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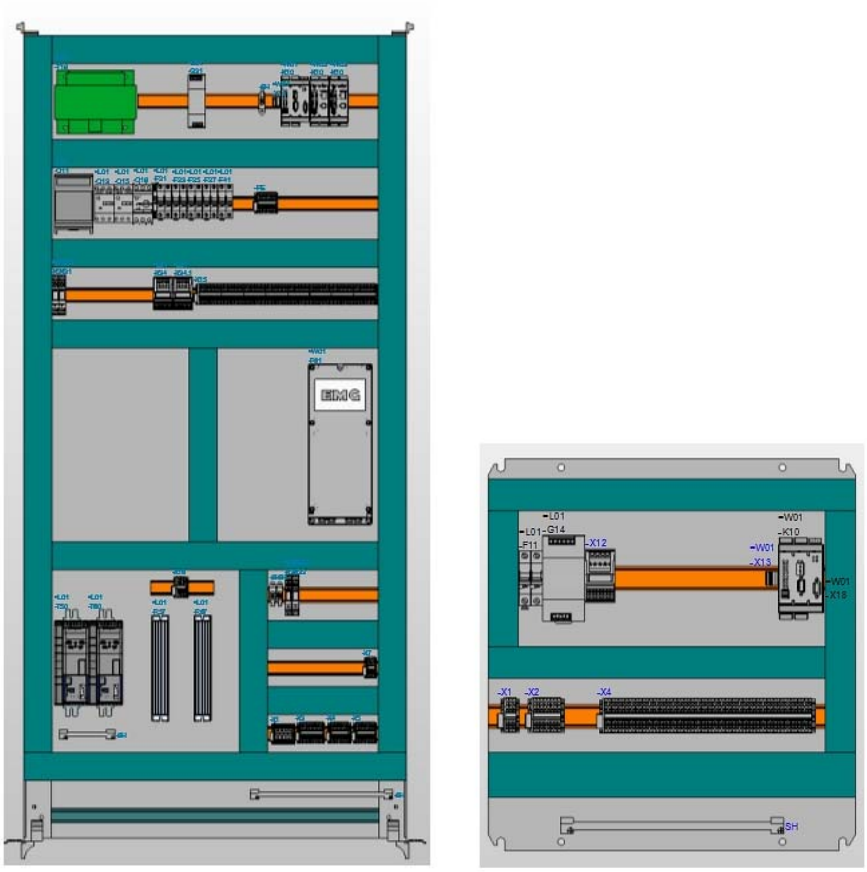
Implementation guideline for EMG control cabinets



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1 Preliminary remarks

The implementation guideline applies to the electrical equipment of incomplete machines, machinery and components. It serves as a supplement to the respective valid standards, regulations and specifications of the end customer.

If the end customer has specifications in place, these are to be considered as a priority, provided that any legal regulations are not violated as a result.

Reference is made to compliance with the following provisions/EU directives in particular:

Low Voltage Directive 2014/35/EU

EMC Directive 2014/30/EU

- EN 60204 Safety of machinery - Electrical equipment of machines
- EN 61000-3-2 Limits for harmonic current emissions
- EN 61000-3-3 Limitation of voltage changes
- EN 61000-6-2 Immunity for industrial environments
- EN 61000-6-3 Emission standard for residential, commercial and light-industrial environments
- EN ISO 13849-1 Safety of machinery – Safety-related parts of control systems

2 Identification system for the wiring diagram

2.1 Function group

=Abb

A Function group e.g. **A**=General part, **L**=Power section, **W**=Control unit (1 letter) **bb** Sub-division of the function group (2 digits)

2.2 Location designation

+Cdd

C System area **K**= Control cabinet, **N**= Hydraulics (1 letter) **dd** Consecutive number (2 digits)

2.3 Device tag

–Effg

E Equipment type according to EN 81346 (1 letter)

ff Page number of the circuit diagram (max. 2 digits)

g Current path number 0-9 (1 digit)

2.4 Cable number

W Function identifier-W hhi

hh Page number of the circuit diagram (max. 2 digits)

i Current path number 0-9 (1 digit)

2.5 Terminal strip designation

X Location designation-X jjj

jj Voltage level terminal strip, external (max. 2 digits)

jjj Voltage level terminal strip, internal (3 digits)

2.6 Potential designation

L1, L2, L3 main current

L, N Control voltage 230 V AC

AL Control voltage 24 V DC

BL Control voltage 15 V DC

CL Control voltage 0 V DC

2.7 Evaluations

Terminal diagram: Function identifier, location designation, terminal strip designation, terminal numbers, terminal type, target designation of the individual wires and cables, cable number, cable type, number of wires and cross-sections, wire number or wire colour

Cable list: Cable number, cable type, number of wires and cross-sections, wires used, cable source and cable destination (function identifier and terminal or equipment designation)

Bill of materials: Function identifier, location designation, device tag, device designation according to DIN EN 61346-1, quantity, designation, type and EMG part number.

The circuit diagrams are created with EPLAN P8 Version 2.8. We use the programme EPLAN Pro Panel to create the control cabinet superstructures.

Other identification systems must be communicated prior to ordering.

3 Structure of control cabinets

3.1 Control cabinet supply

In the case of three-phase supplies that are greater than 480 V AC +/-10 %, voltage is adjusted via a mains transformer.

3.2 Main circuits

In principle, all electrical consumers are fully isolated with corresponding switching devices.

3.3 Motor protection

Three-phase motors with a rating of up to 22 kW must be protected by motor protection switches, thermal motor protection relays

(bi-relays) or full motor protection.

Motors that cannot be started directly via the mains are provided with a soft starter and/or a frequency converter.

3.4 230 V AC control circuits

In principle, 230 V AC control circuits are designed in a potentially isolated manner with approved control voltage transformers. The primary side is protected by default with a transformer circuit breaker. The secondary side is protected by double-pole automatic circuit breakers.

3.5 24 V DC control circuits

In principle, 24 V DC control circuits are designed in a potentially isolated manner with approved power supply units. In accordance with the manufacturer's specifications, the primary side is usually protected with automatic circuit breakers. On the secondary side, protection is provided by electronic automatic circuit breakers.

3.6 Safety circuits (emergency shut off, emergency stop)

In principle, EMG components are integrated into the machine / system by the customer in accordance with the Declaration of Incorporation.

The design of the safety circuit is fundamentally based on DIN VDE 0100 Part 460 as well as the standards of DIN VDE 0100.

The operating elements are designed as mushroom pushbuttons with a twist- or pull-to-unlatch mechanism. Only approved switching devices with 24 V technology are used for the safety circuits. If contact replication is required, it is provided via forcibly guided contacts. Feedback from the replication contactors to the switching device is also provided.

3.7 Electromagnetic compatibility (EMC)

The basic principle of electromagnetic compatibility (EMC) is based on EN61000-6-2. Electromagnetic compatibility (EMC) of the systems in which the EMG components are to be installed must fulfil the respective requirements with regard to immunity and interference.

3.8 Control cabinet layout

Depending on the application in question, the electrical supply and control systems are mounted in switch rooms or directly on the system itself.

Depending on the respective design, the electrical components are either attached directly to a galvanised mounting plate or indirectly via a supporting rail TS35/7.5 according to DIN EN 50022. Aluminium rivets are used for mounting.

60 mm high plastic cable ducts of different widths are provided for wiring.

A 10 x 3 mm shield bus and the corresponding shielding terminals are located in the lower section of each control cabinet.

A reserve space of approx. 20% is taken into account for subsequent additions.

3.9 Wiring

Wiring for the control voltage is provided via flexible HO7V-K cables with a minimum cross-section of 0.75 mm², preferably in wiring ducts. For supply lines and motor circuits, the minimum cross-section is 1.5 mm². Flexible lines are provided with ferrules.

Twin ferrules can be used, if necessary, when looping through terminal points.

Jumper wires and conductors are equipped with numbered grommets at both ends (type: PARTEX PA).

The wires are designated in accordance with the target from the circuit diagram.

Designation of jumper wires according to EN60204-1 (VDE0113-1)

Main circuits	black
Centre conductor / neutral conductor	light blue (RAL5015)
Control circuits (alternating current voltage)	red
Control circuits (direct current voltage)	+potential dark blue (RAL5010)
Control circuits (direct current voltage)	+0V/earth dark blue _ white
External voltages	orange
Measuring lines (current transformer K,L)	white
Protective earth conductor	yellow/green
Analogue signals	dark blue (RAL5010)

3.10 Terminal strips

In principle, rail mounted terminals with a push-in connection are used in accordance

with the device list. The terminals are numbered consecutively according to the circuit diagram.

3.11 Component designations

All switching devices are labelled with yellow labelling plates (type: Phoenix 20x8) in accordance with the labelling in the circuit diagram. Labelling is provided on the mounting plate in a simple design.

3.12 Labelling of control cabinets and control boxes.

The control cabinets / control boxes are labelled with self-adhesive labels (type: EML) from Phoenix Contact.

Other labelling materials such as plastic, aluminium or stainless steel plates that are to be glued, riveted or screwed in place are to be specified in the order.

3.13 Cable designation

In the case of prefabricated cables, the cables are marked using cable markers (type: KMK, 25x6) from Phoenix Contact. The cable number, the source and the destination are printed on the cable marker.

3.14 Cable entry

The cables are generally inserted into the control cabinets from below. In the case of free-standing cabinets, the cable ducts are inserted between the sliding bottom panels. Cable entries are not included for wall cabinets.

3.15 Climatisation

The internal temperature of the cabinet must not exceed the maximum operating temperature of the installed devices. Corresponding climate control measures are to be provided by the customer, or the corresponding ambient conditions must be communicated to EMG so that appropriate climate control measures can be provided (for a surcharge).

3.16 Equipotential bonding

All metallic structural components are to be provided with equipotential bonding in a star configuration by the customer in accordance with DIN VDE0100 Part 410 and 540, DIN VDE0190 and DIN18015 Part1.

The conductivity of the equipotential bonding conductors must be at least equal to half the conductivity of the protective conductor that is assigned to the main line. However, it must not be smaller than that of a copper cross-section of 6 mm².

3.17 Testing of electrical power plants up to 1000 V according to VDE 0100

All switching device combinations and control panels are fully wired and tested for functionality.

A test report is created for each control cabinet according to EN 61439-1 (VDE0600-600-1).

3.18 Cables and lines

The cable designations stipulated by the manufacturers are entered in the circuit diagrams by default. When selecting the cables, we assume that they are located in the areas we have specified. If this is not the case, the cable length, cable cross-section and the current load must be adapted to the relevant conditions, while taking into account the 'fixed' or 'flexible' installation type and the ambient temperature.

4 Software

The iCON control amplifiers from EMG are programmed with LOGICAD Software 5.7.

We use Polymath software for configuration of the EMG touch panel iCON VS.

Process visualisations are created using LabVIEW software from National Instruments.

Documentation regarding the visualisations can essentially be found in the operating instructions.

5 Device lists

Component	Manufacturer	Model / series
Insulation monitoring relay	Dold	IP5880 / IL5880
Line circuit breaker	EATON	PXL …
Transformers	EMB Wittlich	DTSN…
Frequency converter	EMG	SCM…
Control amplifier	EMG	ICON…
Touch panel	EMG	ICON VS
Line display	EMG	ECU…
Coupling relay	Finder	Series 49, serie 39
Connectors	Harting	HAN…
Gateways	Hilscher	NT…
Power supply units	Mean Well	SDR / NDR
Coupling relay	Phoenix Contact	PLC…
Connectors	Phoenix Contact	SACC…
Isolation amplifier	Phoenix Contact	Mini MCR…
Terminals	Phoenix Contact	PT…
Emergency stop relay	Pilz	PNOZ…
Control cabinets	Rittal	VX25…
Control cabinet cooling units	Rittal	SK 3…
wall housing	Rittal	AX 1…

Component	Manufacturer	Model / series
Control cabinet lamp	Schneider Elektric	NSYL…
19" server PC	Siemens	IPC 547…
Actuating and signalling elements	Siemens	3SU…
Main switch	Siemens	3LD…
Auxiliary contactors	Siemens	3RH…
Circuit breaker	Siemens	3RV…
Power contactors	Siemens	3RT…
Fuse elements	Siemens	3NP…
Overload relay	Siemens	3RN…
Switch	Weidmüller	ESW …
Thermostats	Finder	7T.91
Temperature transmitter	Phoenix	Mini MCR …