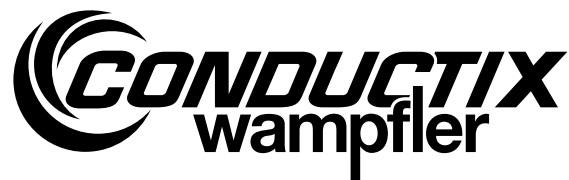


Operating Instructions



Control for festoon systems
GE PLC RX3i and TMdrive-10 converter

BAL0500-0008a-EN



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MCT = motorized heavy duty cable trolleys

1 Target audience for operating instructions

The operating instructions are intended for qualified specialists who design and program controls for crane systems, install the festoon systems, operate them and who are familiar with the requirements regarding work safety and accident prevention.

These operation instructions are only valid together with the operating instruction for festoon systems BAL0300-0006 contenting additional notes for the use of festoon systems.

2 General information

2.1 General safety information

Safety and hazard information: Safety and hazard information is identified in these operating instructions by symbols. Signal words are used to indicate the degree of hazard. 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.



WARNING!

... indicates a possibly hazardous situation, 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.



CAUTION!

... indicates a possibly hazardous situation, which if not avoided, may result in property damage.

Tips and recommendations:



NOTE!

... refers to useful tips and recommendations as well as information for efficient and trouble-free operation.

2.2 Information on operating instructions

These operating instructions describe the construction and the volume of the delivery of the control for motorized cable trolleys and help the customer to design the required control in connection with the installation of a cable festoon system with motorized cable trolleys and the safe and proper handling of the control.

The safety instructions and the valid accident prevention regulations and the general regulations regarding accident prevention for the area of application are to be observed. Before beginning any work on the components, operation and maintenance personnel must have read and understood the operating instructions and applicable documents and the “**Safety**” chapter, in particular.

2.3 Applicable documents

These operation instructions are only valid together with the operating instruction for festoon systems BAL0300-0006 contenting additional notes for the use of festoon systems.

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

- Project-specific technical documentation
- Installation instructions
- Maintenance instructions
- Drawings
- Spare part lists
- Sketches

2.4 Limitation of liability

The actual scope of delivery may vary from the data and information described here as well as the visual representations due to special models, the utilization of additional order options or recent technical changes. For more information, please contact the manufacturer.

All products are subject to technical modifications.

2.5 Copyright

These operating instructions are to be considered as confidential. They are intended solely for persons working with the product. It is forbidden to pass on these operating instructions to third parties without the manufacturer’s prior written consent!



NOTE!

This documentation is protected by copyright law. The rights established herein, including translation, reprinting, the use of figures, radio transmission, reproduction using photographic or similar methods or saving in electronic format remain reserved, even for partial use.

Conductix-Wampfler reserves the right to make technical changes without informing the recipient of these documents/data.

Conductix-Wampfler accepts no liability, in as much as this is legally permissible, for errors in this documentation or for damages that occur in connection with the delivery and use of the documentation.

2.6 Spare parts



WARNING!

Injury due to wrong spare parts!

Wrong or faulty spare parts can result in damages, malfunctions or complete failure as well as impair safety.

Therefore:

- use only original spare parts of the manufacturer!

The use of unauthorized spare parts renders null and void all warranty, service, compensation and liability claims against the manufacturer or his agents, dealers or representatives.

3 Safety

This section gives insight into all of the important safety aspects for optimal protection of personnel as well as for safe and trouble-free operation.

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

73/23/EEC 93/68/EEC	EC Low Voltage 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
	Accident prevention regulations

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3.1 Intended use

The machines are designed and constructed for the intended use only. The **controls for festoon systems** are only used for project-specific requirements.



WARNING!

Possible injury resulting from improper use!

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

Any claims against the manufacturer and/or its representatives for damages resulting from improper use of the products are excluded!

Non-intended use includes the following:

- Exceeding / be lower than projected supply voltages
- Changing of the delivered software modules
- Changing, bridging and/or deactivation of control circuits or interlockings
- Bridging and/or deactivating electrical sensors or switches
- Use of non-approved protective devices
- Re-adjustment of protective devices
- Changing atmospheric conditions (including a change to projected physical location)
- Main trolley speed higher than 50% of nominal speed in case of a fault

Intended use is also considered to be the correct observance of the operating conditions as well as the data and instructions of these operating instructions.

3.2 Content of the operating instructions

Before beginning work, operation and maintenance personnel must have read and understood the operating instructions. This also applies if the aforementioned personnel has already worked with this type or similar machines, or has been trained by the manufacturer. Reading the content of the operating instructions is a precondition to protect personnel from hazards as well as to prevent errors and therefore to operate the product safely and in a trouble-free manner.

It is recommended that the operator have this acknowledgement of the content of the operating instructions confirmed by the personnel.

3.3 Changes and modifications to the machine

To avoid hazards and to ensure optimal performance, no changes or modifications may be made to the machines that have not been expressly approved by the manufacturer.

3.4 Operator responsibility

- These operating instructions must be stored on-site and always be kept readily available in a location near the festoon system.
- The festoon system may only be operated in good technical condition. Before initial commissioning, a visual inspection and predefined inspection is to be performed.
- The instructions in this manual are to be followed completely and precisely.
- In addition to the safety instructions and valid accident prevention regulations, the general regulations regarding accident prevention and general safety regulations as well as the valid environmental regulations are to be observed and adhered to.
- The operator and personnel authorized by him are responsible for the trouble-free operation as well as for determination of responsibilities with regard to installation and maintenance of the products.

3.5 Requirements on the personnel



WARNING!

Injury due to insufficient qualifications!

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

Therefore:

- Only have special activities performed by persons mentioned in the respective chapters of these operating instructions.

The following qualifications have been mentioned in these operating instructions for different areas of operation:

- **Qualified specialists**

can assess the tasks assigned to them and recognize possible hazards based upon their specialized training, knowledge and experiences, as well as knowledge about applicable conditions.

The responsibilities for the work on and with the products (installation, maintenance) must be clearly defined and observed so that there is no unclear allocation of responsibilities and duties under the safety aspect.

Only persons capable of reliable work may work on or with the products. No work methods may be performed that affect the safety of persons, the environment or the described product.

The personnel are obligated to immediately report to the operator any changes occurring on the products which could have an effect on safety.

3.6 Hazards posed by product

The products have undergone a hazard analysis. The construction and design are based on the latest technology.

The products are safe when used properly. However, an element of risk still remains!

The product operates using high voltage current:



WARNING!

Death due to electric shock!

The electrical current could cause serious bodily harm. Faulty insulation or individual components could lead to personal injury through electrical shock!

Causes:

- Touching or coming too close to un-insulated current-bearing parts
- Using un-insulated tools
- Current-bearing parts that are laid bare due to insulation failure
- Inadequate safety checks after maintenance work
- Use of improper fuses

Ways to protect yourself:

- Ensure that current to machines and system parts that are to undergo maintenance work is turned off and protected against reactivation.
- Check parts to ensure that they are free of current. Cover and isolate nearby live parts.
- Check electrical equipment regularly.
- Immediately replace loose or damaged cables or lines
- Always replace blown fuses with identical fuses
- Avoid touching live parts.
- Use insulated tools.

All faults must be analyzed before remedying the problem. 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).

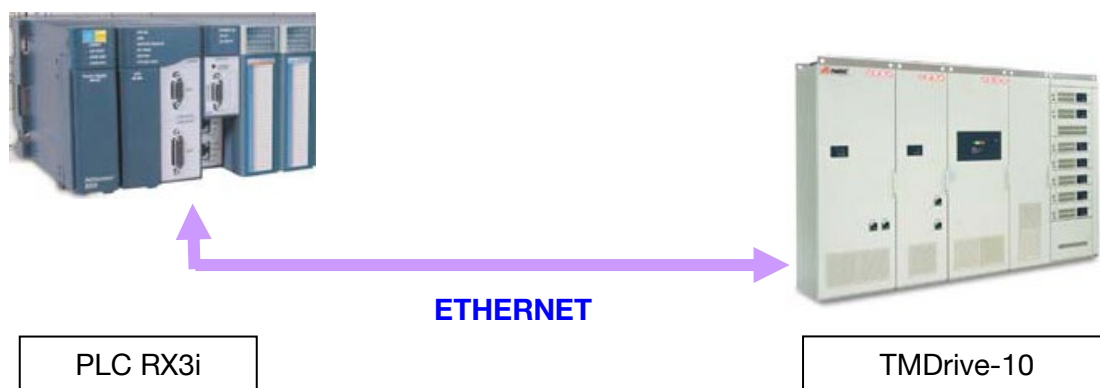
4 Description and construction of the control

Each motorized cable trolley 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 dissipated in the common DC converter link.

The interface module supplied by Conductix-Wampfler has to be integrated into the crane PLC. It is applicable for PLC GE-FANUC PACSystems™ RX3i system. The frequency converters are controlled by the crane PLC via bus connection.

As frequency converter TMGE TMdrive-10 with integrated bus interface will be used.



For basic sketch of festoon system see appendix.

4.1 Scope of supply

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

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

The documentation consists of a technical data sheet for frequency converter dimensioning. The frequency converter and PLC parameters are supplied as a data file.

4.2 Customers scope of supply



WARNING!
Injury due to improper installation!

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

- 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.



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

The complete control and drive panel has to be designed and delivered by the customer.

The function blocks have to be called up in the main (crane) program according to the number of the installed motorized cable trolleys.

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).



NOTE!
Main switch and main contactor for the power supply of the control has to be installed in customer distribution cabinet!

The control voltage for the supply of the anti-condensation heater of the motors has to be switched off by the customer when the system is put in operation.



CAUTION!
Switch off power supply of anti condensation heaters of motor during operation!
The motor winding might be overheated and the motor might get damaged!

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CAUTION!

Damage because of wrong cable connection!

Wrong connected cables might cause to damage of electrical components!



CAUTION!

Use screened cables!

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

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	Interface terminal	Signal level
Power supply Magnetic limit switch	-X-PLC:L	110/230 VAC; 24 VDC
Magnetic limit switch MCT 1, water-side	-X-PLC:1	110/230 VAC; 24 VDC
Magnetic limit switch MCT 1, land-side	-X-PLC:2	110/230 VAC; 24 VDC
Magnetic limit switch MCT 2, water-side	-X-PLC:3	110/230 VAC; 24 VDC
Magnetic limit switch MCT 2, land-side	-X-PLC:4	110/230 VAC; 24 VDC
Magnetic limit switch MCT 3, water-side	-X-PLC:5	110/230 VAC; 24 VDC
Magnetic limit switch MCT 3, land-side	-X-PLC:6	110/230 VAC; 24 VDC

For the connection of the festoon cables the customer has to provide a terminal box with the appropriate dimensions. Screened cables have to be used for fixed installed motor and temperature sensor cables and for signal cables.

MCT No.	Connection	
1	Motor phase U	
1	Motor phase V	
1	Motor phase W	
1	Motor PE	
1	Motor screen	
1	Motor temperature sensor	
2	Motor phase U	
2	Motor phase V	
2	Motor phase W	
2	Motor PE	
2	Motor screen	
2	Motor temperature sensor	
3	Motor phase U	

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3	Motor phase V	
3	Motor phase W	
3	Motor PE	
3	Motor screen	
3	Motor temperature sensor	
1-3	Voltage temperature sensor [L]	
1-3	Motor anti condensation heaters L	
1-3	Motor anti condensation heaters N	
1-3	Motor anti condensation heaters PE	

5 Description of the interface module

This function block is used as interface module for all interface signals between the superior (crane) control and the control of motorized cable trolleys (MCT). It is applicable for PLC GE-FANUC PACSystems™ RX3i system.

As frequency converter TMGE TMdrive-10 with integrated bus interface will be used.

Numbering of function and data blocks is free. Because of the instance data block no flag assignment is necessary.

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



WARNING!

Injury due to wrong parameter adjustment!

Wrong parameter adjustment might cause to malfunction and damage to the festoon system. Parameter adjustment only according to manufacturer instruction and in short steps!

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



NOTE!

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

5.1 PLC hardware description

5.1.1 Controller CPU

The Conductix-Wampfler standard software is written for using the GE-FANUC PACSystems™ RX3i system with the CPU **IC695CPU310** installed in the customer PLC system.

5.1.2 Communication controller ETHERNET

The communication to the frequency converters requires a ETHERNET module type **IC695ETM001**. This has to be installed in the customer PLC system.

5.2 Software description

The Conductix-Wampfler standard software is written with the GE-FANUC software PROFICY Machine Edition for running in a PLC System GE-FANUC PACSystems™ RX3i.

5.2.1 General

All program blocks are written as UDFB blocks (User Defined Function Blocks) in the IEC 61131-3 language ladder logic. For incorporating the UDFB's in the client application program is only a call from UDFB in the logic program main part required. The input and output parameters of the UDFB have to be set by the customer to the programmed I/O addresses for hardware signals. For examples limit switches, push buttons, contactor etc. Also the register addresses from the hardware configuration of the ETHERNET module have to be written to the UDFB I/O parameters. Other programming work is not required. Parameters in ST blocks

5.2.2 Cycle time

The maximum allowed main cycle time for the logic program has to be less then 50 milliseconds. The Conductix-Wampfler cable trolleys are high speed moving systems. If cycle time increases, the accurate positioning is disturbed.

5.2.3 Memory variables

The UDFB block uses only independent instance with its own set of variables to store the values of the input parameters, output parameters, and other values that need to persist (members). The set of variables assigned to a function block instance is represented in the variables tab of the navigator by a symbolic structure variable with a user-defined instance name.

5.3 ETHERNET communication

5.3.1 General

The RX3i ETHERNET Interface Module, IC695ETM001, allows the RX3i CPU to send and receive data on a ETHERNET Network. This module has to be located in a RX3i Universal Back plane.

The ETHERNET Interface Module requires an RX3i CPU with firmware version 3.0 or later and Machine Edition Logic Developer-PLC, version 5.7 SP1 or later for configuration. Review the power requirements of your system to ensure that your power supply has sufficient capacity to support the ETHERNET Interface Module.

5.3.2 Configuring the ETHERNET Interface Module

The ETHERNET Interface Module, IC695ETM001, has to be configured by the equipment vendors and fabrication contractors. Tear no special requirements from Conductix-Wampfler about the used memory areas for the setting tables.

A part of the addressing from the setting parameters are used by the Conductix-Wampfler UDFB block FC180_WMF_GLW_1/2/3_TMDRIVE_10 as I/O parameter. The Network setting of ETHERNET Network has to be done by the equipment vendors and fabrication contractors in according to the used frequency converter.

5.3.3 Adding Devices to the ETHERNET Interface

In EDG (Ethernet Global Data) add Ethernet participants.

The detailed description can be found in the User Guide GFK-1918, Chapter 6.

5.3.4 Configuring ETHERNET Module Data Areas

In EDG (Ethernet Global Data), to define the data areas for read (Consumed Exchanges) and write (Produced Exchanges). Description see User Guide GFK-1918, Chapter 6.

The Conductix-Wampfler UDFB block FC189_WMF_GLW_PB_TMDRIVE_REC used for input and FC189_WMF_GLW_PB_TMDRIVE_SEN for output address a memory area of 10 words, defined as data area that is used to map the data area. In the client ladder logic is required to reserve this data area only for using by Conductix-Wampfler UDFB block FC189_WMF_GLW_PB_TMDRIVE_REC / FC189_WMF_GLW_PB_TMDRIVE_SEN.

5.4 Description of FC180_WMF_GLW_1/2/3_TMDRIVE_10 BLOCK inputs

Input variable of function block		
Formal operand	Format	Function
	BOOL	Enable of function block
CRANE_SWITCH_ON	BOOL	Input crane main switch is ON (base for the operation of the system).
POSITIONING_SIGNAL_OK ¹⁾	BOOL	Input customers position measuring system is ok without fault
ACT_POS_MAIN_TROLLEY ¹⁾	REAL	Input actual main trolley position as 32 bit floating-point number (actual position on the complete distance in [mm])
POS_LIMIT_SWITCH_CHECK ¹⁾	REAL	Input position for function check „Limit switch on“
ACT_SPEED	REAL	Input actual speed of main trolley, scaled to -100 to +100% of maximum speed
DRIVE_SWITCH_POS	BOOL	Input joy stick of trolley moved into positive direction
DRIVE_SWITCH_NEG	BOOL	Input joy stick of trolley moved into negative direction

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ACKN_FAILURE	BOOL	Input reset signal for fault reset
LIMIT_SWITCH_POS ^{2) 3)}	BOOL	Input limit switch positive direction
LIMIT_SWITCH_NEG	BOOL	Input limit switch negative direction
MP_MAIN_POWER_SUPPLY_OK ³⁾	BOOL	Input circuit breakers main power supply ok
MP_CONTROL_VOLTAGE_OK ³⁾	BOOL	Input circuit breaker control power supply ok
INTERMEDIATE_CIR_OK ³⁾	BOOL	Input DC link ok
FC_REC_DATA_ARRAY	INT	Configured start address from the data area of the module from which the data will be read

¹⁾ = Optional: Only in case of limit switch function control

²⁾ = Optional: Only if limit switches for positive direction (waterside) are installed

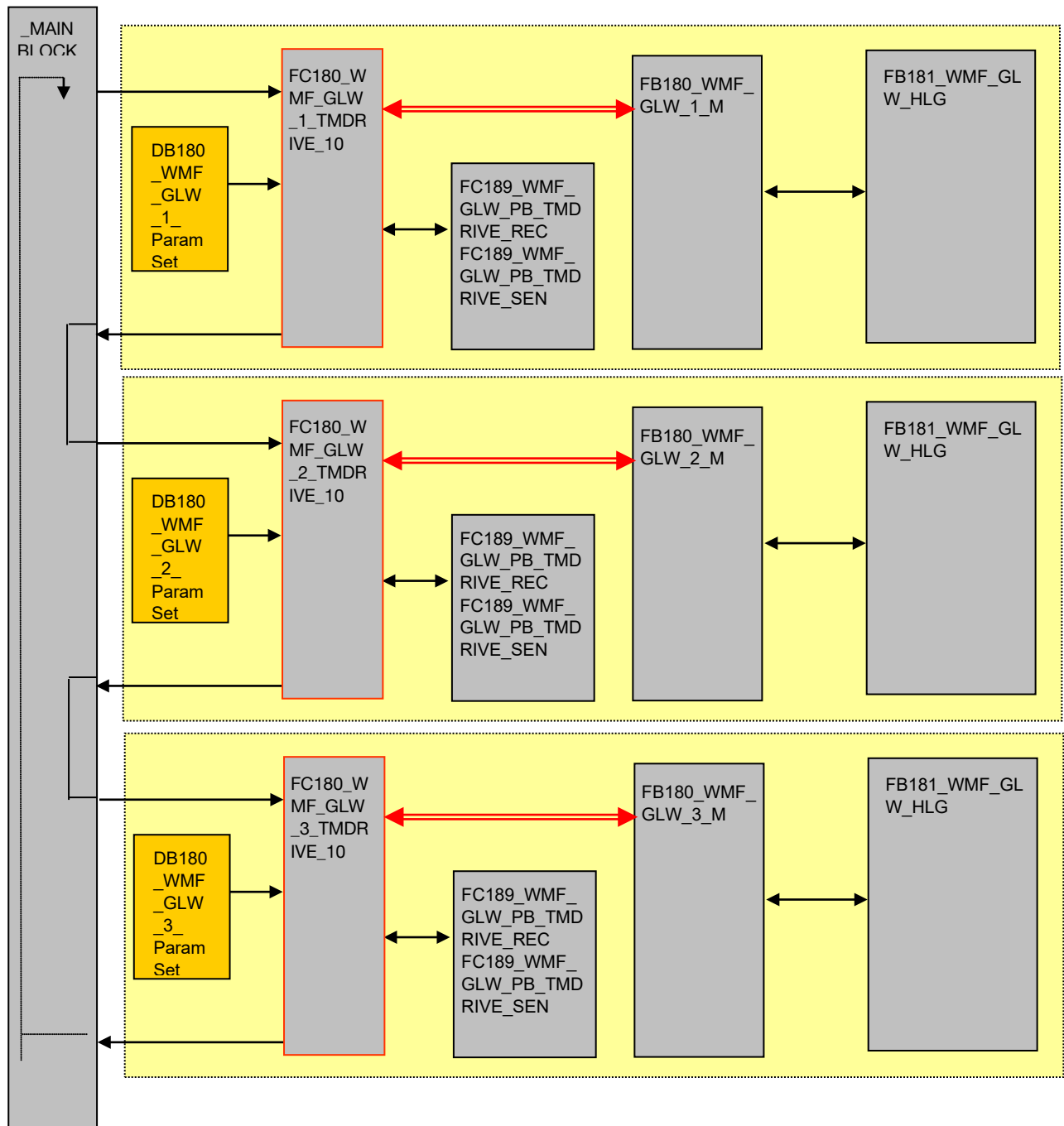
³⁾ = If not exists inputs have to be connected to „1“!

5.5 Description of FC180_WMF_GLW_1/2/3_TMDRIVE_10 BLOCK outputs

Output variables of function block		
Formal operand	Format	Function
	BOOL	Enable output of function block
MAIN_CONTACTOR_ON	BOOL	Output main contactor of drive.
ANTI_COND_HEATING_ON	BOOL	Output contactor motor anti condensation heater.
CABLE_TROLLEY_READY	BOOL	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%).
FAILURE_LIMIT_SWITCH_POS ¹⁾	BOOL	Signal output fault limit switch positive direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
FAILURE_LIMIT_SWITCH_NEG ¹⁾	BOOL	Signal output fault limit switch negative direction. Limit switch was OFF at position „POS_LIMIT_SWITCH_CHECK“!
FAILURE_FREQ_CONVERTER	BOOL	Signal output fault frequency converter or fault communication to frequency converter
FAILURE_TOOTH_BELT_BROKN	BOOL	Signal output tooth belt broken
FAILURE_BUFFER_FC	INT	Failure Nummber
DRIVE_COM_OK	BOOL	Signal output "drive communication ok"
FC_SEND_DATA_ARRAY	INT	Configured start address from the data area of the module from which the data will be write

¹⁾ Optional: Only in case of limit switch function control

5.6 Program chart and implementation into PLC-Program



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MAIN BLOCK

At every PLC sweep or scan, the MAIN block is the first block that executes in its main program. The _MAIN block calls for the UDFB block WMF_GLW as a subroutine.

FC180_WMF_GLW_1/2/3_TMDRIVE_10

The UDFB block FC180_WMF_GLW_X_TMDRIVE_10 contains the ladder logic of the signal exchange to the client ladder program. This block calls several internal subroutines.

FC189_WMF_GLW_PB_TMDRIVE_SEN / FC189_WMF_GLW_PB_TMDRIVE_REC

The UDFB block FC189_WMF_GLW_PB_TMDRIVE_SEN / FC189_WMF_GLW_PB_TMDRIVE_REC contains the ladder logic of the data transfer and handling from WMF_GLW block to the hardware configuration of the ETHERNET module IC695ETM001.

FB180_WMF_GLW_1/2/3_M

The UDFB block FB180_WMF_GLW_X_M contains the ladder logic of the whole internal ladder logic for motorized cable trolley. This block calls several internal subroutines

FB181_WMF_GLW_HLG

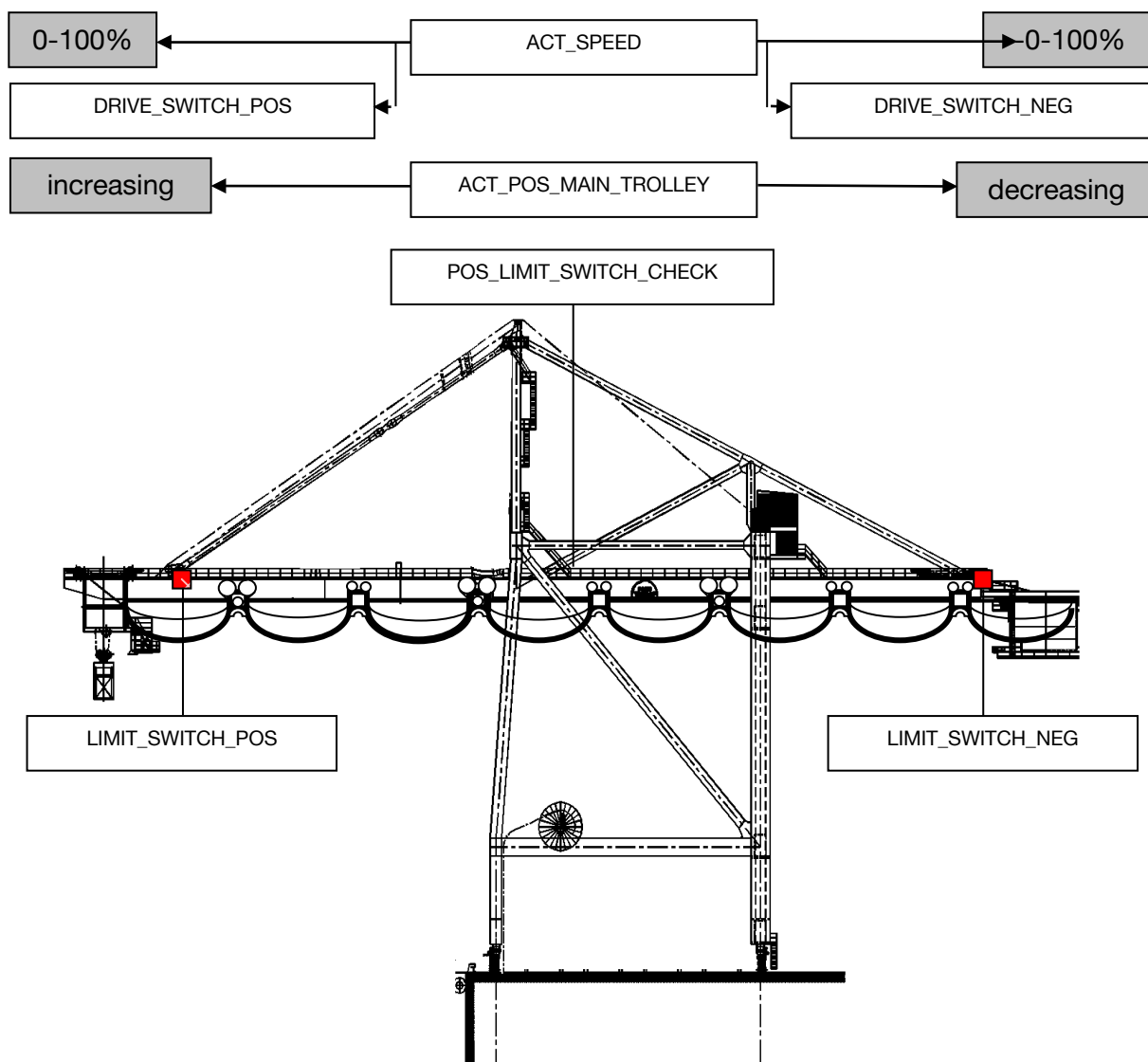
The UDFB block FB181_WMF_GLW_HLG BLOCK contains the ladder logic for building the speed / frequency set value to the frequency drives.

DB180_WMF_GLW_1/2/3_ParamSet

The ST block DB180_WMF_GLW_X_ParamSet contains all adjustable parameters and values.

6 Flow charts and descriptions

6.1 Overview and definitions



6.2 Procedure in case of alarms and faults



WARNING!

System damage from continuation of operation!

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

Therefore:

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).

In case of a fault of a drive unit of the festoon system, it is required, through the superior control (crane control), to immediately restrict the speed of the crane main trolley to a max. of 50% of the rated crane main trolley speed. The speed must not exceed 120 m/min. At the latest after the shift respectively completion of the loading/unloading cycle of the container ship, the fault has to be analyzed and corrected. Conductix-Wampfler has to be informed in writing without delay.

Please note: The operation during emergency modus longer than the loading respectively unloading cycle can cause mechanical overloading and damage of the festoon system.

The following faults are signalled:

- Failure Frequency Converter
- Failure Limit switch landside
- Failure Limit switch waterside
- Failure Tooth belt
- Failure drive communication (DRIVE_COM_OK = OFF)

In case of a fault of the MCT main trolley travel has to stop immediately, and after stopping MCT has to be switched off by the crane PLC. Before continuing of main hoist travel and MCT the fault has to be analyzed and corrected. Conductix-Wampfler has to be informed in writing without delay.

6.3 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	Factory setting	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

6.4 Analysis of crane signals

At lower speed range motorized cable reels 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.

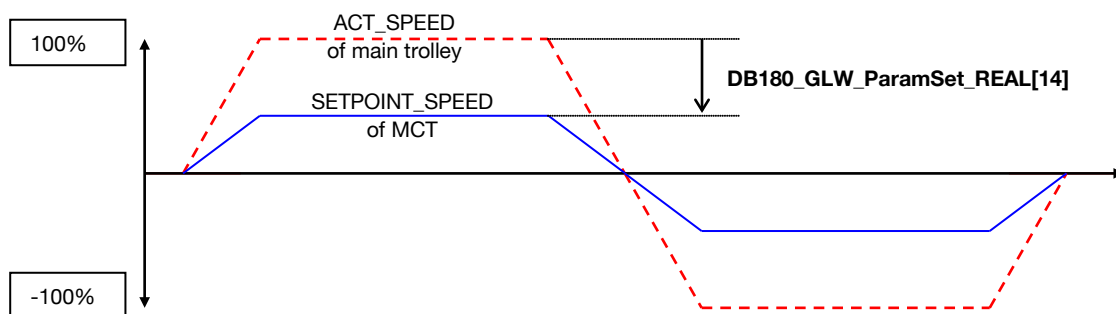
Formal operand	Format	Factory setting	Function
DRIVE_SWITCH_POS	BOOL	-	Input joy stick of trolley positive direction
DRIVE_SWITCH_NEG	BOOL	-	Input joy stick of trolley negative direction
ACT_SPEED	REAL		Actual main trolley speed in %

6.5 Scaling of speed setpoint value of motorized cable trolley

(DB180_WMF_GLW_1/2/3_ParamSet)

To adjust the speed of the motorized cable trolley (motor speed setpoint 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-Wampller 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	Factory setting	Function
DB180_GLW_ParamSet_REAL[14]	REAL		Scaling main trolley speed to speed setpoint value of aGLW [0.0-2.0]



6.6 Monitoring overspeed

In case of pushing or pulling of the motorized cable trolley by the main trolley the speed setpoint value of the motorized cable trolley will be corrected by the control.

6.7 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.

6.8 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 criterias:

Main trolley position (ACT_POS_MAIN_TROLLEY) < programmed value (DB180_GLW_ParamSet_REAL[13]) and negativ limit switch signal (LIMIT_SWITCH_NEG) is OFF → fault signal (FAILURE_LIMIT_SWITCH_NEG) will be latched.

Main trolley position (ACT_POS_MAIN_TROLLEY) [programmed value (DB180_GLW_ParamSet_REAL[13]) and positiv limit switch signal (LIMIT_SWITCH_POS) is OFF → fault signal (FAILURE_LIMIT_SWITCH_POS) 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 (ACKN_FAILURE).

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

Formal operand	Format	Factory setting	Function
ACT_SPEED	REAL	-	Actual main trolley speed in %
DRIVE_SWITCH_POS	BOOL	-	Input joy stick of trolley positive direction
DRIVE_SWITCH_NEG	BOOL	-	Input joy stick of trolley negative direction
LIMIT_SWITCH_POS	BOOL	-	Input limit switch pos. (WATER) direction not activated
LIMIT_SWITCH_NEG	BOOL	-	Input limit switch neg. (LAND) direction not activated
ACT_POS_MAIN_TROLLEY	REAL	-	Actual main trolley position in mm
POSITIONING_SIGNAL_OK	BOOL		Position measuring system no fault
POS_LIMIT_SWITCH_CHECK	REAL	-	Position for monitoring limit switch signals
FAILURE_LIMIT_SWITCH_POS	BOOL		Output fault limit switch pos. (WATER)
FAILURE_LIMIT_SWITCH_NEG	BOOL		Output fault limit switch neg. (LAND)
ACKN_FAILURE	BOOL		Input reset fault

6.9 Monitoring tooth belts



WARNING!

System damage from continuation of operation!

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

Break of tooth belts of the motorized cable trolleys are controlled. If motor current value (TOOTH_BELT_CURRENT) during movement of main trolley is lower as adjusted value (standard: 30%) motor run without load and (TOOTH_BELT_SPEED) is higher as adjusted value (standard: 40%), both tooth belts are broken, fault signal (FAILURE_TOOTH_BELT_BROKN) will be latched.

After having analyzed and corrected the reason of the broken tooth belts, reset is possible by the input (ACKN_FAILURE).

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

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Formal operand	Format	Factory setting	Function
TOOTH_BELT_TIME (DB180_GLW_ParamSet_DINT[8])	TIME	10 sec	Input delay time for tooth belt control
TOOTH_BELT_CURRENT (DB180_GLW_ParamSet_REAL[10])	REAL	30	Input motor current without load (1,1 – 100%)
TOOTH_BELT_SPEED (DB180_GLW_ParamSet_REAL[12])	REAL	40	Set value Speed for checking tooth belt
FAILURE_TOOTH_BELT_BROKN	BOOL		Signal output tooth belt broken
ACKN_FAILURE	BOOL		Input reset fault

6.10 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 Ethernet. In case of a frequency converter fault a general fault signal (FAILURE_FREQ_CONVERTER) 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 (ACKN_FAILURE).

Fault signal (FAILURE_FREQ_CONVERTER) can be used for fault identification system of the crane. At same time the alarm storage of the frequency converter (FAILURE_BUFFER_FC) may be readout.

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

Formal operand	Format	Factory setting	Function
CABLE_TROLLEY_READY	BOOL		Signal output MCT ready for operation
FAILURE_FREQ_CONVERTER	BOOL		Signal output fault frequency converter
ACKN_FAILURE	BOOL		Input reset fault
FAILURE_BUFFER_FC	WORD		Storage faults and warnings of frequency converter

6.11 Enabling operation

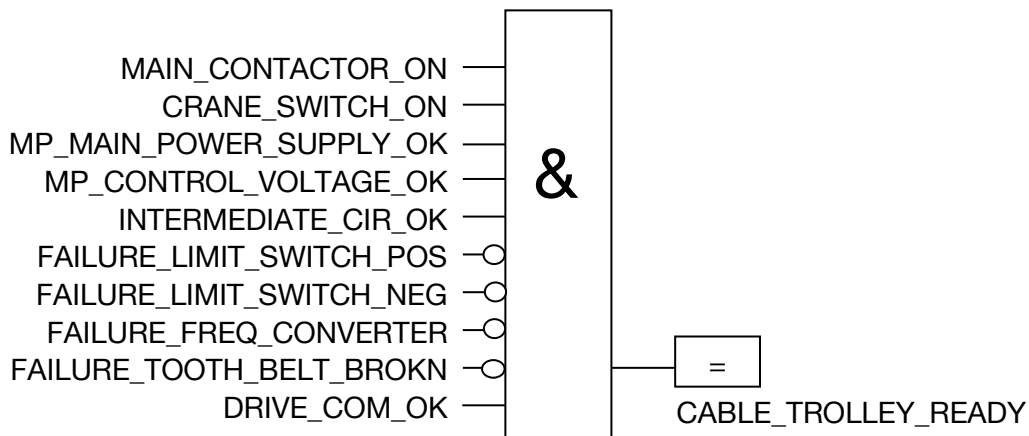
The status bit (CABLE_TROLLEY_READY) indicating the correct function of the motorized cable trolley has to be interlocked into the enabling sequence of the setpoint limiting of the

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main trolley speed. If the signal is „0“ the main trolley speed has to be limited to maximum 50%.

Following preconditions are necessary for enabling operation:



Formal operand	Format	Factory setting	Function
MAIN_CONTACTOR_ON	BOOL	-	Output main contactor
CRANE_SWITCH_ON	BOOL	-	Main contactor crane ON Switch on main contactor and enable operation signal after time delay operation signal after time delay
MP_MAIN_POWER_SUPPLY_OK	BOOL	-	Input circuit breaker main power supply is ON
MP_CONTROL_VOLTAGE_OK	BOOL	-	Input circuit breaker control power supply is ON
INTERMEDIATE_CIR_OK	BOOL	-	Input DC-link (braking unit, braking resistance) has no fault
FAILURE_LIMIT_SWITCH_POS	BOOL	-	Output fault limit switch pos. (WATER)
FAILURE_LIMIT_SWITCH_NEG	BOOL	-	Output fault limit switch neg. (LAND)
FAILURE_FREQ_CONVERTER	BOOL	-	Input frequency converter fault
FAILURE_TOOTH_BELT_BROKN	BOOL	-	Signal output tooth belt broken
DRIVE_COM_OK	BOOL		Signal output "drive communication ok"
CABLE_TROLLEY_READY	BOOL	-	Output MCT ok without fault

7 Maintenance



WARNING!

System damage from wrong action.

- Turn off power supply and ensure that no inadvertent activation is possible.
- Observe the inspection and maintenance intervals described in the maintenance instructions.
- Ensure that sufficient space for maintenance work is available.
- Ensure that the festoon system is not inadvertently activated during maintenance work.
- Screw joints that are disconnected during maintenance work are to be reattached and secured as instructed.
- After finishing work, collect all tools and materials and check that all are present.
- Disassembled parts and components that were exchanged are to be collected, stored in a safe place, recycled or sent back.



WARNING!

Injury due to wrong spare parts!

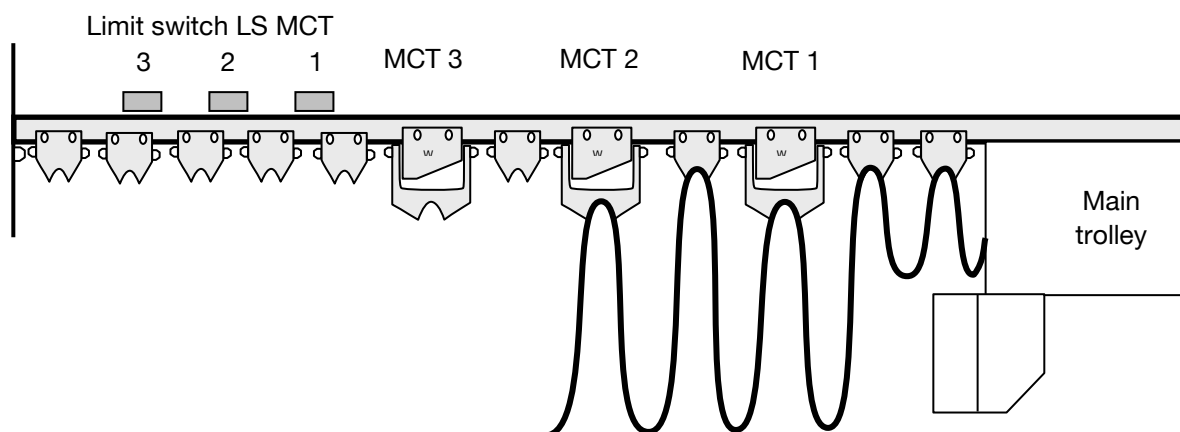
The installation and/or use of unauthorized spare parts or accessories can have a negative impact on the structural properties of the festoon system and therefore affect active and passive safety. No liability is accepted or warranty given for damages that occur from the use of unauthorized spare parts and accessories.

8 Appendix

8.1 Schematic sketch of festoon system

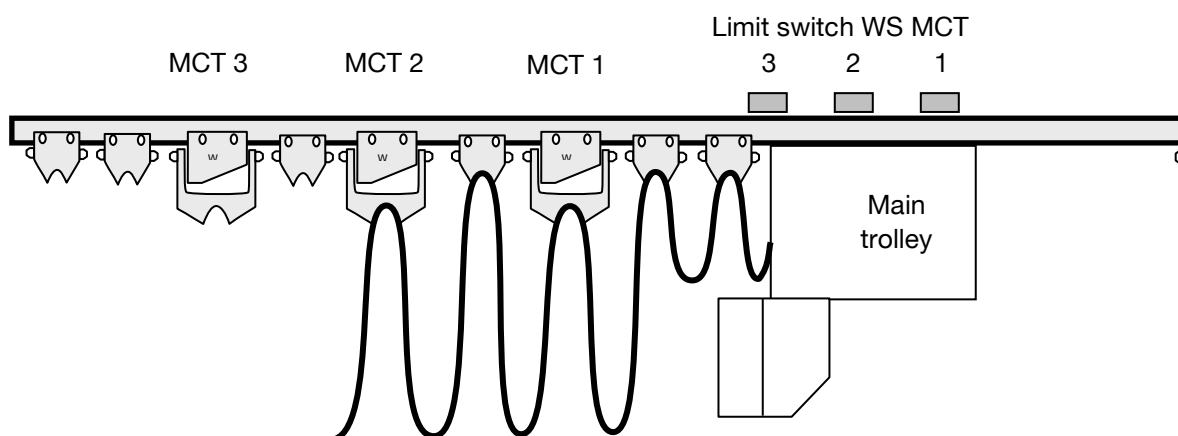
Landside

Waterside

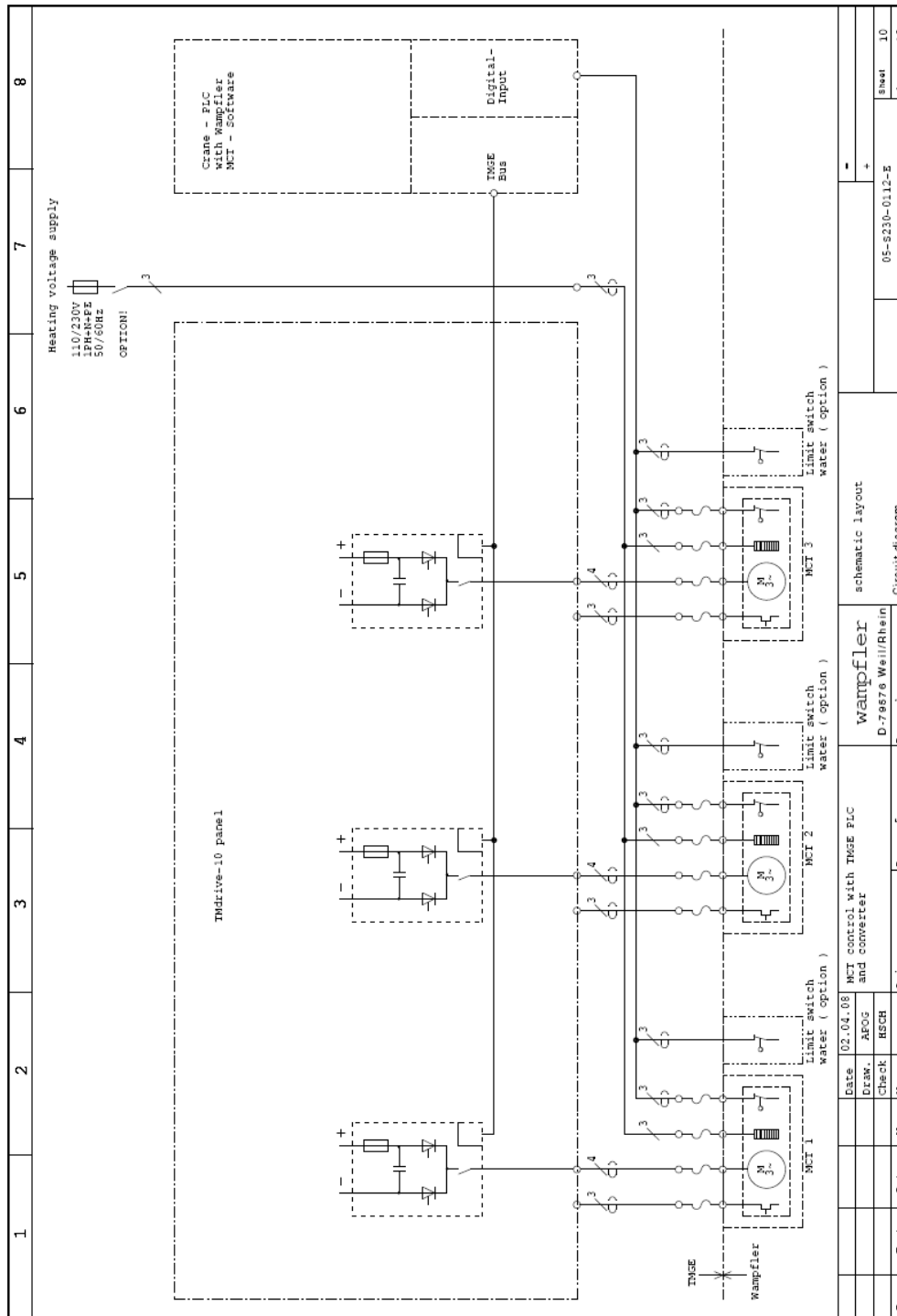


Landside

Waterside



8.2 Schematic sketch of MCT control



Conductix-Wampfler GmbH
Rheinstraße 27 + 33
79576 Weil am Rhein - Märkt
Germany

Phone: +49 (0) 7621 662-0
Fax: +49 (0) 7621 662-144
info.de@conductix.com
www.conductix.com



Importer for the United Kingdom:
Conductix-Wampfler Ltd.
1, Michigan Avenue
Salford
M50 2GY
United Kingdom

Phone: +44 161 8480161
Fax: +44 161 8737017
info.uk@conductix.com
www.conductix.com