counted clockwise relative the home position.

Wait angle 1
When the diverter has released a puck on conveyor 1 it can be set to go to a waiting position. The next receive command is completing the motion to the receive angle. This angle position is also counted clockwise relative the home position.

Wait angle 2
When the diverter has released a puck on conveyor 2 it can be set to go to a waiting position. The next receive command is completing the motion to the receive angle. This angle position is also counted clockwise relative the home position.

Mode
Activates test modes in FEG. This parameter value is automatically reset after reset.

0 = No test
1 = Flashing with LEDs
2 = Show digital input levels on LEDs
3 = Start calibration mode
128 = Command to reboot the FEG processor.

Requested angle
This value is not set by the operator. It is updated by the homing function (Calibration).

Calibrate
Execute internal calibration sequence for a Function motor if Motor Type = 2

Internal FEG Calibrate sequence
1. ECO standing still.
2. FEG changes the mode to: Calibrate mode (PDO2)
3. ECO saves the position and leaves Calibrate mode.
4. Position value in PDO1 is now updated to 0.
5. FEG Request 0 speed. (PDO1)

Thumb of rule for homing position:
- *The home position is always the forward direction of the conveyor the function unit is mounted on*.

Function Parameter 1, 2, 3, 4
See Appendix for detailed description

Pre turn delay
Timer value used for delays (in motor state Pre turn)

During turn delay
Timer value used for delays (in motor state During turn)

Post turn delay
Timer value used for delays (in motor state Post turn)

Interlock delay (on)
Timer value used for delays (max queue)

Interlock delay (off)
Timer value used for delays (max queue)

Interlock mode
0 = No interlock

1 = Normally open
The interlock function is blocking the unit from running when the input (DI4) is active.
This could be interpreted as a max queue mode.
The two interlock timers are activated.

2 = Normally closed
The interlock function is blocking the unit from running when the input (DI4) is inactive.
This could be interpreted as a sensor enable mode.
The two interlock timers are activated.

Program version
This value is the revision of the embedded motor software.
This value is read only and can't be set by the operator.

A-bus enable drive and reset
0 = Disable drive control and clear error through cyclic messages
This means the bits enable and reset in the PDO (cyclic communication) are inactivated. These two signals have to be sent by SDO (acyclic communication). Typically used for stand-alone control.

1 = Enable drive control and clear error through PDO1rx
This means the bits enable and reset in the PDO are activated. These two signals are sent over the A-bus.

Network protocol
This value is setting the network type on the external bus (A-bus).
0 = No network
1 = CANopen
2 = DeviceNet

Positioner mode
Operation mode of a Function motor that runs at positioner.
1 = angular positioner (0 – 360°)
2 = distance positioner (mm)

Positioner ratio
Ratio of mm per revolution if positioner runs as distance positioner

Function group
Depending on the function the motor is used for (drive, divert, merge …) it is member of a group.
For detailed description see documentation of function variants.

Function variant
The function variant is a combination of function group, network protocol, A-bus enable drive and reset, control and variant.
For detailed description see documentation of function variants.

Limit switch wait
Timer value used for delays at drive motor using limit switch.

Motor power consumption
Momentary power consumption in Watts.
Only valid for a conveyor motor.

Operating years
Accumulated time when the enable signal is on (years)
This value is stored in the permanent memory of the motor unit.

Operating days
Accumulated time when the enable signal is on (days)
This value is stored in the permanent memory of the motor unit.

Operating hours
Accumulated time when the enable signal is on (hours)
This value is stored in the permanent memory of the motor unit.

Operating minutes
Accumulated time when the enable signal is on (minutes)
This value is lost when no power is supplied

Operating seconds
Accumulated time when the enable signal is on (seconds)
This value is lost when no power is supplied

Operating cycles (High word)
Accumulated number of cycles executed by a function motor. This value has to be interpreted together with the next parameter (the low word).
This value is stored every operating hour.

Operating cycles (Low word)
Accumulated number of cycles executed by a function motor. This value has to be interpreted together with the next parameter (the high word).
This value is stored every operating hour.

Temperature
This parameter is showing the temperature inside the motor housing. There is an analogue sensor on the PCB board.

Motor state

The function motors have an internal sequence in order to complete its cycle.

	State	
0	Resque	
1	Init	Movement after power up
2	Pre-turn	Movement to receive the puck
3	During turn	Movement to release the puck
4	Post-turn	Movement after releasing the puck
5	Calibration	Movement during calibration
6	Idle	Wait for new order
7	Fault	

Table: Motor state

Motor alarms

The motor unit has seven different faults that can be monitored via the PST (Tool/Monitor) or be read out via the cyclic parameters. Also the LED indicator shows a red light when there is an active alarm.

Over current
Current exceeds 4.9 A.

High UDC
Voltage exceeds 29 VDC.

Low UDC
Voltage is below 19 VDC.
This alarm is not lit the LED to red.
Motor attempts a self-reset when the Low UDC disappears.

PCB over temp
The internal temperature inside the housing is over 100° C.

Locked rotor
The position control loop is unable the reach its required speed setpoint within 2 sec.

Internal fault
Not used

Turn time limit
Not used

Sensor functionality

Both drive motors and function motors have four digital inputs that can be used in many ways. When no network protocol is selected on the A-bus the control of the motors is only depending on the condition of the four digital inputs (DI1-4).

Drive motors

Interlock
The drive motor is by default configured to always start when powered up.
If a start or stop signal is wanted this can be achieved by the interlock function on digital input 4 (DI4). This works also if an A-bus protocol is set.

Second speed setpoint
All motors have two speed parameters, speed setpoint 1 and speed setpoint 2. The motor is by default running on speed setpoint 1. For a drive motor without a network protocol there are two way to get the motor to switch between the speed setpoints. The first solution is to simply let one digital input 3 (DI3) control this. The other solution is to have a limit switch functionality. Then both digital inputs DI3 and DI4 are used to set each setpoint.

Adjusting speed setpoints
The two speed setpoint parameters can be adjusted via the Parameter Setting Tool software using a PC and a communication cable. There is also a possibility to adjust this using the digital input signals. The digital input 1 (DI1) is increasing the speed setpoint parameter. It increases the values with 1 rpm per second the first two seconds. After this it increases the value with 10 rpm per second. The digital input 2 (DI2) is decreasing the speed setpoint parameter with the same timer functions. This fine tuning procedure is adjusting the speed setpoint that currently is chosen. This means if DI3 is inactive it affects speed setpoint 1 and if DI3 is active it affects speed setpoint 2. This fine tuning is only working if the unit is set with no A-bus protocol.

Function motors

Interlock
The function motor is not set to an A-bus protocol; it is by default configured to always start when powered up. If a start or stop signal is wanted this can be achieved by the interlock function on digital input 4 (DI4). This works also if an A-bus protocol is set.

The following description is covering all digital input connected to different kind of functions. The In position is triggered on the event that a puck has entered the gap in the guide disc and the function is ready to start its movement with the puck. The puck entering sensor is triggered by the first puck in the queue waiting to be moved by the guide disc. These sensors are replaced by signals from the PLC if RFID is used.

Diverter
DI1: Puck entering
DI2: Diverter selection (only variant 1/1)
DI3: In position
DI4: Interlock

Merger
DI1: Puck entering on conveyor 1 (only without A-bus communication)
DI2: Puck entering on conveyor 2 (only without A-bus communication)
DI3: In position, conveyor 1
DI4: In position, conveyor 2

Combined diverter/merger
DI1: Puck entering on conveyor 1 (only without A-bus communication)
DI2: Puck entering on conveyor 2 (on parallel version, only without A-bus communication)
DI2: Puck entering on conveyor 3 (on 90° version, only without A-bus communication)
DI3: In position, conveyor 1 (only without A-bus communication)
DI4: In position, conveyor 2 (on parallel version, only without A-bus communication)
DI4: In position, conveyor 3 (on 90° version, only without A-bus communication)

Transfer
DI1: In position, conveyor 1
DI2:
DI3:
DI4: Interlock

Locating unit
DI1: In position, conveyor 1
DI2: Release from locating (only variant sensor)
DI3:
DI4: Interlock

Stop unit
DI1: In position, conveyor 1
DI2:
DI3:
DI4: Interlock

Speed mode
All sensor are used exactly like a drive motor in stand-alone mode (read chapter above).

Line control

The main purpose with the line control system is to send commands to the motors and receive status signals. If RFID are used the status of each RFID has to be read in order to send correct commands. Other tasks could be emergency/safety stop and HMI functionalities and communication with superior systems.

Some system can be designed without a line controller. These motor has to be parameterized to stand alone mode and will not communicate with anything except via digital inputs. The start/stop is following the supplied power.

Communication with motor nodes

Standard block handling the communication with the motor nodes can be downloaded from the X45e software download homepage at www.flexlink.com. There are two variants of these standard blocks:

Allen Bradley (CompactLogix) with a DeviceNet Scanner

Siemens (Simatic S7-300) with a CANopen master from Systeme Helmholz (CAN 300 PRO)

Route handling

All the logic regarding reading and write RFID has to be dealt with in the line controller. This identification results in a route handling that can be achieved by the line controller sends some commands to the motors via the external network.

Alarm handling

The line controller can read out all alarms from the motors.
See chapter *External communication / Cyclic data / Data2:Error* for more info.
It is also possible to send a reset command to the motor units.

Safety functions

Because of the layout with two different power buses (logic and drive), there are possible to communicate with the nodes even under an emergency stop. This safety function has to be dealt with in the line controller.

Line start/stop

The overall start and stop of the line is of course something that has to be controlled from the line controller.

External communication

The external communication is the data transfer between the motors and the line controller. It uses two M12 connectors on each motor in order to interlink the units (daisy chain). These connectors are marked BUS A1 and BUS A2 on the motor label. The communication can be divided into two categories. First there is cyclic data. This data is sent frequent and contains all basic data needed for external control. The other kind of communication is acyclic data. This is not sent frequently but often on request. These two data transfer types have different names depending on which protocol is used. In CANopen it is called PDO and in DeviceNet cyclic communication.

Cyclic data

This data is time critical low volume data (less than 8 byte).

Line controller -> Motor

	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
	Control Byte 0	Control Byte 1	Not used	Not used	Not used	Not used	Not used	Not used

Data 0: Control Byte 0
Bit 7: Reset alarm
Bit 6: Enable
Bit 5: Reversed speed. Only for conveyor motors
Bit 4: Control bit 4 = Receive puck from conveyor 3
Bit 3: Control bit 3 = Receive puck from conveyor 2
Bit 2: Control bit 2 = Receive puck from conveyor 1
Bit 1: Control bit 1 = Release the puck to conveyor 2
Bit 0: Control bit 0 = Release the puck to conveyor 1

Data 1: Control Byte 1
Bit 7: not used
Bit 6: not used
Bit 5: not used
Bit 4: not used
Bit 3: not used
Bit 2: not used
Bit 1: Control bit 1 = Move to Wait angle 2
Bit 0: Control bit 0 = Move to Wait angle 1

Motor -> Line controller

	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
	Status	Confirmation Byte 1	Error	Confirmation Byte 3	Confirmation Byte 4	Not used	Not used	Not used

Data 0: Status
Bit7: In position
Bit6: State bit 3 (see table below)
Bit5: State bit 2
Bit4: State bit 1
Bit3: Digital input 4
Bit2: Digital input 3
Bit1: Digital input 2
Bit0: Digital input 1

State:	Function unit	Drive unit
0	Resque	Resque
1	Init	Running
2	Pre turn	Stopped
3	During turn	Fault
4	Post turn	
5	Calibrate	
6	Idle	
7	Fault	

Table: State bits

Data 1: Confirmation Byte
Bit7: Clear error
Bit6: Enable drive (A-Bus)
Bit5: M1 direction
Confirmation bit 4 = Receive puck from conveyor 3
Confirmation bit 3 = Receive puck from conveyor 2
Confirmation bit 2 = Receive puck from conveyor 1
Confirmation bit 1 = Release the puck to conveyor 2
Confirmation bit 0 = Release the puck to conveyor 1

Data 2: Error
Bit7: Not used
Bit6: Error bit 6 – Turn time limit
Bit5: Error bit 5 – internal fault
Bit4: Error bit 4 – Locked rotor
Bit3: Error bit 3 – PCB over temp
Bit2: Error bit 2 – Low UDC
Bit1: Error bit 1 – High UDC
Bit0: Error bit 0 – Over current

Data 3: Confirmation Byte
Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: Not used
Bit 3 = Not used
Bit 2 = Not used
Bit 1 = Not used
Bit 0 = State bit Waiting (not moving)

Data 4: Confirmation Byte
Bit7: Not used
Bit7: Not used
Bit5: Not used
Bit4: Not used
Bit 3 = Not used
Bit 2 = Not used
Bit 1 = Move to Wait angle 2
Bit 0 = Move to Wait angle 1

Hand shake communication
When using the control and confirmation bits it is recommended use the following guidelines.

These requirements have to be fulfilled before a new command is sent to the unit:
Step = 6 (Idle): Divider/Combiner
Step = 3 (During turn): Locating unit
No old commands are active (either receive or release)
Unique evaluation for the application (RFID, sensor, …)

Then new commands can be sent to the unit. If both receive and release commands are used both can be sent simultaneously. These commands are individually reset by the confirmation bits from the motor.

Acyclic data

Acyclic data are for changing parameters that are not sent frequently over the communication bus. A list of these parameters can be found under Software/Motor software/Motor parameters.

Network trouble shooting

If problems occur regarding the external network Kvaser has software called CanKing that can be useful (for CANopen and DeviceNet). It is free to download from their homepage (www.kvaser.com).

The Parameter Setting Tool software has also some diagnostic features that can be helpful. More info on this issue can be found in the separate user documentation regarding this software (5113270 in the Technical library at www.flexlink.com).

CANopen

The baudrate on the X45e implementation of CANopen is 250Kb.

If Siemens S7-300 is chosen as a line controller and the CANopen master module CAN 300 PRO is used the following PLC blocks are supported and delivered by Systeme Helmholz:

FB20 - CANopen IO Read
FB21 - CANopen IO Write
FB24 - CANopen SDO (both for read and write)

Today there is only support for cyclic communication (not change of state, strobed or polled)

EDS file

Some CANopen masters use an EDS file (Electronic Data Sheet) for configuring how the slave communicates. A CANopen EDS file can be downloaded from the X45e software download homepage at www.flexlink.com.

PDO – Process Data Exchange

Receive-PDO (RPDO) are sent from the master (line controller) and received by the slave (motor).

	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
PDO1Rx	Control Byte 0	Control Byte 1	Not used	Not used	Not used	Not used	Not used	Not used

Transmit-PDO (TPDO) are sent from the slave (motor) and received by the master (line controller).

	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
PDO1Tx	Status	Confirmation Byte 1	Error	Confirmation Byte 3	Confirmation Byte 4	Not used	Not used	Not used

SDO – Service Data Objects

Index	Sub-index	Size	R/W	Min	Max	Scale	Unit	Name in PST
$1017	0	U16	RW	0	65535	1	ms	
$4000	0	U8	R	1	255	1		
$4000	1	U8	WR	1	2	1		Motor type
$4000	3	U8	WR	1	6	1		Function mode
$4000	4	U16	WR	10	65000	1	ms	Signal rate
$4000	5	BOOL	WR	1	65535	1		Calibrate
$4000	6	U8	WR	1	127	1		Address
$4000	7	S16	WR	-400	400	1	rpm	Speed set point 2
$4000	9	S16	WR	-400	400	1	rpm	Speed set point 1
$4000	10	U16	WR	0	100	1	%	Torque
$4000	11	S16	WR	-360	360	1	Deg	Receive angle 1
$4000	12	S16	WR	-360	360	1	Deg	Receive angle 2
$4000	13	S16	WR	-360	360	1	Deg	Release angle 1
$4000	14	S16	WR	-360	360	1	Deg	Release angle 2
$4000	30	S16	WR	-360	360	1	Deg	Receive angle 3
$4000	15	S16	WR	-360	360	1	Deg	Wait angle 1
$4000	16	S16	WR	-360	360	1	Deg	Wait angle 2
$4000	17	U16	WR	1	300	1	cHz/s	Acceleration ramp
$4000	18	U16	WR	1	300	1	cHz/s	Deceleration ramp
$4000	19	BOOL	WR	0	1	1		Enable drive
$4000	20	BOOL	WR	1	1	1		Reset errors
$4000	22	U8	WR	0	3,128	1		Mode
$4000	23	U8	WR	1	20	1		Function parameter 1
$4000	24	U8	WR	1	20	1		Function parameter 2
$4000	25	U8	WR	1	20	1		Function parameter 3
$4000	26	U8	WR	1	20	1		Function parameter 4
$4000	28	U16	WR	0	65000	1	ms	Time A
$4000	29	U16	WR	0	65000	1	ms	Time B
$4000	33	U16	WR	0	65000	1	ms	Time C
$4000	34	U16	WR	0	65000	1	ms	Time D
$4000	47	U16	WR	0	65000	1	ms	Time E
$4000	31	U8	WR	0	1	1		Automatic reset errors
$4000	32	U8	WR	0	1	1		Interlock mode
$4000	35	U8	WR	0	1	1		A-Bus enable and reset
$4000	38	U16	R			1		FEG Program version
$4000	37	U8	WR	0	2	1		A-Bus network protocol
$4000	39	U16	R			1	W	Motor power consumption
$4000	44	U8	WR	0	255	1	y	Operating years
$4000	43	U16	WR	0	365	1	d	Operating days
$4000	42	U8	WR	0	23	1	h	Operating hours
$4000	41	U8	WR	0	59	1	m	Operating minutes
$4000	40	U8	WR	0	59		s	Operating seconds
$4000	45	U16	WR	0	65535			Op. cycles (High word)
$4000	46	U16	WR	0	65535			Op. cycles (Low word)
$4000	48	U8	WR	1	2			Positioner Mode
$4000	49	U16	WR	1	65535			Positioner Ratio
$4000	50	U16	WR	1	65535			Function group
$4000	51	U16	WR	1	65535			Function variant
$4000	52	U16	R	1	65535			ECO Program version
$4000	53	U16	R	1	65535			Temperature
$4000	54	U8	RW	0	1			Enable debug signals
$4000	56	S16	RW	0	360			Position abs closest
$4000	57	S16	RW	0	360			Position abs CCW
$4000	58	S16	RW	0	360			Position abs CW
$4000	59	S16	RW	-360	360			Position relative

$4000	60	U16	R	0	360			Position actual
$1018	0	U16	R					

Table: CANopen SDO table

DeviceNet

The baudrate on the X45e implementation of DeviceNet is 250Kb.

EDS file

Some DeviceNet scanners use an EDS file (Electronic Data Sheet) for configuring how the slave communicates. A DeviceNet EDS file can be downloaded from the X45e software download homepage at www.flexlink.com.

I/O messages

Two bytes of data are sent from the master (line controller) and received by the slave (motor).

	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
	Control Byte 0	Control Byte 1	Not used	Not used	Not used	Not used	Not used	Not used

Four bytes of data are sent from the slave (motor) and received by the master (line controller).

	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7
	Status	Confirmation Byte 1	Error	Confirmation Byte 3	Confirmation Byte 4	Not used	Not used	Not used

Explicit messages

Class	Instance	Size	R/W	Min	Max	Scale	Unit	Name in PST
$70	0	U8	R	1	255	1		
$70	1	U8	WR	1	2	1		Motor type
$70	3	U8	WR	1	6	1		Function mode
$70	4	U16	WR	10	65000	1	ms	Signal rate
$70	5	BOOL	WR	1	65535	1		Calibrate
$70	6	U8	WR	1	127	1		Address
$70	7	S16	WR	-400	400	1	rpm	Speed set point 2
$70	9	S16	WR	-400	400	1	rpm	Speed set point 1
$70	10	U16	WR	0	100	1	%	Torque
$70	11	S16	WR	-360	360	1	Deg	Receive angle 1
$70	12	S16	WR	-360	360	1	Deg	Receive angle 2
$70	13	S16	WR	-360	360	1	Deg	Release angle 1
$70	14	S16	WR	-360	360	1	Deg	Release angle 2
$70	30	S16	WR	-360	360	1	Deg	Receive angle 3
$70	15	S16	WR	-360	360	1	Deg	Wait angle 1
$70	16	S16	WR	-360	360	1	Deg	Wait angle 2
$70	17	U16	WR	1	300	1	cHz/s	Acceleration ramp
$70	18	U16	WR	1	300	1	cHz/s	Deceleration ramp
$70	19	BOOL	WR	0	1	1		Enable drive
$70	20	BOOL	WR	1	1	1		Reset errors
$70	22	U8	WR	0	3,128	1		Mode
$70	23	U8	WR	1	20	1		Function parameter 1
$70	24	U8	WR	1	20	1		Function parameter 2
$70	25	U8	WR	1	20	1		Function parameter 3
$70	26	U8	WR	1	20	1		Function parameter 4
$70	28	U16	WR	0	65000	1	ms	Time A
$70	29	U16	WR	0	65000	1	ms	Time B
$70	33	U16	WR	0	65000	1	ms	Time C
$70	34	U16	WR	0	65000	1	ms	Time D
$70	47	U16	WR	0	65000	1	ms	Time E
$70	31	U8	WR	0	1	1		Automatic reset errors
$70	32	U8	WR	0	1	1		Interlock mode
$70	35	U8	WR	0	1	1		A-Bus enable and reset
$70	38	U16	R			1		FEG Program version
$70	37	U8	WR	0	2	1		A-Bus network protocol
$70	39	U16	R			1	W	Motor power consumption
$70	44	U8	WR	0	255	1	y	Operating years
$70	43	U16	WR	0	365	1	d	Operating days
$70	42	U8	WR	0	23	1	h	Operating hours
$70	41	U8	WR	0	59	1	m	Operating minutes
$70	40	U8	WR	0	59		s	Operating seconds
$70	45	U16	WR	0	65535			Op. cycles (High word)
$70	46	U16	WR	0	65535			Op. cycles (Low word)
$70	48	U8	WR	1	2			Positioner Mode
$70	49	U16	WR	1	65535			Positioner Ratio
$70	50	U16	WR	1	65535			Function group
$70	51	U16	WR	1	65535			Function variant
$70	52	U16	R	1	65535			ECO Program version
$70	53	U16	R	1	65535			Temperature
$70	54	U8	RW	0	1			Enable debug signals
$70	56	S16	RW	0	360			Position abs closest
$70	57	S16	RW	0	360			Position abs CCW
$70	58	S16	RW	0	360			Position abs CW
$70	59	S16	RW	-360	360			Position relative
$70	60	U16	R	0	360			Position actual

Table: DeviceNet explicit messages table

Appendix

Speed parameter settings

Conveyor velocity (m/min)	Speed parameter Conveyor motor (rpm)	Speed parameter Function motor (rpm)	Release puck delay Time B (ms)
5	92	27	350
6	110	32	
7	122	37	
8	138	42	200
9	153	47	
10	168	52	150
11		57	
12	200	62	
13		67	
14		72	
15	250	77	75
16		82	
17		87	
18		92	
19		97	
20	326	102	

Cycle time (Function units)