Operating Instructions

Control for Motorized Festoon Systems

Sinamics S120 with bus interface to crane PLC Siemens S7-1500

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Contents

1 General advice

1.1 About this document

This document facilitates safe and efficient handling and use of the equipment.

The document is an integral part of the equipment and must be kept in its immediately vicinity to allow access by personnel at any time. Prior to commencing any work, personnel must have carefully read through and understood this document. It is a basic requirement for safe working that all safety and procedural instructions contained in this document are complied with.

Local accident protection regulations and general safety guidelines for the area of use of the device or system also apply.

Illustrations in this documentation are provided for basic understanding and may deviate from the actual implementation of the unit or system.

In addition to these installation and operating instructions, attached instructions (if any) for installed components also apply.

1.2 Limitation of liability

All information and instructions in this document have been compiled with due regard to the standards and regulations in force, best engineering practice, and the findings and experience we have accumulated over many years.

The manufacturer is in no way liable for damages resulting from:

- failure to comply with this document,
- improper use,
- use by untrained personnel,
- unauthorized modifications,
- technical changes,
- use of unauthorized spare parts and accessories.

The actual scope of delivery may differ from the explanations and illustrations described here for special variants, if additional order options are utilized, or due to the latest technical changes.

The obligations agreed upon in the delivery agreement and our General Terms of Business apply, as do the delivery conditions of the manufacturer and all regulations applicable at the time the contract was concluded.

All products are subject to technical modifications in the context of improvement of function and further development.

1.3 Copyright

1.4 Spare parts

WARNING!

Safety risk due to faulty spare parts!

Faulty or defective spare parts might affect the security and cause damage, malfunction or complete failure.

→ Use only original spare parts of the manufacturer!

Spare parts can be ordered from your contracted dealer or directly from the manufacturer.
Contact data for spare parts orders: See the last page of this document.

1.5 Material defects

The regulations about material defects are listed in the general terms and conditions of business.

1.6 Technical support

For technical support please contact our staff from the Customer Support Department.
Contact data for technical information: See the last page of these operating instructions.

Our employees are also always interested in new information and experience from the field that can be valuable for the improvement of our products.

1.7 Applicable documents

These operation instructions are only valid together with the following instructions for festoons:

- Mounting Instructions MAL0300-0004-E Festoons Systems for I-beam – 0365, 0370, 385
- Mounting Instructions MAL0300-0006-E Motorized Festoons Systems – 0380
- Commissioning Checklist TDB0380-0001-E ComChecklist Motorized Festoons Sinamics S120
- Operating instructions of Siemens Sinamics frequency converter (delivered on CD-ROM, together with the control panel or downloadable at Supplier Website)

The operator must consider the following documents as supplements of the operating instructions (if applicable):

- Project-specific technical documentation
- Circuit diagram for the control of the motorized cable trolley 03-S210-xxxx
- Drawings
- Spare part lists
- Sketches

2 Safety advice

2.1 Definition of symbols

Safety and hazard information is identified in these operating instructions by symbols. Signal words are used to indicate the degree of hazard in these operating instructions. Always observe safety and hazard information and work carefully to avoid accidents, bodily harm or property damage!

DANGER!

… indicates an immediately hazardous situation, which if not avoided, may result in death or serious injury.

DANGER!

… indicates an immediately hazardous situation due to electricity, which if not avoided, may result in death or serious injury.

WARNING!

… indicates a possibly hazardous situation, which if not avoided, may result in death or serious injury.

WARNING!

… indicates a possibly hazardous situation due to electricity, which if not avoided, may result in death or serious injury.

CAUTION!

… indicates a possibly hazardous situation, which if not avoided, may result in moderate or minor injury and property damage.

ADVICE!

Advice and recommendations:

… gives advice and recommendations as well as information for an efficient and undisturbed operation.

2.2 Requirements concerning personnel

2.2.1 Qualification

WARNING!

Risk of injury in case of insufficient qualification!

Incorrect handling can cause serious injury to persons and heavy damage to property.

→ All activities must be carried out by qualified staff!

The operating conditions indicate the following qualifications for the various fields of activity:

- **Instructed personnel/operators**
  have been instructed by the operator about the tasks assigned to them and the possible dangers due to improper behavior.

- **Specialized staff**
  is able to carry out the works assigned to them and realize and avoid any dangers in this regard, based on their training, knowledge, experiences and knowledge of the respective regulations.
  Personnel are considered qualified if they have successfully concluded training, for example, as electricians, master electricians, electrical engineers, or electrical technicians. Personnel are also considered qualified who have been employed correspondingly for several years, have been educated in theory and practice during that time, and have whose electrical knowledge and skills have been tested.
  The operator of the electrical facility must document that the corresponding certification or other documentation of qualification are present or have been demonstrated.

- Only those persons are authorized for these works, who are expected to do their work properly. Persons with restricted responsiveness, e.g. due to drugs, alcohol or medication are not permitted.

- For the selection of personnel observe the age-specific and job-related prescriptions effective at the place of installation.

2.2.2 Unauthorized personnel

WARNING!

Danger caused by unauthorized personnel!

Unauthorized personnel who do not meet the requirements described in chapter 2.2 do not understand the danger in the working area.

→ Keep unauthorized personnel away from the working area.

→ In case of doubt, address the person and direct them away from the working area.

→ Stop work as long as unauthorized personnel are in the working area.

2.2.3 Instruction

Prior to commissioning the personnel must be instructed by the operator. Report the instructions as follows (example):

Date	Name	Type of instruction	Instructed by	Signature
05.11.2009	John Doe	First safety briefing for the personnel	Will Smith	

2.3 Intended use

The equipment has been exclusively designed and constructed for the intended use described here.
Intended use: Control for motorized festoon system using Siemens Sinamics S120 frequency converter components and software adapted to project specific requirements, connecting to crane PLC Siemens S7-1500 via bus interface.

Additional information: Festoon systems are used to operate a power supply for mobile consumer load, such as cranes, overhead cranes, pallet conveyors, etc.

Claims of any kind due to damage from improper use are excluded.

The operator bears sole liability for all damage resulting from unintended use.

WARNING!

Possible injury resulting from improper use!

Any application that deviates from or goes beyond the intended use described here can result in a hazardous situation.

→ The equipment may only be used as intended.

→ Strictly comply with all specifications of these installation and operating instructions.

→ Do not use the equipment for any other purpose than for the operation of the festoon system in the specific project environment described above.

→ Do not use the equipment in any application other than the one it was designed for.

The **following use of the device is forbidden**. Non-intended use particularly includes the following:

→ Using the equipment with unapproved accessories or accessories not authorized by the manufacturer.

→ Operation of the equipment by untrained personnel.

→ Operation of the equipment with supply voltages higher or lower than projected.

→ Changing the delivered software modules.

→ Changing, bridging and/or deactivation of control circuits or interlocking.

→ Bridging and/or deactivating electrical sensors or switches.

→ Use of non-approved protective devices.

→ Re-adjustment of protective devices.

→ Operation under conditions other than the agreed environmental and operating conditions.

→ Operating the equipment in a location other than the projected physical location.

→ Main trolley speed higher than 50 % of nominal speed in case of a fault.

2.4 Safety measures by the operator

The equipment is used in the commercial sector. The operator is therefore responsible for occupational safety. Besides the safety advice of these operating instructions the operator must observe the safety, accident prevention and environmental protection regulations effective for the range of application of this equipment.

Please note in particular:

- The operator must read the valid work safety regulations and determine any additional dangers in a risk assessment, dangers that might arise from special working conditions at the place of installation of the equipment. The operator then must work out the operating instructions for handling the equipment.
- During the complete operating time the operator must check if his operating instructions are in accordance with the state of technology of rules and standards and adapt them if required.
- The operator must clearly regulate and establish the responsibilities for installation, handling, fault repair and maintenance.
- The operator must ensure that all employees who are handling the equipment, have read and understood these operating instructions. Moreover, he must instruct the personnel at regular intervals and inform them about any dangers.
- The operator must provide the required protective equipment.

The operator must observe the following standards and regulations when operating a festoon system:

2006/95/EG 2004/108/EG	EC Low Voltage Directive EC EMC Directive
IEC 60204-32	Safety of electrical equipment of hoisting machines
IEC 60038	IEC standard voltages
IEC 60364	Electrical installations of buildings
IEC 60947	Low-voltage switchgear and control gear

Moreover, it is in the responsibility of the operator, that the equipment is in perfect technical conditions, this means:

- The operator must ensure that the maintenance intervals described in the operating instructions are observed.
- The operator must have checked all safety devices regularly for their operational capability and completeness.

2.5 Special risks

The following chapter mentions some remaining risks that have been established by risk assessment.

The safety instructions and warning notes listed up in the following chapters of these operating instructions must be observed, in order to reduce health hazards and avoid dangerous situations.

WARNING!

Danger of death due to suspended loads!

Loads falling or swinging sideways in an uncontrolled manner can lead to severe injuries or death.

→ Never step under suspended loads.

→ Only use the attachment points provided; do not fasten lifting accessories to projecting machine parts or eyes built onto components.

→ Be sure the connection elements are firmly seated.

→ Use only authorized lifting accessories and connection elements with sufficient load capacity.

→ Do not use torn or worn ropes or straps.

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them.

→ Move loads only under supervision.

→ Set down loads before leaving the work area.

DANGER!

Risk of fatal injury from electric shock!

Death, heart failure, burns and injury by electric arc are likely to follow when touching electrically life parts. There is also a high risk of injury caused by overreaction after being shocked by electricity.

Before starting maintenance or repair work:

→ Disconnect system from power using the main switch. Main switch: See facility circuit diagram.

→ If there is no main switch, disconnect the energy source from the system according to the instructions of the system manufacturer.

→ Secure system against reactivation,

→ confirm that power has been disconnected,

→ ground and short-circuit parts of the system disconnected from power,

→ cover or block off neighboring parts still carrying electrical current.

→ Before each time the device or system is started, test the insulation resistance according to locally applicable technical standards, directives, and law.

WARNING!

Risk of potentially fatal injury from electric shock due to maintenance deficiencies!

When working on motorized festoon system components, there is a risk of death or injury from electric shock, burning, or electric arc if they are not properly inspected and maintained.

→ Disconnect the system from power as described above.

→ Inspect electrical equipment regularly.

→ Replace loose or damaged cables immediately.

→ Burned fuses must always be replaced with a fuse of identical specifications.

→ Use tools that are insulated against voltage.

→ Before each time the device or system is started, test the insulation resistance according to locally applicable technical standards, directives, and law.

WARNING!

Risk of injury due to flexible components!

Careless operation of the motorized festoon system can cause heavy injury and damage of the equipment.

→ Switch off the motorized festoon system before maintenance and repair work.

→ Do not touch moving components during operation, particularly the surface where the cable trolleys roll on the I-beams.

CAUTION!

Risk of crushing!

When the motorized festoon system operates, there is a risk of bruising of the limbs between the buffer and buffer plate, suspension and track beam, and between tooth-belt and pulleys.

→ Do not step into the danger area of the motorized festoon system when it is being operated.

CAUTION!

Risk of stumbling and falling due to projecting components!

When approaching the motorized festoon system, there is the danger of stumbling.

→ When moving inside the working- and danger area of the motorized festoon system, watch out for depressions or bumps in the ground.

→ There must be no loose items are on the ground.

CAUTION!

Risk of getting caught in the festoon system!
When the motorized festoon system operates, there is a risk of getting caught by parts of the festoon system.
→ Do not step into the danger area of the motorized festoon system when it is being operated.

2.6 Safety devices

DANGER!

Danger of death from malfunctioning safety systems!
Safety can only be guaranteed when the safety systems are intact.
Before starting work:
→ check if the safety systems are functional.
→ check if all covers properly mounted.
→ Never disable safety systems.

2.7 Behavior in case of accidents and disturbances

Measures in case of accident:

- Secure the location of the accident.
- Evacuate personnel from of the danger area.
- Notify rescue services.
- Take first aid measures.
- Inform those responsible for the place of use.
- Free the access path for rescue vehicles.

Measures in case of malfunction:

- Involve qualified personnel for fault analysis.
- Fix the fault before restarting the system or continuing work
- Check for correct function after fault fixing.

3 Technical data

3.1 General

Motorized festoon systems for I-carrier systems, which serve to complete the erection and operation of an energy supply for mobile consumers, such as cranes, warehouse cranes, pallet conveyors, etc. The precise specification of the motorized festoon systems are given in the order confirmation. The dimensions of each motorized festoon systems to be found in the dimension sheet.

3.2 Interfaces

Interface between the crane control system and control cabinet of the motorized festoon systems are provided in the control panel terminal block or the terminals of the supplied field devices.

The control cabinet is mounted in accordance with the customer in an enclosed, electrical equipment room.

ADVICE!

Keep designed power supply voltages!
Operation of the control beyond the power supply voltage tolerances might cause a breakdown of the control or damage to electrical components.
Power supply voltages lower as the nominal motor voltage might cause too high motor current, over-temperature and drive disturbances because of too less motor torque!
That applies for the power supply voltage even during drive acceleration.

ADVICE!

Voltage range:
Voltage and frequency ranges in this operating instruction reflect exemplary system design. Specified voltage and frequency ranges that match project-related requirements are written down in separate, project-related documents (Technical data sheet electrical or circuit diagram).

Description and numbering of interface terminals are usually order specific and may therefore differ from the description and numbering in this document. See also technical data sheet electrical or circuit diagram for the values relating to your project.

For the control of the motorized cable trolleys customer supplies the following power supply:

Designation	Voltage/frequency
Primary current	
Phase L1	380-480 V 50/60 Hz
Phase L2	380-480 V 50/60 Hz
Phase L3	380-480 V 50/60 Hz
Earth conductor PE	
Control voltage AC	
Phase L	110/230 V 50/60 Hz
Neutral conductor N	110/230 V 50/60 Hz
Earth conductor PE	
Control voltage DC	
+ - Potential	24 VDC
0 - Potential (earthed!)	0 VDC
Earth conductor PE	
Power supply for anti-condensation heaters	
Phase L	110/230 V 50/60 Hz
Neutral conductor N	110/230 V 50/60 Hz
Earth conductor PE	

Permitted tolerances at input terminals of the panel according to IEC 60204-32:
Voltages ± 10%
Frequency ± 1%

Other voltages and frequencies are possible, inquiry is required.

The current required for each supply voltage are dependent on the interpretation and indicated in the circuit diagram of the control cabinet.

ADVICE!

Main switch:
Main switch for the power supply of the control has to be installed in customer distribution cabinet!

The main power supply of the festoon system has to be switched off by the customer, if the crane operator leaves the crane and in case of emergency stop (e.g. by the crane main switch). Leading switching-off (> 100 ms) of the release signal for on/off of the festoon control is requested.

ADVICE!

Line filter for category 2:
Line filter for limits according to category 2 of EN61800-3 are available for TN systems!

Conducted electromagnetic disturbances are limited according to the requirements of category 3 of EN61800-3. Limits according to category 2 of EN61800-3 are possible by using of an optional line filter (only for TN system available).

3.3 Operating conditions

ADVICE!

Damage due to wrong operating conditions!
Operation conditions **beyond the specified range** cause damage due to short circuit and early aging and failure of electrical components!
Stress factors are

- Dust and deposits
- Humidity
- Condensation
- High temperatures

Environment:

Designation	Value	Hints
Environmental temperature	+5 up to +40°C	
Humidity (relative), max.	≤ 85 %, without condensation	

4 Description of control and operation

4.1 Overview

Each motorized cable trolley (MCT) is controlled by its own frequency converter depending on the main trolley speed and the position of the cable trolley. When the land-side (optional: also water-side) final position is reached, the corresponding cable trolley will be switched-off by a limit switch.

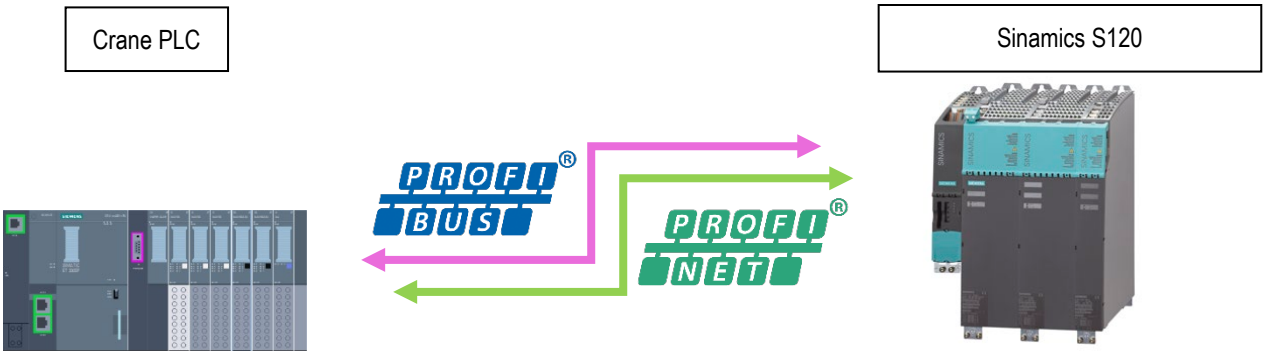
In generator and brake operation, the energy that is fed back by the motors will be recovered to the power supply source.
The drives work in vector mode without encoder.

There are two options available:

- Delivery of software for implementation into customers PLC by Conductix-Wampfler.
- Delivery of the complete MCT-control including PLC and software by Conductix-Wampfler.

4.1.1 MCT control in Crane PLC

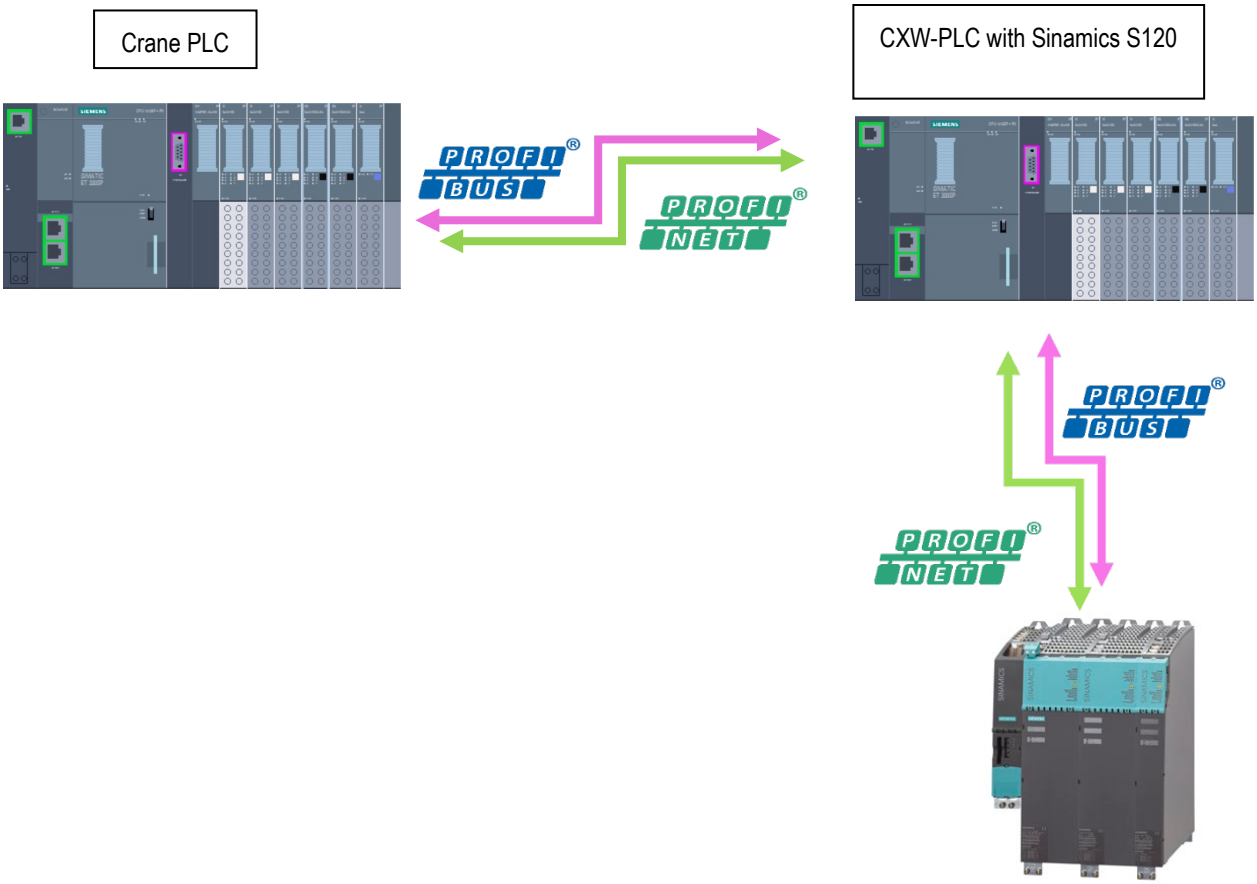
The software module supplied by Conductix-Wampfler has to be integrated into the crane Programmable Logic Controller (PLC).
The frequency converters are controlled by the crane PLC via PROFIBUS or PROFINET connection.



4.1.2 MCT control in Conductix-Wampfler PLC

The interface between customer control Siemens S7-1500 and MCT control Siemens S7-1500 is done by Profibus or Profinet connection.

The frequency converter is controlled by the MCT PLC via Profibus or Profinet connection.



4.2 Concept of frequency converter Siemens Sinamics S120

The frequency converter Siemens Sinamics S120 for Festoons (Motorized Cable Trolleys) consists of 3 modules:

- Control Unit CU320: For communication and control functions for one or more Motor Modules (MOMO) and for the Smart Line Module (SLM). Coupling to SLM, MM and other components by DRIVE_CLIQ. Coupling to PLC by PROFIBUS or PROFINET. All parameters are saved on a Compact Flash Card.
- Smart Line Module SLM: For DC-voltage generation for the Motor Module supply, with or without power recovery.
- Motor Module MOMO: Inverter for motor power supply (number according to the number of motors).

CU320

SLM

MOMO

The complete drive System, consisting of CU320, Smart Line Module and Motor Module will be defined as „frequency converter“.

4.3 Scope of supply

When the complete control is supplied it is mounted in a control cabinet, completely wired, including frequency converters with appropriate reactors and fuses, switching devices, coupling relays, panel lighting, heater and fan. It has to be installed in an air-conditioned electrical operating area.

The frequency converter is parameterized according to the system calculation.
The software module for implementation into the crane PLC is included in the scope of supply, too.

The dimensioning and manufacturing of the control is carried out according to the relevant instructions of DIN VDE/IEC.

All the electrical equipment is marked according to the circuit diagram, the wiring cables will be labeled according to the terminal designation on the equipment.

All the electrical equipment is marked according to the circuit diagram, the wiring cables will be labeled according to the terminal designation on the equipment.
The documentation consisting of components scheme, circuit diagram, terminal diagram and cable list is made with the help of the E-CAD system EPLAN and supplied as pdf file. The frequency inverter parameters are supplied as data file. Software module for crane PLC implementation.

Scope of supply is the software module “MCT_MAIN” for implementation into crane-PLC. Necessary frequency converters and control panel for the MCT drive have to be dimensioned according to Conductix-Wampfler requirements and delivered by the customer.

ADVICE!

Correct installation and connection of the frequency converter is within the responsibility of the crane manufacturer!

4.3.1 Description of the interface module “MCT_MAIN”

This function block is used as interface module for all interface signals between the superior (crane) control and the control of motorized festoon trolleys (Festoon). It is applicable for PLC Siemens S7-1500.

As frequency converter Siemens Sinamics S120 with integrated PROFIBUS or PROFINET interface will be used. The communication proceeds by system function blocks DPRD_DAT and DPWR_DAT integrated into the superior control, too.

For hardware configurations of the drive, is for every motorized cable trolley, a free PPO-type with 10 words PZD for receiving and sending of the data selected. Transmission in PKW area is not necessary and has not to be foreseen.

The function block has to be called up in the main (crane) program. The main function block contains the program for all festoons. The instance data block and the parameter data block have to be assigned to the main function block.

WARNING!

Injury due to wrong parameter adjustment!
Wrong parameter adjustment might cause malfunction of and damage to the festoon system.
Parameter adjustment only according to manufacturer instruction and in small steps!

The function blocks are delivered pre-programmed with order-related parameters, parameter adjusting during commissioning can be necessary.

Because of the instance data block no flag assignment is necessary.

ADVICE!

Data block numbers:
By changing of the numbers of function and data blocks no interference to modules of other manufacturers or functions is allowed!

4.3.2 Use of function block modules

The interface signals of the function block module “MCT_MAIN” are described. Because of the different scope of supply there are differences at the connection of parts of the inputs and outputs.

4.3.3 Memory Size

ADVICE!

Memory size:
Memory size is up to time of design stage of this operating instruction and subject to technical modification. If necessary actual size can be asked for at manufacturer.

Following CPU (Central Processing Unit) memory size is necessary for implementation of the function blocks for 3 motorized cable trolleys:

Memory size		
Loading memory	350	kBytes

4.3.4 Description of FB inputs

Input variable of function block		
Formal operand	Format	Function
FESTOON_INSTANCE	BLOCK_DB	DB-Number for all process parameters.
EN	BOOL	Enable (EN) and Enable output (ENO) of FUP/KOP boxes is realized by BIE-Bits. If EN and ENO are connected, then apply: ENO = EN AND NOT (error of box) If a fault occur (error of box = 0), it is ENO = EN. The EN-/ENO mechanism is used for: ■ arithmetic operations ■ transmission and convert operations ■ shift and rotate operations ■ block calls Not used in the function block!
CRANE_SWITCH_ON	BOOL	Input crane main switch is ON (base for the operation of the system).
POSITIONING_SIGNAL_OK	BOOL	Input customers position measuring system is ok without fault
ACT_POS_MAIN_TROLLEY	REAL	Input actual main trolley position as 32 bit floating-point number (actual position on the complete distance in [mm])
ACT_SPEED	REAL	Input actual speed of main trolley, scaled to –100 to +100% of maximum speed

Input variable of function block		
Formal operand	Format	Function
DRIVE_SWITCH_WS	BOOL	Input joy stick of trolley moved into waterside direction
DRIVE_SWITCH_LS	BOOL	Input joy stick of trolley moved into landside direction
CRANE_RESET	BOOL	Input reset signal for fault reset
FUSE_MAIN_VOLTAGE_OK [2)]	BOOL	Input circuit breakers main power supply ok
FUSE_CONTROL_VOLTAGE_OK [2)]	BOOL	Input circuit breaker control power supply ok
DC_BUS_OK [2)]	BOOL	Input DC Bus voltage is ok
F1_HW_IO_ADDR	HW_IO	Hardware ID of the module for Festoon 1 from which the data is to be read and write. The hardware ID can be found in the properties of the module in the device view or system constants.
F2_HW_IO_ADDR	WORD	Hardware ID of the module for Festoon 2 from which the data is to be read and write. The hardware ID can be found in the properties of the module in the device view or system constants.
F3_HW_IO_ADDR	WORD	Hardware ID of the module for Festoon 3 from which the data is to be read and write. The hardware ID can be found in the properties of the module in the device view or system constants.
F1_LIMIT_SWITCH_WS [1) 2)]	BOOL	Festoon 1: Input limit switch waterside direction
F1_LIMIT_SWITCH_LS	BOOL	Festoon 1: Input limit switch landside direction
F2_LIMIT_SWITCH_WS [1) 2)]	BOOL	Festoon 2: Input limit switch waterside direction
F2_LIMIT_SWITCH_LS	BOOL	Festoon 2: Input limit switch landside direction
F3_LIMIT_SWITCH_WS [1) 2)]	BOOL	Festoon 3: Input limit switch waterside direction
F3_LIMIT_SWITCH_LS	BOOL	Festoon 3: Input limit switch landside direction

Input variable of function block		
Formal operand	Format	Function
PARA	STRUCT	Structure from Parameter Data Block

[1] = Optional: Only if limit switches for positive direction (waterside) are installed

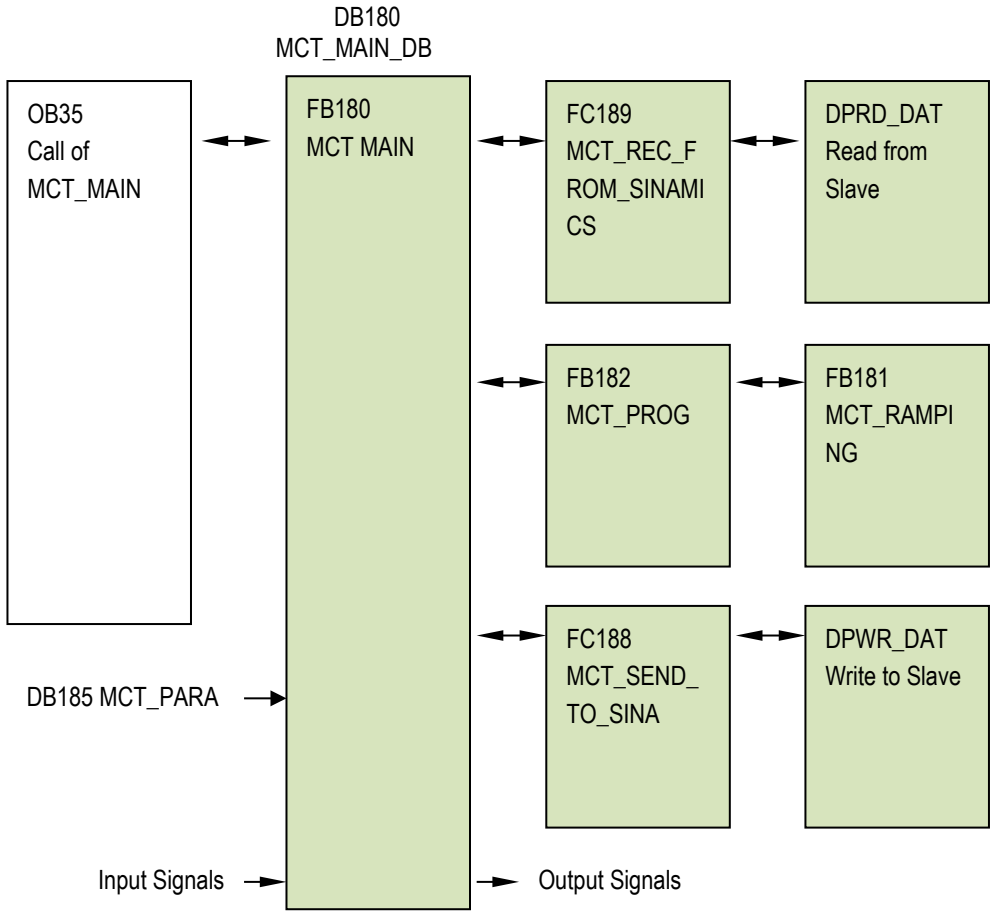
[2] = If not exists inputs have to be connected to „1“!

4.3.5 Description of FC outputs

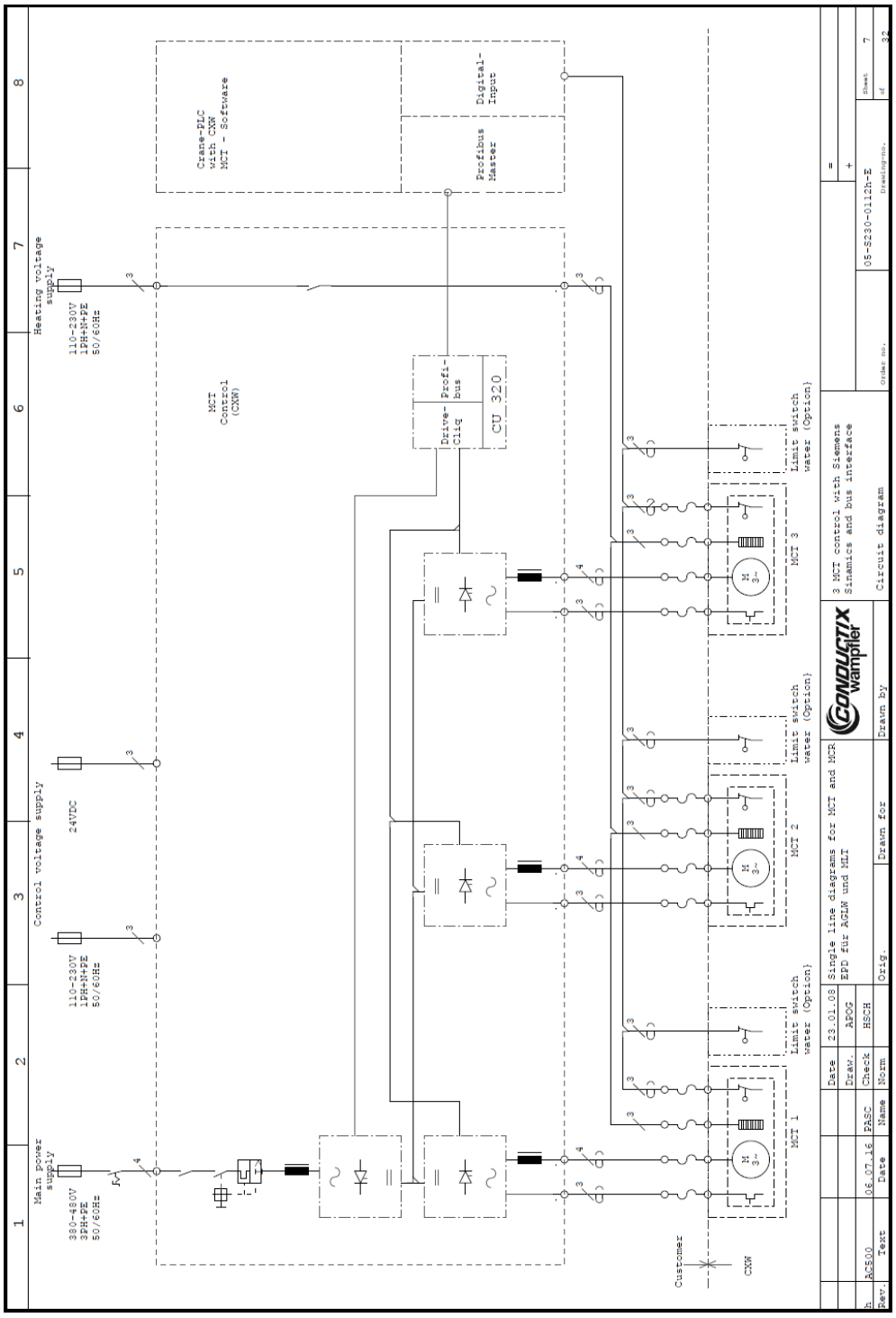
Output variables of function block		
Formal operand	Format	Function
MAIN_CONTACTOR_ON	BOOL	Output main contactor of drive.
CABLE_TROLLEY_READY	BOOL	Signal output Festoon is ok and no fault. (Customer has to interlock trolley main drive with this signal: In case of Low-signal main trolley speed has to be limited to max. 50 %).
ANTI_COND_HEATING_ON	BOOL	Output contactor motor anti-condensation heater.
FAILURE_BUFFER_CU	WORD	Failure number of Control Unit.
FAILURE_BUFFER_SLM	WORD	Failure number of Smart Line Module, only on modules with drive cliq connection.
FAILURE_MAIN_VOLTAGE	BOOL	Fuse of main voltage is not ok
FAILURE_CONTROL_VOLTAGE	BOOL	Fuse of main voltage is not ok
FAILURE_DC_BUS	BOOL	DC BUS voltage is not ok
FAILURE_CU	BOOL	Failure Control Unit
FAILURE_SLM	BOOL	Failure Smart Line Module
COLLECTIVE_FAILURE	BOOL	Signal output collective failure
FAILURE_BUS	BOOL	Failure Profibus or Profinet. Profibus or Profinet connection between PLC and drive is not ok.
F1_FAILURE_BUFFER_MOMO	WORD	Festoon 1: Failure number of Motor Module.
F1_FAILURE_LIMIT_SWITCH_WS	BOOL	Festoon 1: Signal output fault limit switch positive direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
F1_FAILURE_LIMIT_SWITCH_LS	BOOL	Festoon 1: Signal output fault limit switch negative direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
F1_FAILURE_MOMO	BOOL	Festoon 1: Signal output fault motor module
F1_RET_VAL_DPRD	INT	Festoon 1: Failure code from “DPRD_DAT” read data from Sinamics. If an error occurs while the function is active, the return value contains an error. Error Code see Siemens documentation.
F1_RET_VAL_DPWR	INT	Festoon 1: Failure code from “DPWR_DAT” write data to Sinamics. If an error occurs while the function is active, the return value contains an error. Error Code see Siemens documentation.
F2_FAILURE_MOMO	BOOL	Festoon 2: Signal output fault motor module.

Output variables of function block		
Formal operand	Format	Function
F2_FAILURE_LIMIT_SWITCH_WS	BOOL	Festoon 2: Signal output fault limit switch positive direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
F2_FAILURE_LIMIT_SWITCH_LS	BOOL	Festoon 2: Signal output fault limit switch negative direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
F2_FAILURE_BUFFER_MOMO	WORD	Festoon 2: Failure number of Motor Module.
F2_RET_VAL_DPRD	INT	Festoon 2: Failure code from “DPRD_DAT” read data from Sinamics. If an error occurs while the function is active, the return value contains an error. Error Code see Siemens documentation.
F2_RET_VAL_DPWR	INT	Festoon 2: Failure code from “DPWR_DAT” write data to Sinamics. If an error occurs while the function is active, the return value contains an error. Error Code see Siemens documentation.
F3_FAILURE_MOMO	BOOL	Festoon 3: Signal output fault motor module
F3_FAILURE_LIMIT_SWITCH_WS	BOOL	Festoon 3: Signal output fault limit switch positive direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
F3_FAILURE_LIMIT_SWITCH_LS	BOOL	Festoon 3: Signal output fault limit switch negative direction. Limit switch was OFF at position „ POS_LIMIT_SWITCH_CHECK“!
F3_FAILURE_BUFFER_MOMO	WORD	Festoon 3: Failure number of Motor Module.
F3_RET_VAL_DPRD	INT	Festoon 3: Failure code from “DPRD_DAT” read data from Sinamics. If an error occurs while the function is active, the return value contains an error. Error Code see Siemens documentation.
F3_RET_VAL_DPWR	INT	Festoon 3: Failure code from “DPWR_DAT” write data to Sinamics. If an error occurs while the function is active, the return value contains an error. Error Code see Siemens documentation.
ENO	BOOL	Enable (EN) and Enable output (ENO) of FUP/KOP boxes is realized by BIE-Bits. If EN and ENO are connected, then apply: ENO = EN AND NOT (error of box) If a fault occur (error of box = 0), it is ENO = EN. The EN-/ENO mechanism is used for: ■ arithmetic operations ■ transmission and convert operations ■ shift and rotate operations ■ block calls Not used in the function block!

4.3.6 Program chart and implementation into PLC-Program



4.3.7 Schematic sketch of Festoon control – Software in crane PLC



4.4 CXW-PLC with bus communication to crane PLC

ADVICE!

Keep maximum permitted signal delay!
Renege of maximum signal delay cause to a non-synchronized movement and to a damage or to an early abrasion of cable trolley components!

For the measuring and transmission of actual values and interface signals the customer has to consider that these are generated in correct order and are applied at the MCT control with a maximum permissible delay of 200 ms from the creation of the signals at the signal transmitter.

Transfer size:

Customer to CXW = 20 bytes
CXW to customer = 20 bytes

In the hardware configuration of the MCT PLC are two CD-types (Data exchange controller device) with each 20 byte receive and send data selected.

4.4.1 Profibus interface signals crane → MCT

First-Byte = 0.0
End-Byte = 19.7

Address Byte/Bit	Signal	Typ	Initial value	Comment
0.0	CRANE_SWITCH_ON	BOOL	FALSE	Input crane main switch is ON (base for the operation of the system).
0.1	POSITIONING_SIGNAL_OK	BOOL	FALSE	Input customers position measuring system is ok without fault
2	ACT_POS_MAIN_TROLLEY	REAL	0.000000e+000	Input actual main trolley position as 32 bit floating-point number (actual position on the complete distance in [mm])
6	ACT_SPEED	REAL	0.000000e+000	Input actual speed of main trolley, scaled to -100 to +100% of maximum speed -0% to -100% to mean drive direction land side 0% to 100% to mean drive direction water side
10.0	DRIVE_SWITCH_WS	BOOL	FALSE	Input crane moved into positive direction
10.1	DRIVE_SWITCH_LS	BOOL	FALSE	Input crane moved into negative direction

10.2	CRANE_RESET	BOOL	FALSE	Input reset signal for fault reset
10.3	FUSE_MAIN_VOLTAGE_OK	BOOL	FALSE	Input fuse main power supply ok (NO-contact).
10.4	FUSE_CONTROL_VOLTAGE_OK	BOOL	FALSE	Input fuse control power supply ok (NO-contact).
10.5	DC_BUS_OK	BOOL	FALSE	Input “DC power supply frequency converter” is OK
10.6	spare4	BOOL	FALSE	Reserve
10.7	spare5	BOOL	FALSE	Reserve
12	spare6	WORD	W#16#0	Reserve
14	spare7	WORD	W#16#0	Reserve
16	spare8	REAL	0.000000e+000	Reserve

4.4.2 Profibus interface signals MCT → crane (general)

First-Byte = 20.0
End-Byte = 27.7

Address Byte/Bit	Signal	Type	Initial value	Comment
20.0	CABLE_TROLLEY_READY	BOOL	FALSE	Signal output MCT is ok and no fault. (Customer has to interlock trolley main drive with this signal: In case of low-signal main trolley speed has to be limited to maximum 50%).
20.1	COLLECTIV_FAILURE	BOOL	FALSE	Signal output collective failure
20.2	FAILURE_BUS	BOOL	FALSE	Signal Output failure Profibus/Profinet between CXW-PLC and CXW Sinamics converter.
20.3	FAILURE_MAIN_VOLTAGE	BOOL	FALSE	Signal output fault “fuse main voltage”.
20.4	FAILURE_CONTROL_VOLTAGE	BOOL	FALSE	Signal output fault “fuse control voltage”.
20.5	FAILURE_DC_BUS	BOOL	FALSE	Signal output fault “DC power supply frequency converter”.
20.6	FAILURE_SLM	BOOL	FALSE	Signal output fault “Smart Line Module”.
20.7	FAILURE_CU	BOOL	FALSE	Signal output fault “Control Unit”.
22	FAILURE_BUFFER_SLM	WORD	W#16#0	Failure number of Smart Line Module, only on modules with drive cliq connection.
24	FAILURE_BUFFER_CU	WORD	W#16#0	Failure number of Control Unit.
26	spare	WORD	W#16#0	Reserve

4.4.3 Profibus interface signals F1 → crane

First-Byte = 28.0
End-Byte = 31.7

Address Byte/Bit	Signal	Typ	Initial value	Comment
28	F1_ FAILURE_BUFFER_MOMO	WORD	W#16#0	Failure number of Motor Module.
30.0	F1_FAILURE_LIMIT_SWITCH_WS	BOOL	FALSE	Signal output fault limit switch positive direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
30.1	F1_FAILURE_LIMIT_SWITCH_LS	BOOL	FALSE	Signal output fault limit switch negative direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
30.2	F1_FAILURE_MOMO	BOOL	FALSE	Signal output fault motor module festoon 1 or fault communication to motor module festoon 1
30.3	F1_spare	BOOL	FALSE	Reserve
30.4	F1.spare	BOOL	FALSE	Reserve
30.5	F1.spare1	BOOL	FALSE	Reserve
30.6	F1.spare2	BOOL	FALSE	Reserve
30.7	F1.spare3	BOOL	FALSE	Reserve
31.0	F1-LIMIT_SWITCH_WS	BOOL	FALSE	Info limit switch waterside signal from limit switch waterside
31.1	F1_LIMIT_SWITCH_LS	BOOL	FALSE	Info limit switch landside signal from limit switch landside
31.2	F1.spare4	BOOL	FALSE	Reserve
31.3	F1.spare5	BOOL	FALSE	Reserve
31.4	F1.spare6	BOOL	FALSE	Reserve
31.5	F1.spare7	BOOL	FALSE	Reserve
31.6	F1.spare8	BOOL	FALSE	Reserve
31.7	F1.spare9	BOOL	FALSE	Reserve

4.4.4 Profibus interface signals F2 → crane

First-Byte = 32.0
End-Byte = 35.7

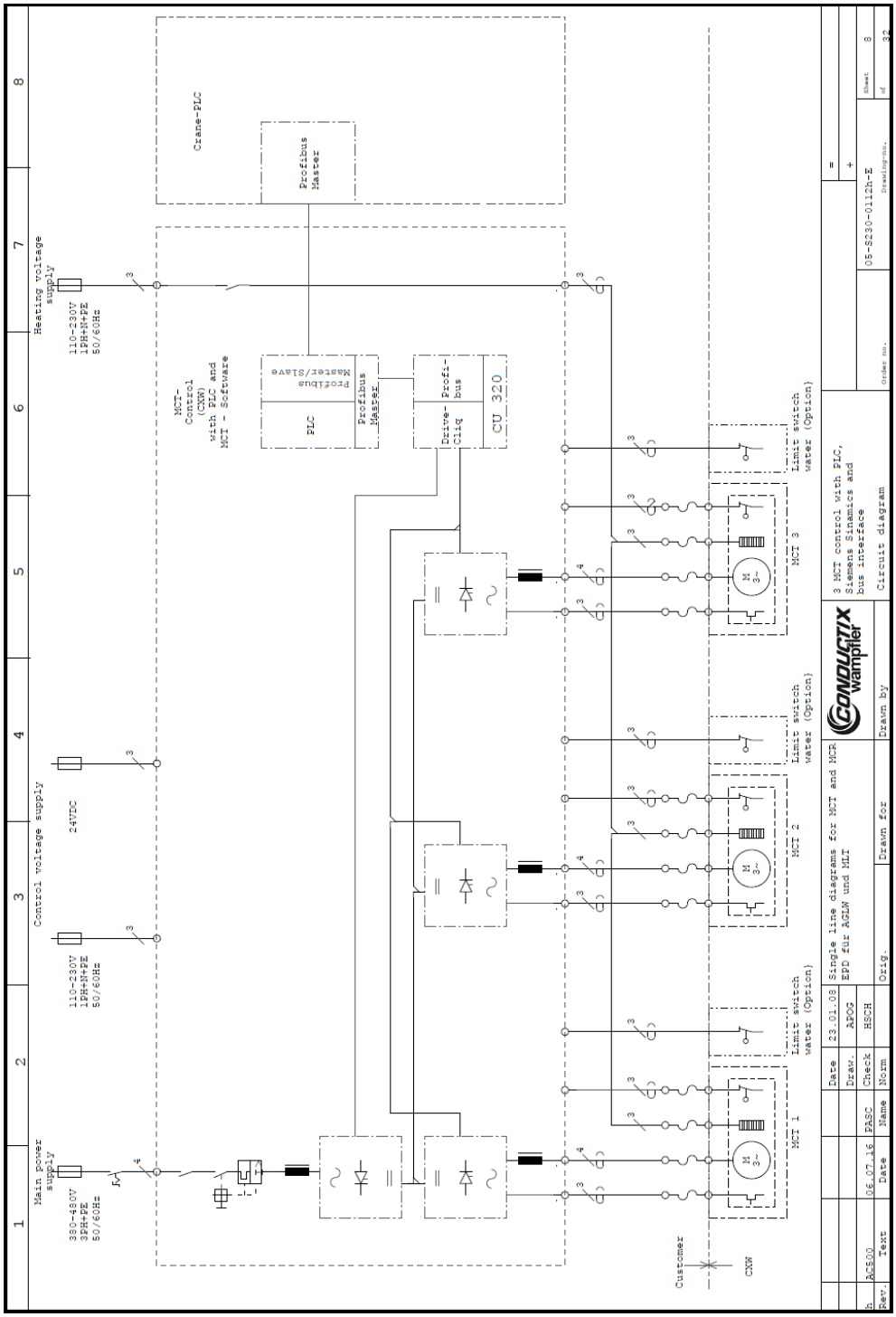
Address Byte/Bit	Signal	Type	Initial value	Comment
32	F2_ FAILURE_BUFFER_MOMO	WORD	W#16#0	Failure number of Motor Module.
34.0	F2_FAILURE_LIMIT_SWITCH_WS	BOOL	FALSE	Signal output fault limit switch positive direction. Limit switch was OFF at position „ POS_LIMIT_SWITCH_CHECK“!
34.1	F2_FAILURE_LIMIT_SWITCH_LS	BOOL	FALSE	Signal output fault limit switch negative direction. Limit switch was OFF at position „ POS_LIMIT_SWITCH_CHECK“!
34.2	F2_FAILURE_MOMO	BOOL	FALSE	Signal output fault motor module festoon 2 or fault communication to motor module festoon 2
34.3	F2_spare	BOOL	FALSE	Reserve
34.4	F2.spare	BOOL	FALSE	Reserve
34.5	F2.spare1	BOOL	FALSE	Reserve
34.6	F2.spare2	BOOL	FALSE	Reserve
34.7	F2.spare3	BOOL	FALSE	Reserve
35.0	F2_LIMIT_SWITCH_WS	BOOL	FALSE	Info limit switch waterside signal from limit switch waterside
35.1	F2_LIMIT_SWITCH_LS	BOOL	FALSE	Info limit switch landside signal from limit switch landside
35.2	F2.spare4	BOOL	FALSE	Reserve
35.3	F2.spare5	BOOL	FALSE	Reserve
35.4	F2.spare6	BOOL	FALSE	Reserve
35.5	F2.spare7	BOOL	FALSE	Reserve
35.6	F2.spare8	BOOL	FALSE	Reserve
35.7	F2.spare9	BOOL	FALSE	Reserve

4.4.5 Profibus interface signals F3 → crane

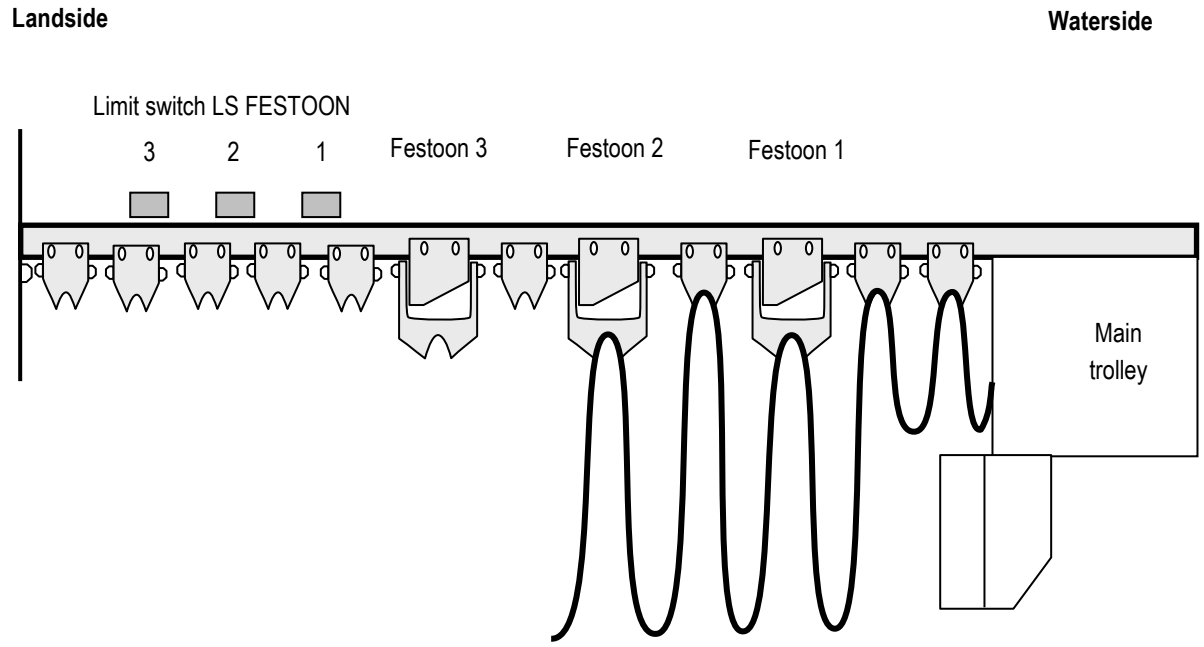
First-Byte = 36.0
End-Byte = 39.7

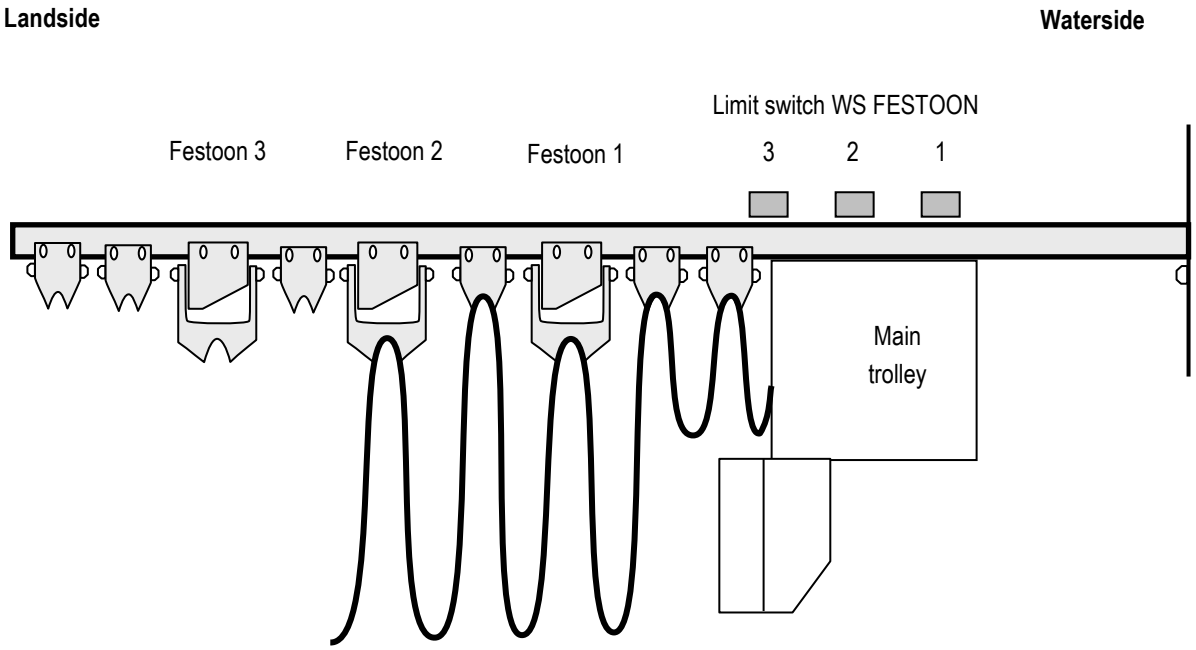
Address Byte/Bit	Signal	Type	Initial value	Comment
36	F3_ FAILURE_BUFFER_MOMO	WORD	W#16#0	Failure number of Motor Module.
38.0	F3_FAILURE_LIMIT_SWITCH_WS	BOOL	FALSE	Signal output fault limit switch positive direction. Limit switch was OFF at position „ POS_LIMIT_SWITCH_CHECK“!
38.1	F3_FAILURE_LIMIT_SWITCH_LS	BOOL	FALSE	Signal output fault limit switch negative direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
38.2	F3_FAILURE_MOMO	BOOL	FALSE	Signal output fault motor module festoon 3 or fault communication to motor module festoon 3.
38.3	F3_spare	BOOL	FALSE	Reserve
38.4	F3.spare	BOOL	FALSE	Reserve
38.5	F3.spare1	BOOL	FALSE	Reserve
38.6	F3.spare2	BOOL	FALSE	Reserve
38.7	F3.spare3	BOOL	FALSE	Reserve
39.0	F3_LIMIT_SWITCH_WS	BOOL	FALSE	Info limit switch waterside signal from limit switch waterside
39.1	F3_LIMIT_SWITCH_LS	BOOL	FALSE	Info limit switch landside signal from limit switch landside
39.2	F3.spare4	BOOL	FALSE	Reserve
39.3	F3.spare5	BOOL	FALSE	Reserve
39.4	F3.spare6	BOOL	FALSE	Reserve
39.5	F3.spare7	BOOL	FALSE	Reserve
39.6	F3.spare8	BOOL	FALSE	Reserve
39.7	F3.spare9	BOOL	FALSE	Reserve

4.4.6 Schematic sketch of Festoon control with CXW PLC



4.5 Schematic sketch of festoon system





5 Transport, packing and storage

5.1 Transport

5.1.1 Safety advice for transport

WARNING!

Danger of death due to suspended loads!

Loads falling or swinging sideways in an uncontrolled manner can lead to severe injuries or death.

→ Never step under suspended loads.

→ Only use the attachment points provided; do not fasten lifting accessories to projecting machine parts or eyes built onto components.

→ Be sure the connection elements are firmly seated.

→ Use only authorized lifting accessories and connection elements with sufficient load capacity.

→ Do not use torn or worn ropes or straps.

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them.

→ Move loads only under supervision.

→ Set down loads before leaving the work area.

CAUTION!

Damage from improper transport!

Improper transport can result in substantial property damage.

→ Move the cabinet lying in the transport crate.

→ Act with care when unloading the packaged unit as well as during internal transport, and observe the symbols and the hazard information on the packaging.

→ Use only the attachment points provided.

→ Remove packaging only shortly before installation.

5.1.2 Transport inspection

Delivered goods must be checked for completeness and transport damage immediately after arrival.
If any transport damage is recognizable from the outside, proceed as follows:

- Do not accept the delivery or only with reservation.
- Note extent of damage on the transport documents or on the delivery note of the carrier.
- Initiate complaint.

ADVICE!

Complain about each fault, as soon as you have noted it. Claims for damages can only be raised within the respective terms.

5.2 Packing

The individual packages have been packed according to the expected transport conditions. We have used environmentally sound packing material only.
The packing shall protect the individual components up to the assembly from transport damage, corrosion and other kind of damage. This is the reason why the packing material should not be destroyed and only be removed immediately before starting with the assembly.

Handling of packing material:

Dispose of packing material according to the respective legal regulations and local prescriptions.

CAUTION!

Environmental damage due to incorrect disposal!

Packaging material is a valuable resource and can be processed or recycled. In many cases, it can also be reused.

→ Dispose of packaging material in an environmentally responsible manner.

→ Follow all locally applicable disposal regulations; if necessary; engage a specialist company with disposal.

5.3 Storage

Store packages under the following conditions:

- Do not store in the open air.
- Keep in a dry and dust-free atmosphere.
- Do not expose to aggressive media.
- Protect from solar radiation.
- Avoid mechanical vibration.
- Storage temperature: +5°C -+40°C
- Relative humidity: < 85%, without condensation.
- In case of a storage time of more than 3 months, check the general condition of all parts at regular intervals. If required, refresh and renew the preservation.

ADVICE!

You will possibly find some advice on the packages about storage, which is given additionally to the advice given here. These must be observed as well.

6 Assembly and commissioning

6.1 Safety

Personnel:

- Assembly and initial commissioning must only be executed by especially trained staff.

The following personal protective equipment has to be worn when carrying out assembly works and initial commissioning:

- Protection clothes
- Protective helmet
- Safety shoes
- Protective gloves

WARNING!

Danger of death due to suspended loads!

Loads falling or swinging sideways in an uncontrolled manner can lead to severe injuries or death.

→ Never step under suspended loads.

→ Only use the attachment points provided; do not fasten lifting accessories to projecting machine parts or eyes built onto components.

→ Be sure the connection elements are firmly seated.

→ Use only authorized lifting accessories and connection elements with sufficient load capacity.

→ Do not use torn or worn ropes or straps.

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them.

→ Move loads only under supervision.

→ Set down loads before leaving the work area.

WARNING!

Risk of injury due to improper installation or commissioning!

Improper installation and commissioning can result in serious injury to person and property.

→ Before starting work, ensure sufficient installation room and that the conditions to start the mounting are fulfilled.

→ Handle open, sharp components with care.

→ Maintain order and cleanliness in the installation area. Loosely stacked or piled components and tools are sources of accidents.

→ Mount components properly. Comply with specified screw tightening torques.

→ Secure components so they cannot fall or tip over.

WARNING!

Uncontrolled device behavior by ineffective emergency stop circuit!

Effect-free emergency-stop circuit can cause serious injury to cause death.

→ Observe the installation instructions.

→ Install protective covers properly.

→ Installation may only be performed by trained personnel.

WARNING!

Electric shock caused by missing or defective protective cover!

→ Install protective covers properly.

→ Installation may only be performed by trained personnel.

→ Never use equipment without protective covers mounted.

WARNING!

Risk of electric shock when power line connections remain open!

Open power connections can cause serious injury and even death.

→ Install protective covers properly.

→ Never use equipment without protective covers mounted.

WARNING!

Misconduct of the devices due to incorrect device setting!

Incorrect instrument settings can lead to serious injury and even death.

→ Observe the operation instructions.

→ Installation may only be performed by trained personnel.

→ Check the parameters and data sets.

→ Use only settings which match the function intended.

WARNING!

Electric shock caused by missing or defective protection devices!

Missing or defective protection devices can cause serious injury and even death.

→ Install protective devices according to regulations.

→ Installation may only be performed by trained personnel.

→ Check the protection device.

WARNING!

Risk of electric shock when disconnecting or connecting connectors under voltage!

Disconnecting or connecting connectors under voltage can cause serious injury to cause death.

→ Turn off the power supply voltage and DC-24-V supply voltage.

→ Ensure the device is disconnected from power.

→ Never separate or join connectors under voltage.

The grounding of the equipment is mandatory regardless of the type of energy is required. Hold down while following rules that:

- Grounding of the unit by the shortest route.
- Use a grounding cable to the color green-yellow.

6.2 Preparations

Required tools:

- Insulated Electrical Screwdriver
- Insulated Side Cutters
- Stripping
- Press pliers for ferrules
- Meter for voltage, current, isolation
- Laptop with PLC and frequency converter software
- Wrench

6.3 Assembly

DANGER!

Injury due to improper installation!

Improper installation can result in serious injury to person and property.

→ The operation and maintenance personnel must have read and understood the operating instructions and in particular the guidelines on safety.

→ Installation of the festoon system must be performed by sufficiently qualified and trained specialists.

→ Protective gear for operation and maintenance personnel must be provided and used.

→ The system operator or his/her representative is to supervise machine operation to ensure the safety of personnel when working on or with the system.

Personnel:

- Execution by qualified persons

Control panel installation

The control panel has to be installed in an air-conditioned electrical room. The connection of the external equipment outside the control panel (motors, limit switches etc.) is made by the customer according to the information given in the documentation. Power and signal cables have to be installed in separate cable trays.

Reset button position

It is recommended to position the reset button (e.g. for a reset after a fault signal followed by an inspection and corrective actions by authorized staff) near the storage of the festoon system.

CAUTION!

Damage because of wrong cable connection!
Wrong connected cables might cause damage to electrical components!

CAUTION!

Use screened cables!
Use of non-screened cables might cause malfunction of and damage to electrical components!

CAUTION!

Avoid hum loops!
To avoid hum loops, correct dimensioning and installation of earth system of all panels has to be considered for 24 V DC power supply!

ADVICE!

Voltage range:
Voltage and frequency ranges in this manual reflect exemplary system design. Specified voltage and frequency ranges that match project-related requirements are written down in separate, project-related documents (Technical data sheet electrical or circuit diagram).

Description and numbering of interface terminals are usually order specific and may therefore differ from the description and numbering in this document. See also Technical data sheet electrical or circuit diagram for the values relating to your project.

All field devices are connected according to the documentation. Description and numbering of interface terminals are usually order specific and may therefore differ from the description and numbering in this document.

Signals from field devices to the customers crane PLC as potential-free contacts (wired to the terminal strip, signal level depends on PLC input module):

Designation	Signal level
Power supply Magnetic limit switch	110/230 VAC; 24 VDC
Magnetic limit switch Festoon 1, waterside	110/230 VAC; 24 VDC
Magnetic limit switch Festoon 1, landside	110/230 VAC; 24 VDC
Magnetic limit switch Festoon 2, waterside	110/230 VAC; 24 VDC
Magnetic limit switch Festoon 2, landside	110/230 VAC; 24 VDC
Magnetic limit switch Festoon 3, waterside	110/230 VAC; 24 VDC
Magnetic limit switch Festoon 3, landside	110/230 VAC; 24 VDC

6.4 Commissioning and Checklist

WARNING!

Risk of injury due to improper commissioning!

Improper commissioning may cause dangerous situations for the personnel.

→ Prior to commissioning, test equipment according to the manufacturer's test list.

→ Never put motorized festoon system into operation without testing equipment according to the manufacturer's test list.

→ Before commissioning, make visual inspection and audit work required.

→ Refrain from any risky procedure.

→ Report damage to the motorized cable trolley system to the person in charge instantly.

→ Secure the motorized cable trolley system against accidental or unauthorized use.

→ Staying in the area of influence of the motorized festoon system is prohibited!

CAUTION!

Risk of crushing!

When the motorized festoon system operates, there is a risk of bruising of the limbs between the buffer and buffer plate, suspension and track beam, and between tooth-belt and pulleys.

→ Do not step into the danger area of the motorized festoon system when it is being operated.

CAUTION!

Risk of getting caught in the festoon system!

When the motorized festoon system operates, there is a risk of getting caught by parts of the festoon system.

→ Do not step into the danger area of the motorized festoon system when it is being operated.

A festoon system is usually commissioned by Conductix-Wampfler (CXW) Commissioning Engineers together with the Crane Manufacturer/Crane Control Manufacturer. A separate checklist (“Commissioning Checklist TDB0380-0001-E ComChecklist Motorized Festoons Sinamics S120“) is available for guiding through the full Mechanical and Electrical commissioning of a system with motorized Festoon and a PLC with SIEMENS Sinamics software.

After the commissioning has been successfully completed, a Final Acceptance Certificate (FAC) will be signed by both parties, certifying that the commissioning corresponds to all specified requirements.

→ The completed and signed Checklist for Mechanical and Electrical Commissioning must be sent by e-mail to: service.de@conductix.com.

→ This e-mail must include the following data:

- Frequency converter parameters,
- Complete actual PLC-Program with the latest parameter changes included.

→ Safely store the signed original Checklist hardcopy together with the Final Acceptance Certificate (FAC).

7 Operation

7.1 Safety

WARNING!

Danger of death due to suspended loads!

Loads falling or swinging sideways in an uncontrolled manner can lead to severe injuries or death.

→ Never step under suspended loads.

→ Only use the attachment points provided; do not fasten lifting accessories to projecting machine parts or eyes built onto components.

→ Be sure the connection elements are firmly seated.

→ Use only authorized lifting accessories and connection elements with sufficient load capacity.

→ Do not use torn or worn ropes or straps.

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them.

→ Move loads only under supervision.

→ Set down loads before leaving the work area.

WARNING!

Risk of injury due to improper operation!

Improper operation can result in serious injury to person and property.

→ Perform all operating steps as specified in this operation instruction.

→ Before starting work ensure that all covers and safety devices are installed and working properly.

→ Never disable safety systems.

→ Maintain order and cleanliness in the installation area. Loosely stacked or piled components and tools are sources of accidents.

WARNING!

Danger to life due to heavy weight, electric energy and moving machinery!

Unauthorized persons who do not meet the requirements described in chapter 2.2 "Requirements concerning personnel" do not understand the danger in the working area. They might get run over, get crushed, they might touch electrically live parts or manipulate equipment in a dangerous way.

→ Keep unauthorized persons away from the working area.

→ In case of doubt, address the persons and direct them away from the working area.

→ Stop work as long as unauthorized persons are in the working area.

WARNING!

Misconduct of the devices due to incorrect instrument setting!

Incorrect instrument settings and might lead to uncontrollable behavior of devices, which can lead to serious injury and even death.

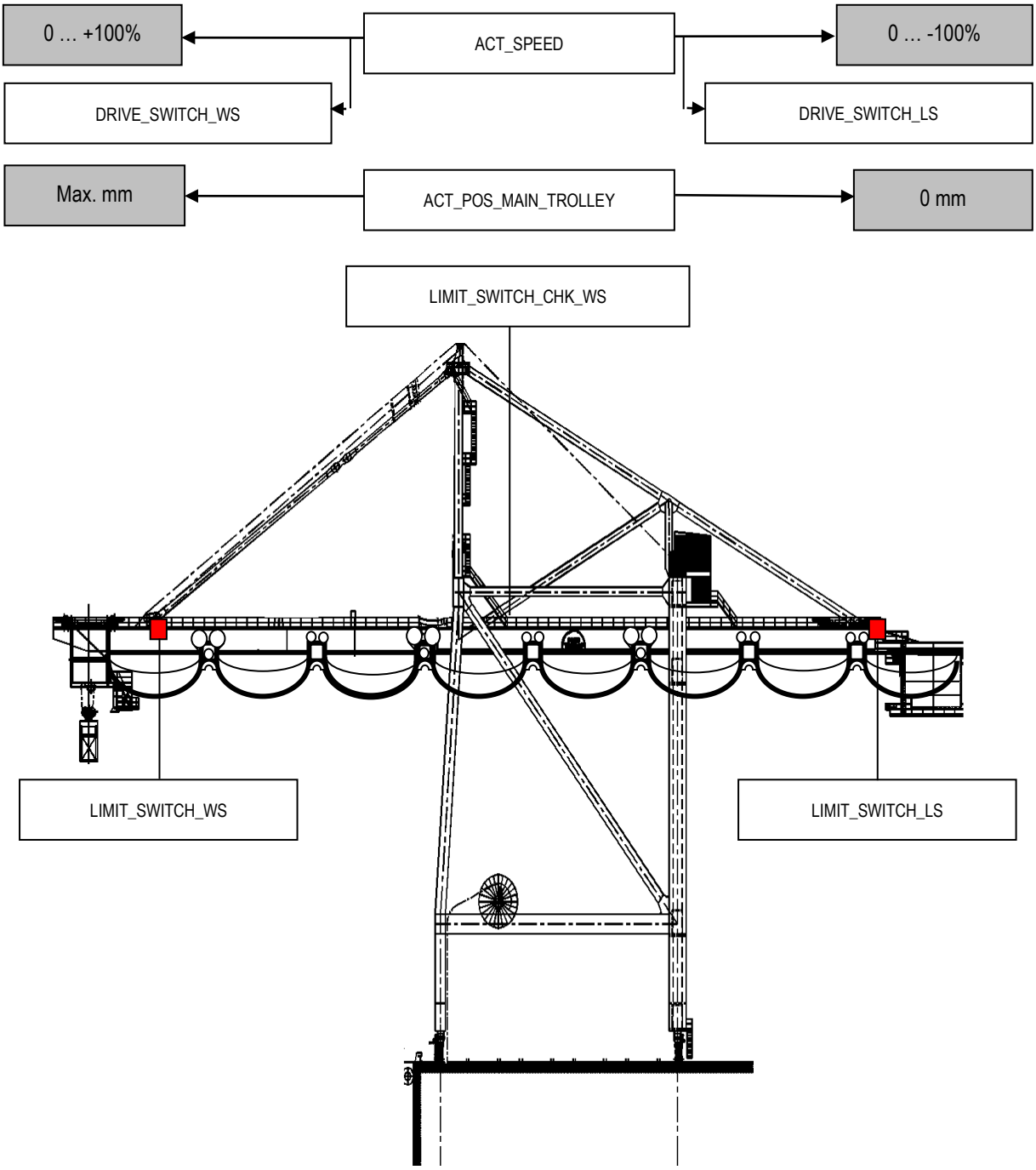
→ Never change parameters and data sets without consulting the manufacturer.

→ Do not change settings of protective devices.

Personnel:

- Operation by trained personnel only!

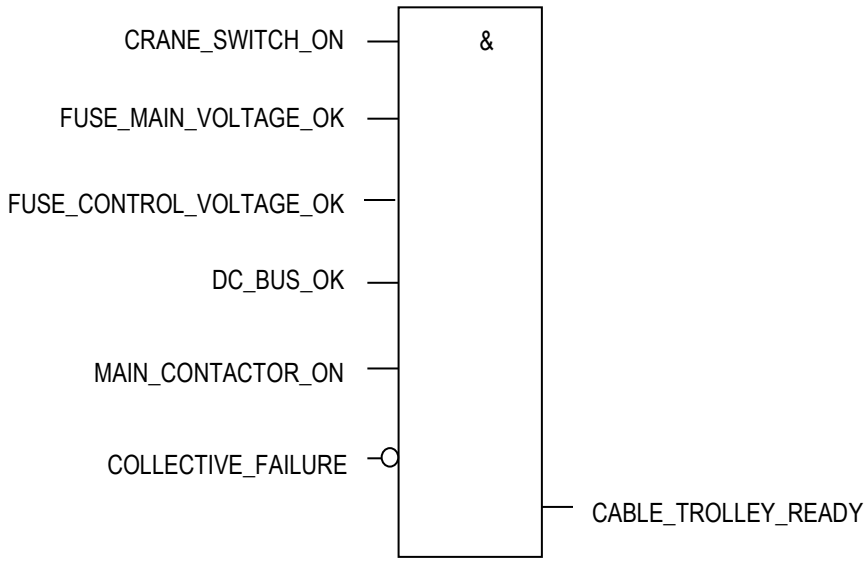
7.2 Overview and Definition



7.3 Enabling operation

The status bit (CABLE_TROLLEY_READY) indicating the correct function of the motorized cable trolleys has to be interlocked into the enabling sequence of the set point limiting of the main trolley speed. **If the signal is „0“, the main trolley speed has to be limited to maximum 50 % and has not to be higher than 120 m/min.**

Following preconditions are necessary for enabling operation:



Formal operand	Format	Function
CRANE_SWITCH_ON	BOOL	Main contactor crane ON, switch on main contactor and enable operation signal after time delay
FUSE_MAIN_VOLTAGE_OK	BOOL	Input fuse main power supply is ok
FUSE_CONTROL_VOLTAGE_OK	BOOL	Input fuse control voltage is ok
DC_BUS_OK	BOOL	Input DC Bus is ok
MAIN_CONTACTOR_ON	BOOL	Output main contactor
COLLECTIV_FAILURE	BOOL	Signal output collective failure
CABLE_TROLLEY_READY	BOOL	Output Festoon ok without fault

7.4 Main contactor ON/Anti condensation heater ON

Signal (CRANE_SWITCH_ON) sets output for drive main contactor (MAIN_CONTACTOR_ON). At the same time output for the contactor of motor anti condensation heater (ANTI_COND_HEATING_ON) will be switched off.

Signal (CRANE_SWITCH_ON) for the drive of the motorized cable trolley mustn't switch off before actual speed of main trolley is 0 to ensure motor deceleration of the motorized cable trolley according to the designated ramp-down time.

Formal operand	Format	Function
CRANE_SWITCH_ON	BOOL	Crane main switch ON
MAIN_CONTACTOR_ON	BOOL	Output main contactor of drive
ANTI_COND_HEATING_ON	BOOL	Output contactor motor condensation heater

7.5 Analysis of crane signals

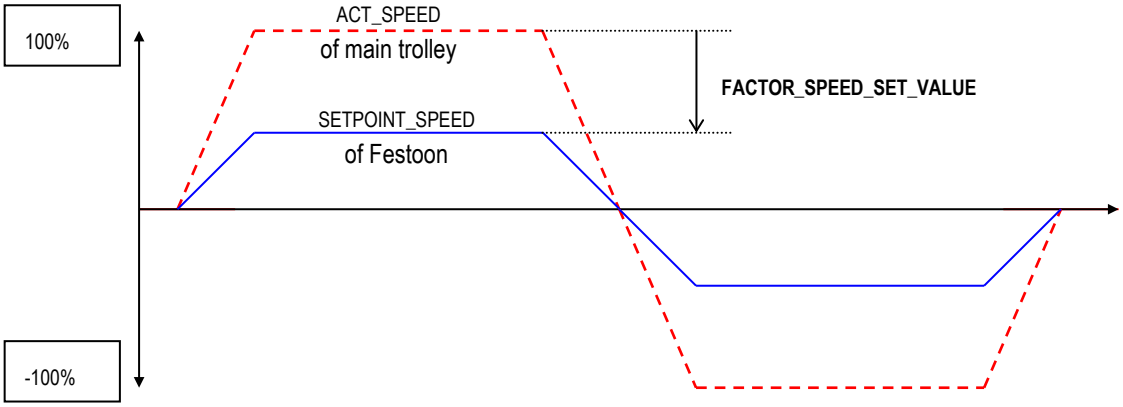
At lower speed range motorized cable trolleys are controlled by joy stick signals negative or positive direction. At higher speeds and for detection of acceleration and deceleration scaled main trolley speed is used.

Formal operand	Format	Function
DRIVE_SWITCH_WS	BOOL	Input joy stick of trolley waterside direction
DRIVE_SWITCH_LS	BOOL	Input joy stick of trolley landside direction
ACT_SPEED	REAL	Actual main trolley speed in %

7.6 Scaling of speed set point value of motorized cable trolley

To adjust the speed of the motorized cable trolley (motor speed set point value) the actual main trolley speed has to be multiplied by a scaling factor. The scaling factor will be calculated for each drive by Conductix-Wampfler and has to be incurred as a given constant by the customer during PLC programming. If necessary adjusting of scaling, factor has to be done during commissioning of the festoon system.

Formal operand	Format	Function
FACTOR_SPEED_SET_VALUE	REAL	Scaling main trolley speed to speed set point value of Festoon [0.0-1.0] (in Parameter-DB)



7.7 Switching off by limit switches

The speed setpoint value will be reduced according to the adjustable deceleration ramp up to the given stop frequency if the positive or negative direction limit switch is actuated by the motorized cable trolley.

8 Service and maintenance

8.1 Safety

WARNING!

Risk of injury due to improper maintenance works!

Improper maintenance works may cause heavy injuries to persons and damage to properties.

→ Prior to starting work make sure that the conditions to start the mounting are fulfilled.

→ Ensure that the workplace is clean and tidy! Loose components and tools, that are lying around may cause accidents.

→ If components have been removed, ensure that they are mounted correctly, reinstall all fasteners and observe the screw tightening torques.

→ Observe the protective covers and contact guards.

→ Ensure proper coverage of power connections.

8.2 Maintenance schedule

The following chapters describe the maintenance works, which are required for an optimum and undisturbed operation.
The realized maintenance work must be recorded in writing.
If signs of stronger abrasion are found during regular controls, reduce the maintenance intervals in accordance with the actual signs of wear.
For questions concerning maintenance works and intervals contact the manufacturer, see service address on the last page.

Interval	Maintenance work	To be effected by
Half-yearly	Filters of panel ventilator have to be changed	Expert

ADVICE!

Replace tooth-belts every 6000 operating hours!

After 6.000 crane operating hours, both tooth-belts on the motorized trolleys must be replaced. This replacement must be triggered by the PLC/CMS through a warning signal to the crane operator.

9 Fault diagnosis

WARNING!

Risk of injury due to improper fault clearance!

Improper fault clearance may cause heavy injuries or damage to property.

→ In case of disturbance contact the manufacturer.

→ Fault clearance must only be carried out by workers of the manufacturer or by personnel authorized by the manufacturer.

WARNING!

System damage from continuation of operation!

- Damage of buffers
- Damage of tooth-belts
- Possible injury from falling objects!

→ All faults must be analyzed before remedying the problem.

WARNING!

Death due to electric shock!

Work on electrical systems or production equipment may only be performed by specialized electricians or persons under the supervision and direction of an electrician in accordance with electrical rules (qualified specialists).

9.1 Procedure for faults or alarms

WARNING!

Severe system damage from continuation of operation!

In case of any fault of a drive unit of a festoon system, it is required to immediately **restrict the speed of the crane trolley to a max. of 50 % or to less than 120 m/min** through the superior control/crane control and to visualize the fault in the CMS. Further crane operation in this emergency mode is only allowed temporary for max. 1 shift until the completion of the ship loading/unloading cycle. The fault has to be analyzed followed by a visual inspection of all relevant parts. Conductix-Wampfler has to be informed in writing without delay. After corrective actions as service or repair, the fault reset must only be given by authorized service staff.
It is recommended to position the reset button near the storage of the festoon system.

During operation the frequency inverter can generate sporadic alarm signals **(Axxx**), on the display. These are required for subsequent processing within the inverter program and do not have any influence on the operation of the system and can therefore be ignored.

9.2 Monitoring limit switch function

WARNING!

System damage from continuation of operation!

- Damage of buffers
- Damage of tooth-belts
- Possible injury from falling objects!

By latching of the first priority signal (POSITIONING_SIGNAL_OK) and programming of the position value (ACT_POS_MAIN_TROLLEY) limit switch signals will be monitored during operation according to following criteria's:

- Main trolley position (ACT_POS_MAIN_TROLLEY) >programmed value (LIMIT_SWITCH_CHK_LS) and landside limit switch signal (LIMIT_SWITCH_LS) is OFF → fault signal (FAILURE_LIMIT_SWITCH_LS) will be latched.
- Main trolley position (ACT_POS_MAIN_TROLLEY) <[programmed value (LIMIT_SWITCH_CHK_WS) and waterside limit switch signal (LIMIT_SWITCH_WS) is OFF → fault signal (FAILURE_LIMIT_SWITCH_WS) will be latched.

After having analyzed and corrected the reason of the wrong switching performance of the limit switch, reset is possible by the input (CRANE_RESET).

In case of a fault main trolley speed has to be limited to maximum 50 %!

Formal operand	Format	Function
ACT_SPEED	REAL	Actual main trolley speed in %
DRIVE_SWITCH_WS	BOOL	Input joy stick of trolley waterside direction
DRIVE_SWITCH_LS	BOOL	Input joy stick of trolley landside direction
LIMIT_SWITCH_WS	BOOL	Input limit switch pos. waterside direction not activated
LIMIT_SWITCH_LS	BOOL	Input limit switch neg. landside direction not activated
ACT_POS_MAIN_TROLLEY	REAL	Actual main trolley position in mm
POSITIONING_SIGNAL_OK	BOOL	Position measuring system no fault
LIMIT_SWITCH_CHK_WS	REAL	Position for monitoring waterside limt switch signal (in Parameter-DB)
LIMIT_SWITCH_CHK_LS	REAL	Position for monitoring landside limt switch signal (in Parameter-DB)
FAILURE_LIMIT_SWITCH_WS	BOOL	Output fault limit switch waterside
FAILURE_LIMIT_SWITCH_LS	BOOL	Output fault limit switch landside
CRANE_RESET	BOOL	Input reset fault

9.3 Frequency converter

WARNING!

System damage from continuation of operation!

- Damage of buffers
- Damage of tooth-belts
- Possible injury from falling objects!

Communication between crane PLC and frequency converter is carried out with Profibus or Profinet.
In case of a frequency converter fault a fault signal (F1_FAILURE_MOMO), (F2_FAILURE_MOMO), (F3_FAILURE_MOMO), (FAILURE_CU), or (FAILUER_SLM) occurs, the signal (CABLE_TROLLEY_READY) will be switched off. The main drive has to be stopped. Reason of fault signal has to be analyzed and fixed before reset of the fault (CRANE_RESET).
The fault signals can be used for fault identification system of the crane. At same time the alarm storage of the frequency converter (F1_FAILURE_BUFFER_MOMO), (F2_FAILURE_BUFFER_MOMO), (F3_FAILURE_BUFFER_MOMO), (FAILURE_BUFFER_CU) or (FAILURE_BUFFER_SLM) may be readout.

In case of a fault main trolley speed has to be limited to maximum 50%!

Formal operand	Format	Function
CABLE_TROLLEY_READY	BOOL	Signal output Festoon ready for operation
F1_FAILURE_MOMO	BOOL	Signal output fault on Motor Module of festoon trolley 1
F2_FAILURE_MOMO	BOOL	Signal output fault on Motor Module of festoon trolley 2
F3_FAILURE_MOMO	BOOL	Signal output fault on Motor Module of festoon trolley 3
CRANE_RESET	BOOL	Input reset fault
F1_FAILURE_BUFFER_MOMO	WORD	Failure number of Motor Module of festoon trolley 1
F2_FAILURE_BUFFER_MOMO	WORD	Failure number of Motor Module of festoon trolley 2
F3_FAILURE_BUFFER_MOMO	WORD	Failure number of Motor Module of festoon trolley 3
FAILURE_BUFFER_CU	WORD	Failure number of Control Unit
FAILURE_BUFFER_SLM	WORD	Failure number of Smart Line Module, only on modules with drive cliq connection

10 Disassembly and disposal

10.1 Safety

DANGER!

Risk of fatal injury from electric shock!

Death, heart failure, burns and injury by electric arc are likely to follow when touching electrically life parts. There is also a high risk of injury caused by overreaction after being shocked by electricity.

Before working on parts potentially under voltage:

→ Disconnect system from power using the main switch.

→ If there is no main switch, disconnect the energy source from the system according to the instructions of the system manufacturer.

→ Secure system against reactivation,

→ confirm that power has been disconnected,

→ ground and short-circuit parts of the system disconnected from power,

→ cover or block off neighboring parts still carrying electrical current.

→ Before each time the device or system is started, test the insulation resistance according to locally applicable technical standards, directives, and law.

WARNING!

Risk of injury due to improper disassembly!

Stored residual energy, edged components, tips or corners at or in the device or at the required tools may cause injuries.

→ Make sure there is enough room prior to starting works.

→ Be careful with open, sharp-edged components.

→ Ensure that the workplace is clean and tidy! Loose components or tools that are lying around may cause accidents.

→ Dismount components properly. Note that some components have a heavy net weight. Use hoist units if required.

→ Secure components, so that they cannot fall down or turn over.

→ In case of questions, consult the manufacturer.

CAUTION!

Risk of stumbling and falling due to projecting components!

When approaching the motorized festoon system, there is the danger of stumbling.

→ When moving inside the working- and danger area of the motorized festoon system, watch out for depressions or bumps in the ground.

→ There must be no loose items are on the ground.

CAUTION!

Risk of crushing!

When the motorized festoon system operates, there is a risk of bruising of the limbs between the buffer and buffer plate, suspension and track beam, and between tooth-belt and pulleys.

→ Do not step into the danger area of the motorized festoon system when it is being operated.

WARNING!

Danger of death due to suspended loads!

Loads falling or swinging sideways in an uncontrolled manner can lead to severe injuries or death.

→ Never step under suspended loads.

→ Only use the attachment points provided; do not fasten lifting accessories to projecting machine parts or eyes built onto components.

→ Be sure the connection elements are firmly seated.

→ Use only authorized lifting accessories and connection elements with sufficient load capacity.

→ Do not use torn or worn ropes or straps.

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them.

→ Move loads only under supervision.

→ Set down loads before leaving the work area.

10.2 Disassembly

When the device has reached the end of its useful life, disassemble it and dispose of it in an environmentally compatible way.

Prior to starting the disassembly:

- Remove and dispose of operating and auxiliary material as well as remaining items in an environmentally compatible way.
- Disconnect the whole installation from power.
- Then clean assemblies and components properly and decompose them with regard to the valid local instructions for operational safety and environmental protection

10.2.1 Disassembly of the assembly group

DANGER!

Risk of fatal injury!

→ Pay attention to the safety instructions given in chapters *Disassembly and disposal (chapter* 10*), Assembly and commissioning* (chapter 6) and *Specific hazards* (see above).

Personnel:

- Execution by instructed personnel

Required tools:

- Insulated Electrical Screwdriver
- Insulated Side Cutters
- Voltage Meter
- Wrench

10.3 Disposal

If return or disposal arrangements have not been made, use decomposed components for recycling:

- Scrap metals.
- Provide plastic elements for recycling.
- Dispose of remaining components separately according the material consistence.

CAUTION!

Environmental damage due to incorrect disposal!

Electric scrap, electronic components, lubricants and other auxiliary materials are subject to hazardous waste treatment and may only be disposed of by approved specialist companies!

→ Dispose of electric scrap, electronic components, lubricants and other auxiliary materials in an environmentally responsible manner by handing these materials over to hazardous waste treatment authorities.

→ Follow all locally applicable disposal regulations; if necessary; engage an approved, specialist company with disposal.

The local authority or specialized service centers for disposal give advice as to environmentally compatible disposal.

11 Further documents

11.1 Spare parts list

The number of individual parts and the type (power, voltage) are order specific!

- PLC Relay Socket
- Coupling relay
- Control
- Smart Line Module
- Single Motor Module
- Filter mat
- Lamp use
- Motor protection switch

11.2 Applicable documents

Listing of applicable documents:

- Mounting Instructions MAL0300-0004-E Festoons Systems for I-beam – 0365, 0370, 385
- Mounting Instructions MAL0300-0006-E Motorized Festoons Systems – 0380
- Commissioning Checklist TDB0380-0001-E ComChecklist Motorized Festoons Sinamics S120
- Operating instructions of Siemens Sinamics frequency converter are downloadable at Supplier Website

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